United States Department of the Interior

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In Reply Refer To:
FWS/R2/OKES/
21440-2010-F-0449

September 14, 2010

Ronald L. Hilliard
State Conservationist
Natural Resources Conservation Service
100 USDA, Suite 206
Stillwater, Oklahoma 74074-2655

Dear Mr. Hilliard:

The Natural Resources Conservation Service and the U. S. Fish and Wildlife Service have jointly agreed to a streamlined consultation process whereby a biological assessment and biological opinion regarding potential impacts to federally-listed threatened and endangered species that may result from implementation of the Healthy Forest Reserve Program (HFRP) in five counties in northeastern Oklahoma are jointly developed (PBABO). The specific HFRP project has been identified as the Ozark Plateau Karst-Dependent Species Conservation Initiative. Protection and habitat restoration efforts that contribute to the recovery of the gray bat, Ozark big-eared bat, and Ozark cavefish are a primary objective of the HFRP in Oklahoma.

Enclosed is the final joint PBABO. This consultation document has been prepared pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 United States Code [U.S.C.] 1531 *et seq.*) and 50 Code of Federal Regulations [CFR] §402 of our interagency regulations governing section 7 of the ESA. The purpose of this joint PBABO is to expedite consultations on proposed HFRP activities. Please indicate your approval of the PBABO by providing your signature on the enclosed document.

We appreciate the collaboration of your staff in development of the joint PBABO, and look forward to our continued partnership as the HFRP is implemented in Oklahoma. If you have any questions, please contact Richard Stark of this office at 918-581-7458, extension 240.

Sincerely,

Dixie Bounds

Dixie Bounds, Ph.D.
Field Supervisor

Enclosure

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PROGRAMMATIC BIOLOGICAL ASSESSMENT

AND

PROGRAMMATIC BIOLOGICAL OPINION

FOR THE

NATURAL RESOURCES CONSERVATION SERVICE

OKLAHOMA HEALTHY FORESTS RESERVE PROGRAM

Written by

U. S. Fish and Wildlife Service
Oklahoma Ecological Services Field Office

and

Natural Resources Conservation Service
Oklahoma State Office

September 2010

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INTRODUCTION

This document presents the findings and conclusions of both the Natural Resources Conservation Service's (NRCS) Programmatic Biological Assessment (PBA) and the U.S. Fish and Wildlife Service's (Service) Programmatic Biological Opinion (PBO) regarding potential impacts to federally listed threatened and endangered species that may result from implementation of the Healthy Forests Reserve Program (HFRP) in five northeastern Oklahoma counties. The specific HFRP project has been identified as the Ozark Plateau Karst-Dependent Species Conservation Initiative (OPKDS). The NRCS and the Service have jointly agreed to a streamlined consultation process whereby a biological assessment and biological opinion are jointly developed (PBA/PBO).

Four federally-listed species, including the endangered gray bat (*Myotis grisescens*), endangered Ozark big eared-bat (*Corynorhinus townsendii ingens*), threatened Ozark cavefish (*Amblyopsis rosae*), and the endangered American burying beetle (*Nicrophorus americanus*) occur within the HFRP project area and are subject to project impacts. These four species, herein referred to as "covered species" are specifically addressed in this biological assessment. Protection and habitat restoration efforts that contribute to the recovery of three of the four "covered species" including the gray bat, Ozark big-eared bat, and Ozark cavefish are a primary objective of the OPKDS initiative. Management plans intended to protect caves, restore foraging habitats and improve surface and groundwater quality for the benefit of these cave-dependent "targeted" species will be documented in individual HFRP Habitat Restoration Plans (HRPs). Secondary species that are present in the project area, but are not "covered" by this biological assessment and are not "targeted" for management through this initiative, include the state-listed endangered Oklahoma cave crayfish (*Cambaraus tartarus*) and longnose darter (*Percina nasuta*). Two federal candidate species including the Neosho mucket mussel (*Lampsillis rafinesquana*) and the Arkansas darter (*Etheostoma cragini*) are also found within the project area.

The purpose of this joint PBA/PBO is to expedite consultations on proposed HFRP activities. This consultation document has been prepared pursuant to Section 7 of the Endangered Species Act (ESA) of 1973 (the Act), as amended (16 United States Code [U.S.C.] 1531 *et seq.*) and 50 Code of Federal Regulations [CFR] §402 of our interagency regulations governing section 7 of the ESA.

Section 7(a)(2) of the Act requires federal agencies to consult with the Service to ensure that any action authorized, funded, or carried out is not likely to jeopardize the continued existence of any federally-listed species nor destroy or adversely modify critical habitat. The Service and the federal agency or its designated representative are to implement Section 7 of the Act by consulting or conferring on any federal action that may affect federally-listed or proposed threatened and endangered species and/or designated or proposed critical habitat.

This PBA/PBO is based on the best available scientific and commercial data including electronic mail and telephone correspondence between NRCS and Service staffs, Service files, websites, pertinent scientific literature, discussions with recognized species authorities, and other scientific sources. A complete administrative record of this consultation is on file in the Oklahoma Ecological Services Field Office in Tulsa, Oklahoma.

This PBA/PBO concerns all HFRP activities including easements, landowner cost-share agreements, Habitat Restoration Plans (HRP), landowner protections, and conservation practices/measures used to implement HFRP in the eligible program area including Delaware, Cherokee, Adair and portions of Ottawa and Sequoyah counties in northeastern Oklahoma (Figure #1). HRPs that are consistent with the PBO terms and conditions may be appended to this PBO only as the Service deems appropriate. In addition, NRCS is responsible for making sure that individual HRPs comply with this PBO and that "take" is not exceeded.

CONSULTATION HISTORY

December 3, 2003 – 108th Congress passed H.R. 1904, the Healthy Forests Restoration Act of 2003 (Public Law 108–148). Title V of the Act designates a Healthy Forests Reserve Program (HFRP) with objectives to 1) promote the recovery of threatened and endangered species, 2) improve biodiversity, and 3) enhance carbon sequestration.
October 1, 2005 – Congress allocates $2.5 million to NRCS to initiate a pilot HFRP.
March 3, 2006 – Three states, Arkansas, Maine and Mississippi, are selected and notified to receive funding. NRCS and Service discuss consultation requirements, Safe Harbor-like assurances, and implementation of the program at a national level. NRCS drafts implementation rules.
May 17, 2006- NRCS published interim final rule for HFRP.
May 2007 – All three pilot states initiated HFRP planning and implementation.
May 22, 2008 –The Food, Conservation, and Energy Act of 2008 (2008 Farm Bill) re-authorized $9,750,000 in funding for each of the fiscal years 2009 through 2012.
October 20, 2008 – The NRCS national office announced that HFRP would be offered nationwide and requested all interested states to submit project proposals for funding consideration.
November 12, 2008 – Oklahoma NRCS state staff met with representatives of the Service, Oklahoma Department of Wildlife Conservation (ODWC), and Oklahoma Department of Agriculture, Food, and Forestry (ODAFF) Forestry Services to discuss the potential for implementation of HFRP in Oklahoma. The Service representatives informed the group of the potential for HFRP to compliment and expand their agency's efforts to protect federally-listed endangered bat species and threatened cavefish in the Ozark Plateau region of northeastern Oklahoma. The group agreed that conservation and restoration of oak/hickory forest ecosystems surrounding bat and cavefish caves would meet the purposes of the program and agreed to submit a proposal for funding consideration.
November 20, 2008 – Oklahoma NRCS submitted a HFRP proposal identified as the Ozark Plateau Karst-Dependent Species Conservation Initiative (OPKDS).
December 22, 2008 - Oklahoma NRCS was informed by the national office that the OPKDS proposal had been approved for funding with an initial allocation of $2,340,000.
January 20, 2009 - Oklahoma NRCS, Service, and ODAFF Forestry Services staffs met to discuss consultation and coordination procedures for implementing the program.
February 11 to 26, 2009 - Oklahoma NRCS, Service, and ODAFF Forestry Services staffs conducted two field trips of the HFRP project area and visited sites in Arkansas and Oklahoma to observe ongoing forestry management practices benefiting bats and cavefish.

February thru March, 2009 – NRCS and Service developed ranking criteria for purposes of evaluating and funding HFRP landowner applications.
March 30, 2009 – Oklahoma NRCS conducted a teleconference with NRCS and Service national office staff to discuss consultation requirements under Section 7 of the ESA. This teleconference was followed by telephone conversations with Service staff at the Tulsa ES office to finalize procedures for coordination and assign responsibilities for developing the joint PBA/PBO.
April 2, 2009 - NRCS state office staff, the Service, and ODAFF Forestry Services met with NRCS field office staffs in the project area to provide information and guidance on the program, distribute informational materials, and explain the sign-up and time frames for implementation.
April 13 to May 22, 2009 – NRCS field offices in the project area initiated the HFRP signup and accepted applications for the first ranking period. All future applications would be accepted on a continuous basis for consideration under future ranking periods.
June thru July, 2009 – NRCS state office staff, the Service, and ODAFF Forestry Services conducted field reviews and ranked all 22 applications received during the first ranking period.
April 2010 - Oklahoma NRCS was informed by the national office that the Oklahoma HFRP would receive an additional allocation of $1,000,000.
June 2010 – July 30, 2010 - NRCS field offices in the project area initiated a second HFRP signup period and accepted applications for the second ranking period.
September 2010 – The NRCS and Service complete joint PPA/PBO.

DESCRIPTION OF PROPOSED ACTION

NRCS and the Service propose to implement the HFRP and integrate specific operational and structural elements and concepts that already exist under the Service's ESA program authorities. This will be accomplished without the need to create additional bureaucratic or administrative encumbrances on interested landowners or the agencies. A description of the HFRP program is discussed below.

The NRCS will work closely with the Service to further the recovery of targeted threatened and endangered species by providing financial and technical assistance to implement forest management practices specifically designed to improve and manage forest habitats and protect important caves on lands enrolled in the HFRP under cost-share programs, long-term contracts or easements. NRCS will also offer HFRP program participants the opportunity to obtain safe harbor or similar assurances and protections under Section 7(b)(4) or Section 10(a)(1) of the Act, 16 U.S.C. 1536(b)(4), 1539(a)(1). In addition, technical support associated with forest management practices may be provided by the U.S. Forest Service (Forest Service) and Oklahoma Forestry Services. Section 501 of the Act provides that the program will be carried out in coordination with the U. S. Department of the Interior Secretary and the U.S. Department of Commerce Secretary.

Program Requirements and Eligibility

Title V of the Healthy Forests Restoration Act of 2003 (Pub. L.108–148) authorizes the establishment of the HFRP (7 CFR § 625). The HFRP is a voluntary program that the U.S. Department of Agriculture Secretary will administer in coordination with the Secretaries of

Interior and Commerce. The purpose of this program is to assist landowners in restoring and enhancing forest ecosystems to:

1. Promote the recovery of threatened and endangered species.
2. Improve biodiversity.
3. Enhance carbon sequestration.

The interim final rule of May 17, 2006, and the proposed rule changes of January 14, 2009, set forth NRCS procedures for implementing HFRP in order to meet the statutory objectives of the program.

In general, lands eligible for HFRP include private forestland within the boundaries of the designated project area that have potential for restoration, enhancement, improvement, or protection measures that when implemented will increase the likelihood of recovery of a federally listed species under Section 4 of the Act. Other forestlands with the potential to improve the well being of species that are not listed as endangered or threatened under Section 4 of the Act, but are classified as one of the following are also eligible: candidate species for listing under the Act; state-listed species; or species of special concern.

The designated project area for the HFRP in Oklahoma includes all of Delaware, Cherokee, and Adair counties and portions of Ottawa and Sequoyah counties (See Figure #1). More specifically, lands within the eligible project area must support or have the ability to support habitat for the gray bat, Ozark big-eared bat, or the Ozark cavefish, or contribute significantly to the practical administration and management of lands on adjacent HFRP easement, agreement, or contract properties. Ranking criteria will be used to determine the offered tracts that make the greatest contributions to the recovery of targeted species.

The legislation establishes specific priorities for enrollment. The highest priority is to enroll land that provides the greatest conservation benefit to species listed as endangered or threatened under Section 4 of the Act, and the next priority is to enroll land that provides the greatest conservation benefit to species that are candidates for listing under Section 4 of the Act, state listed species, or special concern species. However, the Secretary of Agriculture or a designee also is required to consider the cost effectiveness of each agreement or easement and associated restoration plan to maximize the environmental benefits per dollar expended. If the land meets the basic eligibility criteria, the Secretary of Agriculture or a designee is also directed to give additional consideration to land which will improve biological diversity and increase carbon sequestration.

There are four enrollment options available for HFRP applicants: (1) 10-year cost-share agreements; (2) 30-year contracts on Indian Tribal lands; (3) 30-year easements; and (4) permanent easements. Land will be enrolled according to the approximate proportion of landowner interest shown in each enrollment method. A maximum of two million acres may be enrolled in the program nationwide, regardless of the length of enrollment. NRCS evaluated whether the HFRP could be administered by collaborating with third parties to acquire easements, in a manner similar to the Farm and Ranch Lands Protection Program, 16 U.S.C. 3838h and 3838i, and concluded that the Act does not provide authority to do so. Thus, the Department of Agriculture will hold title to HFRP easements.

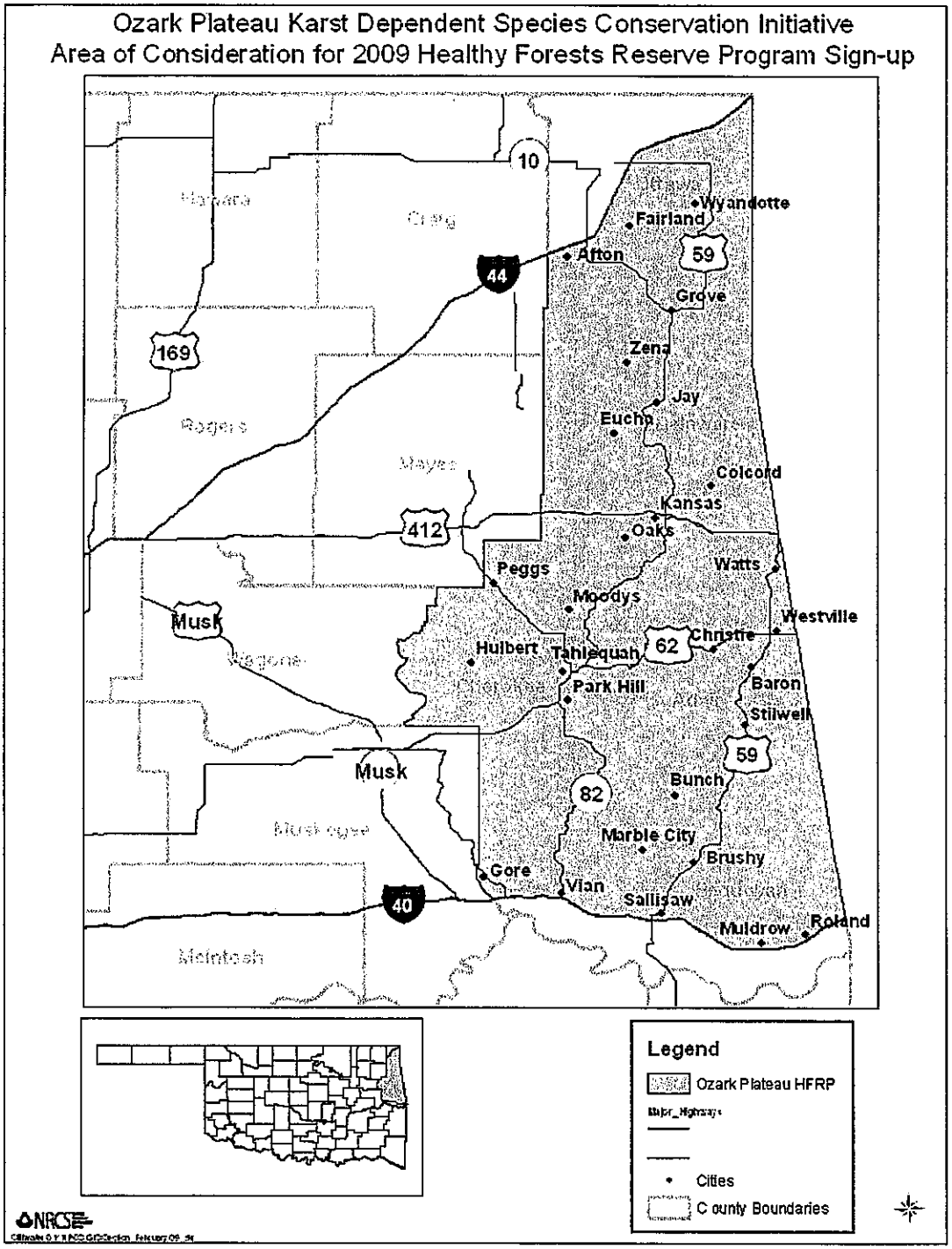

Figure 1. Area of Eligibility for the Oklahoma Healthy Forests Reserve Program.

Application Ranking Criteria

The NRCS State Conservationist is responsible for developing eligibility requirements as detailed above. In order to accomplish this task, NRCS coordinated with the Service to establish program eligibility, project area boundaries, ranking priorities, and the specific ranking criteria in order to assure maximum benefits to the targeted species. All applications will be evaluated according to the jointly developed ranking criteria as shown in Appendix 1 of this document.

Applications on lands with caves having known populations of targeted threatened and endangered species (gray bats, Ozark big-eared bats, and/or Ozark cavefish) will be given the highest priority. Priority will then be given to applications that are in close proximity of caves having known populations of targeted species. Additional consideration will also be given to sites that are presently in oak/hickory forest, sites that are in close proximity to water and aquatic habitats, and applications that benefit more than one targeted threatened and endangered species.

Program Benefits

Landowners who enroll private forestland in HFRP are eligible for Landowner Protections from the Act through a safe harbor-like agreement. These protections will allow for incidental take of threatened and endangered species back to a baseline condition that will be determined upon acceptance into the HFRP.

Landowners who enroll their private forestland in a HFRP permanent easement can receive two types of payments. One payment will be for the value of the easement and another payment will be for implementation of conservation practices (cost share payments). The payment for the permanent easement will be 100 percent of the appraised value of the enrolled land during the period the land is subject to the easement, less the fair market value of the land encumbered by the easement. The cost share payment will be for 100 percent of the average cost of approved practices/measures.

Landowners who enroll their private forestland in a HFRP 30-year easement or 30 year contract (applicable only to some Tribal lands) will receive the same kinds or types of payments as a permanent easement. However, the payment for the easement will be 75 percent of the appraised value of the land, less the fair market value of the land encumbered by the easement. The cost share payment for implementing conservation practices and measures will be 75 percent of the average cost of approved practices/measures.

Landowners who enroll private forestland in a HFRP ten year agreement will receive a 50 percent cost share payment based on the average cost of applying the approved practices/measures.

Provisions of the HFRP also allow for the following financial contributions: (1) NRCS may accept and use contributions of non-federal funds to make HFRP payments; (2) NRCS may provide additional conservation measures that are identified after the final HFRP restoration plan has been approved and signed. In this case, the landowner may also receive additional HFRP cost-share assistance to implement those measures/practices; (3) Landowners may receive

technical assistance for compliance with restoration plans that are incorporated in their HFRP agreements or easements; and (4) NRCS may use the services of certified technical service providers to develop and implement the HFRP.

Enrollment Process

Interested landowners having property within the HFRP project area can sign up for the program by visiting their local NRCS county office and filling out an application. The offered property will then be ranked based on the developed ranking criteria. Tracts of land will be selected for funding beginning with the highest ranking score and moving down the list of offers based on the availability of funds. Owners of selected tracts will then be sent a "Letter of Intent to Continue" (LIC). By signing and returning the letter, the landowner agrees to continue in the enrollment process.

Upon receipt of the signed LIC for a 30-year or permanent easement, the NRCS will order an appraisal to be completed on the tract. After completion of the appraisal, the landowner has the option to accept or decline the NRCS offer. If the offer is declined, the process ends. If the offer is accepted, the landowner, NRCS, and the Service will determine baseline conditions and prepare a HRP (See Appendix 2). The NRCS and the landowner are responsible for implementing the HRP. Certified technical service providers may be contracted to complete approved practices. A legal survey of the easement boundary will be conducted and, upon closing, a Conservation Easement Deed (Deed) will be conveyed by the landowner. The Deed identifies the permitted, prohibited, restricted and reserved activities (Appendix 3).

Upon receipt of the signed LIC for a 10-year agreement, the landowner, NRCS, and the Service will immediately begin preparation of a HRP. Once the plan has been approved, the landowner will sign the contract and implementation will begin. The NRCS and the landowner are responsible for implementing the HRP. As stated earlier, Certified technical service providers may be contracted to complete the approved practices.

Habitat Restoration Plan

A HRP, also referred to as a Forest Management Plan by the Deed (Section IV.A.), shall be developed for all land enrolled in the HFRP. The HRP is developed jointly by the Landowner and the Secretary of Agriculture or a designee in coordination with the Secretaries of Interior and Commerce or their designee(s). The HRP must include any restoration practices or measures necessary to protect, restore and enhance habitat for the targeted species. HRPs will describe the conservation measures and practices that are to be implemented and the goals and objectives during each 10-year period. Forest management is dynamic. Therefore, HRPs will be updated as necessary, but at least every 10 years for 30-year easements, 30-year contracts, and permanent easements.

