United States Department of the Interior

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In Reply Refer To:
FWS/R2/OKES/
2011- F-0145

June 9, 2011

Dennis E. Rankin
Project Manager
U.S. Department of Agriculture
Rural Utilities Service
1400 Independence Avenue, S.W.
Washington, DC 20250-0700

Dear Mr. Rankin:

This document transmits the U. S. Fish and Wildlife Service's (Service) biological opinion (BO) based on our review of the KAMO Electric Cooperative's (KAMO) proposed Blackberry-Chouteau 345kV Transmission Line in northeast Oklahoma, and its effects on the American burying beetle (ABB) *Nicrophorus americanus* and its habitat in eastern Oklahoma in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). KAMO is requesting financing from the U.S. Department of Agriculture (USDA), Rural Utilities Service (RUS) to construct and maintain an electric transmission line and associated facilities. Your April 5, 2011, letter requesting formal consultation was received on April 18, 2011, and your October 2010 BA was received on December 10, 2010. A complete consultation package was received on June 6, 2011.

This BO is based on information provided in the October 2010 biological assessment (BA), December 2007 environmental assessment (EA), October 2009 supplemental EA, electronic mail correspondence, telephone communication, mapping data, and other sources of information. A complete record of this consultation is on file at the Oklahoma Ecological Services Field Office (OFO).

The Service appreciates the cooperation extended by the Cherokee Nation during this consultation. If further assistance or information is required, please contact me at the above address or telephone (918) 382-4504.

Sincerely,

Dixie Bounds

Dixie Bounds, PhD
Field Supervisor

cc: Regional Director, Service, Albuquerque, NM
Manhattan Ecological Services Field Office, Attn: Dan Mulhern, Manhattan, KS
Columbia Ecological Services Field Office, Attn: Scott Hamilton, Columbia, MO

CONSULTATION HISTORY

On April 13, 2007, KAMO, RUS, and Burns and McDonnell sent written correspondence to Service personnel in Oklahoma, Kansas, and Missouri regarding the Blackberry-Chouteau 345kV Transmission Line (Transmission Line).

On April 30, 2007, the Service received Burns and McDonnell's April 26, 2007, letter requesting comments for the development of an EA for the proposed Transmission Line.

On July 25, 2007, the Service met with KAMO and RUS. KAMO informed the Service of the Transmission Line and gathered information on the potential impacts to threatened and endangered species in the project area. During this meeting, the Service discussed potential concerns for the ABB. The Service indicated that the ABB may be present near KAMO's proposed Transmission Line and construction of the proposed Transmission Line could result in mortality and habitat loss and fragmentation.

On August 24, 2007, the Service received a compact disk with mapping shapefiles of the proposed Transmission Line.

On September 12, 2007, the Service responded to RUS's Notice of Intent to hold public scoping meetings and to prepare an EA regarding KAMO's Transmission Line. Our letter included the federally listed species within the proposed action area that RUS should include in their environmental review.

On December 27, 2007, the Service received Burns and McDonnell's December 17, 2007, letter, and EA submitted on behalf of RUS. Their letter requested the Service's comments on the EA for KAMO's proposed Transmission Line.

On February 7, 2008, the Service notified RUS via electronic mail that we concurred with their EA determination that impacts to the ABB are likely. We further recommended that a BA be prepared and formal consultation be requested.

The Service received a courtesy copy of Burns and McDonnell's May 21, 2009, letter to RUS regarding the Blackberry to Chouteau Transmission Line ABB impacts assessment. Burns and McDonnell and KAMO determined that the proposed Transmission Line will not have any adverse affects to the ABB.

In August 2010, the Service received a copy of KAMO's October 2009 Supplemental EA for the Blackberry to Chouteau Transmission Line prepared for RUS.

On August 24, 2010, the Service notified RUS via electronic mail our comments regarding the supplemental EA, which described RUS's determination that KAMO's project would have no effect on the ABB. This is inconsistent with our previous comments regarding impacts to the ABB from the proposed Transmission Line and RUS's findings in their EA. We have provided verbal and written information to RUS that it would be difficult or impossible to completely avoid adverse affects for the project and that formal consultation is recommended.

On September 8, 2010, the Service submitted a letter to RUS Oklahoma State Conservationist. Our letter expressed concerns that KAMO was not in compliance with the Act because we have not received any request for consultation regarding this project, which we recommend because the ABB is likely to be impacted. We further informed RUS that we would not support an easement without mitigation on existing Partners for Fish and Wildlife Program Site, Wetland Reserve Program (WRP) site or other wetland sites located in the proposed right-of-way.

In their December 2010 BA, RUS and KAMO identified the following federally listed species as potentially occurring in the counties included in the study area: American burying beetle (*Nicrophorus americanus*), Eskimo curlew (*Numenius borealis*), gray myotis (*Myotis griseascens*), interior least tern (*Sterna antillarum*), Neosho madtom (*Notrus placidus*), Ozark cavefish (*Amblyopsis rosae*), piping plover (*Charadrius melodus*), and the western prairie fringed orchid (*Platanthera praeclara*). Suitable habitat for the interior least tern, Eskimo curlew, piping plover, gray bat, Neosho madtom, Ozark cavefish ,and western prairie fringed orchid were avoided during the routing process and are not impacted by the proposed project. Other Best Management Practices (BMPs) will aid in maintaining soil stability throughout the project, including preventing siltation of the creeks and rivers crossed by this project, therefore avoiding impacts to aquatic protected species. RUS and KAMO determined that the proposed project will have no effect on these species. RUS and KAMO recognized the bald eagle (*Haliaeetus leucocephalus*) occurs within the study area and is protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act; however, as of June 2007 it is no longer protected under the Act. Consequently, RUS and KAMO did not address this species in the BA.

On December 14, 2010, the Service received RUS's December 10, 2010, BA for the proposed Transmission Line project.

On March 8, 2011, the Service notified RUS that additional information was needed for a complete BA and that a letter specifically requesting initiation of formal consultation is needed from RUS.

On April 18, 2011, the Service received RUS's letter dated April 5, 2011, requesting initiation of formal consultation for KAMO's impacts on the ABB and the additional information we requested.

On May 17, 2011, the Service notified Burns and McDonnell via electronic mail that additional information was needed. This same day Burns and McDonnell provided the requested information. Later that same day the Service notified RUS that we now had complete consultation package to begin developing our biological opinion. However, later that same day we determined the consultation package to still be incomplete because the shapefiles provided were not organized in a manner that allowed the Service to verify KAMO's determination of areas deemed suitable or unsuitable habitat for ABBs. The Service explained via electronic mail and telephone of the information necessary in the shapefiles to constitute a complete consultation package.

On May 27, 2011, the Service notified Burns and McDonnell that the Service had not yet received new shapefiles.

On June 6, 2011, the Service met with representative from KAMO and Burns and McDonnell. Burns and McDonnell described their process for determining suitable and unsuitable habitat for the ABB along the transmission right-of-way. Burns and McDonnell provided the soil data spreadsheet via electronic mail to the Service. This resulted in the Service having a complete consultation package.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

KAMO contracted with Burns and McDonnell Engineering, Inc. (Burns and McDonnell) during October 2010 to prepare a BA to evaluate potential effects of the proposed project on threatened and endangered species.

Conservation Measures

When used in the context of the Act, "conservation measures" represent actions pledged in the project description that the action agency or the applicant will implement to further the recovery of the species under review. The beneficial effects of the conservation measure are taken into consideration for both jeopardy and incidental take analyses.

RUS and KAMO propose the following to minimize the adverse effects to the ABB from the Transmission Line and to improve the conservation status of the species beyond that which would occur without the action. However, impacts could not be eliminated entirely.

KAMO and Burns and McDonnell took steps during the routing process to reasonably avoid or minimize impacts to the habitat for the ABB, including avoiding or minimizing woodlands along the proposed alignment. Cropland and pastureland were preferred to woodland to reduce ground disturbance, lower intensity of construction related activities, and reduce permanent habitat changes. In the wooded areas where clearing will be required, clearing will be done using tired vehicles, rather than bulldozing trees. Stumps and root systems will be left in place to help maintain soil stability, and reduce soil disturbance and impacts to ABBs. When feasible, existing disturbed areas, such as roads, railroads, and existing Transmission Lines, will be paralleled to reduce the amount of new disturbance required. The use of the right-of-way for overland travel by construction vehicles will be followed, as opposed to the construction of new roads. Additionally, the hand clearing and implementation of soil stabilization BMPs in areas near the creeks and rivers crossed by this project will help maintain soil stability and avoid negative impacts to aquatic protected species due to erosion of the creek and stream banks into the water.

Approximately 27.86 acres of suitable wooded ABB habitat occur within the right-of-way of the proposed project. Based on the location and acreages of suitable affected habitat, a total of 12 survey transects in Mayes, Craig, and Ottawa counties would be necessary to determine the presence or absence of ABB in these areas (Table 1).

Table 1 Summary of ABB Presence/Absence Survey Requirements

County	State	Transects
Mayes	OK	2
Craig	OK	8
Ottawa	OK	2
Total		12

Action Area (This information is from the RUS-KAMO's BA)

The action area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR § 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment.

