Habitat Conservation Plan

Indiana Bat (*Myotis sodalis*)
Gray Bat (*Myotis grisescens*)
&
Short-eared owl (*Asio flammeus*)
Upland Sandpiper (*Bartramia longicuda*)
Northern Harrier (*Circus cyaneus*)
Loggerhead Shrike (*Lanius ludovicianus*)

Prepared for:

Adams Electric Cooperative

Prepared by:

Kaskaskia Engineering Group, LLC

December 2009

Photo credits on cover page:
Indiana bat – Adam Mann
Henslow's Sparrow – John Cassady
Short-eared Owl – Paul Higgins

Table of Contents

Appendices:

Acronyms:

AEC – Adam's Electric Cooperative

DOI – Department of Interior

ESA – Endangered Species Act

IDNR – Illinois Department of Natural Resources

IESPA – Illinois Endangered Species Protection Act

IESPB – Illinois Endangered Species Protection Board

ITA – Incidental Take Agreement

MBTA – Migratory Bird Treaty Act

NEPA – National Environmental Policy Act

USDA – United States Department of Agriculture

USFWS – United States Fish and Wildlife Service

1.0 Purpose of the Conservation Plan

1.1 Introduction

The Adam's Electric Cooperative (AEC) is in the process of constructing two wind driven turbines in Illinois: one northeast of Payson in Adams County and one southeast of Mt. Sterling in Brown County. The purpose of this document is to create a Habitat Conservation Plan (hereafter referred to as the Plan) inclusive of both facilities; however, the Payson facility is the primary driver of the Plan. The Payson facility is located near the Mississippi River valley which is a major migratory flyway and approximately five miles from Burton Cave which is a known bat hibernaculum.

The AEC, as a cooperative organization, is tasked with providing reliable energy service to its members. The co-op has over 8,000 members serving communities in seven Illinois Counties (Adams, Brown, Schuyler, Pike, Hancock, McDonough, and Fulton County). Sustainability is part of maintaining reliability and the co-op continually explores ways to utilize developing 'green' energy from sources such as solar and wind. The construction of the two wind turbines will serve to enhance the co-op's ability to tap into a sustainable energy source while reducing the carbon footprint needed to produce that energy. While a wind turbine provides a source of emission free, renewable energy, it may have an environmental downside: avian and bat species are known to be killed by striking the tower structures (primarily the spinning rotor blades) or as a result of barotraumas.

1.2 Regulating Authority

Regulating wind power facilities is largely the responsibility of state and local governments through processes such as zoning ordinances to permit construction and operation. Federal regulation is generally limited to facilities that are on federal lands or have some form of federal involvement, such as receiving federal funds. In these cases, the wind power project must comply with federal laws, such as the National Environmental Policy Act (42 U.S.C. 4371 et seq.) in addition to any relevant state and local laws. There is a federal nexus to the project via funding through a United States Department of Agricultural (USDA) Section 9006 grant. The federal laws involving this project which hold jurisdiction regardless of a federal nexus include the Migratory Bird Treaty Act (16 U.S.C. 703-712) and the Endangered Species Act (16 U.S.C. 1531-1544). The Migratory Bird Treaty Act (MBTA) implements four treaties which provide international protection for all migratory birds and birds of prey. The MBTA maintains strict liability: regardless of intent, the 'taking' of a protected species can be a violation. The Endangered Species Act (ESA) provides protection to those species listed as threatened, endangered, or included as a 'candidate' (species which are being considered and will most likely be placed on the federal list) by the federal government. While the ESA makes it unlawful to harass, harm, pursue, hunt, shoot, wound, kill, capture, or collect or attempt to engage in any such conduct, the U.S. Fish and Wildlife Service (USFWS) under the Department of Interior (DOI) is authorized by the ESA to permit "incidental takes" which occur as a result of an otherwise legal activity.