Implementation of HFRP and Integration of ESA Assurances

The Service and NRCS both acknowledge the significant overlap between the legislative intent of HFRP and existing ESA incentive programs. Moreover, the Service and NRCS agree to adopt

specific operational aspects of the Service's existing Safe Harbor Policy[1] and Candidate Conservation Agreement with Assurances Policy[2] for purposes of implementing the HFRP. Furthermore, NRCS and the Service agree that various aspects of the implementation of the HFRP will need a consistent framework to work effectively and efficiently at a national scale. This framework includes the following elements: the effective mechanism to deliver the landowner protection/regulatory assurances; enrollment process; minimum information requirements of the HRP; establishing the net conservation benefit; identifying the conservation activities necessary to produce the net conservation benefit; mechanisms for accounting for incidental take events; and use of general procedures for coordination and consultation. Each of the main elements are described and explained below.

Delivery of Landowner Protections/ESA Regulatory Assurances

When conservation activities on lands enrolled in the HFRP are anticipated to result in either stabilized or increased populations of listed, candidate, or other species, the legislation provides that the landowner will receive safe harbor or similar assurances and protection under the Act. These are called "Landowner Protections" by NRCS. The Service and NRCS agree that the HRP offers the appropriate mechanism within the scope of this federal action to deliver the landowner protection provisions and to describe the conservation benefits to the target species. Landowners will be offered landowner protection provisions at the time of HFRP enrollment. However, the provisions are not automatic. Following program eligibility requirements, Landowner Protections are only provided when it has been determined that a net conservation benefit to the targeted covered species is likely to be achieved and other purposes and objectives of the HFRP are met. Furthermore, the protections are contingent upon the landowner managing the enrolled property in compliance with the agreed upon HRP.

These protections allow the landowner to alter or modify the enrolled property upon termination of the HRP, even if such alternation or modification results in the incidental take of the covered species. However, such "take" will not result in the loss of habitat or populations below the originally established baseline conditions. These protections may apply to the entire enrolled property or to portions of the enrolled property as designated or otherwise specified in the HRP.

Unforeseen events and/or changed circumstances affecting the covered species' status have the potential to change or alter the extent of Landowner Protections. If because of these unforeseen events and/or changed circumstances, additional management, restoration, or other measures are necessary to achieve the HFRP conservation objectives for the affected species, NRCS will only require such measures by the landowner when they maintain the original terms of the HRP, and are limited to modifications of the plan. Further, these additional conservation measures will not involve the commitment of additional land, water, or financial compensation, or additional restrictions on the use of land, water, or other natural resources available for development or use under the original terms of the HRP without the consent of the landowner.

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[1] The Service's Safe Harbor Policy is found and described in the June 17, 1999 *Federal Register* Notice, 64FR 32717.

2 The Service's Candidate Conservation Agreement with Assurances Policy is found and described in the June 17, 1999 *Federal Register* Notice, 64FR 32726

NRCS will work cooperatively with the Service to determine if unforeseen events and/or changed circumstances exist that would affect the status of covered species using the best scientific and commercial data available. These findings must be documented and based upon reliable technical and scientific information about the status and habitat requirements of the affected species. Considerations include, but are not limited to, the following factors:

1. Size and extent of the current range of targeted species.
2. Percentage of the species' range enrolled in HFRP.
3. Ecological significance of the range affected by the HFRP.
4. Level of knowledge about the targeted species.
5. Impact on survival and recovery of targeted species where planned practices are not implemented by landowners.

Enrollment Procedures

Each landowner interested in enrolling in HFRP and performing voluntary conservation activities that result in a net conservation benefit for the covered species and who agree to the other elements as presented herein will receive Landowner Protections. In some situations, landowners may not be willing to engage in all conservation activities necessary to produce a net conservation benefit, yet their activities still achieve other stated goals of the HFRP. In those cases, Landowner Protections will not be provided within the HRP.

NRCS staff will meet with landowners that are interested in conservation of the covered species. The HRP will then be developed from the guidelines and requirements presented herein. The landowner and NRCS must sign the HRP for it to be valid. Specific information for each individual easement/contract will be documented in the ranking evaluation form (Appendix 1). The HRP will include the incidental take authorizations, Landowner Protections, and other information as outlined in Appendix 2. Upon completion and signing of the HRP, the Service will formally append the completed HRP to this PBA/PBO (Appendix 5).

Minimum Easement/Agreement Requirements

Each valid and executed Easement/Agreement that incorporates Landowner Protections via the HRP must state that the HRP is the primary guiding document for implementation of management decisions and activities and the delivery mechanism for Landowner Protections.

Minimum HRP Requirements

Each valid and executed HRP that incorporates Landowner Protections must follow the format and template as outlined in Appendix 2.

Development of the Net Conservation Benefit Standard

The requirement of a HRP in the HFRP provides an opportunity to include a description of the agreed-upon conservation activities that will produce a net conservation benefit. Net

conservation benefits must contribute, directly or indirectly, to the recovery of the targeted covered species. This contribution toward recovery may vary and may not be permanent. The benefit to the species depends on the nature of conservation measures, the activities to be undertaken, where they are undertaken, and their duration. Although species-specific standards may be tailored for the species highlighted in implementation of the HFRP, the following conditions are generally the minimum requirement for achieving a net conservation benefit:

1. Occupied breeding, feeding, and/or foraging habitats are maintained or enhanced.
2. Suitable habitats are protected, enhanced, restored, and/or expanded.
3. Habitat connectivity increases because of habitat restoration and expansion efforts.
4. Reduction of the adverse effects from catastrophic events is likely.
5. Compatible buffers are established around or near existing prioritized populations/habitats on protected lands (e.g., wildlife management areas and publicly-owned lands managed for wildlife, etc).
6. Existing threats to the species and/or its necessary habitat components are expected to be reduced.
7. Offspring are re-introduced to previously abandoned habitats or relocated to habitats protected by longer-term conservation arrangements.
8. New populations and/or associated habitat components are created and maintained.
9. New management techniques are tested and/or developed.

In situations where the affected landowner desires Landowner Protections, NRCS will develop an appropriate level of documentation to demonstrate that one or more of the elements listed above will provide a net conservation benefit to the covered species. The level of specificity for the species and landowner will be tailored to the individual circumstance, and the finding must clearly describe the expected net conservation benefits and how NRCS reached that conclusion.

Development of Conservation Practices/Activities Necessary to Provide a Net Conservation Benefit

The Service, ODAFF Forestry Services and NRCS have worked cooperatively to identify the conservation practices necessary to provide a net conservation benefit for the targeted species. These include both intensive and passive management. The specific management activities that will be identified in the HRP and implemented by the landowner will likely vary on a case-by-case basis due to site-specific factors. These factors include, but are not limited to, the presence of covered species on the enrolled property, successional stage and condition of suitable habitat, other HFRP requirements, and the landowner's management goals and objectives. However, all HRPs will include a description of the nature, extent, timing, and other pertinent details of the conservation activities that the landowner will voluntarily undertake to provide a net conservation benefit, including a schedule for implementation of the conservation practices.

In some cases, implementation of only one of the ten conservation practices listed below may be necessary in a HRP to achieve the required net conservation benefit. In other situations, more than one conservation practice may be necessary to achieve the net conservation benefit. It is the responsibility and decision of NRCS to determine if more than one conservation practice would be necessary to meet the conservation benefit standard. Regardless of the number of practices,

the NRCS will ensure that the planned conservation practices will result in the required net conservation benefit.

HFRP Conservation Practices in Oklahoma:

Forest Stand Improvement - Forest Stand Improvement is the manipulation of species composition, stand structure, and stocking by cutting or killing selected trees and understory vegetation. This practice applies to forestland where competing vegetation hinders development and stocking of preferred overstory, midstory, understory, and herbaceous species. This practice will be used for the following purposes in the HFRP:

1. Decrease basal area of oak/hickory forest being managed as habitat for targeted species.
2. Adjust stand structure to achieve predominantly open understory necessary for flight patterns of the targeted bat species.
3. Initiate forest stand regeneration.
4. Improve forest health by reducing the potential damage from pests and moisture stress.
5. Restore natural plant communities.
6. Achieve or maintain a desired native understory plant community.

The following methods can be used to achieve forest stand improvement: (1) Hand release – selective thinning of mid-story hardwood trees with herbicide application and/or hand cutting tools to release desirable oak/hickory species and target a basal area of 50 to 60 square feet per acre. (2) Mechanical release - selective thinning of mid story hardwood trees with bulldozer, tree saw, hydraulic circular saw, or other approved heavy equipment, to release desirable oak/hickory species and achieve a target basal area of 50 to 60 square feet per acre.

The preferred tree species will be identified and retained to improve the stand for targeted wildlife species and to restore desired ecological site conditions. Spacing, density, and amounts of preferred plants will be carefully planned. Consideration will be given to the health of the total forest ecosystem.

Tree/Shrub Establishment – The Tree/Shrub Establishment conservation practice establishes native woody trees by planting bare rooted tree seedlings. This practice will be used in the HFRP to re-establish oak/hickory forests to restore or enhance or maintain suitable habitat for the target species. Site adaptation is a major consideration for success in establishing trees and shrubs. Careful consideration is also given to the suitability of selected species for the planned purposes of restoring natural diversity, storing carbon in biomass, improving wildlife habitat and overall restoration of the forest ecosystem. Application of this practice may include mechanical or manual planting methods. The following factors will be considered when implementing this practice:

1. Composition of planted species will be adapted to the site and suitable for the planned purposes.
2. Species considered locally invasive or noxious will not be used.

3. Planting rates will be adequate to accomplish the planned purposes for the site.
4. Planting techniques and timing will be appropriate for the site and soil conditions.

Tree/Shrub Site Preparation – Tree/Shrub Site Preparation is the practice of treating areas to provide optimum site conditions for establishing trees. This practice will be used to facilitate the Tree/Shrub Establishment conservation practice in HFRP. This practice applies to areas having undesirable vegetation or soil conditions that inhibit the survivability of planted trees. The purpose of the practice is to prepare the land for establishing a stand of desirable trees by controlling undesirable vegetation or altering site conditions. Application of this practice is achieved by the following methods:

1. Mechanical seedbed preparation – Treating previously non-cultivated ground with tillage (disking, plowing, etc.) to improve site conditions for establishing trees in heavy grass sod.
2. Ripping – Treating areas by ripping 18-24 inches deep to improve site conditions for establishing trees.
3. Chemical site preparation – The use of knockdown herbicide applications to control perennial herbaceous cover, such as Bermuda grass, prior to planting trees.

Prescribed Burning – Prescribed burning is the application of controlled fire on a pre-determined area of land. It will be used in the HFRP to promote the development of historic plant communities in oak/hickory forests while also reducing hardwood understory density for the targeted species. Use of prescribed burning in conjunction with Forest Stand Improvement will restore, enhance, or maintain desirable habitat. Burning should be managed with consideration for targeted species needs, particularly smoke management near cave entrances. A prescribed burn plan is required prior to the implementation of the burn. A trained and qualified individual will formulate this plan considering overall ecological restoration, smoke management, required safety equipment, special precaution areas, and techniques.

Prescribed burning is basic to the management, conservation, and recovery of the targeted species. The burning should mimic natural fire regimes as closely as possible, but it must be carefully planned and conducted to reduce the likelihood of damage to targeted species foraging habitat. Application of this practice is achieved by the following methods:

1. Level I Burn - Applying a prescribed burn according to a designed burn plan in order to maintain ecological processes on grassland or woodland sites with slopes generally less than 12 percent and where the burn can be completed in one day or less.

2. Level II Burn - Applying a prescribed burn according to a designed burn plan in order to maintain ecological processes on sites with deep canyons and slopes exceeding 12 percent, requiring extra time and labor or when more than 1 day is needed to complete the burn.

Firebreak - A firebreak is a permanent or temporary strip of bare or vegetated land planned to retard fire. This practice applies on all land uses where prescribed burning is applied. Use of this practice in the HFRP will facilitate the prescribed burning conservation practice. Firebreaks

shall consist of bare ground or fire-resistant vegetation. Firebreaks will be of sufficient width and length to contain the expected fire. They will be located and constructed in areas to minimize risk (detrimental effects) to the target species. Erosion control measures will be installed to prevent sediment from leaving the site. Plant species selected for vegetated firebreaks will be non-invasive and capable of retarding fire. Application of this practice is achieved by the following methods:

1. Normal equipment – Installing a mineral soil firebreak with 2-3 passes of normal farm machinery such as disks, plows, or similar type equipment.
2. Heavy equipment – Construction of a firebreak that requires heavy equipment such as dozers or graders due to steep, rocky, timbered site conditions that do not allow for use of normal farm equipment.

Fence – A fence is constructed as a barrier to provide access control of livestock or people from a specified area. For the purpose of HFRP, permanent fences will be used to discourage intrusion of humans and domestic livestock to forested habitats and caves managed for the targeted species. Restricting access by livestock will enhance water quality by controlling the amount of animal waste seeping into surface and ground water.

Pest Management – Pest management will be practiced by utilizing environmentally sensitive prevention, avoidance, monitoring and suppression strategies to manage invasive species, when detected. Invasive species of concern include sericea lespedeza and musk thistle. Chemical pesticide applications will be made according to Oklahoma State University recommendations. All pesticide recommendations shall be made within label instructions, rates and precautionary statements to limit environmental risks, particularly to ground and surface water quality, which can negatively affect the target species.

Structure for Water Control – The structure for water control consists of the construction of an earthen embankment along with associated appurtenances to impound shallow water and provide an aquatic insect food source for the target species. Application of this practice is achieved by the following methods:

1. Construction – Constructing an earthen embankment to impound shallow water and function as a wetland.
2. Critical area planting – Establishing permanent vegetation on the embankment and disturbed areas of a constructed structure for water control.
3. Nutrient management – Application of fertilizer to promote the establishment of vegetation on a constructed structure for water control.

Brush Management - Brush management will be used to control the invasion of eastern red cedar, through selective removal by clipping or sawing. Eastern redcedar is highly invasive and has a negative impact on the target species by reducing the overall health and vigor of the oak/hickory forest by competing for nutrients, sunlight and moisture. If left uncontrolled it can become the dominant tree species in the forest, thus reducing the food supply and altering the flight patterns of the target species.

Riparian Forest Buffer – A riparian forest buffer is an area of predominantly trees and/or shrubs located adjacent to perennial or intermittent streams, lakes, ponds, wetlands and areas associated with ground water recharge. Dominant vegetation consists of existing or planted native trees and shrubs suited to the site and retained to achieve the intended purposes of improving the riparian area for targeted species and overall ecological restoration. Grasses and forbs that re-establish under natural conditions further enhance the wildlife habitat and filtering effect of the practice. The total width of the riparian forest buffer will be 200 to 300 feet adjacent to the riparian area, not to exceed the width of the floodplain. The density of preferred plants is carefully planned and maintained to achieve the intended purposes. The riparian forest buffer is a multi-purpose practice designed to accomplish one or more of the following:

1. Create shade to lower or maintain water temperatures.
2. Improve habitat for aquatic animals.
3. Provide a source of debris necessary for healthy, robust populations of aquatic organisms and wildlife.
4. Act as a buffer to filter out sediment, organic material, nutrients, pesticides and other pollutants that may adversely affect the water body, including shallow ground water.
5. Provide protection against scour erosion within the floodplain.
6. Restore natural riparian plant communities.
7. Increase carbon storage in plant biomass and soils.

Baseline Concepts and Considerations

The purpose of determining baseline conditions is to ensure that the status of covered species on enrolled lands is no worse after HFRP participation than before enrollment. The most important feature of the baseline concept is that it will be determined by the existing ESA responsibilities present within the eligible enrolled lands. Baseline conditions can be zero (no current ESA responsibilities as illustrated by no occupied habitat or species present throughout the identified property). Baseline conditions may be described in terms related to population size, such as number of bat colonies or a specific number of individuals. However, in many cases, baseline conditions are best described using measurements of available suitable habitat and habitat conditions rather than numbers of individuals present. No matter whether population or habitat-based methods are used to determine baseline, there should be a description of the existing habitat type, representative species present and number (where known), water and wetland resources, condition of the habitat, and any other information necessary to describe the baseline conditions.

Determining Baseline Conditions

The NRCS will work cooperatively with landowners and seek assistance from the Service as appropriate to determine baseline conditions. If NRCS, the Service, or their respective agents do not directly take part in surveys to determine the baseline conditions, review and concurrence with the baseline determination is mandatory.

As stated above, there are generally two approaches to establishing baseline conditions. One method is based on population studies and the other method is based on habitat criteria. The

rationale for selecting a habitat approach to establish baseline conditions for the OPKDS HFRP project is presented below.

The primary purpose of the HFRP in the OPKDS project area is to improve the forest ecosystem for the benefit of the Ozark big-eared and gray bat and the Ozark cavefish. Upland and riparian forests are important habitat components for each species. Maintaining high quality water in caves occupied by the Ozark cavefish is identified as an important recovery need. Restoring, enhancing and or maintaining healthy upland forests and wooded riparian zones along water bodies that occur within the recharge area of caves used by the Ozark cavefish would help protect and improve surface and ground water quality. Gray bats prefer to feed on aquatic insects along streams and over water bodies and wetlands within and adjacent to forestlands. Gray bats also utilize forested areas as protective flight corridors between caves and foraging areas. Therefore, upland forest and wooded riparian zones also are important habitat for gray bats. Ozark big-eared bats forage in edge, riparian, and forested habitat primarily on woodland species of moths. Forested areas not only are utilized as foraging habitat, but also are important in the production of their preferred prey.

Management plans and practices will be designed to improve foraging habitat for the gray and Ozark big-eared bats on properties enrolled in the program. Plans also will serve to maintain or improve surface and groundwater quality for the gray bat and Ozark cavefish, and protect important cave sites used by both bats and cavefish from human entry and disturbance. However, not all important foraging habitat, cave habitat or land that occurs within a cave's recharge area will be enrolled. Ozark big-eared and gray bats forage up to 7.3 km (about 4.5 miles) and 20 km (about 12 miles) from caves, respectively. The recharge area of caves (*i.e.,* the area that contributes water to a cave) used by the Ozark cavefish can be extensive (*e.g.,* 20 square miles). Actions on other properties over which the HFRP participant have no control that impact water quality or cave or foraging habitat used by these species could affect overall population size. Therefore, colony, population size, and water quality will not be utilized to establish baseline conditions.

Landowners have more control over maintaining habitat conditions and protecting cave sites on their property than they do over maintaining a population. Habitat conditions can be specifically measured, documented, and replicated in order to determine the status of habitat on enrolled lands over the life of the HFRP agreement. With these considerations in mind, NRCS and the Service agree that a baseline condition, which measures specific habitat parameters at cave sites and surrounding forestland, is the best approach to use for this HFRP project.

Specific Measurement Parameters

HFRP landowner agreements, plans, and responsibilities will be based on protecting cave sites from human disturbance and on implementing and maintaining specific habitat management practices. Protection of caves from human disturbance and destruction are identified as the most important recovery need for all three targeted species. The relative extent of human activity and disturbance at cave sites that occur on enrolled properties can be recorded for pre and post enrollment conditions. Consequently, an inventory of all caves on property enrolled in HFRP will be made to determine the relative extent of human use, damage, and disturbance occurring

on the site at the time of enrollment. This record will serve as the baseline indicator of human disturbance at cave sites for all three targeted species.

The NRCS and the Service agree that the objective of restoration and enhancement plans should be to restore habitat on enrolled properties to conditions believed to have existed prior to European settlement, fire suppression, and other anthropogenic stressors. The earliest descriptions of the Ozark regions of Oklahoma noted the presence of grass-covered savannahs and open woodlands with an abundant understory of grasses, wildflowers, and other herbaceous plants. However, loss of the natural fire regime has resulted in overcrowded forest conditions.

Implementing management practices that would promote a more open, and regenerating, mature forest condition (*e.g.*, basal area of 50-60) is anticipated to provide an enhanced foraging environment and abundant food source for the Ozark big-eared bat, and protect important flight corridors for gray bats. Enhanced and restored forested riparian zones also will serve to protect surface and ground water quality and provide important foraging habitat. The practices that will address these needs are complimentary with the HFRP goal of improving the overall health of the forest ecosystem.

There are several recognized methods of evaluating specific forest site conditions and habitat variables. These measurements can be easily replicated and should provide a reliable method of determining conditions before and after application of management plans and practices. The specific parameters to be evaluated on an individual property will be determined by mutual agreement between the NRCS and the Service, and described in each habitat restoration plan. Criteria used to compare present upland forest site conditions with the preferred conditions and serve as the measurement of baseline conditions would include the following: (1) Basal area; (2) Tree species composition; (3) Stems per acre; (4) Tree canopy cover; and (5) Diameter at Breast Height (DBH). The baseline for aquatic habitat will be evaluated using the Stream Visual Assessment Protocol (USDA, 1998). The baseline for riparian forest buffer will be based on criteria contained in the NRCS standard and specification for Riparian Forest Buffer (USDA, 1997).

Maintaining Baseline Conditions

Landowners that have an existing baseline responsibility above zero, (*e.g.*, desired habitat conditions already exist), must agree to maintain that baseline using necessary conservation practices. NRCS and the affected landowner will agree on the required conservation practices that must be implemented in order to ensure that baseline conditions are maintained on each enrolled property. The required conservation practices and a description of how management practices will be implemented on the enrolled property (e.g., schedule of implementation) will be described in the HRP.

Adjusting Baselines Downward

In spite of management and protection efforts, there may be circumstances, through no fault of the landowner, where existing individuals or populations and/or occupied habitats of targeted

species are reduced or cease to exist. Should this situation occur, the enrolled landowner would not be held accountable for the loss subject to the following provisions:

1. The landowner allows NRCS and the Service access to the enrolled property to conduct an investigation of the circumstances and evaluate the loss (Permission for access will be specifically included in the HRP).
2. The loss of the baseline occurred through no fault of the landowner and in spite of total compliance with the HRP.