The action area for this biological opinion is only the portion of the project in Ottawa, Craig, and Mayes counties in Oklahoma (Appendix 1). The project area will be located in southeastern Kansas, southwestern Missouri and northeastern Oklahoma (Appendix 2). It includes portions of Cherokee County in Kansas, portions of Jasper County in Missouri, and Ottawa, Craig, and Mayes counties in Oklahoma.

The project right-of-way is underlain by level to slightly tilted shale, sandstone, and siltstone strata in the Pennsylvanian-age Atoka Formation and the Cane, Boyd Shale, and Prairie Grove members of the Hale Formation. Parts of the northern edge are underlain by the Mississippian-age Pitkin Limestone, Fayetteville Shale, and Batesville Sandstone. Alluvium consisting of an unconsolidated mixture of clay, silt, sand, and gravel is deposited in river valleys. Most of the bedrock consists of sedimentary rocks, including Ordovician-age dolostone and sandstone, Lower Mississippian-age limestone and dolostone, and Pennsylvanian-age sandstone and shale. Remnants of an ancient loess deposit ranging from a few inches to several feet in thickness are on the nearly level upland divides. The loess is thickest in the northern and eastern parts of the area. Most of the exposed bedrock consists of limestone and dolostone formations that have thick layers of chert bedrock or chert fragments. The chert generally occurs in long, wavy beds less than 1 foot thick. In some areas; however, it occurs in massive layers more than 6 feet (2 meters) thick. Several old and inactive geologic faults are in the area.

Climate in northeast Oklahoma is characterized by hot summers and moderately cold winters. Average July temperatures range from 94 degrees Fahrenheit (°F) for highs to 71°F for lows.

Average January temperatures range from 49°F for highs to 28°F for lows. Annual rainfall in this region is 43 inches on average with most of the rainfall occurring between the months of April and June. This region typically receives six (6) inches of snow each year. The typical growing season is from April through October with the last freeze occurring on or around March 31 and the first freeze occurring on or around November 4.

The study area contains primarily undeveloped rural lands. Based on a geographic information system (GIS) analysis of the National Land Cover Data (NLCD) 2001 maps, the most prominent land covers within the study area include cropland and pastureland (MRLC 2001). More areas that are level generally have been cleared for agricultural use, while areas along drainage-ways and riparian areas and in more hilly areas remain wooded.

The agricultural land in Oklahoma is mostly used as pastureland, sparsely intermixed with row crop production for corn, wheat, and sorghum. Smaller concentrations of forestland and grassland are interspersed throughout the area. Some wetland areas are located along streams and lakes. The northern portion of the study area is dominated by cropland, while the southern portion is dominated by pastureland. Developed land within the study area is minimal because most communities were excluded from the study area. Below is a description of the land cover in the study area by county:

• Ottawa County, OK – mostly pastureland, with some areas of cropland; woody wetlands along river; area of barren land associated with the Tri-State Mining District.

• Craig County, OK – majority pastureland, cropland, and deciduous and evergreen forest fairly equally dispersed throughout the area.

• Mayes County, OK – mostly pastureland, with dispersed areas of cropland, grassland and deciduous forest; area of more heavily forested land towards southern end of corridor; some smaller concentrations of woody wetland and emergent herbaceous wetland.

Vegetation throughout the study area forms a mosaic of different community types. These types range from bottomland hardwood species in riparian areas, to oak-hickory timbered hilly areas to mixed warm and cool season pastures to cultivated cropland. Vegetation near the proposed Blackberry Substation site consists of pasture and cultivated crops. The proposed Chouteau Substation site is surrounded by cleared rights-of-way composed of herbaceous shrubs and grasslands with deciduous woodlands on both the east and west sides. Existing transmission lines occur throughout the area to the north and south. There are no unique or unusual vegetation communities in the study area. Some scattered native prairie hay meadows may potentially occur in the study area.

Action Description (This information is from the RUS-KAMO's BA)

The project consists of approximately 100 miles of 345-kV electric transmission line, approximately 2 miles of single circuit 161-kV transmission line, and two 345-kV substations, all located in southeastern Kansas, southwestern Missouri and northeastern Oklahoma. The new 345-kV transmission line will tie into an existing 345-kV line at the new Blackberry Substation located 3.5 miles north of Asbury, Missouri in western Jasper County, Missouri and end at the Grand River Dam Authority Coal-Fired Complex, located east of the City of Chouteau in Oklahoma. The new single circuit 161-kV line will start at the new 345/161-kV Chouteau Substation located approximately two miles east of AECI's Chouteau Gas Plant, where the 161-kV line ends.

Wood or wood-equivalent weathering steel H-Frame structures are proposed for the new 345-kV transmission line. The new 161-kV transmission line will use H-frame structures made of wood or wood-equivalent weathering steel poles. The anticipated pole height for the 345-kV and 161-

kV lines ranges from 65 to 115 feet above ground elevation, with an average pole height of 80 to 85 feet. The average span for the 345-kV line will be 800 feet and the average span for the 161-kV line will be 300 feet. The 345-kV structure will also contain two optical ground wire (OPGW) fibers and the 161-kV structure will contain one OPGW fiber. These will be used for communications and protective relaying. Surplus capacity will be offered for commercial communications.

The new 345-kV and the new 161-kV lines will both require 150 feet of new right-of-way. KAMO land agents will work individually with property owners to purchase easements for the new 345-kV and 161-kV lines following the RUS approval of the project. KAMO will pay just compensation for easements, and landowners will retain ownership of the property. The amount of just compensation for each tract will be determined in the manner prescribed by the particular statutes of the state in which the Transmission Line is located. Under the agreement, property owners could not place any permanent structures within the corridor that will restrict complete access and maintenance of the line or right-of-way. In addition to the right-of-way, fiber optic regeneration sites will be purchased in fee and separate from right-of-way easements. These sites will likely be located near road crossings to provide all-weather access. Given the terrain in the area, no construction of access roads outside of the 150-foot right-of-way will be needed. If obstructions exist that are completely blocking ingress and/or egress along the 150-foot right-of-way corridor, such as flowing creeks, KAMO will arrange with landowners to use existing field roads to access the structure locations.

Construction involves a number of steps, which are listed below:
- Detailed survey of the route alignment
- Right-of-way acquisition and clearing
- Construction of access roads, if necessary
- Installation of structure foundations, if necessary
- Assembly and erection of new structures
- Stringing and tensioning of the conductors
- Final clean-up and land rehabilitation

All appropriate materials will be delivered and assembled at each structure location. Most structures will be directly imbedded into the ground, with a hole excavated for placement of the pole. Poles will be backfilled following placement. Excess soil from the holes will be evenly distributed at each pole site and the soil stabilized. No poles are anticipated to be placed in wetlands. However, if necessary, the method used for the installation of poles in wetland areas will depend on the sub-surface conditions; excess soil will be removed to an upland site. If poor subsurface soil conditions are expected, concrete bearing plates may be necessary. Typical construction equipment will include hole diggers, cranes, wire-stringing rigs, tensioners, backhoes, and trucks.

The conductor, OPGW and Overhead Ground Wire (OHGW) will be installed under tension utilizing guidance contained in IEEE 524-2003, *IEEE Guide to the Installation of Overhead Transmission Line Conductors*. Stringing under tension will be used to assure the protection of the public, line construction workers and livestock. Particular attention will be given to railroad crossings, highway crossings, transmission line crossings, and distribution line crossings. Pulling under tension will also protect the conductor, OPGW and OHGW from physical damage.

The appropriate transportation agency for each roadway will be contacted for highway crossing permits. KAMO will comply with each jurisdiction's permit requirements. A Traffic Control Plan will be developed for each highway crossing and the traffic control devices/methods will conform to the Manual of Uniform Traffic Control Devices

Maintaining the right-of-way under the Transmission Lines is essential for the reliable operation of the line and public safety. Operation and maintenance of the line will consist of periodic inspections of the line and right-of-way, occasional replacement of hardware as necessary and periodic treatment of woody vegetation within the corridor. The periodic inspections will occur on a regular basis and utilize both aerial and walking patrols. Normal operation and maintenance will require only infrequent visits by KAMO or their contractors. Agricultural activities will be allowed to continue within the right-of-way.

To treat woody vegetation, selective low-volume herbicide applications targeting only tree species will take place every three to five years. Herbicides will be applied as an individual spot treatment, and not broadcast across the entire right-of-way. KAMO will acquire sufficient right-of-way so that cutting or trimming danger trees outside the right-of-way will not be necessary. KAMO only uses herbicides on power line right-of-way that are approved by the Environmental Protection Agency (EPA), such as Rebound, Escort, and Accord XRT. These herbicides will only be applied by a licensed professional.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this BO relies on four components: (1) the *Status of the Species*, which evaluates the ABB range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the ABB in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the ABB; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated or interdependent activities on the ABB; and (4) *Cumulative Effects*, which evaluates the effects of future, non-federal activities in the action area on the ABB.

Status of the Species

The scale for this jeopardy analyses is the listed entity throughout its current range.