The State of Illinois maintains its own regulations for species considered threatened or endangered under the Illinois Endangered Species Act [520 ILCS 10/4 and 11(c)]. The Illinois Endangered Species Protection Board (IESPB) is tasked with responsibility of maintaining the list of threatened or endangered species. The Illinois Department of Natural Resources (IDNR) is responsible for administration of the current law. Under the Illinois Code, "Endangered Species" means any species of plant or animal classified as endangered under the Federal Endangered Species Act of 1973 and amendments thereto, plus such other species which the Board may list as in danger of extinction in the wild in Illinois due to one or more causes including but not limited to, the destruction, diminution or disturbance of habitat, over-exploitation, predation, pollution, disease, or other natural or manmade factors affecting its prospects of survival, but not including nursery plant stock obtained from a non-wild source, nor pre-act or legally obtained birds of prey held by licensed falconers; "Threatened Species" means any species of plant or animal classified as threatened under the Federal Endangered Species Act of 1973 and amendments thereto, plus such other species which the Board may list as likely to become endangered in Illinois within the foreseeable future. Modeled after the USFWS 'incidental take' permitting process, the IDNR is responsible for authorizing and implementing an 'incidental take' permit for state listed threatened or endangered species.

1.3 Initial Agency Coordination

The USDA has not requested preparation of either an Environmental Assessment or Environmental Impact Statement for the two wind turbines. Although wind turbines are in general known to be hazardous to avian and bat species, the specific impacts of wind turbines on migratory species and/or threatened and endangered species have not been clearly documented and are still under scientific study.

The USFWS issued an interim guidance memorandum for avoiding and minimizing wildlife impacts from wind turbines in 2003, which is used by all review personnel. The USFWS has not objected to the project nor has it requested formal consultation under the Section 7 process for the two proposed turbines; however, this does not release AEC from the potential for responsive action from the USFWS at any point in the future should a federally threatened or endangered species be found to be killed by the wind turbines.

Initial coordination with the IDNR, through the online resource Ecological Compliance Assessment Tool (Eco-CAT), identified state listed threatened and endangered species in the general proximity of the turbine locations. The presence of protected species triggered an additional information request by the IDNR to assess potential impacts. Subsequent coordination with the IDNR determined that although official consultation could be considered terminated, a voluntary implementing agreement with the IDNR for the 'taking' of selected species of concern was strongly recommended. The highest level of concern is in regard to the Federal and Illinois endangered Indiana bat (*Myotis sodalis*). The growing body of scientific literature on the interaction between wind turbines and wildlife is further defining/refining the risks posed to wildlife, but there is not a comprehensive understanding of the risks posed. The IDNR has expressed the desire to enter into an implementing agreement due to the known populations of Indiana bats declining at a precipitous rate.

The AEC has chosen to be proactive in its approach to the concerns raised regarding the identified species and is engaging in consultation with the IDNR to enter into an implementing agreement to receive an incidental take permit via the preparation of this Plan. This agreement will be between the IDNR and AEC; however, the USFWS has been encouraged to participate in the process by providing comments for incorporation into this document. The Plan will serve to document the existing and proposed conditions of the project area, describe the potentially affected species of concern, and provide proposed mitigating actions in the unfortunate event a species of concern is 'taken'. It has been requested that the implementing agreement be held active for the life expectancy of the turbines (twenty years). After the terms of the implementing agreement expire, any 'take' as a result of the turbines will require reauthorization unless previously deferred based on future agreements between AEC and the IDNR.

1.4 Identification of the Species of Concern

The Illinois Department of Natural Resources has provided records of hibernating Indiana bats (*Myotis sodalis*) at Burton Cave and maternity roosts in trees surrounding the cave north of the Payson site. However, the cave is also a known hibernaculum of gray bats (*Myotis grisescens*) and both proposed wind turbine facilities are located within the migratory corridors of the following threatened or endangered avian species: the northern harrier (*Circus cyaneus*), loggerhead shrike (*Lanius ludovicianus*), short-eared owl (*Asio flammeus*), and upland sandpiper (*Bartramia longicuada*). Table 1 identifies the status of these species in the State of Illinois.