If the provisions described above are met, the landowner must make a written request for a reduction in the baseline conditions. The HRP will then be revised to reflect the change in baseline conditions.

Conveyance of Incidental Take Authorizations

After lands are enrolled in the HFRP and HRP plans are developed, NRCS will provide copies of the documents to the Service. Acceptance of the signed HFRP easement/agreement and HRP signifies that the PBA/PBO has been appended and conveyance of incidental take authorization is provided.

The NRCS and the Service acknowledge that any "take" (as defined by the ESA) of the covered species be in accordance with the implementation of the net conservation benefit standards identified in this assessment or at the time which the landowner may exercise their rights to return to the original baseline conditions after the HFRP agreement has expired. In either case, "take" of the covered species will be considered incidental and not the purpose of carrying out an otherwise lawful activity. It is important to note that such taking may or may not ever occur. It is also imperative to emphasize that it is unlikely that the covered species would utilize the habitat involved if not for the voluntary management activities of the participating landowners. These voluntary management activities undertaken through the HFRP will likely increase the number and distribution of the species and increase the amount and quality of habitat managed for the species.

<u>Specific Requirements for Incidental Take Authorizations</u>

An enrolled landowner will be allowed to make any lawful use of his/her property, even if such use results in the incidental take of the covered species provided all of the following qualifications are met:

1. Enrollee must be in total compliance with the HRP, including maintaining baseline responsibilities as specified in the HRP.
2. Covered species may not be shot, captured, or otherwise directly taken as defined by the Act.
3. The "take" is incidental to otherwise lawful activities.
4. The "take" does not occur during species-specific sensitive periods as outlined in detail in the HRP.
5. When incidental take occurs, it is immediately reported to NRCS and the Service.

6. Landowners will notify NRCS and the Service prior to initiating any activity that may result in "take" of a targeted species.

Monitoring and Reporting Responsibilities

NRCS will annually monitor the effects of HFRP implementation and the use of Landowner Protections. To do this, NRCS and/or its authorized agents will contact each landowner at intervals appropriate for a particular HRP for purposes of evaluating and assessing implementation and maintenance of specified management practices and identifying any modifications that may be necessary. In addition, at least 33 percent of all enrolled properties, including all enrolled properties where incidental take was proposed or occurred during the current or previous year, will be visited each year.

NRCS will submit an annual report to the Service no later than December 31 of each calendar year detailing the use of ESA regulatory assurances under HFRP. This report will include accurate records of the following:

1. Number of acres enrolled.
2. Number of landowners enrolled.
3. Summary of any incidental take that has or is expected to occur on enrolled lands.
4. List of all HRPs that have been terminated.
5. List of all conservation practices implemented on each HFRP landowner including area of implementation and date implemented.

Addressing Other Species

There is the possibility that other listed, proposed, candidate species, or species of concern may occur in the future on properties enrolled under the HFRP as a direct result of implementing the planned conservation practices. In such cases, the NRCS and the landowner may request an amendment to the HRP and this PBA/PBO that would establish implementation provisions similar to those described for the originally covered species. However, without such amendments, the incidental take of any other federally-listed species not covered by this PBA/PBO is not authorized.

Emergency Salvage Harvest Situations

Emergencies, such as natural disasters or insect infestations, may require actions such as salvage harvesting of timber on HFRP properties. If situations warrant such actions, the landowner will notify NRCS who will then notify the Service. The landowner will not initiate an emergency action until after receiving notification from NRCS that the action has been approved by both agencies.

Access to Enrolled Lands

NRCS will ensure that the HRP provides the opportunity for NRCS and the Service or their designated agents to access the land enrolled in HFRP with Landowner Protections at least annually to verify compliance with the agreed-upon conditions and expectations; to assess the

baseline condition of targeted species; and to provide other technical assistance, as appropriate. The NRCS will provide the landowner reasonable notice of these scheduled visits and invite participation by the landowner or their agent. The right of access for such purposes is described more specifically under terms of the Conservation Easement.

DESCRIPTION OF THE ACTION AREA

Physical Characteristics

The project area falls within Bailey's Oak-Hickory Forest Ecoregion and includes two major geographic areas commonly referred to as the Ozark Highlands and the Boston Mountains. The majority of the project area is located within the Ozark Highlands, which is a level to highly dissected plateau that has slowly eroded and uplifted throughout geologic history. This has resulted in distinctly varied topography ranging from rugged Precambrian igneous knobs to low rolling mountains, composed of narrow ridgetops and intervening, incised valleys with prominent bluffs. Carbonate rocks, along with associated karst features, such as sinkholes and caves, are common. The area is predominantly underlain with flat-lying, cherty limestone of the Mississippian Boone Formation, but older shales, limestone, and dolomite are also exposed in valley bottoms. The surface generally slopes to the west, southwest, and south. In general, the valleys have been cut 200 to 300 feet below the general level. Springs abound in valleys and contribute to clear, cool perennial streams, however much of the drainage is underground, feeding a number of springs and caves. Small, dry valleys also commonly occur throughout the area.

The Boston Mountains geographic area is located along the southern edge of the project area. This ecoregion is a deeply dissected, mountainous plateau, which is largely underlain by Pennsylvanian-age sandstone and shale. The landscape lacks the complexly folded, well-defined ridges of the nearby Ouachita Mountains. A series of northeastward trending faults separates the area into prominent fault blocks, with steep escarpment faces and gentle dip slopes, capped by the resistant sandstones of the Atoka geological formation. Relief in the Boston Mountains is greater than the Ozark Highlands where valleys 300 to 500 feet deep are common. Tilting of fault blocks gives a stair-step effect, resulting in long, high, narrow ridges capped by gently dipping strata. Stream dissection has cut deep valleys through the ridges, whereas major drainage lines are developed in the softer shales and limestone valleys paralleling the faulting.

Soils

Most of the soils within the action area are Alfisols or Ultisols. They formed in material weathered from cherty limestone. Physical and chemical weathering has caused the cherty limestone to disintegrate into its least soluble components, which are chert and clay. The chert remains in the form of angular fragments or wavy horizon beds interstratified with layers of clay. Down slope movement by gravitational creep and overland water flow has altered the cherty material in the upper part of some soils. In general, the soils are shallow to very deep, moderately well drained to excessively drained, and medium textured to fine textured. The soil

temperature regime is mesic bordering on thermic, the soil moisture regime is udic, and mineralogy is mixed or siliceous.

Many of the soils on nearly level to moderately sloping upland divides are Fragiudults (Captina, and Tonti series). Many of the soils on moderately sloping to steep side slopes in the uplands are Paleudults (Clarksville series). Many of the soils on terraces and the adjacent flood plains are Hapludalfs (Razort and Waben series) and Paleudalfs (Britwater series).

Climate

Northeastern Oklahoma is in a belt of warm, humid, subtropical to continental-type climate. Mild weather prevails during the autumn and spring months. Clear skies and dry atmosphere prevail during the summer months with hot days and relatively cool nights. Winters are generally mild, with spells of cold alternating with periods of mild weather.

Temperatures within the action area average near 59 degrees, with a slight increase from north to south. Temperatures range from an average daytime high of 91 degrees in July and August to an average low of 26 degrees in January. The first killing frost in the area occurs in late October, and the last killing frost in the spring can occur mid to late April. The average annual growing season is about 200 days.

Precipitation within the action area is moderate. Average annual precipitation ranges from 42 inches to 54 inches. Most of the rainfall occurs during the warmer months. May and June are the rainiest months, on average, whereas February is usually the driest month. Snow is usually light and remains on the ground for only a few days at a time. Nearly every winter has at least one inch of snow, with one year in two having ten or more inches.

Winds from the south to southeast are dominant, averaging just over six miles-per-hour. Relative humidity, on average, ranges from 42 percent to 95 percent during the day. During the year, humidity is highest in May through July and lowest in April. Winter months tend to be cloudier than summer months. The percentage of possible sunshine ranges from an average of about 50 percent in winter to nearly 75 percent in summer.

Plant Communities

Prior to the 19th century, uplands were dominated by open stands of mature oak–hickory forest. Savannas consisting of scattered trees and tall grass prairies were also common throughout the project area. The open forest conditions and savannahs were maintained by periodic wild fires that resulted naturally from lightening strikes or were intentionally set by indigenous native tribes. Through decades of fire suppression, the forest stands are now much denser with a closed canopy and a greatly reduced herbaceous understory. Areas once dominated by savannahs have also evolved into dense stands of oak and hickory forest with shaded conditions that no longer support extensive areas of native grasses.

Tree species found on upper drier ridges, include post oak (*Quercus stellata*), blackjack oak (*Quercus marilandica*), and black hickory (*Carya texana*). Shallow eroded soils consist

primarily of post oak and blackjack oak. In the more fertile valleys, burr oak (*Quercus macrocarpa*), white oak (Quercus alba), yellow oak (Quercus muehlenbergii), bitternut hickory (*Carya cordiformis*), and pecan (*Carya illinoensis*) are most common. Black oak (*Quercus velutina*) and mockernut hickory (*Carya tomentosa*) occur on moderately deep soils with intermediate moisture conditions. Riparian zones, swales and wetlands support species such as water oak (*Quercus nigra*), sycamore (*Platanus occidentalis),* sweetgum (*Liquidambar styraciflua*), American elm (*Ulmus Americana*), red elm (Ulmus rubra), and green ash (*Fraxinus pennsylanica*). Persimmon (*Diospyros virginiana*) and sassafras (*Sasssafras albidum*) are found in the open areas where competition for sunlight and space is less intense. On steep north or northeast facing slopes, sugar maple (*Acer saccharum*), white oak (*Quercus alba*), and Shumard oak (*Quercus shumardii*) are common with a scattered occurrence of shagbark hickory (*Carya ovata*). Eastern redcedar (*Juniperus virginiana*), a highly invasive species is rapidly increasing over the entire project area as the result of continued fire suppression. Large areas of forestland throughout the project area have been cleared and planted with bermuda grass (*Cynodon dactylon*) and tall fescue (*Festuca arundinacea*) for pasture and hay production.

Ownership Patterns and Current Land Use

The scenic forested areas of the Ozarks and Boston Mountains in northeastern Oklahoma where the project area is located has recently become one of the most attractive locations for retirees in the region. Four of the counties located within the HFRP project area rank in the top 20 counties in the state, in terms of population growth, since the 2000 census. Increased development pressures, especially for rural homesites and acreages, are causing forest fragmentation and increasing the likelihood of human disturbance. Additionally, the project area is near western Arkansas, which is one of the fastest growing areas in the nation and the related development is moving into eastern Oklahoma.

Based on information compiled by the National Agricultural Statistics Service, using 2008 satellite imagery, the major land uses within the Ozark Plateau ecoregion, where the majority of the project is located, are as follows: 50 percent deciduous oak/hickory forest, 38 percent pasture and hay land, 6 percent development and housing, 4 percent open water in lakes and reservoirs, and 1 percent in crop production. The majority of forestland, pasture/hay land, and cropland in the project area is privately owned by individuals or by tribes. These lands are primarily used for livestock production, small-scale private forestry activities, and recreational activities such as fishing and hunting. The project area includes a large number of confined animal feeding operations that are principally devoted to poultry production. A large percentage of the area is forestland, yet there is very little commercial pine production and no large industrial forest owners are active in the project area.

Federal lands include about 54,000 acres of lakes and reservoirs managed by the Army Corps of Engineers (COE). Much of the rapidly increasing development and population growth related to retirement communities and recreational activities is associated with these COE reservoirs and other large lakes owned and operated by the Grand River Dam Authority and the City of Tulsa. The area contains 49,557 acres in six Wildlife Management Areas administered by the Oklahoma Department of Wildlife Conservation (ODWC). Additionally, there are 3,897 acres in Oklahoma State Parks and the Service's Ozark Plateau National Wildlife Refuge (OPNWR) presently

contains 4,200 acres with plans to expand ownership to approximately 15,000 acres. It should be pointed out that the objectives of this HFRP project are similar to those of OPNWR and will compliment the Service's efforts to acquire, manage, and protect additional lands for the protection of caves, cave dependent species, and surrounding forested habitat.

STATUS OF THE SPECIES/CRITICAL HABITAT

This section summarizes the biology and ecology as well as information regarding the status and trends of the Ozark big-eared bat, gray bat, Ozark cavefish, and the American burying beetle throughout their entire range. The Service uses this information to assess whether a federal action is likely to jeopardize the continued existence of the aforementioned species. The "Environmental Baseline" section summarizes information on status and trends of these species specifically within the action area. This summary provides the foundation for the Service's assessment of the effects of the proposed action, as presented in the "Effects of the Action" section.

Ozark Big-Eared Bat

Species and Critical Habitat Description

The Ozark big-eared bat was federally-listed as endangered on November 30, 1979 (44 FR 69208). Critical habitat has not been designated. The final recovery plan was signed on March 28, 1995 (USFWS, 1995). A five-year review on the current status of the Ozark big-eared bat was completed by the Service on May 22, 2008, wherein the Service determined that the existing listing classification of endangered remains valid (USFWS, 2008).

The Ozark big-eared bat belongs to the plain-nosed bat family, Vespertilionidae. The vesper bats are the second largest mammalian family after the Muridae (Old World rats and mice). The genus name of the Ozark big-eared bat at the time of listing was *Plecotus* based on the revised taxonomy of North American bats by Handley (1959). Handley determined that the three species of North American big-eared bats did not differ enough morphologically from the European species of the genus *Plecotus* to warrant unique generic status. The bats were considered members of the genus *Plecotus* and subgenus *Corynorhinus*. *Corynorhinus* was subsequently elevated from subgenera to full generic status and *Plecotus* was limited to species of the Palearctic as a result of additional studies based on morphology, karyotype, and mitochondrial DNA (Bogdanowicz et al., 1998; Fedyk and Ruprect, 1983; Qumsiyeh and Bickmham, 1993; Stock, 1983; Tumlison and Douglas, 1992; Volleth and Heller, 1994). A recent study on the phylogeny of North American big-eared bats using mitochondrial and nuclear DNA sequences confirmed the designation of three *Corynorhinus* species and corroborates the subspecies classification *Corynorhinus townsendii ingens* (Piaggio and Perkins, 2005).

The Ozark big-eared bat is medium-sized with distinctively large ears (30 – 39 mm; 1.2 – 1.5-inches long) that connect at the base across the forehead. The tragus (*i.e.*, fleshy prominence in front of the external ear opening) is long (11 – 17mm; 0.43 – 0.67 inches) and pointed. Prominent lumps occur on either side of the face (Kunz and Martin, 1982). The long fur is light

to dark brown on the back and paler tan underneath due to the brown base and tan to buff tip of the ventral hairs (Barbour and Davis, 1969; Kunz and Martin, 1982; Tumlison, 1995). The Ozark big-eared bat is the largest and reddest of the five subspecies of *C. townsendii*. The bat has a wingspan of 305 - 330 mm (12 - 13 inches), a forearm length of 39 - 48 mm (1.5 - 1.9 inches), and weighs from 5 - 13 grams (0.2 - 0.5 ounces) (Kunz and Martin, 1982). The toe hairs do not extend beyond the claws.

Life History

The Ozark big-eared bat is an insectivorous bat that uses caves year-round. Colonies typically begin to form at hibernacula in October and November (Clark et al., 1996 and 2002). Both sexes hibernate together in clusters that typically range from 2 -135 individuals (Clark et al., 1993, 1997 and 2002). Ozark big-eared bats also will hibernate singly (Clark et al., 1996, 1997, and 2002) and in larger groups that have consisted of up to about 400 individuals.

Ozark big-eared bats mate during fall and winter. Females become reproductively active during their first fall (Kunz and Martin, 1982; U. S. Fish and Wildlife Service, 1995), while young males do not reach sexual maturity until their second fall (Kunz and Martin, 1982). Females store sperm in their reproductive tract during the winter hibernation period.

The Ozark big-eared bat is known to exhibit winter activity (Kunz and Martin, 1982; Clark et al., 2002). Insect activity typically is very low during cold nights. Winter activity, therefore, may not be for foraging. Activity likely occurs in order to relocate within the same hibernaculum or among hibernacula to find a more thermally stable location when temperatures at the initial location become too extreme (Kunz and Martin, 1982; Harvey and Barkely, 1990). Ozark big-eared bats also may be seeking open water to drink (Avery, 1985; Clark et al., 2002; Speakman and Racey, 1989).

Hibernating colonies gradually begin to break up in spring from April through May (Clark et al., 2002). Females also become pregnant during this time (Kunz and Martin, 1982) and slowly begin to congregate at warm maternity caves to give birth and rear their young over the summer (Clark et al., 1993, 1996, and 2002). Distances between hibernacula and summer caves are known to range from 6.5 to 65 km (4 to 40 miles). The exact timing of the formation of maternity colonies varies between years, but usually occurs between late April and early June (Clark et al., 2002; U. S. Fish and Wildlife Service, 1995). Like other temperate bats, the species exhibits strong roost fidelity, returning to the same maternity sites and hibernacula year after year (Kunz and Martin, 1982; Clark et al., 1996; Weyandt et al., 2005).

Ozark big-eared bats give birth to a single offspring in May or June after a two-three month gestation period (Kunz and Martin, 1982; Clark et al., 2002). Young bats grow quite rapidly and are capable of flight at three weeks and are weaned by six weeks (Kunz and Martin, 1982).

Maternity colonies begin to break up in August (Kunz and Martin, 1982; Clark et al., 1996; Wethington et al., 1996). Males are solitary during the summer maternity period (Kunz and Martin, 1982; Harvey and Barkley, 1990; Clark et al., 1993). Little else is known about their summer habitats (U. S. Fish and Wildlife Service, 1995).

Ozark big-eared bats typically emerge from their caves to forage shortly after sunset (Clark et al., 1993 and 2002). They primarily feed on moths, but also are known to eat beetles and other flying insects (USFWS, 1995; Leslie and Clark, 2002; Dodd, 2006).

Forested habitats are an important source of food for the Ozark big-eared bat. A recent study on the diet of the Ozark big-eared bat and prey abundance in Arkansas found that the bats prey on a wide diversity of moth species, and that most of the species are dependent upon woody forest plants as a host (Dodd, 2006). The study also found a positive correlation between woody species richness and moth occurrence. Conservation of the Ozark big-eared bat, therefore, requires not only protection of important caves but also forested habitat that supports abundant and diverse moth populations (Leslie and Clark, 2002; Dodd, 2006; Dodd and Lacki, 2007). Conservation practices that encourage a diversity of woody forest plant species (*e.g.*, prescribed fire, selective thinning) to provide a rich prey base of moths should benefit Ozark big-eared bat colonies.

Females forage relatively close to the maternity cave (about 1.0 – 2.0 km; 0.6 – 1.2 miles) during the early and middle portions of the maternity season. Female bats likely forage only short distances from the cave in order to return several times during the night to take care of flightless young. As the season progresses, average distance to foraging sites (up to about 7.3 km; 4.5 miles) increases (Clark et al., 1993; Harvey, 1992). Foraging farther distances from the cave later in the summer may reduce competition with newly volant young that have begun to forage.

The Ozark big-eared bat has been shown to selectively forage in both edge and forested habitats and also to use habitats in proportion to their availability. A radio telemetry study of the foraging activity of females during the maternity season, for example, found that females used edge habitats more than expected (Clark et al., 1993). Another study, however, found that males selected forested areas during late summer (*i.e.,* September) while females failed to show preference for foraging habitat (Wethington et al., 1996).

Based on wing-loading characteristics (*i.e.,* the ratio of weight to wing area), the Ozark big-eared bat is considered a highly maneuverable flier. Ozark big-eared bats are well adapted to forage in either a cluttered environment such as the interior of a forest or a relatively more open area, such as edge habitats (Farney and Fleharty, 1969; Leslie and Clark, 2002; Clark et al., 2003; Wethington et al., 1996). The Ozark big-eared bat, therefore, is not as restricted in its selection of foraging habitats as other less maneuverable species. Selection of foraging habitat by this subspecies may change seasonally and likely is due to both foraging efficiency and the availability of prey (Clark et al., 1993; Dodd, 2006; Wethington et al., 1996). Edge habitat may be selected at times of high moth abundance because it is relatively less costly to forage there as compared to the more cluttered forest interior and woodland moths are abundant enough that the probability of encounter is high. However, during times of reduced moth abundance, Ozark big-eared bats may move into the forest interior to forage where the occurrence of their preferred prey is relatively higher (Dodd, 2006).

A recent genetics study provides further insight into the need to protect each maternity colony. Weyandt et al. (2005) examined population genetic variability and found that maternally

inherited markers differed among sites, indicating very strong site fidelity and limited dispersal by females and high natal philopatry. Due to the natural tendency for limited dispersal by female Ozark big-eared bats and the apparent corresponding lack of connectivity among colonies, caves that experience a local extinction are unlikely to be naturally re-colonized. These results suggest that failure to protect a maternity site may result in the loss of genetic variation.

Disease and predation were not considered major factors for the endangered status of the Ozark big-eared bat. There was little information available on disease. Likely predators of the Ozark big-eared bat include wildlife known to prey on other bat species such as snakes, owls, raccoons, bobcats, and feral house cats. Predation currently is not considered a significant threat.

White-nose syndrome (WNS), however, is a new bat malady first observed in four caves in New York during the winter of 2006-2007 that potentially could affect the Ozark big-eared bat in the near future. The fungus *Geomyces destructans* is believed to be the causative agent of WNS, which frequently results in the deaths of infected hibernating bats. The fungus thrives in the cold and humid conditions characteristic of caves, and affected bats have the fungus growing around their nose or other bare surfaces including the wings.

WNS currently is known from 11 States in the northeastern and eastern United States and two Canadian Provinces. Experts estimate that over 1,000,000 bats have died due to WNS during the past 4 years. The primary mode of disease transmission is believed to be bat-to-bat contact. Research is ongoing to determine whether all bats that come into contact with the fungus will develop the disease.