Species and Designated Critical Habitat Description

The ABB was proposed for federal listing in October 1988 (53 FR 39617) and designated as an endangered species on July 13, 1989 (54 FR 29652). Critical habitat has not been designated for the ABB. The draft recovery plan was issued on July 25, 1991, and the final recovery plan was signed on September 27, 1991. The ABB's species recovery priority number is 5c. A rank of 5c indicates that the listed taxon is a full species, facing a high degree of threat with a low recovery potential. The suffix "c" connotes conflict with construction or other development projects (48 FR 43098). The Service completed a 5-year review of the listing status in 2008. The concluding recommendation of the 5-year review was to retain the species status as endangered.

A. Species/critical habitat description

Description

The ABB is the largest species of its genus in North America, measuring 1 to 1.8 inches (27-45 mm, Wilson 1971, Anderson 1982, Backlund and Marrone 1997). They are black with orange-red markings and are sexually monomorphic. The hardened elytra (hard wing covers) 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. Males have a large, rectangular, red marking and females have a smaller, triangular, red marking. Beetles can be aged by visual examination.

B. Distribution and Abundance

Historically the geographic range of the ABB encompassed over 150 counties in 35 states, covering most of temperate eastern North America and the southern borders of three eastern Canadian provinces (USFWS 1991, Peck and Kalbars 1987, USFWS 2008; Appendix 3). Records are known from Texas (single record c. 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 (Appendix 3). 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 has disappeared from over 90 percent of its historic range (Ratcliffe 1995). 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 rangewide: 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.* 1999), and northeast Texas (Godwin 2003). Abundance of the ABB range-wide varies significantly within and between known populations, and within and between years. The monitoring of some populations show stable or slightly increasing trends in abundance, while other populations indicate declining abundance (USFWS 2008).

Numerous ABB surveys have been conducted throughout eastern Oklahoma. The majority of these surveys are driven by the need to protect ABBs from specific soil disturbance actions associated with development projects. Therefore, most survey data is temporally and spatially random, with only a small portion of the survey data from standard survey efforts. Consequently, the number of trapnights varies among counties and years, ranging from 24 trap nights in Tulsa County to 17,388 in Muskogee County. Presently, eastern Oklahoma contains one large concentration of ABBs within their historic range, at Camp Gruber in Muskogee County. In 2007, 676 ABBs were captured in 1,305 trapnights at Camp Gruber. Smaller concentrations of ABBs in Oklahoma include the McAlester Army Ammunition Depot and Defense Ammunition Center in Pittsburg County, the four-county area of Atoka, Coal, Hughes, and Pittsburg counties and the Tallgrass Prairie Preserve in Osage County. In 2009, a survey effort of 2,472 trapnights resulted in 415 ABB captured on The Nature Conservancy's (TNC) Tallgrass Prairie Preserve.

Less than 7 percent of the land within the ABB range in Oklahoma exists in public ownership. Public landowners include the Service, U.S. Army Corps of Engineers, Bureau of Indian Affairs, Bureau of Reclamation, U.S. Department of Defense, U.S. Forest Service, Oklahoma Department of Wildlife Conservation, Oklahoma Department of Tourism, and Oklahoma State School Lands Commission (U.S. Geological Survey 1995). Some private conservation lands owned by TNC within eastern Oklahoma also support ABB populations. Most existing populations, however, 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 (although the last two survey efforts have not found ABBs at Camp Maxey).

C. Habitat

Feeding Habitat

The ABB is considered feeding habitat generalists and has been successfully live-trapped in several vegetation types including native grasslands, grazed pasture, riparian zones, coniferous forests, mature forest, and oak-hickory forest, as well as a variety of various soil types (Creighton *et al.* 1993a, Lomolino and Creighton 1996, Lomolino *et al.* 1995, USFWS 1991). Ecosystems supporting ABB populations are diverse and include primary forest, scrub forest, forest edge, grassland prairie, riparian areas, mountain slopes, and maritime scrub communities (Ratcliffe 1996, USFWS 1991). Holloway and Schnell (1997) found significant correlations between the numbers of ABBs caught in traps and the biomass of mammals and birds, irrespective of the predominant vegetation.

Reproductive Habitat

While studies indicate that the ABB is a habitat generalist in terms of feeding, it is likely more stenotopic when selecting burial sites for breeding. In Oklahoma, ABBs are found within a mixture of vegetation types from oak-hickory and coniferous forests on lowlands, slopes, and ridgetops to deciduous riparian corridors and pasturelands in the valleys (Service 1991, Creighton *et al.* 1993a). However, for reproduction, soil conditions must be conducive to excavation by ABBs (Anderson 1982, Lomolino and Creighton 1996). Soils in the vicinity of captures are all well drained and include sandy loam and silt loam, with a clay component noted at most sites. In 1996, more than 300 specimens were captured in Nebraska habitats consisting of grassland 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. At Fort Chaffee in Arkansas, Schnell and Hiott (2002) 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. 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).

D. Life history

The life history of the ABB is similar to that of other *Nicrophorus* species (Kozol *et al.* 1988; Pukowski 1933; Scott and Traniello 1987; Wilson and Fudge 1984). The ABB is an annual species, nocturnal, active in the summer months, inactive during the winter months, and typically only reproduce once in their lifetime. They bury themselves in the soil for the duration of the winter. The young of the year overwinter as adults and comprise the breeding population the following summer (Kozol 1990b). Both adults and larvae are dependent on carrion for food and reproduction. They must compete with other invertebrate species, as well as vertebrate species, for carrion. Even though ABBs are considered feeding habitat generalists, they have still disappeared from over 90 percent of their historic range. Habitat loss, alteration, and fragmentation, which creates edge habitat, leads to a reduced carrion prey base and an increase in vertebrate scavengers, which works against the ABB (Service 1991).

Summer Active Period

In Oklahoma, ABBs are typically active at night from mid-May to late-September (May 20-September 20) when nighttime ambient temperatures are consistently above 60°F. Nightly activity is most prevalent from 2 to 4 hours after sunset (Walker and Hoback 2007). The ABB may delay nocturnal activity when temperatures are very warm, greater than 75°F (24°C). Weather, such as rain and strong winds, result in reduced ABB activity (Bedick *et al.* 1999). During the daytime ABBs are believed to bury under the vegetation litter. During late May and early June, ABBs secure a mate and carcass for reproduction. About 12 days afterward (once larvae enter pupae phase), adult ABBs emerge and search for food. The reproductive process takes approximately 48-69 days.

Winter Inactive Period

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), typically September 21- May 19 in Oklahoma. Recent studies indicate that ABBs bury an average depth of 2.4 inches (Schnell *et al.* 2008). Habitat structure (i.e., woodland vs. grassland) does not appear to be an influencing factor.

Preliminary data suggest that significant mortality occurs during the overwintering inactive period (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.* 2008, Raithel unpubl. Data 1996-2006).

Feeding

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 2 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.* (1993b) recorded ABBs traveling as much as 2 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 6-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).

Reproduction

Parental care in this genus is elaborate and unique because both parents participate in the rearing of young (Bartlett 1987, Fetherston *et al.* 1990, Scott 1990, and Trumbo 1990), with care by at least one parent, usually the female, being 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. Reproductive activity commences in mid-May and is completed in mid-August in Oklahoma and Arkansas. Immediately upon emergence from their inactive period, ABBs begin searching for a proper carcass, 3.5-7.0 ounces in weight, for reproduction. ABBs are able to locate carcasses using chemoreceptors on their antennae and they are able to move the carrion laterally for up to 3 feet (USFWS 1991).

The pair cooperatively bury the carcass and construct a brood chamber around the carcass (Kozol *et al.* 1988). 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). Both male and female parents regurgitated meat to the larvae. The larvae are soon capable of feeding directly from the carcass. In about 10-14 days large, third instar larvae burrow a short distance from the now-diminished carcass and form pupation cells. One or both of the parents may remain with the pupae for several days and at least one parent, usually the female, may remain with the pupae until they pupate (Kozol 1991). Therefore, for approximately 22-28 days, adult ABBs are present with their brood. New adult's eclose in about 26-51 days. The reproductive process from carcass burial to eclosure is about 48 to 79 days (Ratcliffe 1996, Kozol 1991, Bedick *et al.* 1999). 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).

While the ABB has life history requirements similar to other carrion beetles, it is the largest *Nicrophorus* in North America and requires a larger carrion item to realize its maximum reproductive potential (*i.e.*, to raise a maximum number of offspring) than the other *Nicrophorus* (Service 1991, Kozol *et al.* 1988, Trumbo 1992). Preferred carrion sources are dead birds and mammals weighing from 1.7-10.5 oz (48.19 – 297.67 g), with an optimum weight of 3.5-7.0 oz (99.22 – 198.45 g, Service 1991). Other *Nicrophorus* species are able to utilize much smaller carrion, ranging from 0.11 - 0.18 oz (3-5 g, Trumbo 1992).