Table 1: Identification of Species of Concern

Scientific Name	Common Name	Illinois Status	Notes
Bats			
Myotis sodalis	Indiana bat	Endangered[+]	Last recorded in Adams County in 1997, has not been recorded in Brown County
Myotis grisescens	Gray bat	Endangered[+]	Last recorded in Adams County in 1997, has not been recorded in Brown County
Birds*			
Asio flammeus	Short-eared owl	Endangered	There are no recent recordings in either Adams or Brown County
Bartramia longicuada	Upland sandpiper	Endangered	There are no recent recordings in either Adams or Brown County
Circus cyaneus	Northern harrier	Endangered	There are no recent recordings in either Adams or Brown County
Lanius ludovicianus	Loggerhead shrike	Endangered	Last recorded in Adams County in 1989, no recent recordings in Brown County

**the Bald Eagle was reported for the project area but was not requested to be included in the species of concern list*
[+]Federally listed also

2.0 Description of the Project and Project Area

The wind turbines selected for use at each site include one AWE 900 kilowatt ("kW") wind turbine (or comparable unit) mounted on a 75-meter hub-height tower. The rotors are 54 meters, which results in a 108 meter diameter blade arc. The Payson turbine will be located in the northeast 1/4 of Section 3 of Payson Township in Adams County, Illinois. The Mt. Sterling turbine will be located in the southwest 1/4 of Section 13 of Mt. Sterling Township in Brown County, Illinois. Both sites are east of Quincy and lie between the Mississippi and Illinois River Valleys. The Payson site is closer to the Mississippi River while the Mt. Sterling site nearer the Illinois River (Figure 1).

2.1 Landscape Scale

Physiography

Physiographic regions were developed nearly a century ago to use major landforms to define landscape scale areas. The process uses a tiered approach to classify landforms based on geologic structure and history. The project lies within the Galesburg Plain of the Till Plains Section of the Central Lowland Province (Leighton, 1948).

The Central Lowland Provinces covers much of the upper mid-west of North America. The Till Plains Section encompasses most of Illinois (about four-fifths), and is characterized by broad till plains from continental glaciations which are generally uneroded or geologically youthful. The Till Plains Section in Illinois is subdivided into seven areas with distinctly differing surface deposits. The Galesburg Plain includes the western segment of the Illinoian drift-sheet which is notable for its few morainic ridges. The Illinoian drift is generally thick and is underlain by Kansan and Nebraskan deposits which result in few observable features of the bedrock topography. Prominent glacial topography in this plain is limited to distinct local features (primarily along river valleys).

Ecoregion

Ecoregions have been defined for the North American Continent over the last several years to provide ecosystem boundaries using a holistic classification system which encompasses all the primary components of an ecosystem. The purpose of this system is to produce an effective way to place environmental concerns within a framework which is ecologically meaningful from a continental scale all the way down to a local scale.

Transitional zones between various ecosystems are used to create the boundaries of ecoregions. A hierarchical classification system has been established to be able to address environmental issues according to scale. There are three hierarchal levels that have been currently developed for the North American continent, with each level further refining the details of the ecological zones within them. Level I Ecoregions use very broad ecological zones to define 15 regions within North America. Level II subdivides Level I regions based on nationally defined characteristics and results in 52 distinct regions. Level III regions are further defined using regionally distinguishable ecological characteristics. The hierarchal classification continues beyond Level III; however, these classifications are being completed on a state by state basis. Level IV Ecoregions have recently been developed for Illinois and provide more relevance to localized land use planning.

The project area lies within the following Ecoregion hierarchy:

- Level I – Eastern Temperate Forests
- Level II – Southeastern USA Plains
- Level III – Interior River Valleys and Hills
- Level IV – Western Dissected Illinoian Till Plain

The Western Dissected Illinoian Till Plain is a well dissected, pre-Wisconsinan till plain with broad, nearly level interfluves, and many forested slopes, ravines, and floodplains. The dissected environment is more forested than the Level IV ecoregions to the east and is physiographically distinct from the hills and broad flats of the Southern Illinoian Till Plain. This ecoregion is capped with loess and till, and underlain by Pennsylvanian and Mississippian limestone, sandstone, shale, and coal. Rocky outcrops are common in the valleys and ravines. Alfisols make up the dominant soil types. These soils are associated with forested environments and are low in organic matter, acidic, and well drained. The Mollisols within this area developed in thick loess and are high in organic matter. Sheet erosion can be severe on cultivated slopes.