Although mortality attributable to WNS has not occurred within Oklahoma, the fungus associated with WNS recently was documented on a single cave myotis *Myotis velifer* collected alive from a cave on May 3, 2010, in northwestern Oklahoma. The fungus also was found on gray bats in Missouri during the spring of 2010, a species that co-occurs in caves with the Ozark big-eared bat. Should WNS move into the range of the Ozark big-eared bat (and should Ozark big-eared bats prove to be susceptible to the disease), the potential impact would be severe due to the high mortality rate of affected bats in the northeastern and eastern United States, and the small population size and limited distribution of the Ozark big-eared bat.

Maximum life span is estimated to be about 16 years based on recovery of banded bats (Paradiso and Greenhall, 1967; Harvey, 1992).

Population Dynamics

Ozark big-eared bat populations at essential hibernacula and maternity sites have been monitored using minimal census techniques since each essential site was discovered to obtain estimates on colony size and population trends (Puckette, 2008; Harvey et al., 2006). Monitoring data reveal a disparity between summer and winter population estimates. Numbers of Ozark big-eared bats estimated from summer maternity counts are larger than those found during winter hibernacula counts. For example, for the last year in which a representative count of both Ozark big-eared bat hibernacula and maternity sites occurred (2003), 701 bats were counted at hibernacula while maternity counts resulted in an estimate of about 1,600 bats. This indicates there likely are major

hibernacula that have not yet been located. Population estimates and trends are therefore based on maternity colony counts.

The Service recently completed a 5-year review for the Ozark big-eared bat (USFWS, 2008). Five-year reviews are assessments of the best scientific and commercial data currently available for a listed species, and are used to determine whether or not a change in the federal classification of a species is warranted. The 5-year document examined abundance and population trends for data collected through the 2006 maternity season. The document contains the most recent summary of information pertaining to population size, variability, and stability. Therefore, information from that analysis is summarized here. Data collected from the 2008 maternity colony surveys also are utilized here for estimates of current population size (Although the 2009 data are available, the 2008 estimates are used to estimate population size and trends because counts were not conducted at all maternity caves during the 2009 maternity season.).

At the time of listing, the Ozark big-eared bat was known from only a few caves in northwestern Arkansas, southwestern Missouri, and northeastern Oklahoma. The entire population was estimated to consist of about 100-200 individuals (Figure 2). Since listing, additional caves used by maternity colonies in the summer and as hibernacula have been discovered in Oklahoma and Arkansas. The population is estimated to currently consist of about 1,800 individual bats (Figure 2 and 3) with about 400 in Arkansas (Figure 4) and 1,400 in Oklahoma (Figure 5).

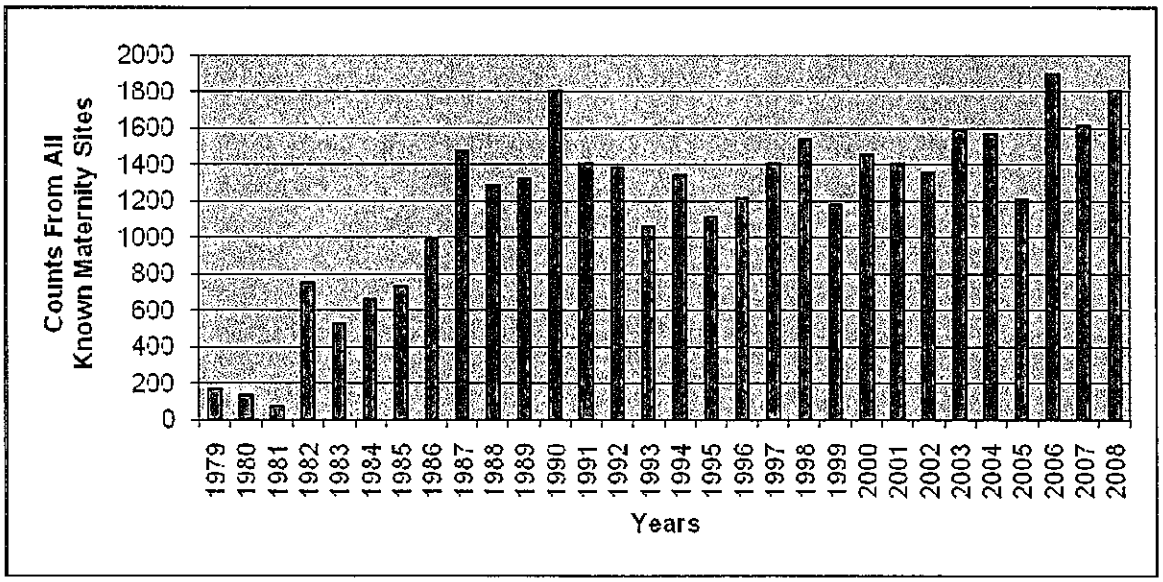

Figure 2. Population estimates of the Ozark big-eared bat by year since listing as endangered in 1979.

Census counts indicate that the overall population has experienced a slightly increasing trend since 1997 (Figure 3), when the last discovered essential maternity site from which we have several years of population data (a maternity cave in Arkansas) was added to the annual counts. The overall population estimate has averaged about 1,500 bats between 1997 and 2008. An increasing population trend is observed over this time period when the data from Arkansas is

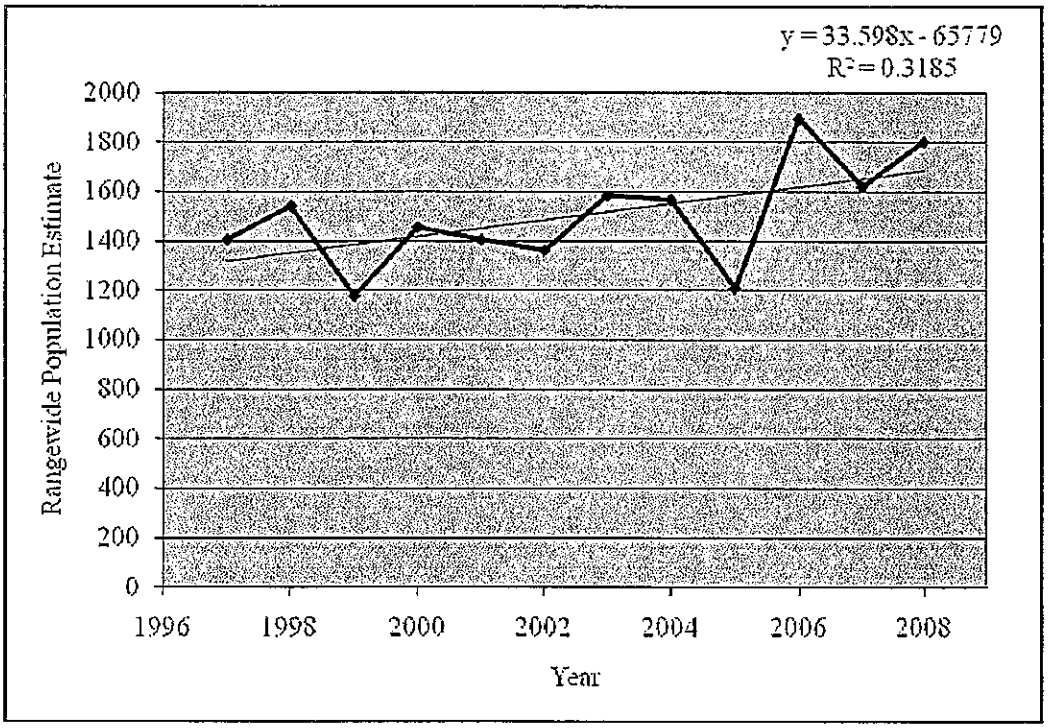

Figure 3. Overall Ozark big-eared bat population estimates based on summer counts from known maternity sites since 1997.

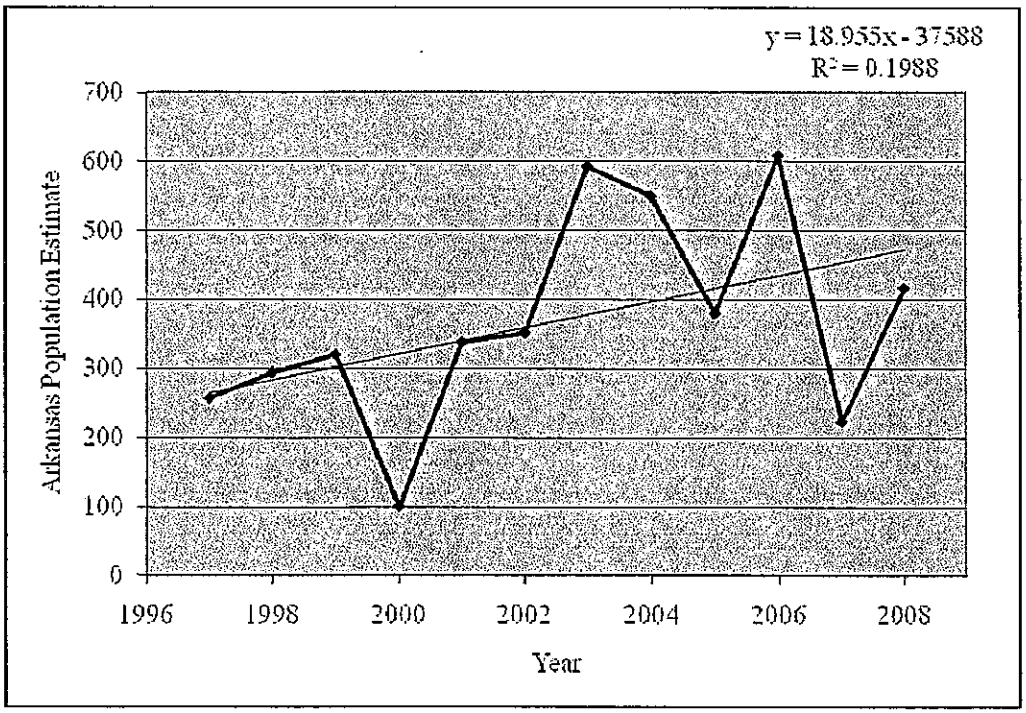

Figure 4. Arkansas Ozark big-eared bat population estimates based on summer counts from maternity sites in Arkansas from 1997 to 2008.

considered alone (Figure 4). In contrast, estimates from exit count data for Oklahoma indicate that the population size in Oklahoma has experienced an overall slightly declining trend since 1987 (Figure 5), the first year in which annual monitoring efforts included all known essential maternity sites from the state. The apparent declining trend in Oklahoma may be attributable to movement among caves, including sites not known to us, and not an actual decrease in bat numbers, and due to the difficulty in monitoring bats at certain caves.

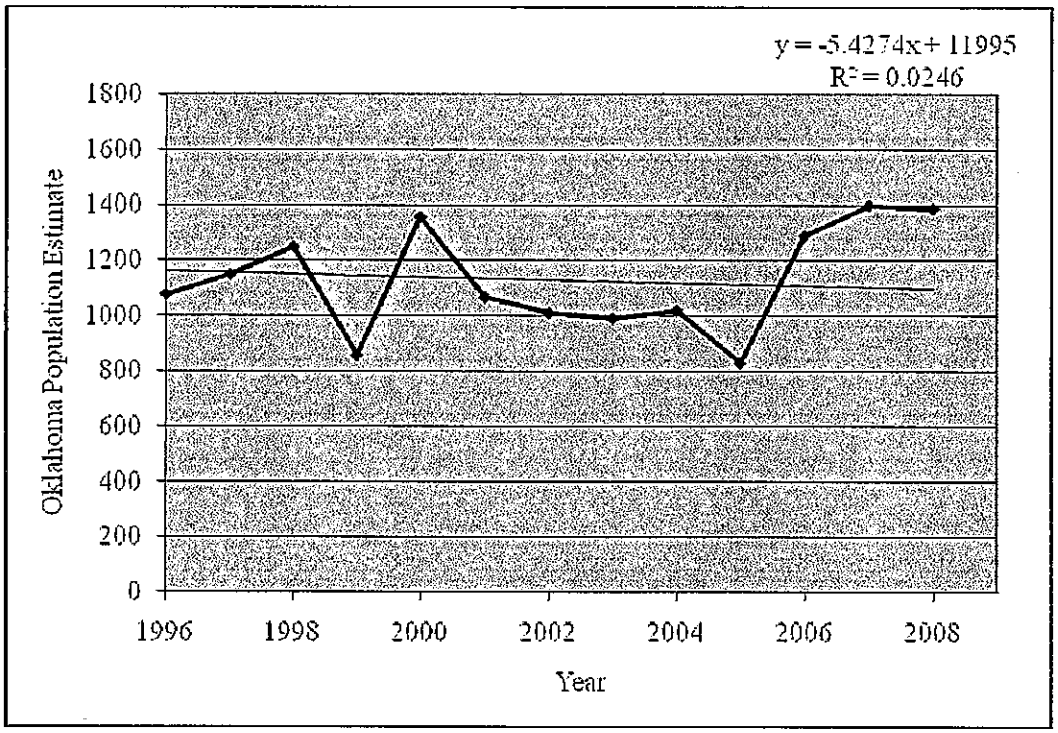

Figure 5. Oklahoma Ozark big-eared bat population estimates based on summer counts from maternity sites in Oklahoma from 1987 to 2008.

Status and Distribution

The Ozark big-eared bat was federally-listed as endangered in 1979 due to its small population size, reduced and limited distribution, and vulnerability to human disturbance. Disturbance of hibernating bats causes the loss of critical fat stores and increases the probability of starvation during the winter, while disturbance at maternity roosts can result in loss of young. The bat also is listed as endangered by the States of Oklahoma, Arkansas, and Missouri (although the species is believed to have been extirpated from Missouri).

The Ozark big-eared bat is endemic to the Ozark Highlands and Boston Mountains ecoregions (Omernik, 1987) where it occurs in oak-hickory hardwood forests (Clark, 1991; Leslie and Clark, 2002; and U.S. Fish and Wildlife Service, 1995). The current range of the Ozark big-eared bat includes northeastern Oklahoma and northwestern Arkansas. In Oklahoma (*i.e.*, the project area), Ozark big-eared bats currently are known to occur in Adair, Cherokee, and Sequoyah counties. They were historically known from two caves in Delaware County, but have not been observed there recently. Twelve caves considered essential for the continued existence of the Ozark big-eared bat (*i.e.*, used by colonies of Ozark big-eared bats for maternity sites

and/or hibernacula) occur in Oklahoma. In Arkansas, the Ozark big-eared bat is known to occur in Crawford, Marion, Searcy, Washington, and Franklin counties. Seven essential caves occur in Arkansas.

The Ozark Highlands ecoregion is under considerable development pressure and is one of the fastest growing areas in the country due to relatively inexpensive land prices and the aesthetics of the area. For example, the human population of Washington and Benton County, Arkansas, and Adair and Cherokee counties, Oklahoma, increased 39.0 percent, 59.0 percent, 14.2 percent, and 24.9 percent, respectively, from 1990 to 2000. Over the same period, the human population within the states of Oklahoma and Arkansas, and within the United States increased by only 9.7 percent, 13.7 percent, and 13.2 percent respectively (U.S. Census Bureau, 2001). The Oklahoma Department of Commerce (ODOC) projects the human population of Adair and Cherokee counties, Oklahoma, to grow by about 35 percent over the next 23 years (ODOC, 2002).

Based on population estimates since 1997, when the most recently discovered essential maternity site was added to the annual monitoring efforts, the overall long-term population trend appears to be slightly increasing. However, during a five-year review on the current status of the Ozark big-eared, the Service (2008) determined that neither the down nor de-listing criteria identified in the current recovery plan (USWFS, 1995) had been met, and that significant threats to this species remain. Although additional essential caves have been discovered and protected since the time of listing, not all known caves have been afforded some form of protection (*e.g.,* a cave gate/grill, signs, fee-title purchase, conservation easement, etc). Population trends of all individual colonies at essential caves are not well explained by available monitoring data.

Vandalism and unauthorized human activity at maternity roosts and hibernacula still occur even at gated and signed caves. Therefore, human disturbance remain a serious threat. The disparity between summer and winter counts indicates there likely are more caves of importance to the Ozark big-eared bat of which the bat conservation community is not yet aware. A prerequisite to protecting these sites is knowledge of their location, so the need to continue search efforts for unknown Ozark big-eared bat caves continues. Current and future human population growth and development within the Ozark big-eared bat's range will result in the loss and fragmentation of foraging habitat. In addition to protecting the caves used by the Ozark big-eared bat, it will become increasingly important to protect and restore foraging habitat around these caves as development pressures increase in the future (Leslie and Clark, 2002; Wethington et al., 1996).

Climate change could have a significant impact on all temperate region bats, including the Ozark big-eared bat. Projected changes in climate could impact bats by adversely affecting their food supply and the internal roosting temperature of caves (Bogan, 2003). The Ozark big-eared bat preys on a wide diversity of moth species, but most of the moth species are dependent upon woody forest plants as a host. Climate change may affect the Ozark big-eared bat by impacting plant resources which could alter the timing and abundance of moth prey. Ozark big-eared bats have specific cave microclimate requirements. Only those caves with appropriate microclimates are used as maternity roosts and hibernacula. Changes in the internal roosting temperature of caves may change the suitability of certain caves. Changes in food resources and cave microclimates may affect hibernation periods, and the birth and survival of pups.

The fungus associated with WNS recently has been found (Spring 2010) in close proximity to the range of the Ozark big-eared bat (northwestern Oklahoma and Missouri). WNS threatens to spread to the range of the Ozark big-eared bat in the near future. Should WNS move into the range of the Ozark big-eared bat, the potential impact could be severe due to the high mortality rate of affected bats to date, and the small population size and limited distribution of the Ozark big-eared bat.

Analysis of the species habitat likely to be affected

The Ozark big-eared bat potentially will be affected by implementation of HFRP conservation measures/practices. Critical habitat has not been designated for the Ozark big-eared bat. Therefore, none will be affected.

Gray Bat

Species and Critical Habitat Description

The gray bat was federally-listed as endangered on April 28, 1976 (41 FR 17740). Critical habitat has not been designated. The final recovery plan was signed on July 8, 1982 (USFWS, 1982). The Service completed a five-review on the status of the gray bat on September 30, 2009 (USFWS, 2009). The Service determined that the existing listing classification of endangered remains valid primarily due to the potential threat of WNS.

The gray bat is a medium-sized bat with gray fur. The species belongs to the plain-nosed bat family, Vespertilionidae, and is one of the largest species within the genus *Myotis* in eastern North America (Decher and Choate, 1995). The gray bat has a wingspan of 25 - 28 cm (10 - 11 inches) and forearm lengths of 40 - 47 mm (1.5 - 2.0 inches). Weights range between approximately 7.0 - 16 g (0.3 - 0.65 ounces) (Tuttle, 1976a; U.S. Fish and Wildlife Service, 1980; Harvey et al., 1981; Decher and Choate, 1995).

The gray bat can be distinguished from other species in the genus *Myotis* by the uniform color of its dorsal fur in which hair shafts are gray from base to tip. The dorsal hairs of other bats within its range are bi- or tricolored. Additionally, the wing membrane attaches at the ankle of the foot instead of at the base of the toes as in other members of the genus (Barbour and Davis, 1969; Harvey et al., 1981; Decher and Choate, 1995; Tuttle and Kennedy, 2005). The calcar on gray bats is not keeled and the skull has a distinct sagittal crest (Harvey et al., 1981; Mitchell, 1998).

Life History

Gray bats are one of the few species of bats in North America that inhabit caves year-round, migrating each year between winter and summer caves. Gray bats have been documented to regularly migrate from 17 to 437 km between summer maternity caves and winter hibernacula (Tuttle 1976b; Hall and Wilson 1966). Gray bats exhibit strong philopatry to both summering and wintering sites (Tuttle, 1976a; Tuttle, 1979; Kennedy and Tuttle, 2005; Martin, 2007).

Courtship and mating of gray bats occurs in the fall when the bats begin to arrive at hibernacula. Male gray bats arrive at hibernacula first and compete for females (Tuttle and Kennedy, 2005). After copulation, females enter hibernation for the winter. Males and juveniles typically continue feeding for several weeks. Males may remain active until early November before entering hibernation (Tuttle, 1976a), but by mid-November, most gray bats are in hibernation.

Winter hibernation sites are typically deep vertical caves that trap large volumes of cold air (Tuttle, 1976a; Harvey et al., 1981; Harvey, 1994; Martin, 2007). Hibernation sites also often have multiple entrances where there is good air flow (Martin, 2007). Temperatures are approximately 5-9°C (41-48° F), though 1-4° C (34-39° F) appears to be preferred (Tuttle and Kennedy, 2005). During hibernation, the species typically forms large clusters with some aggregations numbering in the hundreds of thousands of individuals (Harvey, 1994; Tuttle and Kennedy, 2005). Gray bat hibernacula are often made up of individuals from large areas of their summer range. It is estimated that 95 percent of the species range-wide population hibernates in only nine caves (Tuttle, 1979).

Adult females begin to emerge in late March, followed by juveniles and adult males. Females become pregnant after emerging in the spring (Harvey, 1994; Tuttle and Kennedy, 2005), and form maternity colonies of a few hundred to many thousands of individuals. Maternity colonies typically form on domed ceilings that are capable of trapping body heat from clustered individuals. Temperatures typically range between 14-25° C (57-77° F) (Harvey, 1992; Harvey, 1994; Tuttle and Kennedy, 2005; Martin, 2007).