Movement

The ABB readily moves between differing habitats (Creighton and Schnell 1998, Lomolino *et al.* 1995). Nightly movement of ABBs ranges from 0.101 to 1.03 miles (0.16 – 1.66 km). Creighton and Schnell (1998) conducted a study on movement patterns of ABBs at Camp Gruber and Fort Chaffee in 1992 and 1993. They recaptured 68 ABBs over a 12-night period. Of those 68, 23 (29.5 percent) were recaptured at a site different than the original site of capture. The mean distance moved of the 23 recaptured ABBs over the 12-night sampling period was 1.21 miles (1.95 km) for each ABB [0.101 miles (0.16 km) per night per ABB]. The minimum and maximum distance moved by an individual recaptured ABB was 0.16 mile (0.25 km) in 1 night and 4.3 miles (6.5 km) in 5 nights [0.8 miles (1.29 km) per night], respectively. Six ABBs were recaptured two or three times. The mean movement for these six ABBs was 6.2 miles (10 km) over 6 nights [1.03 miles (1.66 km) per night] over the entire sampling period. The maximum distance moved by one of these six was 0.76 mile (1.23 km) in one night.

Bedick *et al.* (2004) reported average nightly movements of 0.62 mile (1.0 km) with 85 percent of recaptures moving distances of 0.31 miles per night. Schnell *et al.* (1997-2003) annually determined the average nightly movements of the ABB to be 0.62 miles (1.0 km), using marked individuals over a 9-year period at Camp Gruber. The smallest average nightly movement for any given active season over that same period was 0.52 miles (0.84 km). Schnell *et al.* (1997-2006) reported a one day movement of 2.6 miles (4.25 km); previously the greatest distance moved was 1.78 miles (239 km, Creighton and Schnell 1998). While this data could be interpreted to imply that an ABB could move 95 miles [153 km, 0.62 (mean nightly movement) times 154 days (May 20 – September 20)] during the active season, the Service does not believe this is an accurate interpretation. Mark and recapture studies at Camp Gruber and Fort Chaffee have yet to find any ABBs that have moved between these installations, a distance of about 54 miles (87 km, Schnell *et al.* 1997-2003, and Schnell *et al.* 1997-2005). Even if ABBs moved such long distances, the Service assumes it is unlikely ABBs move in such a consistently linear direction.

E. Population Dynamics

Population size

Most standard techniques used to estimate population size assume that marked and unmarked individuals are equally likely to be captured, and that a substantial number of the animals remain in the trappable population from one trapping period to the next. During a 10 – 12 night period in the summer, ABBs were not recaptured after 6 nights. This indicates a relatively rapid turnover rate in the trappable ABB population due to factors such as natural mortality, dispersal, and burrowing underground and attending carrion/broods (Creighton and Schnell 1998). The high turnover of trappable individuals observed in ABBs strongly suggests that the latter portion of this overall assumption is not valid for ABBs, and that conventional methods of estimating population numbers may not be applicable. As such, accurate estimates of absolute or even relative population size or densities of ABBs remain a challenge.

Research on genetic variation within and between populations of ABBs indicate low levels of genetic variation (Kozol *et al.* 1994, Szlanski *et al.* 2000), which is often a result of founder effect, genetic drift and inbreeding and suggests multiple bottleneck events, small population size and high levels of inbreeding.

Variability and Stability

When important resources fluctuate seasonally or annually, population of species dependent on those resources fluctuate. The ABB is an annual species (living for only one year) and the following year's numbers are dependent upon the reproductive success of the previous year. The land use at Fort Chaffee, Arkansas and Camp Gruber, Oklahoma differs, but each installation maintains a relatively consistent land use pattern of its own through time. However, Schnell *et al.* (1997-2003) and Schnell *et al.* (1997-2005) reported the number of ABBs captured and the location of high density ABB concentrations varies annually at each site. They reported that areas of high concentration appeared to shift annually throughout the sites. Surveys conducted in a given area have resulted in ABB captures during one survey effort but surveys conducted in the same given area within the same active season have resulted in negative ABB captures. These observations of variability indicate that ABBs are annually cyclic and experience a relatively rapid turnover rate in the trappable ABB population, which could be due to factors such as natural mortality, dispersal, and burrowing underground and attending carrion/broods (Creighton and Schnell 1998).

F. Reasons for Listing/Threats to Survival

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, the prevailing theory on the ABB's decline was habitat degradation, loss and fragmentation (USFWS 1991).

Data show that species in the family Silphidae are generally widely distributed and occur in many habitat types (Peck and Kaulbars 1987). Even though ABBs are considered feeding habitat generalists they still have disappeared from over 90 percent of their historic range. The Recovery Plan identifies the following issues as potential threats to the ABB: disease/pathogens, DDT, direct habitat loss and alteration, interspecific competition, increase in competition for prey, increase in edge habitat, decrease in abundance of prey, loss of genetic diversity in isolated populations, and agricultural and grazing practices. None of these theories alone adequately explain why the ABB declined while congeneric species are still relatively common rangewide [there are eight sympatric congeners, which are not in peril (Sikes and Raithel 2002). There is little doubt that habitat loss and alteration affect this species at local or even regional levels, and could account for the extirpation of populations once they become isolated from others (Kozol 1995, Ratcliffe 1996, Amaral *et al.* 1997, Bedick *et al.* 1999). The prevailing theory regarding the ABBs' decline is habitat fragmentation (USFWS 1991) which reduced the carrion prey base and increased the vertebrate scavenger competition for this prey (Kozol 1995, Ratcliffe 1996, Amaral *et al.* 1997, Bedick *et al.* 1999) due to its relatively large size and specialized breeding behavior (Creighton *et al.* 2009).

Direct Habitat Loss and Alteration

Habitat is the place in which an organism lives, characterized by its physical features or by the dominant plant types (Oxford Dictionary of Biology 2000). Fragmentation is the breakup of extensive habitats into small, isolated patches that are too limited to maintain their species stocks into the indefinite future and reduction of the total amount of habitat available (MacArthur and Wilson 1967, Williamson 1981). There is not a size limitation of disturbed areas that constitute fragmentation. The limiting factor of fragmentation is not only the loss of habitat but the inability to move between undisturbed areas, the quality of the disturbed area species move around in and through, the spatial structure of the undisturbed habitat and disturbed areas, and the ratio of edge habitat created from fragmentation to the amount of contiguous undisturbed area. Fragmentation of natural habitat that historically supported high densities of indigenous (native) species (made more severe by direct taking, ca. 1900, of birds and other vertebrates) may have been a contributing factor in the decline of ABBs.

Land conversion to agriculture and development, logging, fire suppression, and intensive domestic livestock grazing are the main causes of habitat loss and fragmentation within eastern Oklahoma today. Since European settlement, fires have been largely suppressed within eastern Oklahoma, 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).

Initial fragmentation may have minimal affects on vegetation, and species composition and abundance patterns. However, as gaps increase in size and quantity, these gaps become the dominant habitat type in a landscape. Ecosystem functions are more likely to be disrupted at finer scales of fragmentation, although the organisms affected are smaller and the overall process is less noticeable to human observers. Probably some of the strongest effects of fragmentation on ecological processes will turn out to involve the invertebrate community (Didham *et al.* 1996). Invertebrates are critically important in decomposition, nutrient cycling, disturbance regimes, and other natural processes in ecosystems, and they appear to be quite sensitive to disruption of microclimate and other effects of fragmentation. Increased use of land for urbanization and commercial agriculture and forestry has had a demonstrative negative impact on numerous insect species (Pyle *et al.* 1981). Pipelines, roads, well pads, utility corridors, etc. are all actions that result in fragmentation of habitat type creating edge habitat.

Fragmentation of habitat that historically supported high densities of indigenous (native) species, coupled with increased loss (ca. 1900) of birds and other vertebrates, may have contributed to the decline of ABBs by changing the prey species composition and reproductive success. 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 this way, historically large expanses of natural habitat that once supported high densities of indigenous species are now habitat fragments that not only support fewer or lower densities of indigenous species that supported ABB populations, but also facilitated increased competition for limited carrion resources among the "new" predator/scavenger community. A number of these species, especially the raccoon and striped skunk, have undergone dramatic population increases over the last century (Garrott *et al.* 1993), and the coyote and opossum have expanded their range. These scavengers may range hundreds of feet from edges into forest in eastern North America. Matthews (1995) experimentally placed 64 carcasses in various habitats in Oklahoma where ABBs and *N. orbicollis* had been previously documented, then tracked the organisms that scavenged them. Of the carcasses 83 percent were claimed by ants, flies, and vertebrate scavengers; about 11 percent were claimed by *N. orbicollis*, and only one was claimed by ABBs.

In the Midwest, agriculture, 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.

Dispersal is more likely to maintain metapopulations in naturally patchy landscapes than in formerly continuous landscapes fragmented by human activity (den Boer 1970). Natural patchy landscapes have less contrast between adjacent patches, whereas anthropogenic fragmentation creates intense, sudden contrast between patches. This edge habitat is a zone where the light, wind, microclimate, and moisture are altered. The effects of these changes extend into different forest types at distances of 450, 656 to 1,640 feet. Climate edge effects may explain why dung and carrion beetle communities in 2.5 and 25 acre forest fragments in Brazil contain fewer species, sparser populations, and smaller beetles than do comparable areas within intact forest (Klein 1989). The drier conditions in small fragments, which are largely edge habitat, may lead to increased fatal desiccation of beetle larvae in the soil.