Oak–hickory forests covered the well-drained slopes prior to European settlement, while prairies were found on nearly level interfluves. Marshes and wet prairie occurred, but were less common than in the Central Corn Belt Plains. Since settlement, cropland and pastureland have almost entirely replaced the native prairies. Corn and soybeans are the primary agricultural crops. Steep slopes and ravines remain largely wooded, but forested acreage is less than it was at the time of settlement. Artificial drainage is less extensive than in neighboring Ecoregions and, partially as a result, nitrate concentrations in the surface waters tend to be lower than in adjacent ecoregions.

2.2 Local Land Cover

Payson

Adams County, as is most of central Illinois, is dominated by agricultural lands. Of the approximately 560,000 acres in the county, 50 percent are in some form of agricultural production with the predominant crops being corn and soybeans. The Payson facility will be located in the southwest corner of Adams County in an agricultural field (row crop). The turbine will be situated on a knoll within the field, generally surrounded by other agricultural parcels. Forested cover is limited to buffers along unnamed tributaries or upland swales passing through or along the edges of the fields. There are no large contiguous stands of forest within several miles of the turbine location. The wooded areas present along the drainageways are composed of early successional tree species that are typically all of the same age (young) and relative size (diameter). The composition is indicative of areas that were either unforested or clear-cut in the past.

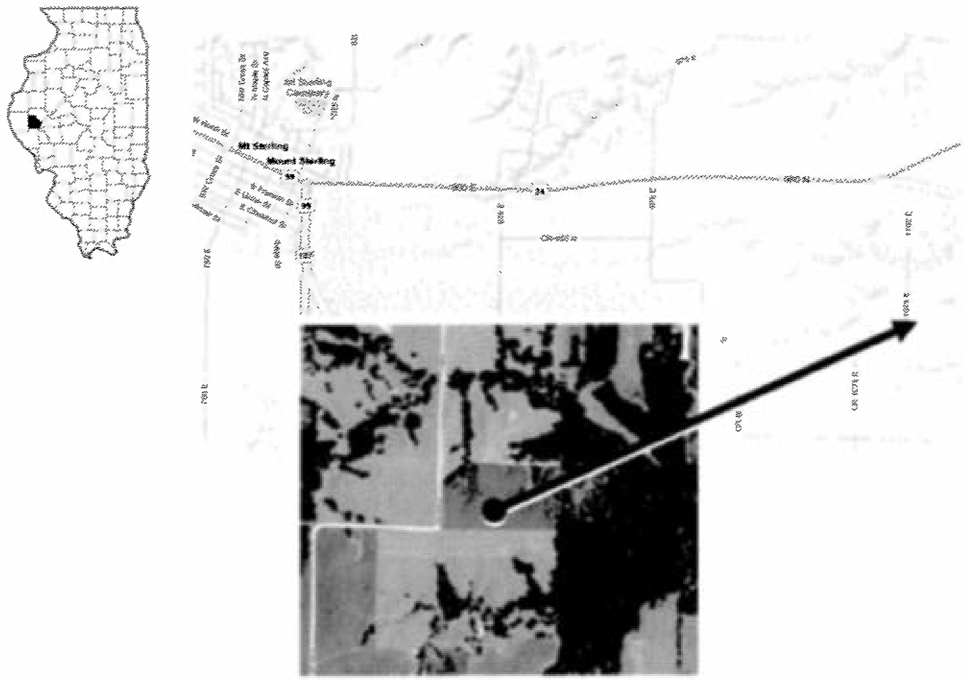
The project is located 3-4 miles east of the Mississippi River valley/floodplain. There are narrow, but higher quality forested lands along the bluffs. Large tracts of floodplain forest are present along the length of the Mississippi River. While pastures are present in the lands surrounding the turbine, these are heavily grazed; there are no fallowed or lightly grazed grasslands.