Females typically do not give birth until the second year (Miller 1939). Average gestation is approximately 64 days. A single offspring is born in late May or early June. Newborn bats weigh approximately one-third of their mother's weight. Newborns typically become volant within 21-33 days after birth (Tuttle, 1976b; Harvey, 1994; Tuttle and Kennedy, 2005).

Bachelor males also segregate into separate aggregations. Home range of these colonies usually includes several caves that may extend up to 70 km along a particular river valley (Tuttle and Kennedy, 2005).

Gray bats feed on flying insects over bodies of water including rivers, streams, lakes and reservoirs. Mayflies, caddisflies, and stoneflies make up the major part of their diet, but beetles and moths also are consumed (Harvey, 1994; Tuttle and Kennedy, 2005). Gray bats are known to travel up to 35 kilometers from caves to prime feeding areas (La Val et al., 1977; Tuttle and Kennedy, 2005). However, most caves are within 1-4 km (0.6 – 2.5 miles) of foraging areas (Tuttle, 1976b).

Likely predators include wildlife known to prey on bat species such as snakes, owls, raccoons, bobcats, and feral house cats. Predation and disease were not considered significant threats at the time of listing.

The fungus associated with WNS *G. destructans* recently was documented on gray bats in Missouri during the spring of 2010. Mortality events attributable to WNS have not occurred in any gray bat populations to date. Research is ongoing to determine whether all bats that come

into contact with the fungus will develop WNS. However, the discovery of the fungus on gray bats is cause for concern. WNS appears to kill only hibernating bats. Conservation biologists, therefore, are concerned that gray bat populations may be impacted during future hibernation seasons. Because a large percentage of the gray gat population hibernates in a limited number of caves, disease transmission could occur rapidly and the resulting impacts could be severe.

Recorded longevity for gray bat is approximately 14-17 years (Harvey, 1992; Tuttle and Kennedy, 2005).

Population Dynamics

Population surveys have been ongoing throughout the range of the gray bat at hibernacula and maternity sites since the recovery plan was approved in 1982. There also have been surveys conducted for the species associated with various development projects. Techniques used to monitor various gray bat populations include direct counts, emergence counts, and measuring the extent of guano piles or ceiling stains at established roosts. Colonies of this species also have been monitored recently using near-infrared (NIR) or thermal infrared (TIR) videography with computer and statistical software packages.

Of the 29 priority 1 maternity sites listed in the 1982 approved Gray Bat Recovery Plan, populations at 13 sites (45 percent) have been stable or increasing (Martin, 2007; Sasse et al., 2007; Elliott, 2008; USFWS, 2009). Populations of many gray bat priority 2 caves also have been monitored, and roughly 33 percent of priority 2 caves across the species' range have stable or increasing populations (USFWS, 2009).

Ellison et al. (2003) statistically analyzed 1,879 observations of gray bats obtained from 334 roost locations (103 summer colonies and 12 hibernacula) in 14 south-central and southeastern states. Their analysis indicated that 94.4 percent (85.4 percent no trend; 9 percent upward trend) of the populations showed stable or increasing populations while 6 percent revealed a decreasing population. Stable or increasing populations were reported for 83 percent (58 percent no trend; 25 percent upward trend) of the 12 hibernating colonies examined. However, in some areas (*e.g.*, Florida) the species has declined significantly at both hibernacula and maternity sites.

Sasse et al. (2007) analyzed data from 48 gray bat maternity sites involving three subpopulations in the Ozark Highlands of Missouri, Arkansas, and Oklahoma between 1978 and 2002. The authors report that 79 percent of these colonies were stable or increasing. However, Elliott (2008) estimated that despite an overall increase in gray bat numbers in Missouri, the overall state population of this species was still only about 46 percent of what the maximum past population historically was.

Status and Distribution

The gray bat was federally-listed as endangered in 1976 due to vulnerability to human disturbance. Habitat loss and degradation and contamination from pesticides also were considered a cause of decline.

Human disturbance at both maternity roosts and hibernacula can be very detrimental. Disturbance during the sensitive maternity period can result in bats moving to less preferred roost sites within caves or cave abandonment. Disturbance during early summer before the young can fly can result in thousands of young becoming dislodged and falling to their deaths (Tuttle, 1979). Every arousal during hibernation is energetically expensive. Fat reserves required to sustain the bats are utilized to some extent during each winter arousal. These fat reserves cannot be replaced until spring. Therefore, too many arousals during hibernation can exhaust a bat's limited fat reserves and result in mortality (Brady et al., 1982). Furthermore, only about 5 percent of available caves are suitable for gray bats (Tuttle, 1979). For example, about 95 percent of the entire population hibernates in only 9 caves. Consequently, a large percentage of the population could be impacted due to disturbance at only a few caves.

Despite the gray bat's recovery in many areas, human disturbance continues to be the main reason for the continued decline of gray bats in caves that are not protected (Tuttle 1979, 1987; Rabinowitz and Tuttle, 1980; U.S. Fish and Wildlife Service, 1982; Mitchell, 1998; Martin et al., 2000, 2003; Shapiro and Hohmann, 2005; Martin, 2007; Sasse et al., 2007; Elliott, 2008). Vandalism and breeching of locked cave gates and fences has been noted at multiple caves and is ongoing.

Degradation of foraging habitat, protective flight corridors, and food resources also presents a major threat to the gray bat. Gray bats feed primarily on aquatic insects in riparian areas and over rivers, streams, and other water bodies. Gray bats also utilize forested areas for protection from predators such as screech owls as they travel between caves and foraging sites. Deforestation of wooded tracts and riparian zones in the vicinity of maternity caves (gray bats are known to forage up to 12 km from a summer cave) due to development and agricultural activities negatively impacts gray bats by reducing available foraging habitat and the wooded flight corridors that provide protection from predators (LaVal et al., 1977; USFWS, 1982). Practices that result in increased pollution, turbidity and siltation in waterways over which gray bats forage, such as development and agricultural activities and the clearing of woody riparian zones, can be detrimental by reducing the local abundance of important prey, especially species sensitive to aquatic pollution such as mayflies, caddisflies, and stoneflies (Tuttle, 1979; USWFS, 1982).

Natural flooding and impoundment of waterways has resulted in temporary impacts to some caves and the complete submersion and loss of other important cave sites (Barbour and Davis, 1969; LaVal et al., 1977; Tuttle, 1979). Natural and man-made flooding remains a threat at some gray bat sites.

Pesticide contamination has been well documented in some populations of gray bats (Clark et al., 1978, 1980, 1983; Clawson and Clark, 1989; Clawson, 1991; Sasse, 2005). Juvenile bats can be especially affected as they receive concentrated amounts of pesticides through their mother's milk when adult bats feed on insects exposed to pesticides (Clark et al., 1978).

Major populations of the gray bat are found in Alabama, Arkansas, Kentucky, Missouri, and Tennessee. Smaller populations also occur in Florida, Georgia, Indiana, Illinois, Kansas, Mississippi, North Carolina, Oklahoma, and West Virginia.

Overall, gray bat populations have increased and recovered in many areas throughout the species' range (Tuttle, 1987; Harvey and Britzke, 2002; Ellison et al., 2003; Tuttle and Kennedy, 2005; Martin, 2007; Sasse et al., 2007; USFWS, 2009). Dr. Michael Harvey of Tennessee Technological University has estimated changes in the overall population size across the range of the species based on general population trends. He reported that the species increased from approximately 1,575,000 to roughly 2,678,000 in 2002, and to ca. 3,400,000 in 2004 (USFWS, 2009). Martin (2007) noted that gray bat population levels have increased approximately 104 percent since 1982.

Climate change could have a significant impact on temperate region bats, including the gray bat. Bogan (2003) predicted that projected climate changes could impact bats by adversely affecting their food supply or the internal roosting temperature of important caves.

The Service (2009) recently completed a 5-year review of the gray bat to assess whether the listing classification of endangered was still appropriate (USFWS, 2009). Although the gray bat has recovered in many areas and the overall range-wide estimate continues to increase, the Service determined that the current listing classification of endangered should be retained primarily due to the potential threat of WNS.

Subsequently, the fungus associated with WNS was documented on gray bats in Missouri (Spring 2010). Mortality attributable to WNS has not occurred in any gray bat populations to date. However, the discovery of the fungus on gray bats is cause for concern. A large percentage of the gray gat population hibernates in a limited number of caves. Mortality rates reported from hibernacula in the northeastern United States are unprecedented (*e.g.*, 90 percent mortality in affected caves and over 1,000,000 bats estimated to have died due to WNS). Therefore, should gray bats develop WNS, disease transmission could occur rapidly and the resulting impacts could be severe.

Analysis of the species habitat likely to be affected

The gray bat potentially will be affected by implementation of HFRP conservation measures/practices. Critical habitat has not been designated for the gray bat. Therefore, none will be affected.

Ozark Cavefish

Species and Critical Habitat Description

The Ozark cavefish was listed as threatened on November 1, 1984 (49 FR 43965). Critical habitat has not been designated. The final recovery plan was signed on December 17, 1986 (USFWS, 1986). A five-year review of the listing status is currently being conducted by the Service.

Ozark cavefish are small fish reaching a maximum total length of about 5.0 cm (about two inches). The fish are true troglobites (*i.e.*, obligatory cave inhabitants). They lack pigment, but appear pinkish-white because their translucent skin reveals blood and organs. The head is

flattened and the lower jaw slightly protrudes. The dorsal and anal fins are located further back than other fishes. The caudal fin is rounded and contains two to three rows of sensory pits (papillae) on the lower and upper halves. They lack pelvic fins. The Ozark cavefish has only rudimentary eyes and no optic nerve.

The Ozark cavefish is difficult to distinguish from other cavefish species in the field. Differentiation is based on degrees of cave adaptation. Ozark cavefish differ from the Southern cavefish (*Typhlichthys subterraneus*) and the Northern cavefish (*Amblyopsis spelaeus*), for example, by the absence of a postcleithrum bone, in the arrangement of cutaneous sense organs, and by the number of dorsal, anal, and caudal rays (Poulson, 1961; USFWS, 1989; Romero, 1998).

Life History

Knowledge of cavefish life history is limited. The species is believed to have low reproductive capacity and to be slow to reproductive maturity (Robinson and Buchanan, 1988). The size and shape of the gill chamber indicate that the species may be a gill chamber brooder. Only about 20 percent of the population is believed to breed in any given year (Poulson, 1963). Infrequent reproduction may be an adaptation to a limited food supply.

The Ozark cavefish primarily feeds on small crustaceans such as copepods, isopods, and amphipods. Cavefish also prey upon small crayfish, small cavefish, oligochaetes (*e.g.*, segmented worms), small salamanders and salamander larvae (Poulson, 1963).

The Ozark cavefish is considered the most adapted of all the cavefish for cave life due to well-developed sensory papillae. They tend to occur in caves with groundwater recharge (as opposed to caves that rely on surface water sources), and generally are acknowledged to be a groundwater obligate. Ozark cavefish occur in flowing cave streams with chert rubble substrate and pool areas. They also have been found in wells and sinkholes.

Ozark cavefish have no known documented predators. Predation likely occurs at times by species known to use caves such as raccoons, but this has not been documented. Similarly, disease currently is not considered to be a factor in population viability.

Population Dynamics

The Ozark cavefish has not been observed for over six years in 19 of the 35 sites that currently are considered occupied. Of the remaining 16 sites, the Service currently considers six populations to be in decline while 10 are considered stable (David Kampwerth, USWFS Recovery Lead, pers. comm.). However, Graening et al. (2009) recently conducted population trend analyses for seven currently occupied caves, and found two to have increasing population trends. Trends were not detected from the other five caves examined due to high variance and limited data.

Poulson (1985) estimated that typical populations of the Ozark cavefish likely would consist of 100 – 200 individuals based upon field observations. Similarly, Willis and Brown (1985)

estimated populations would consist of about 150 individuals. The largest populations observed based on the most recent monitoring counts include Cave Springs Cave and Logan Cave in Arkansas with 123 and 43, respectively; Kellhofer's Cave in Missouri with 12; and Long's Cave in Oklahoma with 7 individuals. Cave Springs and Logan caves represent approximately 80 percent of all countable Ozark cavefish. The other 12 occupied sites are represented by counts of 1-2 individuals typically, although higher counts have occurred.

A range wide estimate of countable cavefish using recent population monitoring numbers suggests about 220 individuals (Graening et al., 2009; David Kampwerth, USWFS Recovery Lead, pers. comm.). However, it must be noted that the population size of the Ozark cavefish is difficult to estimate. Biologists can only enter those "portals" (*i.e.*, caves with streams, sink holes, wells) large enough to accommodate our size. Because we are unable to access groundwater conduits that the fish are distributed throughout, we can only count fish in accessible reaches of caves and wells.

Status and Distribution

The Ozark cavefish was federally-listed as threatened in 1984 due to habitat alteration and over-collecting. Ozark cavefish historically occurred at approximately 53 sites (Brown and Todd, 1987). At the time of listing, the species was known from only 14 caves in six counties of the Springfield Plateau of southwestern Missouri, northwestern Arkansas, and northeastern Oklahoma. There currently are about 35 Ozark cavefish caves and wells that are considered active or currently occupied. The species currently is known from 9 caves in Arkansas, 16 caves in Missouri, and 10 caves in Oklahoma.

Since listing, many cavefish caves in each state have received some form of protection. Of the 35 current cavefish sites, 16 sites are either gated or fenced in an attempt to reduce direct human disturbance. Logan Cave was purchased by the Service to establish Logan Cave National Wildlife Refuge in Arkansas. Cave Springs Cave in Arkansas, which contains the majority of the known population, is owned and managed by the Arkansas Natural Heritage Commission. In Missouri, the Service established Ozark Cavefish National Wildlife Refuge with the purchase of Turnback Creek Cave. The Missouri Department of Conservation also owns and manages a cave for cavefish. Three of the Oklahoma caves are owned by The Nature Conservancy. A fourth Oklahoma cave was purchased as an addition to the Ozark Plateau National Wildlife Refuge.

In the past, removal for scientific purposes and the aquaria trade had a demonstrated impact. A large scientific collection made from a cave in the 1930's in Arkansas possibly could be the reason for the low population currently in this cave. There number of Ozark cavefish catalogued in museum collections (over 300) exceeds any published total population estimates (Graening et al., 2009). However, over-collection no longer appears to be an active threat, and endangered species permits to take cavefish are not issued by the Service (David Kampwerth, USWFS Recovery Lead, pers. comm.).

The construction of impoundments historically also may have impacted the Ozark cavefish (Graening et al. 2009). Several caves within the Spavinaw Creek Basin of Oklahoma, the current range of the cavefish in Oklahoma, were completely inundated by the construction of Lake

Eucha (Looney, 1972). Several impoundments constructed in Arkansas and Missouri on the White River inundated extensive cave systems that occur within the range of the cavefish (Graening et al., 2009).

Habitat degradation and pollution due to agricultural activities and development currently are considered primary threats to the Ozark cavefish. The karst environments (*i.e.,* a landscape that is marked by caves, sinkholes, springs, and other features and has special drainage characteristics due to the greater solubility of certain rocks) in which the cavefish occur are highly vulnerable to groundwater pollution. Water enters the groundwater systems rapidly in karst areas as it passes through sinkholes and cracks and crevices in the ground surface, losing streams (*i.e.,* a stream with a bed that allows water to flow directly to the groundwater system), or fractured limestone under thin layers of permeable soils. Groundwater in karst areas can travel as quickly as a few thousand feet to over a mile per day. Degradation of sensitive, underground habitats used by the cavefish can, therefore, occur rapidly. These characteristics of karst ecosystems make the underground environment relatively fragile and highly susceptible to disturbances.

The Ozark Highlands ecoregion also is one of the fastest growing areas in the country due to relatively inexpensive land prices and the aesthetics of the area. For example, the population in Benton County (in which approximately 80 percent of all countable Ozark cavefish occur) between 1990 and 2000 increased 57.3 percent.

Agriculture is considered the primary threat within the recharge zone (*i.e.,* areas involved with input of water into the cave system) of 17 out of 35 active sites (David Kampwerth, Service Recovery lead, pers. comm.). Various agricultural activities can threaten groundwater quality (Aley and Aley, 1997). Chemicals and fertilizers that are applied on agricultural lands can rapidly infiltrate groundwater and cave systems during rain events due to the karst topography of the Ozark Highlands. As forested areas are harvested or lands are converted from forest to pasture, valuable canopy cover for ground temperature regulation and soil moisture retention is lost. In 1968, 59 percent of the Logan Cave recharge zone was forested. By 1987 the amount of forested land was about 43 percent, representing a 17 percent decrease (David Kampwerth, Service Recovery lead, pers. comm.).

Confined animal feeding operations (CAFOs) also are believed to pose a threat (Aley and Aley, 1999). Metals and other contaminants pass through poultry and other livestock and can reach groundwater through land application of wastes. Aley and Aley (1999) identified CAFOs as the greatest threat within the recharge area of Long's, MGee's, and Engelbrecht Caves in Oklahoma. CAFOs also are believed to be a threat to the water quality of Cave Springs Cave and Logan Cave in Arkansas (Graening and Brown, 2003). The 11 square mile recharge zone of Logan Cave alone contains approximately 50 hog and poultry facilities (Aley and Aley, 1987).

Urbanization and development are considered primary threats within the recharge areas of 17 cavefish caves (David Kampwerth, Service Recovery lead, pers. comm.). As development and associated impervious surfaces (*e.g.,* roads, parking lots, etc.) increase, areas that otherwise would allow natural infiltration and percolation are lost or significantly diminished. Increased groundwater withdrawals for home, community, and agricultural use also can deplete groundwater and limits available habitat. Other threats include groundwater contamination from

inadequate or un-maintained sewage disposal systems (Aley, 1978; Graening and Brown, 2003) and point pollution sources that occur within recharge zones such as wastewater treatment plant outfalls, salvage yards municipal landfills, and stormwater runoff from residential areas, parking lots and highways, that often contains numerous contaminants including automotive fluids, brake dust, roof tar, and pesticides/herbicides (Aley, 2005; Aley, 2008).

Relatively few studies have addressed the extent to which contaminants are detected in caves used by the Ozark cavefish. Recent water quality studies at springs, wells, and streams in the Ozarks of Arkansas, Oklahoma, and Missouri found numerous contaminants at low but detectable levels. Graening and Brown (2003) consistently found high levels of fecal coliform, excess nutrients, and metals in water, sediment, and tissue samples at Cave Springs Cave. They further identified beryllium, copper, selenium, and zinc at levels exceeding Arkansas limits for chronic and acute toxicity to aquatic life.

Bidwell et al. (2010) found 55 organic wastewater contaminants in Ozark cavefish caves in Oklahoma and Arkansas. Contaminants identified include plasticizers, herbicides, insect repellants, organochlorine pesticides, fire retardants, fragrance/flavors, antibiotic and other pharmaceutical compounds, and halogenated organic compounds. Because water concentrations of chemicals detected were not calculated it is not possible to draw any specific conclusions regarding the risk the chemicals detected pose. However, some of these compounds (*i.e.,* plasticizers, halogenated organic compounds) have been linked to estrogenic effects on aquatic organisms that may be enhanced when chemicals occur in mixture. Other possible threats from detected contaminants include increased incidences of cancer and the development of antibiotic-resistant bacteria.

Unauthorized human entry also continues to be a threat at protected sites and at sites with no protection measures in place. Gates/fences have been vandalized with evidence of recent human access. Use at ungated caves is occurring based on evidence such as new paint, foot prints, and writing found during biannual monitoring surveys. Human entry causes increased turbidity decreasing cavefish sensory ability. Unauthorized human entry also increases the potential for direct trampling of individuals, and can interrupt feeding and breeding behaviors. As interest in recreational caving continues to increase, caves supporting cavefish are likely to receive additional unauthorized entry.

Analysis of the species habitat likely to be affected

The Ozark cavefish potentially will be affected by implementation of HFRP conservation measures/practices. Critical habitat has not been designated for this species. Therefore, none will be affected.

American Burying Beetle

Species and Critical Habitat Description

The American burying beetle (ABB) was designated as an endangered species on July 13, 1989 (54 FR 29652). Critical habitat has not been designated for the ABB. The final recovery plan

was signed on September 27, 1991 (USFWS, 1991). A five-year review of the listing status is currently being conducted by the Service.

The ABB has disappeared from over 90 percent of its historic range. The species currently is found in 28 counties and reasonably likely to occur in 6 other counties within eastern Oklahoma. The decline may be attributed to habitat loss, alteration, and degradation. The Service concluded that the likely explanation for the decline of ABBs involved an increase in edge habitat brought about by increased fragmentation, which leads to a reduced carrion prey base and an increase in vertebrate scavengers, all of which may be detrimental to the ABB (USFWS, 1991).

The ABB is the largest species of its genus in North America, measuring 0.4 - 0.5 cm (one to 1.4 inches) long. The hardened elytra are smooth, reflective black, and each elytron has two scallop shaped orange-red markings. The pronotum (hard back plate of the front portion of the thorax of insects) over the mid-section between the head and wings is circular in shape with flattened margins and a raised central portion. The most diagnostic feature of the ABB is the large orange-red marking on the raised portion of the pronotum, a feature shared with no other members of the genus in North America (USFWS, 1991). The ABB also has orange-red frons and a single orange-red marking on the top of the head (triangular in females and rectangular in males). Antennae are large, with notable, orange club-shaped tips.

Life History

The ABB is an annual species and typically reproduces once in its lifetime. It competes with other invertebrate species, as well as vertebrate species, for carrion. Although ABBs are considered feeding habitat generalists, they are believed to be more selective regarding breeding habitat.

ABBs are typically active at night from mid-May to late-September when nighttime ambient temperatures are consistently above 60°F. Nightly activity is most prevalent from two to four hours after sunset (Walker and Hoback, 2007). Weather events, such as rain and strong winds, result in reduced ABB activity. During the daytime ABBs are believed to bury under the vegetation litter.