There is evidence to support a direct correlation between edge, or fragment size, and vertebrate scavenger pressure, with much of this work involving nesting bird populations (Paton 1994, Yahner and Mahan 1996, Suarez *et al.* 1997). Trumbo and Bloch (2000) found that *Nicrophorus* species had significantly greater success in larger woodland plots and attributed this in part to lower vertebrate scavenger success in those areas. Sikes (1996), working with *N. nigrita*, found that most transects laid more than 328 feet from a trail or road had 10 percent or fewer carcasses taken by vertebrates, whereas transects near trails or roads had an average of 85 percent of the carcasses taken by vertebrate scavengers. Schnell *et al.* (1997-2005) found higher numbers and abundances of ABBs within Fort Chaffe and Camp Gruber boundaries than outside.

Although, some mobile species can integrate into a number of habitat patches this does not appear to be the case with the ABB. Schnell *et al.* (1997-2006) found that ABBs avoided clear-cut areas in southeast Oklahoma. Such fragmentation is comparable to pipelines, roads, well pads, utility corridors, commercial and residential development and quarries. The effect of competition, which should be strongly linked to habitat conditions, is likely to be a scale-dependent phenomenon. Tillman *et al.* (1994) suggest that even moderate levels of habitat destruction and fragmentation can 'cause time delayed, but deterministic extinction' of 'dominant competitors in remnant patches'.

The eclectic occurrences and extinction vulnerability of ABBs is likely due to the species having specialized habitat or resource requirements and carrion being a finite resource widely scattered in space and time (Karr 1982, Pimm *et al.* 1988, Peck and Kaulbars 1987). Data available for the ABB on Block Island supports the contention that the primary mechanism for the species' rangewide declines lies in its dependence on carrion of a larger size class relative to that utilized by all other North American *Nicrophorus* species, and that the optimum-sized carrion resource base has been reduced throughout the species' range over time (USFWS 1991). Further, when resources fluctuate seasonally or annually, species dependent on those resources fluctuate. This population variability predisposes species to extinction. The higher level of fluctuation the greater the chance of extinction. Habitat fragmentation affects these types of species by reducing the number of sites that contain critical resources, and by isolating suitable sites and making them harder to find.

Since the middle of the 19th century, certain faunal species in the favored weight range for ABBs have either been eliminated from North America or significantly reduced over their historic range (USFWS 1991), including, the passenger pigeon *Ectopistes migratorius*, greater prairie chicken *Tympanchus cupido* and wild turkey *Meleagris gallopavo*. The passenger pigeon was estimated at one time to have been the most common bird in the world, numbering 3 to 5 billion (Ellsworth and McComb 2003). There were once as many passenger pigeons within the approximate historic range of the ABB as there are numbers of birds of all species overwintering in the U.S. today. Wild turkeys, for example, occurred throughout the range of the ABB, and until recently, were extirpated from much of their former range. Black-tailed prairie dogs *Cynomys ludovicianus*, which occur in the northern portion of the ABB's range, have drastically declined (Miller *et al.* 1990) and such dense populations of mammals may have supported ABBs. Although much of the evidence suggesting the reduction of carrion resources as a primary mechanism of decline is circumstantial, this hypothesis fits the temporal and geographical pattern of the disappearance of ABBs, and is sufficient to explain why ABBs declined while congeneric species did not. ABBs are the largest species of *Nicrophorus* in the New World and require carcasses of 3.5 to 7.0 ounces (99.22 to 198.45 g, Kozol *et al.* 1988) to maximize its fecundity, whereas all other *Nicrophorus* species can breed abundantly on much smaller carcasses, with the smaller species using carcasses of 0.11 to 0.18 ounces (3.12 to 5.10 g, Trumbo 1992). In a fragmented ecosystem, larger species have been shown to be negatively affected before smaller species, a phenomenon which has been well-documented with carrion and dung beetles in South America (Klein 1989).

Wide-ranging animals, like the ABB, are typically among the species most threatened by habitat fragmentation, in part because small areas fail to provide enough prey, but also because these animals are more likely to be killed by humans or their vehicles (Karr 1982, Pimm *et al.* 1988, Mladenoff *et al.* 1994, Noss *et al.* 1996). Large mobile species that roam over large areas daily must attempt to move through the fragmented habitat. Moving relatively long distances among different habitat types increases the ABB's chance of encountering appropriate-sized carcasses, but also increases the potential for encountering natural and unnatural mortality, such as predation, insecticides, insect traps (i.e., bug zappers), and nocturnal light pollution (Mladenoff *et al.* 1994, Noss *et al.* 1996). The probability of individual ABBs being subjected to these types of hazards also increases as areas become more developed (Lomolino and Creighton 1996). A study in southeastern Ontario and Quebec found that several species of small mammals rarely ventured onto road surfaces when the road exceeded 65 feet (19.8 m, Oxley *et al.* 1974). Studies elsewhere report similar findings. These studies reveal potential indirect effects to the ABB by limiting its food and reproductive resources. These findings may explain, in part, why the highest densities of ABBs are in relatively large military installations with little agricultural, commercial or residential development.

Species Size

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). For most guilds, larger species tend to feed on larger prey, occupy a greater diversity of habitats, dominate in interference competition, and maintain larger home ranges, but may suffer from exploitative competition from smaller species (Ashmole 1968, Gittleman 1985, Hespenheide 1971, Rosenzweig 1968, Schoener and Gorman 1968, Werner 1974, Wilson 1975, and Zaret 1980). Because larger prey are less abundant than smaller prey (Peters 1983, Brown and Maurer 1987, Damuth 1991, and Lawton 1990), larger guild members require larger home ranges. In addition, larger carcasses are harder to bury than smaller ones (Creighton *et al.* 2009). While large size alone does not necessarily confer endangerment, within trophic or guilds rarity and extinctions tend to be higher for the larger species (Diamond 1984, Martin and Klein 1984, Vrba 1984, Owen-Smith 1988, and Stevens 1992). At less than 2 grams, the ABB is the largest member of a guild that specialize on rare and unpredictable resources, vertebrate carcasses. In contrast to other guild members the ABB must range over a larger area and a greater diversity of habitats to find suitable carcasses.

Trumbo and Thomas (1998) investigated *Nicrophorus* species composition on several small islands in New England (lacking ABBs) and found that smaller islands were not able to support viable populations of large-bodied *Nicrophorus* species. They suggested that larger species required more carrion resources and were therefore more prone to local extinctions. The extant population of ABBs on Block Island seems to be relatively free of competitive pressures; not only are there unusually large populations of ground-nesting birds, but there are few mammal predators or scavengers and supplemental carrion provisioning is provided annually (Amaral *et al.* 1997). This hypothesis is among those most well supported by the available evidence. However, more studies on response of silphid communities to habitat fragmentation are needed, especially those that will contrast historic and current habitats, or compare multiple extant sites of ABBs.

DDT and Pesticide Use

Hoffman *et al.* (1949) showed, in a controlled study, that DDT spraying eliminated populations of three *Nicrophorus* species (*N. orbicollis*, *N. sayi*, and *N. defodiens*). Kozol (1995) and the USFWS (1991) concluded that given the apparent timing and pattern of decline exhibited by ABBs, particularly in the Northeast, DDT could not have been responsible for most extirpations, since populations had largely gone a full 25 years before organ chlorine compounds were broadly applied as pesticides. In addition, some populations persisted following DDT spraying in Oklahoma, Nebraska, and Missouri, while other unsprayed areas within the ABBs historical range no longer support the species. In the Midwest however, several ABB populations disappeared during or right after the general period from 1940 to 1972, when DDT was actively applied as a pesticide. Although, this hypothesis is rejected as the primary explanation, it remains possible that some ABBs may have been extirpated by DDT use.

Intraspecific and Interspecific Competition

Intrasexual competition occurs until usually only one male and female remain. Size appears to be the most important determinant of success in competition for securing carrion; the largest individuals displace smaller *Nicrophorus* (Kozol *et al.* 1988). Even after burial of a carcass ABBs have been recorded as commandeering a carcass buried by another *Nicrophorus* species. However, factors other than size might affect the outcome of competition (i.e., temperature or activity patterns). Trumbo (1992) showed that the potential for *Nicrophorus* congener competition for carrion increased with carcass size and Scott *et al.* (1987) found the same results with carrion-feeding flies. Congener competition extends from the increase in vertebrate scavenger pressure, exacerbated by habitat fragmentation, and a decrease in carrion of the ideal weight size, due to extinction and population declines, the competition between ABBs and sympatric congeners for sub-optimally sized carcasses will be expected to increase.

The ABBs most similar congener is *N. orbicollis*, based on historical geographic range, presumably the ecological tolerances (diel periodicity, breeding season, etc.), and phylogenetic information indicating these species may be each other's closest surviving relatives (Szalanski *et al.* 2000). Being so similar, they likely are each other's greatest congeneric competitors (Sikes and Raithel 2002). Interspecific competition may affect populations at the local level. Typically, surveys for ABBs result in 10 or more times more *N. orbicollis* than ABBs (Lomolino and Creighton 1996, Amaral *et al.* 1997, Carlton and Rothwein 1998). Kozol (1989) demonstrated that *N. orbicollis* was about eight times more abundant than ABBs on Block Island, Rhode Island while Walker (1957) collected 19 times more *N. orbicollis* (175) than ABBs (9) in the single trapping array where the latter species was encountered in Tennessee. While the ABB is more successful than *N. orbicollis* in utilizing carcasses greater than 100 g, these data suggest that this congeneric species may pose formidable competitors for the ABB (Sikes and Raithel 2002) and may have actually increased (been "released") in those areas where ABBs disappeared (USFWS 1991). In addition, *N. marginatus* may be a formidable competitor to ABBs. *N. marginatus* is on average slightly larger and utilizes larger carcasses than *N. orbicollis* and in Nebraska and South Dakota is typically more abundant (Backlund and Marrone 1997 and Bedick *et al.* 1999). Another, threat to ABB reproductive success is the oviposition by other *Nicrophorus* species near an ABB buried carcass, allowing brood parasitism (Müller *et al.* 1998, Trumbo 1994). Trumbo (1992) found that mixed *Nicrophorus* broods were more common on larger carcasses.

The imported fire ant *Solenopsis invicta* has become a formidable competitor for carrion and a potential source of mortality for *Nicrophorus* beetles when they co-occur at a food source (Warriner 2004, Godwin and Minich 2005). Scott *et al.* (1987) concluded that the inability of *N. carolinus* to successfully bury carrion provided experimentally in Florida was due to interference by imported fire ants. Only 5 of 48 carcasses were successfully exploited by *N. carolinus*, despite pitfall trapping that demonstrated that *N. carolinus* was locally abundant. Collins and Scheffrahn (2005) noted that fire ants may reduce ground-nesting populations of rodents and birds, and in some instances, may completely eliminate ground-nesting species from a given area. Fire ant infestations are not evenly distributed; rather, they tend to be more numerous in open, disturbed habitats (Carlton in litt. 1996). Fire ants now infest all or parts of Alabama, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, New Mexico, North Carolina, Oklahoma, Puerto Rico, South Carolina, Tennessee, and Texas (USDA 2003).

Loss of Genetic Diversity in Isolated Populations

Kozol *et al.* (1994) examined ABB genetic variation within and between the Block Island and the eastern Oklahoma and western Arkansas population. Both populations have low levels of genetic variation, and most of the variation occurs within a single population. There were no unique diagnostic bands within either population, but they found the OK/AR population to be somewhat more diverse. This reduced genetic variation is often a result of founder effect, genetic drift, and inbreeding. They suggest that multiple bottleneck events, small population size, and high levels of inbreeding may be factors contributing to the pattern of diversity in ABBs.

Szalanski *et al.* (2000) expanded on Kozol *et al.*'s study and examined ABBs from five populations: Block Island, Arkansas, South Dakota, Oklahoma, and Nebraska. The authors found little evidence that the five populations have maintained unique genetic variation and no evidence to suggest that these five populations should be treated as separate, genetically independent conservation segments.

G. Recovery Efforts

A summary report of ABB recovery implementation progress can be viewed at the Service's Environmental Conservation Online System (ECOS) under the Recovery section of the ABBs Species Profile page <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=I028>.

Environmental Baseline

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed federal projects in the action area that have undergone section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation in progress.

A. Status of the species within the action area

Oklahoma counties with recently confirmed ABB sightings since 1992 are Cherokee, Craig, Mayes, McIntosh, Muskogee, Rogers, Sequoyah, Tulsa, and Wagoner (Appendix 4). Additional counties within the historic range of the ABB in eastern Oklahoma include, Nowata, Ottawa, and Washington. Unconfirmed recent ABB sightings since 1992 have been recorded in Adair and Delaware counties, which are also within the historic range of the ABB (Service 2005c).

Numerous ABB surveys have been conducted throughout eastern Oklahoma. The majority of these surveys are driven by the need to protect ABBs from specific soil disturbance actions associated with development projects. Therefore, most survey data is temporally and spatially random, with only a small portion of the survey data from standard survey efforts. Consequently, the number of trapnights varies among counties and years, ranging from 24 trap nights in Tulsa County to 17,388 in Muskogee County. Presently, eastern Oklahoma contains one large concentration of ABBs within their historic range, at Camp Gruber in Muskogee County. In 2007, a total of 676 ABBs were captured in 1,305 trapnights at Camp Gruber. .

Structured survey data are collected annually or biennially from Camp Gruber, Ouachita National Forest, and Connors State College. These surveys provide trend data for the ABB. Surveys for the ABB have been conducted annually at Camp Gruber since 1992, accounting for the high number of trap nights (17,388) in Muskogee County. Ouachita National Forest (Forest) conducted annual surveys based on proposed soil disturbance activities from 1991 to 2005. Beginning in 2006 the Forest implemented standard transects to survey annually. Connors State College has an ABB conservation area where ABBs are surveyed biennially. ABB captures at these locations typically fluctuate on an annual or biennial basis, but in general ABB numbers appear stable or increasing. All of these areas provide large tracts of relatively natural habitat for the ABB.

B. Factors affecting species environment within the action area

To adequately evaluate the effects of RUS-KAMO activities throughout eastern Oklahoma on the ABB covered in this BO, the Service must consider the individual and cumulative impacts from these activities. Additionally, the Service must also consider other, separate effects currently ongoing and likely to occur in the foreseeable future that also could have adverse impacts to the ABB within the Action Area.

1. Consultation

During fiscal years 2006, 2007, 2008, and 2009 (October 1 to September 30) the Service consulted on approximately 203, 215, 306, and 171 proposed actions, respectively, potentially affecting the ABB in Oklahoma. Project types evaluated included pipelines, roads, quarries, communication towers, residential housing development, bridges, mining, petroleum production, commercial development, recreational development, transmission lines, and water and waste water treatment facilities. Impacts from these activities varied in size and duration, with projects such as quarries being hundreds of acres and having permanent impacts, to water treatment facilities of a few acres with both permanent and temporary impacts.

There are currently six biological opinions with incidental take statements issued and still in effect. One biological opinion authorizes the take of 76 acres within the ABB's range in Osage County for the construction of a botanical preserve. The second biological opinion authorizes take of 35 ABBs per year throughout the Camp Gruber. The third is a programmatic biological opinion for the Federal Highway Administration (FHWA) within the ABB's range in Oklahoma authorizing take of 5,998.98 acres of ABB habitat. The fourth biological opinion is with the Ouachita National Forest authorizing take of 12,191 acres of ABB habitat within Oklahoma and Arkansas. The fifth is with the Bureau of Land Management authorizing take of 200,000 acres. The sixth one is to the U.S. Army Corps of Engineers (Corps) authorizing take of 1,100 acres.

2. Scientific research

Currently, 29 entities or individuals possess section 10 permits for the ABB in Oklahoma. Twenty-eight are section 10(a)(1)(A) scientific research permits to enhance the survival of the species and one is an incidental take permit issued in conjunction with a Habitat Conservation Plan (HCP). Although 28 permits are enhancement of survival permits, some authorized take of ABBs can occur. The permitted research must further conservation efforts for the species, but the loss of some individual ABBs over the short-term from research 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.

In addition, the Service may recommend that ABBs be trapped and relocated in certain instances. While these activities can have adverse impacts, the existing recovery permit allows for take that may occur. The extent of take is usually unknown prior to implementation of this type of activity. However, all accidental deaths are required to be reported to the Service. Between 1997 to 2008 annual ABB incidental deaths in Oklahoma ranged from approximately 5 to 29 individuals.

The Weyerhaeuser HCP is valid for 35 years and does not estimate a number of ABBs that could potentially be taken. The HCP stipulates the following as foreseeable activities implemented by Weyerhaeuser over 35 years: 28,000 acres (average of 800 acres per year) of forest will potentially be harvested; 16 ponds constructed; ten or fewer food plots planted; EPA approved application of pesticides for control of pales weevil damage to planted pine seedlings; ROW vegetation control; two miles of road construction; 20 acres of mineral, oil, or gas exploration; and no more than 600 acres of cattle grazing. Take, in the form of acres, has not been exceeded to our knowledge. From 1997 to 2000 about 10,710 acres of Weyerhaeuser lands were surveyed for the ABB annually and from 2001 to 2003 about 14,382 acres were surveyed. From 1997 to 2005 the following numbers of ABBs were captured: 106, 64, 26, 41, 16, 25, 85, 0, and 0, respectively.

<u>Effects of the Action</u>

Factors to be considered

Construction and maintenance of the Transmission Line could result in impacts to the ABB. The removal of approximately 168, 165, and 148 acres of forested vegetation within or adjacent to the proposed right-of-way for the proposed, first alternate, and second alternate route, respectively, will reduce the foraging, shelter, or nesting habitat for some species.

The RUS-KAMO concluded that human presence and activity during construction will disturb and displace wildlife (potential prey species) in the area of construction. However, impacts to most species will be temporary and short-term in nature, limited to the period during the construction phase, and will consist primarily of displacement and disturbance. Some less mobile species occurring in the construction corridor could be directly impacted, and movements between habitat areas could be temporarily impeded due to noise and human presence. Additional temporary disturbances could occur during future maintenance activities along the line.

The RUS-KAMO proposed to leave stumps in place and minimize soil disturbance during clearing activities in wooded areas of the proposed project right-of-way. They believe these measures will minimize the potential for adverse effects. The ABB may be found in areas with suitable habitat characteristics that are not wooded; however, they did not include these areas in the assessment due to minimal ground disturbance required and therefore the minimal potential to affect ABB. Grassland throughout these counties is managed intensely for hay production and livestock forage. Pasture areas are also subject to seasonally intense vehicle traffic associated with hay cutting, bailing, and bail removal, as well as seeding and fertilizing at other intervals. Disturbances from the proposed action in grassland areas will be limited to the drilling of foundations and overland travel by construction equipment, which will be minimal compared to other activities on these areas.