During the winter months, when the nighttime ambient temperature is consistently below 60°F, ABBs bury themselves into the soil and become inactive (USFWS, 1991). In Oklahoma, this typically occurs in late September lasting until mid-May. Recent studies indicate that ABBs bury an average depth of 2.4 inches (Schnell *et al.*, 2007). Habitat structure (*i.e.,* woodland vs. grassland) does not appear to be an influencing factor.

Preliminary data suggest that overwintering results in significant mortality (Bedick *et al.*, 1999). Winter mortality has only recently begun to be investigated, but may range from 25 percent to about 70 percent depending on year, location, and availability of carrion in the fall (Schnell *et al.*, 2007; Raithel unpubl. data 1996-2006).

When not involved with brood rearing, adult food sources include an array of available carrion, as well as capturing and consuming live insects. *Nicrophorus* species are capable of finding a

carcass between one and 48 hours after death at a distance up to two miles (Ratcliffe, 1996). Success in finding carrion depends upon many factors, including availability of optimal habitats for small vertebrates (Lomolino and Creighton, 1996), density of competing invertebrate and vertebrate scavengers, individual searching ability, reproductive condition, and temperature (Ratcliffe, 1996).

Adult ABBs in search of carrion move an average of 0.7 miles per night (Creighton and Schnell, 1998). Creighton *et al.* (1993a) recorded ABBs traveling as much as two miles during one night. Creighton and Schnell (1998) found that the mean distance recaptured ABBs moved from their original site of capture was 1.66 miles, with a minimum distance of 0.01 mile in one night to a maximum distance 6.2 miles over a six night period. Bedick *et al.* (1999) indicated that ABBs may travel distances up to 3.72 miles in a single night.

By moving relatively long distances among different habitat types, ABBs increase the chance of encountering proper sized carcasses, but also increase exposure to a diversity of natural and unnatural sources of potential adverse impact, including predation, insecticides, commercially available insect traps, and nocturnal light pollution. The probability of individual ABBs being subjected to these types of hazards also increases as areas become more developed (Lomolino and Creighton, 1996).

ABBs are considered feeding habitat generalists and have been found in several vegetation types, including undisturbed grasslands, grazed pasture, riparian zones, oak-hickory forest, coniferous forests on lowlands, slopes, and ridgetops, as well as in various soil types (Creighton et al., 1993b; Lomolino and Creighton, 1996; Lomolino et al., 1995; NatureServe Explorer, 2001; USFWS, 1991). Rangewide, ecosystems supporting ABB populations are diverse and include primary forest, scrub forest, forest edge, prairie, riparian areas, mountain slopes, and maritime scrub communities (Ratcliffe, 1996; USFWS, 1991).

Soil conditions must be conducive to ABB excavation (Anderson, 1982; Lomolino and Creighton, 1996). Soils in the vicinity of captures are well drained and include sandy loam and silt loam, with a clay component noted at most sites. Level topography and a well formed detritus layer at the ground surface are common (USFWS, 1991).

At Camp Gruber, Oklahoma, Schnell and Hiott (2002a) reported more ABB captures within the installation than at the disturbed perimeters. Also, Schnell and Hiott (2002c) conducted surveys within Weyerhaeuser lands in southeast Oklahoma and southwest Arkansas where they reported fewer ABBs along roads than in the interior of tree plots. At Fort Chaffee in Arkansas, Schnell and Hiott (2005b) also noted that ABBs tended to avoid soils with less than 40 percent sand, greater than 50 percent silt, and greater than 20 percent clay.

For breeding, habitat preference studies in Oklahoma indicate ABBs select undisturbed, mature oak-hickory forests with substantial litter layers and deep, loose soils over grasslands or bottomland forests (Lomolino and Creighton, 1996; Creighton *et al.*, 1993b). In 1996 more than 300 specimens were captured in Nebraska habitats consisting of prairie, forest edge, and scrubland (Ratcliffe 1996). These surveys have found certain soil types, such as very xeric (dry), saturated, or loose sandy soils, to be unsuitable for carcass burial and thus are unlikely habitats.

Lomolino and Creighton (1996) found reproductive success to be higher in forested sites than grassland sites. Carcasses tended to be buried deeper in the soil at grassland sites, as compared to forested sites (e.g., just below the litter layer).

Reproductive activity occurs between mid May and mid August and commences once a suitable carcass is found on which to feed and lay eggs. Both parents often participate in the rearing of young with care by at least one parent, usually the female, which is critical for larval survival (Ratcliffe, 1996). This is a rare and highly developed behavior in insects, known only among bees, ants, wasps, termites, and a few scarab beetle species. The pair buries appropriately-sized carrion, about 3.5-7.0 ounces in weight, within a brood chamber constructed around the carcass. Prior to carcass burial, ABBs may move the carrion laterally for up to three feet (USFWS, 1991).

Eggs are laid in the soil beside the carcass. Brood sizes vary between 3-31 individuals (USFWS, 1991), with a positive correlation between carrion weight and number of larvae (Kozol, 1990). The larvae pupate and emerge as adults in about 48-60 days. Generally, the ABB produces only one brood per year and these newly hatched adults overwinter to reproduce the following year. Occasionally the emerging generation of adults succeeds in producing another brood if summers are long and warm (USFWS, 1991).

Status and Distribution

At the time of listing in 1989, the prevailing theory on the ABB's decline was habitat fragmentation (USFWS, 1991). Fragmentation of natural habitat that historically supported high densities of indigenous (native) species, coupled with increased direct taking (ca. 1900) of birds and other vertebrates, may have contributed to the decline of ABBs by changing the species composition and lowering the reproductive success of prey species required for ABB reproduction. Likewise, by increasing edge habitat, there may have been an attendant increase in the occurrence and density of vertebrate predators and scavengers, such as the American crow *Corvus brachyrhynchos*, raccoon *Procyon lotor*, fox *Vulpes* sp., opossum *Didelphis virginiana*, and skunk *Mephitis* sp., which compete with ABBs for available carrion.

In the Midwest, windbreaks, hedgerows, and park development have all provided new "edge" habitat for these scavengers, as well as for domestic and feral animals such as dogs and cats. All of these animals utilize carrion that may be suitable for ABBs (Ratcliffe, 1996). In this way, fragmented habitats not only support fewer or lower densities of indigenous species that historically may have supported ABB populations, but there is more competition for those limited resources among the "new" predator/scavenger community.

Although much of the evidence suggesting the reduction of carrion resources as a primary mechanism of decline is circumstantial, this scenario fits the temporal and geographical pattern of the disappearance of ABBs, and is sufficient to explain why ABBs declined while congeneric species did not. Research has shown that in a fragmented ecosystem, larger species are negatively affected before smaller species, a process which has been well documented with carrion and dung beetles in South America (Klein, 1989).

Since the publication of the ABB recovery plan, additional research has been conducted. Sikes and Raithel (2002) examined the literature from the last 20 years. They evaluated several possible threats to the ABB: DDT/pesticide use; artificial lighting; pathogens; habitat alteration; habitat fragmentation; vertebrate competition; loss of ideal carrion; and congener competition. The paragraphs below discuss these threats.

The USFWS (1991) concluded that the best explanation for the decline of ABBs involved habitat fragmentation, which reduced the carrion prey base and increased the vertebrate scavenger competition for this prey. Kozol (1990), Ratcliffe (1996), Amaral *et al.* (1997), and Bedick *et al.* (1993) have reiterated this theme. The ABB is the largest species of *Nicrophorus* in the New World and require carcasses of 3.5 to 7.0 ounces (Kozol *et al.,* 1988) to maximize fecundity (productivity), whereas all other *Nicrophorus* species can breed on the more abundant smaller carcasses of 0.11 to 0.18 ounces (Trumbo, 1992).

Frequent low intensity and widespread fire, drought, and grazing by native herbivores were the principle historic and natural sources of disturbance within much of the historic range of the ABB (McNab and Avers, 1996). Fires removed most of the brush and young woody growth in forested areas, while retarding succession to woody vegetation in grasslands (The Nature Conservancy, 2000, 2003a, 2003b). Fires also returned nutrients to the soil and stimulated the growth of grasses and forbs in prairie areas (The Nature Conservancy, 2000). Other climatic influences included winter ice storms and spring tornadoes (McNab and Avers, 1996).

Land conversion to agriculture and development, logging, fire suppression, and intensive domestic livestock grazing are major causes of habitat loss and fragmentation today. Since European settlement, fires have been largely suppressed in many areas, leading to changes in community types and species composition. Riparian areas and bottomland habitats have been severely degraded not only as a result of conversion to agriculture and logging, but also because of inundation by numerous reservoirs (Ruth, 2006). The anthropogenic breakdown of barriers to dispersal also has permitted the invasion of non-indigenous species (Northern Prairie Wildlife Research Center, 2006).

Historically the geographic range of the ABB encompassed over 150 counties in 35 states, covering most of temperate eastern North America (USFWS, 1991; Peck and Kalbars, 1987). Records are known from Texas (single record ca. 1935) in the south, north to Montana (single record in 1913) and the southern fringes of Ontario, Quebec, and as far east as Nova Scotia and Florida. Documentation is not uniform throughout this broad historical range. More records exist from the Midwest into Canada and in the northeastern United States than from the southern Atlantic and Gulf of Mexico region (USFWS, 1991).

During the 20th century, the ABB disappeared from over 90 percent of its historical range (Ratcliffe, 1995). The last ABB specimens along the mainland of the Atlantic seaboard, from New England to Florida, were collected in the 1940's (USFWS, 1991). In July 1989, the species was federally-listed as endangered based on its drastic decline and elimination over nearly its entire range (54 FR 29652). At the time of listing, known populations were limited to Block Island, Rhode Island, and a few counties in eastern Oklahoma. Currently, the ABB is known to occur in only eight states: on Block Island off the coast of Rhode Island; Nantucket Island off the

coast of Massachusetts; eastern Oklahoma; western Arkansas; the Sand Hills region in north-central Nebraska; the Chautauqua Hills region of southeastern Kansas (Sikes and Raithel, 2002); south central South Dakota (Ratcliffe, 1996; Bedick *et al.*, 1993); and northeast Texas (Godwin, 2003).

Most existing populations of the ABB are located on private land. Populations known to exist on public land include: Ouachita National Forest; Arkansas/Oklahoma; Ozark-St. Francis National Forests, Arkansas; the McAlester Army Ammunition Depot and Defense Ammunition Center, Oklahoma; Camp Gruber, Oklahoma; Fort Chaffee, Arkansas; Sequoyah National Wildlife Refuge, Oklahoma; Block Island National Wildlife Refuge, Rhode Island; Valentine National Wildlife Refuge, Nebraska; and Camp Maxey, Texas.

Analysis of the species habitat likely to be affected

The ABB potentially will be affected by implementation of HFRP conservation measures/practices. Critical habitat has not been designated for the ABB. Therefore, none will be affected.

ENVIRONMENTAL BASELINE

The environmental baseline is defined as the effects of past and ongoing human induced and natural factors leading to the status of the species, its habitat, and ecosystem, within the project area. The environmental baseline is a snapshot of the Ozark big-eared bat, gray bat, Ozark cavefish, and American burying beetle status at this time.

Ozark big-eared bat

Status of the species within the action area

The range of the Ozark big-eared bat is limited and includes only eight counties in Oklahoma and Arkansas. The action area of the HFRP in Oklahoma includes three of these eight counties (Adair, Cherokee, and Sequoyah counties), and the entire known range of the Ozark big-eared bat within Oklahoma. Ozark big-eared bats also were historically known from two limited-use caves in Delaware County, Oklahoma (DL-4 and DL-21), which also is part of the action area, but have not been observed there recently.

The entire Ozark big-eared bat population currently is estimated to consist of about 1,800 individual bats. Most of the known population (1,400/1,800 or 78 percent) occurs within the action area in Oklahoma. Estimates from exit count data for Oklahoma indicate that the population size in Oklahoma has experienced an overall slightly declining trend since 1987 (see Figure 5), the first year in which annual monitoring efforts included all known essential maternity sites from the state.

The Ozark Plateau NWR (formally known as the Oklahoma Bat Caves National NWR) was established April 1, 1986, in Oklahoma to provide long term habitat protection to help assure the

continuing existence, and aid in recovery of the Ozark big-eared bat and other listed and at-risk cave species. The refuge currently consists of nine units, all of which occur within the action area, totaling 4,200 acres in Adair, Cherokee, Delaware, and Ottawa counties.

Twelve essential caves (*i.e.,* a cave used by a maternity colony or as a hibernaculum) are known to occur within the action area. Seventy-five percent of these caves currently receive some form of protection. Five essential caves occur on the Ozark Plateau NWR and one occurs on land owned by the National Speleological Society (NSS). Seven of the caves have been gated to prevent unauthorized human entry and disturbance.

Population trends of all essential sites/colonies were analyzed as part of the recent (2008) five-year status review of the Ozark big-eared bat. Only one of the 12 essential sites/colonies that occur within the action area showed a statistically significant increasing population trend (USFWS, 2008). The other colonies in Oklahoma showed no significant trends over the period of analysis. The inability to detect whether populations were increasing, decreasing, or stable at the other essential sites is likely attributable to several factors. Not only is it inherently difficult to monitor a sensitive, nocturnal cave species, but Ozark big-eared bats also are known to move among some caves (some of which may be unknown). Populations also may be fluctuating due to factors not well understood at this time.

Achieving the criterion of stable or increasing populations at essential caves in Oklahoma will require implementation of conservation measures designed to ensure adequate long-term protection of each cave and to protect and enhance associated foraging areas. Monitoring colonies at all essential maternity sites and hibernacula will be necessary to assess the effect of conservation efforts in the action area.

Limited-use caves also occur within the action area on the Ozark Plateau NWR, other public lands, and private property. Data on all known limited-use sites including the protective status (*e.g.,* gated, cooperative agreement, etc.) and location has not been compiled to date. Sites on public land are protected by management and cave gates. Several private sites are protected by gates and landowner agreements, but many private land sites are not yet afforded protection.

Factors affecting species environment within the action area

The Ozark Highlands ecoregion (Omernik, 1987) is under considerable development pressure and is one of the fastest growing areas in the country due to relatively inexpensive land prices and the aesthetics of the area. Although most of the observed growth to date within the range of the Ozark big-eared bat has occurred in Arkansas, the Oklahoma Department of Commerce (ODOC) projects the human population of Adair and Cherokee counties, Oklahoma, to grow by about 35 percent over the next 23 years (ODOC, 2002). As population growth and development pressures increase in the future, it will be increasingly important not only to protect important essential and limited-use caves, but also to protect and restore foraging habitat around these caves (Leslie and Clark, 2002; Wethington et al., 1996) through measures such as conservation easements and/or fee title acquisition of important tracts, the construction of cave gates, and implementation of habitat enhancement and restoration measures.

Disturbance within caves while bats are roosting continues to pose a threat to the Ozark big-eared bat in Oklahoma. Although seventy-five percent of the known essential caves in Oklahoma currently are protected by conservation measures such as cave gates, fee title acquisition, and conservation easements, adequate protection measures are still needed at three essential sites and numerous limited-use caves that occur on private property. The bat colonies and solitary individuals that use these caves therefore are still at high risk of human disturbance. Bats that roost in non-gated caves that occur on protected tracts also are at risk of disturbance because the properties/caves cannot be monitored at all times. Even bats that roost in caves where cave gates have been constructed also continue to be at risk of human disturbance because cave gates annually are vandalized.

Land management practices implemented within close proximity of caves without consideration for the Ozark big-eared bat's life history requirements and high susceptibility to disturbance also may be affecting this species. For example, the majority of a maternity colony that roosts in an essential Adair County cave (monitored since 1982) could not be located during annual monitoring efforts in 2005. A timber harvest had occurred around this essential cave during the early summer of that year prior to annual monitoring efforts. The disturbance from this activity resulted in temporary cave abandonment. The colony returned the following summer. Biologists assume that the cave to which the bats temporarily relocated likely was a less preferred cave based on the otherwise consistent use of the known maternity cave prior to the logging and subsequent return of the colony to the known essential cave the following maternity season. Frequent displacements to less preferred caves potentially may affect the success of pregnancies and survivorship of young.

Five Ozark big-eared bat essential, four limited-use, and two historically used caves have been gated through an ongoing project funded through Section 6 of the Endangered Species Act entitled Management and Cave Protection for the Ozark Big-eared Bat and Gray Bat in Oklahoma. This project has been ongoing since 1993 and is implemented in cooperation with the ODWC and Rogers State University. The objectives of the project are to identify caves considered important habitat for the Ozark big-eared and gray bat in northeastern Oklahoma.

Management/protection plans for these caves are developed and implemented. These management/protection plans are coordinated with the landowners and include posting a warning sign at cave entrances, placing human restrictive structures at or within caves such as fencing around the cave entrance or a gate/grill structure within the cave's passage. Caves also are subsequently monitored to determine the effectiveness of restrictive management plans, particularly gated caves, and to determine the impact of these structures or other protection measures implemented at the site. This project is expected to be funded through at least 2012.

Other entities that have gated the entrance of caves used by this species are the National Speleological Society and the Service's Partners for Fish and Wildlife Program (Partner's Program). The NSS gated an essential cave utilized by large numbers of Ozark big-eared bats during the fall, while the Partner's Program has provided financial assistance for the construction of cave gates at one essential and one limited-use cave within the action area. Where possible, the Partner's Program is anticipated to continue to be used to protect cave sites from human disturbance and restore and enhance foraging habitat through financial and technical assistance.

The Ozark Plateau NWR currently provides protection for five essential Ozark big-eared bat caves (three used as both a maternity roost and hibernaculum, one used only as a maternity cave, and one cave utilized by large numbers during the fall). Habitat enhancement measures on forested tracts around refuge caves consist primarily of carefully planned prescribed burns that are intended to mimic the historic fire regime, encourage native flora and fauna, maintain a mosaic of plant communities representative of the ecosystem, and to reduce fuel loading and the risk of unplanned and unnatural high intensity wildfires. Because most of the species of moth selected as prey by the Ozark big-eared bat are dependent upon woody forest plants as a host (Dodd, 2006), conservation practices that encourage a diversity of woody forest plant species such as prescribed fire should serve to provide a rich prey base of moths. The long-term effects of the prescribed burns are therefore anticipated to be beneficial.

The Service approved expansion of the Ozark Plateau NWR in 2005. The refuge was approved to expand up to 15,000 acres within Adair, Delaware, Ottawa, Sequoyah, Craig, Mayes, and Cherokee counties, Oklahoma. Therefore, additional caves and surrounding foraging areas could be protected as the refuge expands. However, fee title acquisition of land by the Service for refuge additions of all areas necessary for the recovery of the Ozark big-eared bat likely would not be possible due to the large area used by Ozark big-eared bats. Therefore, working with private landowners will continue to be an important recovery tool.

WNS has not been documented in Oklahoma or within the range of the Ozark big-eared bat. WNS is not known to currently affect the Ozark big-eared bat. During May 2010, the fungus associated with WNS, however, was documented on a single cave myotis in northwestern Oklahoma, and on gray bats in Missouri, a species that co-occurs in caves with the Ozark big-eared bat. Should WNS move into the range of the Ozark big-eared bat (and should Ozark big-eared bats prove to be susceptible to the disease), the potential impact would be severe due to the high mortality rate of affected bats in the northeastern and eastern United States, and the small population size and limited distribution of the Ozark big-eared bat.

There currently are no Biological Opinions with incidental take statements issued for the Ozark big-eared bat in Oklahoma.

Gray bat

Status of the species within the action area

The action area in northeastern Oklahoma represents the western edge of the gray bat's range. The gray bat is known to roost in caves located within each of the five counties of the action area. Large maternity colonies (around 5,000 bats or more) are known from caves in Adair, Cherokee, Delaware, and Ottawa counties. A few individuals also are located within caves in Sequoyah County from time to time. Although a few individuals also may be found in Oklahoma caves during the winter, most gray bats that summer in Oklahoma migrate to northern Arkansas and southern Missouri for the winter. No hibernating colonies are known from Oklahoma.

Gray bat summer colonies typically use several roosting caves located within a home range area along a stream, river, or reservoir. Within the action area, sizeable maternity colonies currently are known to utilize eleven caves during the spring and summer. Most caves are located near Grand, Tenkiller, and Ft. Gibson reservoirs. The population in Oklahoma currently is estimated to consist of about 140,000 bats.

Ten (about 91 percent) of these caves currently receive some form of protection. Six caves have been gated. Two caves (one of which is gated) are owned and managed by The Nature Conservancy. One non-gated cave receives protection through a cooperative management agreement between the landowner and The Nature Conservancy. Three of the caves (two of which are gated) occur on the Ozark Plateau National NWR.

Sasse et al. (2007) analyzed data from 48 gray bat maternity sites in the western portion of the species' range involving three subpopulations in Missouri, Arkansas, and Oklahoma between 1978 and 2002. The analysis indicated that 79 percent of the colonies in the western portion of the range were stable or increasing, while 86 percent of the Oklahoma colonies were stable or increasing. Based on review of more recent data (1978-2007), there appears to be no change in the trends identified by Sasse et al. (2007) for the Oklahoma gray bat colonies.

Factors affecting species environment within the action area

The Ozark Plateau NWR currently provides protection for three important gray bat maternity caves and surrounding foraging habitat within the action area. The Service approved expansion of the Ozark Plateau NWR in 2005. The refuge was approved to expand up to an additional 12,000 acres (15,000 total acres) within Adair, Delaware, Ottawa, Sequoyah, Craig, Mayes, and Cherokee counties in Oklahoma. Protection of additional caves and foraging habitat is possible as the refuge expands. However, because most surface foraging habitat occurs on private land, and the protection of all properties necessary through fee title acquisition and/or conservation easements would not be possible due to the large area used by gray bats (up to 20 km from a cave), working with private landowners within the action area will continue to be an important recovery tool.