The RUS-KAMO used the "American Burying Beetle Biological Assessment/Evaluation Guidelines" provided by the Service to evaluate possible impacts to potential ABB habitat along the proposed route alignment and right-of-way. The Service's document details habitat characteristics considered to be unsuitable for the ABB. The ten unfavorable habitat conditions are:

- Soil that is greater than 70% sand
- Soil that is greater than 70% clay
- Land where greater than 80% of the soil surface is comprised of rock
- Land where greater than 80% of the subsurface soil structure within the top 4 inches is comprised of rock
- Land that has already been developed and no longer exhibits surficial topsoil or leaf litter
- Agricultural land that is tilled on at least an annual basis
- Land in an existing right-of-way/bar ditch along a roadway
- Urban areas
- Stockpiled soil
- Land inundated with water

The RUS-KAMO used the following sources to determine suitable ABB habitat:

- Visual inspection of aerial photography (identify woodlands)
- National Land Coverage Data (identify woodlands and land use)
- National Resource Conservation Data (evaluate soil suitability)
- National Wetland Inventory data (water regime)

Based on the information above, the RUS-KAMO conducted a multi-component evaluation of the proposed right-of-way to identify potential areas of suitable and non-suitable habitat. The aerial photography of the proposed route was used to identify any woodland areas within the right-of-way greater than 50 feet in width. The aerial photography data were compiled using ArcGIS with the other data layers to generate a map layer showing habitat that both met the habitat preferences provided by the Service and will also require clearing of trees and brush.

Based on Service data, the portions of the Transmission Line that are located in Craig, Mayes, and Ottawa counties in Oklahoma are within the range of the ABB. The RUS-KAMO analysis of the above data for these three counties shows that within the 1,176 acres of project right-of-way, there are approximately 28 acres of wooded potentially suitable ABB habitat spread throughout the right-of-way (Table 2).

Table 2 Summary of American Burying Beetle Suitable Wooded Habitat in Mayes, Craig, and Ottawa Counties, Oklahoma County

County	**State**	**Project Acres**	**Wooded Habitat Acres**
Mayes	OK	434	15.5
Craig	OK	646	11.51
Ottawa	OK	96	0.85
Total		1,176	27.86

A. Analysis for effects of the action

Direct Effects

Transmission line construction actions that could potentially directly impact ABBs are vegetation clearing and grading, vehicle and equipment traffic, access road construction, and structure installation. These actions could result in soil displacement, soil compaction, rutting, fuel and chemical spills/leaks, alteration of vegetation composition, and displacement of ABBs and their prey. Soil displacement, soil compaction, and rutting could result in killing of ABB adults, larvae, and eggs by crushing, entombment, and exposure to adverse conditions (extreme heat or cold, predators, and competitors) if displaced from soil. Fuel and chemical spills/leaks would contaminant soil, making the soil unsuitable for ABBs. In addition, ABBs could be killed by direct contact with contaminant. The presence of vehicles and equipment could result in ABBs and their prey leaving or avoiding the area. Direct mortality to eggs and larvae could occur via adults abandoning active broods in occupied habitat because of disturbance. Reduced foraging success due to habitat degradation and/or fragmentation (which can lead to an increase in vertebrate competition for carrion) can also result in the direct mortality through starvation.

Indirect Effects

Indirect effects are those project related effects, which are reasonably certain to occur, but later in time. The ABB can be indirectly affected by limitation or reduction in necessary resources, such as food, shelter, and breeding.

The potential indirect impacts to ABB from RUS-KAMO actions are soil compaction, erosion, soil contamination from fuels and chemicals, transmission line maintenance, clearing and grading of habitat, and right-of-way vegetation maintenance. Soil compaction, erosion, and contamination would result in habitat unsuitable for ABBs. The alteration of habitat from woodland to herbaceous creates edge habitat and alters the microclimate in the right-of-way and along the woodland edge. Edge habitat alters the vertebrate species composition limiting or reducing available carrion for ABB feeding and reproduction, and increasing competition for carrion. Clearing, grading, and vegetation maintenance will result in long-term (20 -50 years) and permanent loss, fragmentation, and/or alteration of suitable ABB habitat.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

In addition to those projects with a federal nexus that undergo consultation, there are numerous actions that do not require federal funding, permitting, or authorization, and consequently do not require consultation with the Service. The Service assumes that if there are roughly 200 projects annually with a federal nexus for which we consult there are at least this many or more non-federal nexus projects that are implemented in the action area.

There are over 400 new oil and gas wells constructed annually, on average, in eastern Oklahoma, with the majority not having a federal nexus. Additionally, numerous oil and gas seismic surveys and pipelines are constructed throughout the project area. There are multiple new or expanding surface coal mines in southeastern Oklahoma. Commercial development is expanding to undeveloped lands on the periphery or in suburbs of cities. Residential developments are being constructed outside city limits or in previously undeveloped or rural areas. The development of renewable energy production projects, such as wind energy, are now being actively pursued for development in portions of the ABB range in eastern Oklahoma. The specific numbers of these type of projects or associated acres of disturbance is difficult, if not impossible, to project or quantify. However, it is clear that there are numerous, continuing and expanding impacts to ABBs and their habitat from non-federal nexus projects.

Conclusion

After reviewing the current status of the ABB, the environmental baseline for the action area, the effects of the proposed Transmission Line and the cumulative effects, it is the Service's biological opinion that the Transmission Line, as proposed, is not likely to jeopardize the continued existence of the ABB. No critical habitat as defined under the Act has been designated for the ABB, therefore, none will be affected.
While the ABB has disappeared from approximately 90 percent of its historic range, there are self-sustaining populations in Oklahoma, Arkansas, Nebraska, Kansas, South Dakota, and Massachusetts. Further, there are multiple secure conservation areas (e.g., Camp Gruber, TNC lands, and National Forests) where the ABB is known to occur in Oklahoma and the conservation goals and/or ownerships of these areas are not likely to change. The proposed actions impact roughly 0.01 percent of the total area of eastern Oklahoma and the impacts are expected to be relatively small and localized. Furthermore, some of the anticipated impacts would be temporary in duration.

The Service finds that the proposed action is not likely to jeopardize the ABB for the following reasons:

1. The ABB occurs in several other areas within Oklahoma.
2. There are at least two self-sustaining populations or metapopulations of ABB in Oklahoma.
3. There are multiple populations or metapopulations of ABBs in at least six other states.
4. Capture rates at a representative portion of these other populations or metapopulations indicated stable levels of ABBs.
5. Five of these self-sustaining populations are under the ownership of the federal or state government or a natural resource conservation organization; thereby, ensuring their protection.

The conclusions of this BO are based on full implementation of the project as described in the "Description of the Proposed Action" section of this document, including any Conservation Measures that were incorporated into the project design.

INCINDENTAL TAKE STATEMENT

Section 9 of the Act and federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. *Harm* is defined by the Service as an act that actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). *Harass* is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the 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 considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Measures described below are non-discretionary, and must be undertaken by the RUS so that they become binding conditions for any action, grant, or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. The RUS has a continuing duty to regulate the activity covered by this incidental take statement. If the RUS (1) fails to assume and implement terms and conditions or (2) fails to require adherence to terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of 7(o)(2) may lapse. In order to monitor impact of incidental take, the RUS must report progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service anticipates incidental take of ABBs will be difficult to detect for the following reasons: 1) the species is wide-ranging, 2) the ABB has a small body size making finding a dead or impaired individual unlikely, 3) losses may be masked by seasonal fluctuations in numbers, and 4) the species occurs underground a substantial portion of their lifespan that makes detection difficult. However, the level of take of ABBs can be anticipated by the loss of 28 acres of habitat, because the of the ABBs dependence on soil for reproduction and overwintering, and the amount of time annually (around 9 months) they are buried in the soil.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species.

REASONABLE AND PRUDENT MEASURES

Pursuant to section 7(b)(4) of the Act, the following reasonable and prudent measure(s) (RPM) are necessary and appropriate to minimize the amount of incidental take of ABB:

1. Utilize native species for revegetation when allowable by the landowner.
2. Minimize project footprint to reduce impacts to the ABB and habitat.
3. Monitor and report the level of disturbance to ensure compliance with the incidental take statement of this BO.
4. Monitor and report implementation of project description to ensure compliance with the BO.

The conservation measures negotiated in cooperation with the Service and included in the project design constitute were considered during the Service development of reasonable and prudent measures.

TERMS AND CONDITIONS

In order to be exempt from the prohibition of section 9 of the Act, the agency must comply with the following terms and conditions, which implement reasonable and prudent measures described above and outline required reporting and monitoring requirements. These terms and conditions are non-discretionary and also must be a condition of any federal permits, contracts or grants issued.