The Land Legacy, City of Tulsa, the Service and other partners recently have initiated an effort to acquire permanent conservation easements within the Spavinaw Creek Watershed in Delaware County, Oklahoma. The goal of this project is to protect water quality supplies for the City of Tulsa (Spavinaw and Eucha Lake), riparian corridors, Ozark oak/hickory pine forest and other important habitat on private land in the watershed through the purchase of conservation easements and implementation of best management practices. Several caves used by the gray bat occur within the watershed. Conservation easements will help protect important foraging habitat for this species.

Three important gray bat maternity caves that occur within the action area have been gated through the ongoing cave protection and management project that is implemented with funds from Section 6 of the Endangered Species Act in cooperation with the ODWC and Rogers State University (see "Factors affecting the Ozark big-eared bat" section for more information). Funds from The Nature Conservancy and the Grand River Dam Authority (GRDA provided funding to

comply with the terms and conditions of a biological opinion on GRDA's management of lake levels at Grand Lake which is believed to affect water levels in a gray bat cave) were used to gate one maternity cave. The Tulsa Regional Oklahoma Grotto also has gated a maternity cave (and provide volunteer labor for most cave gating efforts), while another cave has been gated with private funds. The Service's Partners Program also has provided financial assistance for the construction of one of the aforementioned cave gates.

Although 90 percent of the gray bat maternity caves within the action area receive some form of protection, human disturbance within caves continues to pose a threat. One to two cave gates typically are vandalized annually making the repair of cave gates an ongoing effort. Unauthorized human entry still occurs at times in gated and non-gated caves as evidenced by new trash or graffiti in the caves.

Due to the gray bat's preference for caves near rivers, flooding of caves due to impoundments can be problematic. Beaver Dam Cave, a privately-owned maternity cave within the action area, is located along Drowning Creek, a tributary to Grand Lake. The Federal Energy Regulatory Commission (and GRDA) and the COE control the power and flood pools of the reservoir, respectively. The water level in Beaver Dam Cave is affected by water levels in Grand Lake. Flooding associated with the lake operation can result in inundation of the main flyway used by bats to leave the maternity roost area and exit the cave. The Service completed formal section 7 consultation in accordance with the ESA with the FERC in 1992 due to the risk of take of gray bats within the cave due to flooding. During 2008, a higher elevation passage that is not anticipated to become inundated was modified and expanded to provide an alternate flyway for the bats and, thereby, reduce the risk of take. Because the COE controls the flood pool, section 7 consultation has been reinitiated on this project to address the COE's management of the reservoir.

Mortality of bats at wind power facilities is well documented (Arnett *et al.*, 2008), and increasingly has become an issue of concern as wind energy development has expanded in North America. There currently are no wind power farms within the action area. However, the Service is aware of a wind power facility proposed to be located within the action area in Delaware County. The Service is concerned that take of the gray bat may occur as a result of the proposed wind farm due to the location of the general project area between a concentration of maternity caves in northeastern Oklahoma and winter hibernacula in Arkansas and Missouri.

Pesticide contamination has been well documented in some populations of gray bats (Clark et al., 1978, 1980, 1983; Clawson and Clark, 1989; Clawson, 1991; Sasse, 2005). Accordingly, Martin (1992) conducted a study at several gray and Ozark big-eared bat caves within the action area to assess contaminant concentrations of bat guano and dead gray bats found in caves. The study found that gray bats were being exposed to environmental contaminants, especially organochlorine pesticides and trace elements. Adornato (2005), during a follow–up study, assessed contaminant levels, especially of heavy metals and organochlorines, in caves within the action used by gray bats, and found that organochlorine concentrations in dead bats and bat guano were generally low or below detection limits. Similarly, Sasse (2005) noted that gray bats at four maternity caves in Arkansas remain exposed to pesticide residues but at lower levels than previously reported by others (e.g., Clark et al., 1988; Clawson and Clark, 1989; Clawson, 1991).

Continued periodic monitoring of pesticide residues in guano and carcasses will be needed within the action area to identify possible contaminant issues in the future.

WNS has not been documented within the action area. During May 2010, the fungus associated with WNS, however, was documented on a single cave myotis in northwestern Oklahoma, and on gray bats in Missouri. The Service recently completed a 5-year review of the gray bat to assess whether the listing classification of endangered was still appropriate (USFWS, 2009), and determined that the current listing classification of endangered should be retained primarily due to the potential threat of WNS. If WNS spreads to populations of gray bats and results in the unprecedented mortality rates reported elsewhere in the Northeast (*e.g.*, 90 percent mortality in affected caves and over 1,000,000 bats estimated to have died due to WNS), the species would be severely impacted within the action area.

Ozark Cavefish

Status of the species within the action area

The Ozark cavefish historically was known to occur in 12 caves within the action area in Delaware and Ottawa counties. Currently, the species is known from 10 caves in these counties. Population monitoring at these sites has not occurred on a regular basis. Biologists also have not been granted access to two Ozark cavefish caves that occur on private property in over nine years. Consequently, data from complete survey efforts for this species within the action area are limited.

Graening et al. (2009) analyzed Ozark cavefish survey data from across its range for trends and found the results for Oklahoma caves (as well as most caves through the range) to be inconclusive because the data sets were too limited to detect a trend. Therefore, population trends for this species within the action area currently are not well understood.

Available data that has been collected over the past 50 years indicate that either no cavefish or only small numbers of cavefish typically are encountered during survey efforts in all caves within the action area except Long's Cave (DL-148), which occurs on a preserve owned by The Nature Conservancy in Delaware County. An average of about seven cavefish has been observed during the six surveys conducted in Long's Cave since the first survey in 1990. The average for every other cave ranges from 0.33 to 2.9 Ozark cavefish observed per survey (Table 1).

Such low numbers could be attributable to truly small populations. However, the inherent difficulties associated with survey attempts for this species also must be considered. Biologists can only enter those caves and areas within caves that accommodate our size. Because we are unable to access groundwater conduits that the fish are distributed throughout, we can only count fish in accessible reaches. Therefore, an overall population estimate for this species is difficult to assess. Considering these limitations, the summation of the most recent data from each currently occupied cave provides a rough population estimate of about 15 Ozark cavefish within the action area.

Factors affecting species environment within the action area

Five of the ten Ozark cavefish caves that occur within the action area have been gated to protect the cavefish and its habitat from human disturbance. Although these sites are protected from human disturbance, vandalism and access to these sites continues, which threatens population viability. Use at ungated caves also is occurring based on evidence such as new graffiti, foot prints, and writing on cave walls found during monitoring surveys. As interest in recreational caving continues to increase, caves supporting cavefish are likely to receive additional unauthorized entry.

Table 1. Average number of Ozark cavefish observed during survey efforts in currently occupied caves that occur within the action area.

Cave	Number of Surveys (Time Period)	Average Number Observed per Survey	Largest Count Since 1990
DL-21 (Engelbrecht Cave)	9 (1982 - 2005)	0.67	3
DL-38 (Jail Cave)	20 (1967 - 2008)	1.45	2
DL-39 (January-Stansbury Cave)	4 (1960 - 2006)	0.25	0
DL-47 (Mitchell's Cave 3)	7 (1983 - 1991)	0.43	0
DL-48/49 (Mitchell's Cave 1and 2)	3 (1970 - 1987)	0.33	NA
DL-74 (Star Cave)	6 (1971 - 2006)	1.17	1
DL-91 (Twin Cave)	31 (1970 - 2010)	2.9	4
DL-119 (Mgee's Cave)	6 (1990 - 2008)	2.0	2
DL-148 (Long's Cave)	8 (1991 - 2007)	6.6	19
OT-19 (Cave Springs Cave)	9 (1954 - 2005)	1.0	2

Four Ozark cavefish caves within the action area have been protected through fee title acquisition and management. Three of the Oklahoma caves are owned by The Nature Conservancy (all of which also are gated), while a fourth Oklahoma cave (ungated) was purchased as an addition to the Ozark Plateau NWR.

The recharge area (*i.e.,* the area around a cave that contributes water to the cave system) for seven Ozark cavefish caves (DL-21, DL-38, DL-39, DL-74, DL-91, DL-119, and DL-148) that occur within the action area have been delineated. Recharge zones range in size from about 0.50 to 23.9 square miles. Vulnerability and hazard assessments to identify potential sources of contamination also have been completed for four of these caves (DL-21, DL-38, DL-74, and DL-91). One hundred and six point sources of potential water contamination were identified in the recharge area of these four caves. Potential sources of contamination include confined animal feeding operations for poultry and hogs, petroleum storage sites, trash dumps, and sewage treatment plant effluent (Aley and Aley, 1990; Aley, 2005).

Threats from contaminants may be affecting the Ozark cavefish within the action area. Bidwell et al. (2010) investigated the occurrence organic wastewater and other contaminants in four of the Ozark cavefish caves that occur in the action area. Organic wastewater compounds and other contaminants were found in each cave. Contaminants identified include pesticides, antibiotics

and other pharmaceuticals, fragrances, and plasticizers. The study indicates that cavefish are experiencing exposure to anthropogenic contaminants. Because water concentrations of contaminants detected were not calculated it is not possible to draw any specific conclusions regarding the risk the chemicals detected pose. However, some of these compounds (*i.e.*, plasticizers, halogenated organic compounds) have been linked to estrogenic effects on aquatic organisms that may be enhanced when chemicals occur in mixture.

There currently are no Biological Opinions with incidental take statements issued for the Ozark cavefish in Oklahoma.

American Burying Beetle

Status of the species within the action area

Numerous ABB surveys have been conducted within the action area over the past 20 years (Table 2). However, the majority of these surveys are driven by the need to protect ABBs from specific soil disturbance actions associated with development projects. The survey data, therefore, is temporally and spatially random. Consequently, an estimate of the population size within the action area is difficult to assess.

Table 2. Results of ABB surveys that have been conducted within the action area over the last twenty years.

County	Number of Surveys	Total Number of ABBs Captured
Adair	16 surveys since 1994	0
Cherokee	26 surveys since 1991	146*
Delaware	39 surveys since 2004	0
Ottawa	26 since 2005	0
Sequoyah	24 since 1991	13

*145 of the 146 ABBs were captured during surveys conducted in 1991 and 1994 at the Cherokee Wildlife Management Area.

Oklahoma counties within the action area with recently confirmed ABB sightings since 1992 (*i.e.*, current range) are Cherokee and Sequoyah counties (Table 2). Unconfirmed recent ABB sightings within the action area since 1992 (*i.e.*, potential range) have been recorded in Adair and Delaware counties. The ABB historically occurred in Ottawa County, and is currently believed to persist there due to recent confirmed and unconfirmed occurrences in adjacent Craig and Delaware counties, respectively (USFWS, 2005).

Structured survey data are collected annually or biennially from several areas in eastern Oklahoma: the McAlester Army Ammunition Plant; Camp Gruber; Ouachita National Forest; Connors State College ABB conservation area; and Weyerhaeuser lands in Oklahoma. Although none of these properties occur within the action area, Camp Gruber and the Connors State conservation area occur in Muskogee County which is adjacent to two counties within the action area (Cherokee and Sequoyah counties). These surveys, therefore, represent the best trend data currently available for the ABB in the vicinity of the action area. ABB captures at these

locations typically fluctuate on an annual or biennial basis, but in general ABB numbers appear stable or increasing.

Less than 7 percent of the land within the ABB range in eastern Oklahoma exists in public ownership. Public landowners include: the Service; COE; U.S. Bureau of Indian Affairs; U.S. Bureau of Reclamation; U.S. Department of Defense; U.S. Forest Service; ODWC; Oklahoma Department of Tourism; and Oklahoma State School Lands Commission (U.S. Geological Survey, 1995).

Factors affecting species environment within the action area

The ABB is closely tied to soil, spending between 7 and 10 months in the soil during the winter and spring reproduction. Consequently, proposed projects that involve significant ground disturbance (greater than 1.2 acres) within the species range are considered to have potential to adversely impact the ABB. Between 2007 and 2009, the Service reviewed an average of 22 projects per year pursuant to section 7 of the ESA for potential impacts to the ABB within the action area. Specific measures typically are recommended on how to avoid unnecessary take of this species, and often initially include presence and absence surveys to determine whether the ABB occurs in the immediate project area. When survey results are positive, additional measures, such as baiting beetles out of the project area or tapping and relocating them, are recommended. The proper implementation of recommended conservation measures is assumed to alleviate any adverse affects to the ABB associated with the proposed project.

Land use within northeastern Oklahoma varies considerably and includes rangeland, pastureland, cropland, livestock farming, poultry production, oil and gas production, logging and commercial pine plantations, mining, and outdoor recreation (Woods et al., 2005). The mining district near Picher, Oklahoma, in Ottawa County, was a primary source of lead and zinc mining in the U.S. during the first half of the 20th century. It is now abandoned and has become the Tar Creek Superfund site (Woods et al., 2005). Eastern Oklahoma also has been highly impacted by the effects of agricultural conversion of arable lands (U.S. Geological Survey, 1990).

There are three current Biological Opinions (BO) with incidental take statements issued for the ABB in Oklahoma. Only one of these Biological Opinions is applicable within the action area. A programmatic biological opinion (PBO) was issued to the Federal Highway Administration in 2008 regarding highway construction activities undertaken within eastern Oklahoma. The PBO allows incidental take within a maximum of 5,999 acres of suitable habitat within eastern Oklahoma in the form of killing, harming and/or harassing from 2008 – 2012. A Biological Opinion also was issued to the Department of Defense pertaining to Camp Gruber in Muskogee County, which is adjacent to the action area. This BO allows for the take of 35 ABBs per year for the life of the project.

Currently, 20 entities or individuals possess valid section 10(a)(1)(A) scientific research permits to enhance the survival of the species in Oklahoma. These permits are valid within the action area. Although the work performed under the enhancement of survival permits must further conservation efforts for the species, some authorized take of ABBs can occur. The loss of some individual ABBs over the short-term from research and surveys is allowed as long as the survival

of the ABB is not jeopardized. The Service requires that every available precaution be implemented to reduce and/or eliminate authorized take associated with research activities.

EFFECTS OF THE ACTION

General Effects of HFRP Implementation

Implementation of the HFRP involves conservation measures and management practices that will contribute to sustainable forests on private lands and contribute to conservation of federally-listed threatened and endangered species. Moreover, any landowner desiring participation in the program will be required to implement a HRP. Initial evaluation of the property will identify immediate management needs and conservation practices to be carried out in 10-year increments. Therefore, 30-year easements, 30-year contracts and permanent easements will require review of each individual landowner's HRP on a 10-year basis. As described in the "Description of Proposed Action", the Service, Oklahoma Forestry Services and NRCS will jointly develop, review, and amend each HRP to ensure consistency with the goals and objectives of the HFRP and maximize benefits to the targeted species. The NRCS will be responsible for conducting annual status reviews to ensure program consistency and intent.

HRPs are expected to provide a net conservation benefit to the targeted species via implementation of the conservation actions and practices described in the "Description of Proposed Action" section. Further, we expect a positive response at the landscape level for each of the targeted species, due to the cumulative and sequential impact accrued through successive years of HFRP enrollment (e.g., as more acreage is enrolled and more conservation practices are implemented throughout the project area).

For as long as management activities are carried out and the resulting habitat improvements persist, overall health of the enrolled forestlands will benefit from conservation of the targeted species. With this cooperative effort, management of the landowner's property for the targeted species is assured into the foreseeable future. Therefore, the cumulative impact of the HFRP will provide a net conservation benefit to the aforementioned species.

While minimal net conservation benefits may be achieved in the early stages of HFRP implementation, the long-term implementation and subsequent addition of HFRP enrolled lands are expected to further targeted species recovery goals. Lands enrolled under permanent easements will provide continuous benefits to targeted species. Additionally, the habitat maintained through commitments created by the HRPs will not necessarily cease to exist upon expiration or termination of 10 year contracts, 30 year contracts, or 30 year easements. Enrolled landowners may choose to maintain the habitat improvements above baseline following termination of the agreement. If the HFRP continues in future years and new landowners continue to enroll under the program over an extended period, the net effect will be an increasing matrix of lands being maintained for conservation of the targeted species, with a net conservation benefit. The information provided below in Table 3 describes the short term and long-term impact of project implementation on habitats and the general effect on the suite of species targeted for protection and management by this HFRP project.

Table 3. HFRP Practices with Anticipated Ecological Impacts and Effects on Covered Species

Practice	Impact	Effect on Species
Brush Management	Controlling the invasion of eastern red cedar to simulate a historic plant community.	Short-term potential adverse effects from soil disturbance activities during equipment operation and tree removal; substantial long-term beneficial effects by reducing oak/hickory competition and removing obstacles within the flight patterns of the targeted species
Critical Area Planting	Facilitates Structure for Water Control by establishing permanent vegetation on the embankment and disturbed areas.	Short-term adverse effects to water quality and soil from erosion caused by disturbance activities during planting operations; substantial long-term beneficial effect by establishing native vegetation.
Fence	Excludes and discourages the intrusion of people, domestic livestock or vehicles from areas being managed for the targeted species.	Substantial long-term beneficial effect by limiting human and livestock access to target species habitat and by improving water quality.
Firebreak	Facilitates prescribed burning by exposing strips of bare ground to control prescribed fire.	Short-term potential adverse effect to soil and water quality from erosion; short-term beneficial effect by facilitating a successful prescribed burn; long-term beneficial effect by facilitating a historic fire regime.

Forest Stand Improvement	Control the species composition and stand density of oak/hickory forestland by thinning mid story trees to target a site specific basal area.	Slight short-term potential adverse effects to soil and water quality from erosion during thinning operations and associated activities; slight short-term adverse effects due to downed debris interfering with the flight path of the targeted species; substantial long-term beneficial effects by improving/restoring native habitat .
Nutrient Management	Facilitates Structure for Water Control by promoting healthy vegetative cover on the embankment through an application of fertilizer.	Slight potential adverse effects immediately after application during untimely rainfall events; long-term beneficial effects by enhancing soil stability and restoring native habitat.
Pest Management	Control of invasive herbaceous species such as musk thistle and sericea lespedeza within the habitat area of the targeted species.	Substantial long-term beneficial effect by restoring native habitat.
Prescribed Burning	Promote the restoration of native plant communities in oak/hickory forestland while also reducing hardwood understory and manipulating species composition.	Potential short-term adverse effects to species and habitat by smoke inhalation, loss of soil moisture, loss of food sources, loss of shelter, loss of reproductive habitat, and displacement of individuals; substantial long-term beneficial effects by restoration/ improvement of native habitat by mimicking historic ecological events.
Riparian Forest Buffer	Establishing and maintaining trees and shrubs adjacent to perennial or intermittent streams, lakes, ponds, wetlands and areas associated with ground water recharge.	Long-term beneficial effects to riparian habitat, and water quality by reducing erosion; substantial long-term beneficial effects by restoring native habitat.
Shallow Water Development and Management for Wildlife	The inundation of land to provide habitat for aquatic insects.	Slight short-term adverse effects to soil and water quality from construction activities; long-term adverse effects by

		loss of upland habitat; long-term beneficial effects by providing feeding habitat.
Structure for Water Control	Impounding shallow water to provide habitat for aquatic insects.	Slight short-term adverse effects to soil and water quality from construction activities; long-term beneficial effects through creation of aquatic insect habitat.
Tree/Shrub Establishment	Re-establishing oak/hickory forests which have been converted to pastureland or cropland.	Short-term adverse effects due to soil disturbance; substantial long-term beneficial effect by restoring native habitat, decreasing forest fragmentation and improving water quality.
Tree/Shrub Site Preparation	Improve the survivability of planted trees by controlling undesirable, competitive vegetation or altering site conditions through ripping/subsoiling.	Short-term adverse effects to soil and water quality from soil erosion during preparation activities; substantial long-term beneficial effect by restoration of native habitat.
Upland Wildlife Habitat Management	Develop and manage desirable habitat for the targeted species.	Substantial long-term beneficial effects by enhancing or restoring native habitat.
Use Exclusion	Excludes domestic livestock and human activities from a protected area.	Substantial long-term beneficial effects by improving native habitat.

Covered Species-Specific Effects

Ozark Big-Eared and Gray Bats

The Ozark Highlands ecoregion (Omernik, 1987) is under considerable development pressure and is one of the fastest growing areas in the country due to relatively inexpensive land prices and the aesthetics of the area. As population growth and development pressures increase in the future, it will be increasingly important not only to protect important caves, but also to protect and restore forested foraging and flight corridor habitat around the caves.

The purchase of either a 30-year or perpetual conservation easement on properties that contain caves used by the Ozark big-eared and/or gray bat or that provide foraging and/or flight corridor habitat for these species would ensure that these areas would not be developed or converted to agriculture uses. Therefore, the purchase of conservation easements would be entirely beneficial.

HRPs that would be implemented on properties that occur within the known range of these species will be designed to protect, enhance, and/or restore upland and riparian forested habitat. HRPs will contain forest management practices intended to produce conditions believed to exist prior to fire suppression and other anthropogenic effects.

Upland oak-hickory forests historically had a fire regime and fires have played a significant role in their composition and structure (Lorimer, 2001; Abrams, 2005; Hutchinson et al., 2008). Most ecologists believe that, prior to European settlement, the Ozarks supported a lower-density forest, and that tree density generally has increased while the cover of herbaceous understory vegetation has been reduced due to fire suppression (Sauer, 1920; Howell and Kucera, 1956; Heikens, 1999).