Terms and Conditions

1. A. All plants listed on the USDA's and the state of Oklahoma's invasive species list shall not be planted.
   B. Restore disturbed areas with native seeds/vegetation when landowners will permit.
2. Utilize currently disturbed areas such as existing roads, rights-of-way, staging areas, and etc. where feasible.
3. Provide a report to the Service's OFO quarterly and at the conclusion of the project. The report shall summarize the amount acres of forest habitat cleared, the number of acres remaining before reinitiation of consultation is required, and the total acres (both woodland and herbaceous) disturbed by the project.
4. The quarterly report to the Service's OFO shall include the type of project actions implemented.

The Service believes that no more than 28 acres of ABB habitat will be incidentally taken as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of reasonable and prudent measures.

The Service is to be notified within three working days upon locating a dead, injured or sick endangered or threatened species specimen. Initial notification must be made to the nearest U.S. Fish and Wildlife Service Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death, if that occurs. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact the U.S. Fish and Wildlife Service Law Enforcement Office at (425) 883-8122, or the Service's Washington Fish and Wildlife Office at (360) 753-9440.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to utilize their authorities to further the purpose 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 effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information needed to conserve the species.

1. Require co-location on future transmission projects.

2 Conduct ABB related research at project site in coordination with the Service. This might include an analysis of small mammal and avian populations pre- and post-project.

3 Avoid use of chemicals, especially from mid-May to late September.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests written notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on actions outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or authorized by law) and if, (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to listed species or critical habitat not considered by in this opinion, or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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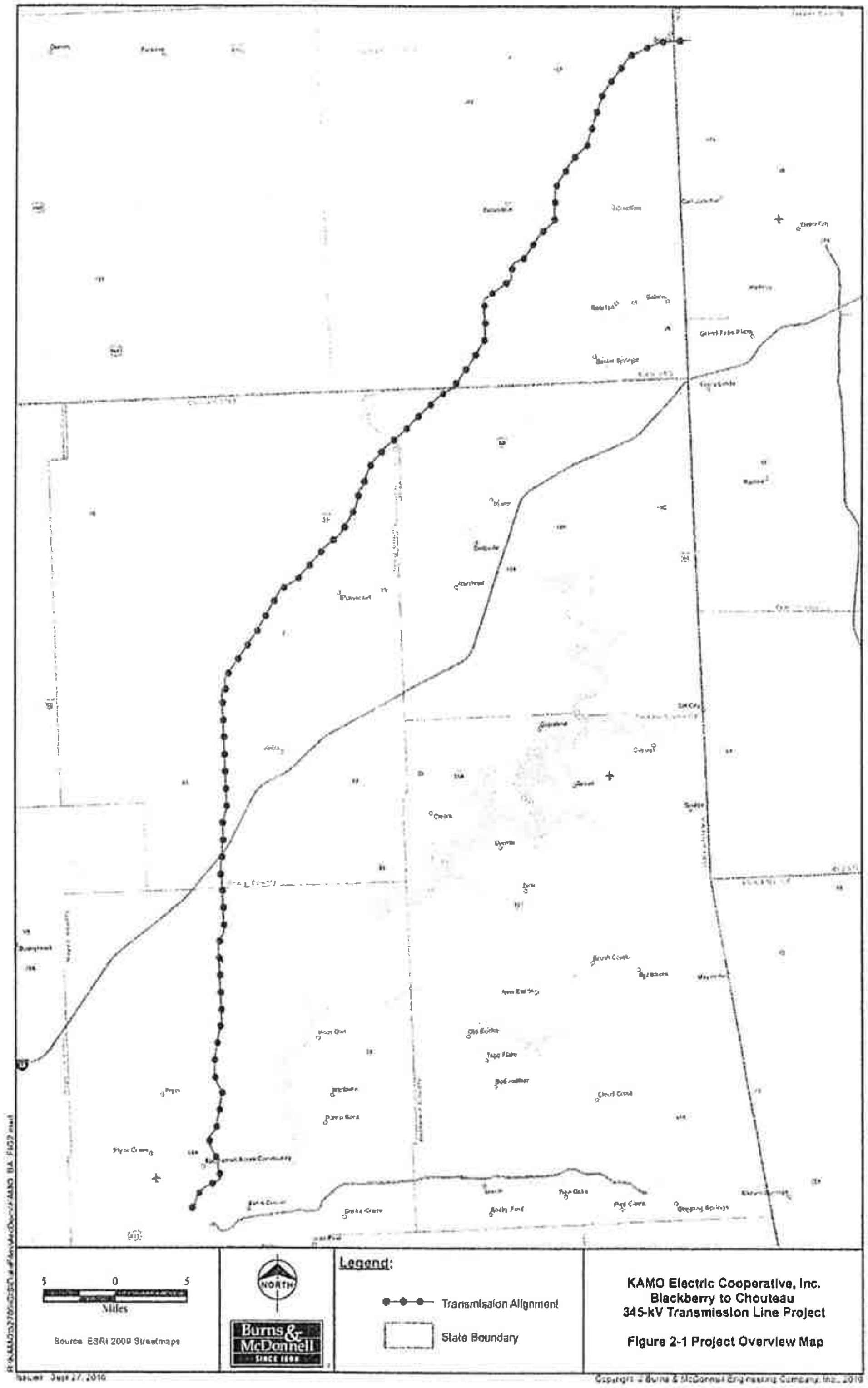
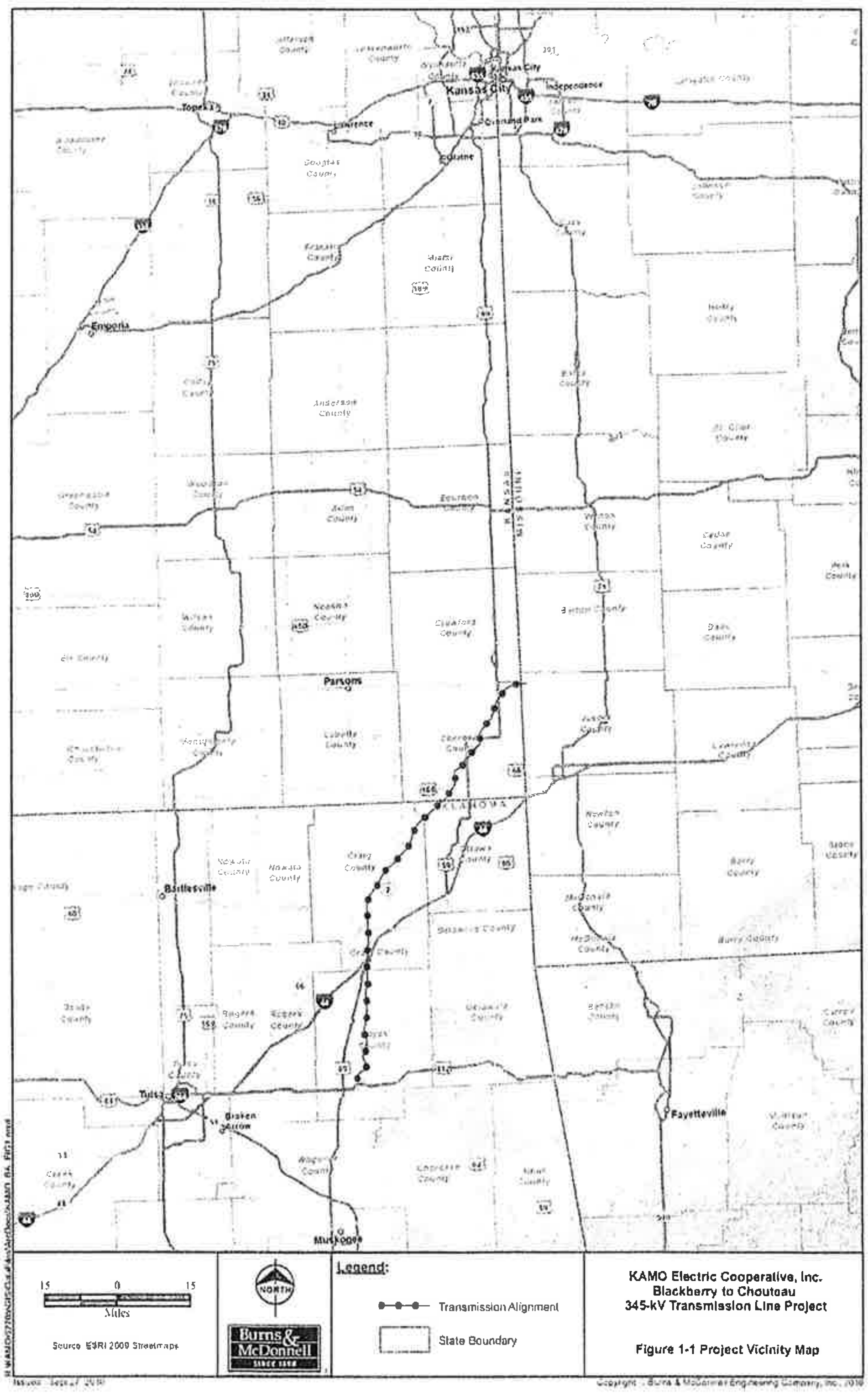
Appendix 1. Project route located within Oklahoma.



Appendix 2. Entire project route in Oklahoma, Kansas, and Missouri



Appendix 3. Historic and current range of the American burying beetle in North America and Canada.