Objectives of HRPs, therefore, would be to manage for an open canopy, moderately stocked, mature oak-hickory forest with an herbaceous understory. Prescribed fire and selective thinning encourage the regeneration of forest plant species by preparing the seed bed and reducing the amount of shade on the forest floor that inhibits the germination and growth of herbaceous plants and new seedlings (Abrams, 1996; Alexander et al., 2008; Barnes and Van Lear, 1998; Dey and Hartman, 2005). Therefore, HRP objectives initially would be accomplished by re-introducing fire into the landscape, or continuing the use of this practice. A series of timber thinnings also will be applied, where appropriate, over an initial 10 year period to accelerate the process. Following the initial 10-year treatment period, prescribed burns will be continued during the remainder of the easement period, on a 3-7 year interval.

The immediate effect of prescribed fire on bats in general is not well understood due to a lack of scientific research on the subject (Clark et al., 2002; Lacki et al., 2009). The use of prescribed fire may have some short-term adverse effects on the Ozark big-eared and gray bat. Potential adverse effects include smoke entering caves while bats are roosting (on those properties on which caves might occur), disturbances to foraging bats due to smoke and heat, and impacts to insect prey abundance and distribution.

Prescribed burns would be planned so that factors such as location of caves in relation to prescribed burns, wind direction, and temperature would be considered during the design of the burn plan to prevent smoke from entering caves. As an additional precautionary measure, burning around maternity caves during the early maternity season (*e.g.*, May 1- June 30) would not occur so that the potential for smoke to enter a cave that contains non-volant young would be completely avoided. Similarly, burning around hibernacula would not occur during the typical winter hibernation period (e.g., November 1 – March 15) to avoid disturbance to hibernating bats.

During a recent study on the response of northern long-eared bats (*M. septentrionalis*) to prescribed fire, Lacki et al. (2009) found the bats to be tolerant of prescribed fires. The bats responded to habitat alterations by shifting foraging areas to track insect abundance. We believe that the Ozark big-eared and gray bat also would be tolerant of prescribed fire while burns are being implemented. Because bats are mobile, the bats should be able to avoid areas during the burn to avoid any possible direct effects of smoke and heat. Bats also may selectively forage in or near the area due to increased dispersal of insects from the burn site. Should foraging bats

avoid the area, suitable foraging habitat should not be significantly limited due to the temporary nature of the fire. Lacki et al. (2009) also found that the abundance of all insects combined was shown to increase following the prescribed burns. An increase in insects would benefit the Ozark big-eared and gray bat by providing more prey items in the environment.

Predicting the exact long-term vegetation response to individual HRPs (*i.e.,* prescribed fire and selective thinning) is difficult due to the complex interaction of numerous factors such as topography, terrain, season of burn, plant phenology, and initial forest condition and composition on individual properties. However, it is anticipated that the long-term effect of reintroducing fire, implementing selective thinning, and managing for a regenerating, moderately stocked mature forest would be beneficial to the Ozark big-eared and gray bat.

The Ozark big-eared bat is considered a moth specialist (USFWS, 1995; Leslie and Clark, 2002; Dodd and Lacki, 2007). A recent study on the diet of the Ozark big-eared bat and prey abundance in Arkansas found that the bats prey on a wide diversity of moth species, and that most of the moth species are dependent upon woody forest plants as a host (Dodd, 2006). The study also found a positive correlation between woody species richness and moth occurrence (Dodd et al., 2008). Conservation of the Ozark big-eared bat, therefore, requires not only protection of important caves but also forested habitat that supports abundant and diverse moth populations (Leslie and Clark, 2002; Dodd et al., 2008). Implementing forest management practices that encourage the forest regeneration process and help maintain a healthy forest condition should benefit the Ozark big-eared bat by ensuring the ongoing production of a rich prey base of moths.

Converting a forest that has become overcrowded due to fire suppression to a moderately stocked condition also would be anticipated to benefit the Ozark big-eared bat by creating an enhanced foraging environment. The Ozark big-eared bat is considered a highly maneuverable flier based on wing-loading characteristics (*i.e.,* the ratio of weight to wing area). They are well adapted to forage in either a cluttered environment, such as a dense forest, or a relatively more open area, such as edge habitats or a more open forest (Farney and Fleharty, 1969; Leslie and Clark, 2002; Wethington et al., 1996). The Ozark big-eared bat, therefore, is not as restricted in its selection of foraging habitats as other less maneuverable species, and the selection of foraging habitat by the Ozark big-eared bat likely is due to both foraging efficiency and the availability of prey (Clark et al., 1993; Dodd, 2006; Wethington et al., 1996).

The Ozark big-eared bat has been shown to selectively forage in both edge and forested habitats and also to use habitats in proportion to their availability. A radio telemetry study of the foraging activity of females during the summer maternity season, for example, found that females used edge habitats more than expected (Clark et al., 1993). Another study, however, found that males selected forested areas during late summer/early fall (*i.e.,* September) while females failed to show preference for foraging habitat (Wethington et al., 1996).

Edge habitat likely is selected at times of high moth abundance (*e.g.,* the summer) because it is relatively less costly to forage there as compared to the more cluttered forest interior and woodland moths are abundant enough that the probability of encounter is high. However, during times of reduced moth abundance (*e.g.,* the fall), Ozark big-eared bats may move into the more

cluttered forest interior to forage where the occurrence of their preferred prey is relatively higher (Dodd, 2006). HRPs that promote a moderately stocked mature oak-hickory forest are anticipated, therefore, to benefit the Ozark big-eared bat by providing habitat that is not only rich in their preferred prey, but also less cluttered and, therefore, less energetically costly to forage within as compared to a forest that has become dense due to fire suppression.

Gray bats are adapted at foraging in open areas, such as over a stream, or gaps in a forest, and are a relatively less maneuverable flier than the Ozark big-eared bat. However, they utilize forested areas for protection from predators such as screech owls as they travel between caves and foraging sites. Converting a forest that has become overcrowded due to fire suppression to a moderately stocked condition would be anticipated to benefit the gray bat by creating a more open environment through which it should be easier to navigate and avoid predation.

Riparian forest buffer restoration, enhancement, and maintenance will be included in HRPs that would be implemented on those properties that have perennial or intermittent water bodies. Riparian buffers are critical to the protection and enhancement of streams, rivers, ponds, and lakes. Vegetated riparian buffers shade water bodies, and improve and protect water quality by filtering and reducing the amount of sediment, organic material, nutrients and pesticides that enter water bodies from surface runoff (Naiman and Decamps, 1997).

Riparian forests are important foraging habitat for the Ozark big-eared bat, especially in fragmented landscapes where they represent the remaining forested habitat. They are used during foraging bouts (Clark 1991; Wilhide et al., 1998), and provide an abundant source of moth prey (Dodd et al., 2008). The restoration, enhancement, and maintainence of riparian buffers will provide long-term beneficial effects by enhancing and maintaining areas that produce moth prey, and are used as flight corridors and foraging habitat.

Gray bats feed primarily on aquatic insects in riparian areas and over rivers, streams, and other water bodies (Harvey, 1994; Tuttle and Kennedy, 2005). Riparian forest buffer restoration, enhancement, and maintenance, therefore, also is anticipated to provide long-term beneficial effects to the gray bat by enhancing and maintaining important foraging habitat.

Certain practices including plantings, brush management, creating firebreaks, and thinning operations may result in temporary increases in soil erosion and subsequent temporary impacts to water quality. Due to the importance of streams and other water bodies as foraging habitat for the gray bat, it is possible that the implementation of these practices could result in short-term adverse effects to the gray bat.

In summary, we believe that any adverse effects on the Ozark big-eared and gray bat due to implementation of HRPs are likely to be only ephemeral. The temporary effect would be in the form of harm and/or harassment. Because wildfires were historically frequent and widespread in the Ozark Highlands, are important for the health and regeneration of upland forests, and are likely to increase prey abundance, we believe that the long-term effects of HRPs would be beneficial and outweigh any temporary adverse effects. We believe that implementation of HRPs for the Ozark big-eared and gray bat would be reasonably expected to result in protection, enhancement, and restoration of cave and upland oak-hickory and riparian foraging habitat

during the period that the HRP is valid and operating. We believe these benefits will occur on a landscape scale over time as additional lands are enrolled in HFRP.

Ozark Cavefish

The Ozark cavefish occurs in underground aquatic environments that are relatively fragile and highly susceptible to disturbances. Aquatic cave environments are highly vulnerable to groundwater pollution due to the high level of connectivity between surface and ground water in karst areas. Surface water can enter the groundwater systems rapidly as it passes through sinkholes and cracks and crevices in the ground surface, such as fractures in stream beds (*i.e.*, losing streams), or fractured limestone under thin layers of permeable soils. Groundwater in karst areas can travel as quickly as a few thousand feet to over a mile per day. Degradation of sensitive, underground habitats and the associated groundwater can, therefore, occur rapidly in areas of karst topography.

The recovery plan for the Ozark cavefish (U.S. Fish and Wildlife Service, 1989) recommends certain conservation actions to help recover the species. These actions include determining the recharge area of important caves (*i.e.*, areas involved with input of water into the cave system) used by the species. Other recommendations include implementing actions within the recharge area to help protect and improve groundwater quality within the cave.

Habitat degradation and ground water pollution due to agricultural activities and development currently are considered primary threats to the Ozark cavefish. The purchase of either a 30-year or perpetual conservation easement on properties that contain caves used by the Ozark cavefish or occur within the recharge area of caves used by the Ozark cavefish would ensure that these areas would not be developed or converted to agriculture uses. Therefore, the purchase of conservation easements would be entirely beneficial.

HRPs that would be implemented on properties that occur within delineated recharge areas of caves used by the Ozark cavefish would be designed to protect, enhance, and/or restore upland and riparian forested habitat. HRPs will contain forest management practices that would be used to produce conditions believed to exist prior to fire suppression and other anthropogenic effects. Objectives of HRPs would be to manage for a regenerating, moderately stocked mature oak-hickory forest with an herbaceous understory using prescribed fire and selective thinning (as discussed above in the Ozark big-eared bat and gray bat section). Objectives also would be to protect, enhance, and restore forested riparian areas.

Certain practices that may be implemented as part of HRPs could have temporary adverse effects on the Ozark cavefish. These negative effects would be due to impacts to water quality as a result of temporary increases in soil erosion. These activities include brush management, creating firebreaks, plantings, and thinning operations.

Activities implemented to protect, enhance, and restore upland forests and riparian areas (*e.g.*, fencing out cattle, plantings, and selective thinning) within the recharge zone of caves used by the Ozark cavefish would have long-term beneficial effects to the Ozark cavefish. Upland forests provide valuable canopy cover for ground temperature regulation and soil moisture

retention. Vegetated riparian buffers help improve and protect water quality by filtering and reducing the amount of sediment, organic material, nutrients and pesticides that enter water bodies from surface runoff (Naiman and Decamps, 1997). Restoring, enhancing and/or maintaining a healthy, wooded riparian zone along water bodies that occur within the recharge areas of caves used by this species would help protect and improve surface and ground water quality.

In summary, we believe that any adverse effects on the Ozark cavefish due to implementation of HRPs are likely to be only ephemeral. The temporary effect would be in the form of harm and/or harassment and not anticipated to be in the form of direct mortality. The long-term effects of HRPs are anticipated to be beneficial and outweigh any temporary adverse effects. We believe that implementation of HRPs for the Ozark cavefish would be reasonably expected to result in protection, enhancement, and restoration of cave and forested upland and riparian habitat during the period that the HRP is valid. These benefits are anticipated to occur on a landscape scale over time as additional lands are enrolled in HFRP.

American Burying Beetle

The ABB spends anywhere from 26 to 51 days in the soil during the breeding season and approximately 8 months in the soil during their inactive period. The ABB, therefore, potentially could be exposed to adverse effects and potential take through soil disturbance throughout the majority of the year.

Potential impacts to ABBs are possible through clearing, grading, restoration, soil compaction, vegetation alteration, temporary soil displacement, erosion, soil contamination from spills and leaks, and rutting. Vegetation clearing, grading, vehicle and equipment traffic could result in the direct killing by crushing of ABB adults, larvae, and eggs. ABBs could be exposed to adverse conditions if displaced during soil excavation. Direct mortality to eggs and larvae could occur via adults abandoning active broods in occupied habitat as a result of disturbance, habitat degradation, and/or fragmentation. Reduced foraging success also could occur over the short-term due to habitat alteration.

The primary limiting factor for ABBs is believed to be habitat loss, degradation, and fragmentation (Service, 1991). We believe that the restoration of habitat to native conditions through the implementation of HRPs would create new or improved habitat for ABBs and reduce fragmentation. This in turn would lead to increased food and reproductive carrion sources. Although implementation of HRPs is likely to result in take in the form of direct mortality, harm, and/or harassment, we believe that the long-term effects of HRPs would be beneficial to the ABB and outweigh any adverse effects. The proposed enhancement and restoration of habitat within the proposed project area would provide a beneficial effect for the ABB during the period that the HRP is valid and operating.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local, private, or other non-federal entity activities on endangered and threatened species and their critical habitat that are reasonably certain to occur in the action area. Future federal actions unrelated to the proposed action are not considered in this section because they are subject to consultation pursuant to section 7 of the Act.

Numerous non-federal actions that could affect listed species are reasonably certain to occur within the action area. These will typically include agriculture, grazing activities, and urban development. Each of these future activities could contribute to cumulative effects on listed species or their habitat in the action area.

Ozark Big-Eared Bat

Non-federal actions that may negatively impact the Ozark big-eared bat include the loss of important foraging habitat around caves due to urbanization and conversion of land to agricultural use. Although these activities will likely continue to be implemented by non-federal entities, the actions, in conjunction with the proposed action, are not likely to significantly negatively affect the continued survival of the Ozark big-eared bat. In fact, the HFRP is anticipated to positively affect the recovery of the Ozark big-eared bat by protecting and enhancing important forested foraging habitat that occurs on private land.

Gray Bat

The gray bat may be negatively affected by the loss of important forested flight corridors and riparian areas due to residential and commercial development and conversion of forested land to agricultural use (*e.g.*, pasture). Gray bats also may be impacted by water quality degradation caused by the clearing of riparian buffers, agriculture, and urbanization. These activities likely will continue to be implemented by non-federal entities. However, these activities, in conjunction with the proposed action, are not likely to significantly negatively affect the continued survival of the gray bat. In fact, the HFRP is anticipated to positively affect the recovery of the gray bat by protecting and enhancing important forested flight corridors, riparian areas, and foraging habitat that occurs on private land.

Ozark Cavefish

Habitat degradation and ground water pollution due to agricultural activities and development currently are considered primary threats to the Ozark cavefish. Although agricultural activities and development by non-federal entities are likely to continue, these activities, in conjunction with the proposed action, are not likely to significantly negatively affect the continued survival of the Ozark cavefish. The HFRP is expected to positively affect the recovery of the Ozark cavefish by protecting, enhancing, and restoring habitat that occurs on private lands within the recharge area of caves used by this species.

American Burying Beetle

There are numerous, continuing, and expanding impacts to ABBs and their habitat from non-federal actions. Non-federal actions that may negatively impact the ABB include oil and gas wells, pipelines, and commercial and residential development. These activities by non-federal entities within the action area will likely continue. However, these actions, in conjunction with the proposed action, are not likely to significantly negatively affect the continued survival of the ABB.

CONCLUSION

After reviewing the current status of the Ozark big-eared bat, gray bat, Ozark cavefish, and American burying beetle, the environmental baseline for the project area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that implementation of the HFRP in the project area is not likely to jeopardize the continued existence of these federally-listed species. Critical habitat for these species has not been designated; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to Section 4(d) of the Act prohibit the take of endangered and/or threatened species, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as "take" that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not prohibited under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

In order for the exemption in Section 7(o)(2) of the act to apply, the measures described below must be non-discretionary and binding on any grant, contract (*e.g.,* HRP), or permit issued to parties conducting activities under the auspices of the HFRP. NRCS has a continuing duty to regulate the activity covered by this incidental take statement. If NRCS (1) fails to assume and implement the terms and conditions or (2) fails to require contractors or other parties conducting work on behalf of NRCS to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, contract (e.g., HRP), or grant document, the protective coverage of Section 7(o)(2) of the act may be invalidated. In order to monitor the impact of incidental take, NRCS must monitor and report land use trends, habitat conditions, and HRPs to the Service as specified in this PBA/PBO.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

Ozark Big-Eared Bat, Gray bat, and Ozark Cavefish

Individual numbers of Ozark big-eared bats, gray bats, and Ozark cavefish in excess of baseline conditions could be taken as an incidental consequence of returning enhanced and/or restored habitat conditions to baseline conditions by discontinuing beneficial land use activities and management. The precise number of individual covered species subject to incidental take cannot be determined because of the demographic and environmental stochasticity and uncertainty inherent in predicting a specific increase in population above the baseline as the result of voluntary management efforts to benefit the targeted species. However, a reduction in habitat conditions to baseline conditions that could result in a corresponding reduction in populations to baseline conditions would be considered as harm and/or harassment. The amount or extent of take incidental to such a return to baseline conditions would not involve any individuals associated with baseline habitat conditions.

NRCS and the Service acknowledge that any incidental take of targeted species will only be permitted after a net conservation benefit standard has been implemented and at such time that the landowner may exercise their right to return to the original baseline conditions upon expiration of the HFRP/HRP contract or agreement. It is important to note that such taking may or may not ever occur. The voluntary management activities undertaken through HFRP will likely increase the number, extent, and duration of the species and increase the amount (*i.e.,* acreage and/or connectivity) and quality (*e.g.,* decrease basal area, canopy cover, or shrub cover) of habitat. The only habitat that may be lost due to incidental take is habitat that has been enhanced or restored above baseline conditions and, as such, does not currently exist, or is unoccupied at the time a landowner enrolls.

American Burying Beetle

Implementation of HRPs is likely to result in take of the ABB in the form of direct mortality, harm, and/or harassment. The level of take is difficult to precisely quantify because the actual extent to which ABB habitat would be affected is unknown. Additionally, the actual level of take would be difficult to detect for the following reasons: 1) the ABB has a small body size making it hard to locate, which makes encountering dead or injured individuals unlikely; 2) ABB losses may be masked by annual fluctuations in numbers and highly concentrated movements; and 3) ABBs spend a substantial portion of their lifespan underground. Therefore, the Service cannot provide a precise measure of the number of ABBs that would be taken. The Service believes using habitat area as a surrogate for take is the most appropriate method to quantify the amount of take that is likely to occur.

Forest management practices anticipated to result in take of the ABB will not be implemented on all acres enrolled in the HFRP. Based upon estimates by the Service and NRCS, it is anticipated that incidental take in the form of killing, harming, and/or harassing may occur during the implementation of forest management practices within a maximum of 5,000 acres of the action area. Individual ABBs also could be taken as an incidental consequence of returning enhanced

and/or restored habitat conditions to baseline conditions by discontinuing beneficial land use activities and management. A return to baseline habitat conditions could result in loss, fragmentation, and/or alteration of suitable ABB habitat. Anticipated ABB response to the return to baseline may include harm, harassment, and eventual mortality by the loss or reduction in available carrion for feeding and reproduction, and increased competition for carrion. Such impacts to the ABB can result in reduced foraging success, reduced fecundity and/or reduced over-wintering survival.

The precise number of ABBs subject to incidental take as an incidental consequence of returning enhanced and/or restored habitat conditions to baseline conditions cannot be determined because of the demographic and environmental stochasticity and uncertainty inherent in predicting a specific increase in population above the baseline as the result of voluntary management efforts to benefit the targeted species. However, a reduction in habitat conditions to baseline conditions that could result in a corresponding reduction in populations to baseline conditions would be considered as harm and/or harassment.

EFFECT OF THE TAKE

The Service does not believe that the level of anticipated take associated with the HFRP in Oklahoma, a program intended to improve habitat for listed species on private lands, is likely to result in jeopardy to any of the targeted species. The Service also has determined that the level of anticipated habitat take is not likely to result in jeopardy to the ABB.

REASONABLE AND PRUDENT MEASURES; TERMS AND CONDITIONS

The Service believes that with effective NRCS and Service cooperation and coordination as outlined in this PBA/PBO, implementation of the proposed HFRP does not require reasonable and prudent measures or terms and conditions since all components of the HFRP are considered as part of the proposed action. Individual reasonable and prudent measures may be required for individual HRPs.

Upon locating a dead, injured, or sick individual of an endangered or threatened species, initial notification must be made to the Oklahoma Ecological Services Field Office in Tulsa, Oklahoma (918/581-7458). Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened

species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse impacts of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. A primary goal of HFRP is to promote recovery of listed species. No additional conservation recommendations are necessary due to the inherent benefits that will occur during implementation of HFRP and the associated HRPs.

REINITIATION NOTICE

This concludes formal consultation pertaining to NRCS actions involving HFRP activities. As provided in 50 CFR Sec 402.16, reinitiation of formal consultation is required where discretionary NRCS involvement or control over the action has been retained (or is authorized by law) and where any of the following circumstances occur:

1. The amount or extent of "taking" specified in the incidental take statement is exceeded (*i.e.*, "take" exceeds baseline conditions in individual HRPs).
2. New information reveals effects of NRCS' action that may affect listed species or critical habitat in a manner or to an extent not previously considered.
3. NRCS' action is subsequently modified in a manner that was not considered in the PBA/PBO.
4. A new species is listed, or critical habitat designated that may be affected by the action.
5. A listed species not covered in this PBA/PBO is discovered on an enrolled landowner's property.

HFRP Programmatic Biological Assessment Approval

Ronald L Hilliard 9-15-10

RONALD L. HILLIARD, State Conservationist
Natural Resources Conservation Service

HFRP Programmatic Biological Opinion Approval

Dixie Bounds 9-14-10

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