Mt. Sterling

Brown County is also dominated by agricultural lands but is less than half the size of Adams County. Of the approximately 200,000 acres of land in the county, 47 percent are in some form of agricultural production. The Mt. Sterling facility is located in the central part of the county within an agricultural field. The turbine will be located near the center of a 20 acre row crop parcel which is bordered to the south and west by more farm fields, to the north by a perennial waterway with an adjacent pasture, and a large contiguous forested area to the east (~150 ac). There is also a small (<1 ac) pond present in the northeast corner of the 20 acre parcel.

The large contiguous block of woods has been heavily disturbed in the past and has been highly fragmented internally. The stand was formerly a dry-mesic upland hardwood (oak-hickory) forest but has been systematically logged over time. Some areas were clear-cut; other areas have been selectively harvested. The removal of the canopy resulted in a flush of early successional trees which moved in and colonized the hillsides (some portions of the forest are quite difficult to traverse because of this dense growth). The disturbance activities have severely degraded the ecological integrity of the woods.

The project is located 8-9 miles west of the Illinois River valley/floodplain. The percentage of forested lands to agricultural lands increases steadily from the project location to the river bluffs. The floodplain of the Illinois River does not contain as large of tracts of floodplain forest as does the Mississippi River.



The Mt. Sterling turbine is located in Brown County approximately 2 miles east of Mt. Sterling in the southwest 1/4 of Section 13 of Mt. Sterling Township

---

The Payson turbine is located in Adams County approximately 2 miles northeast of Payson in the northeast 1/4 of Section 3 of Payson Township

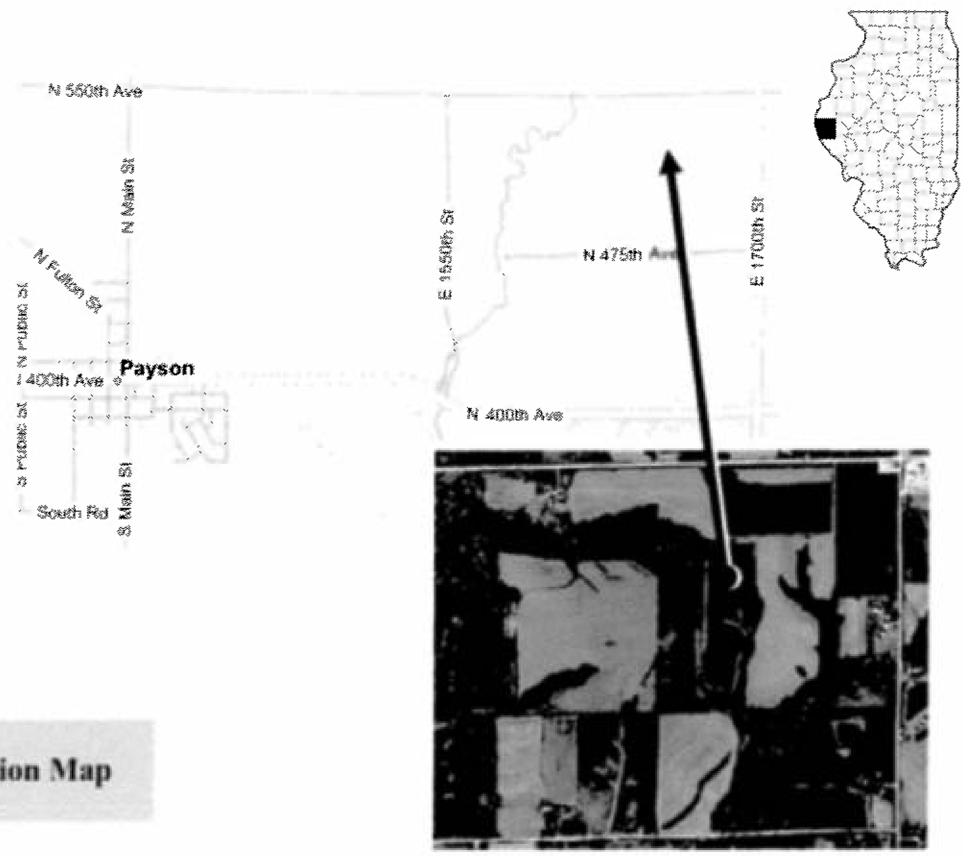


FIGURE 1: Project Location Map

3.0 Description of Potentially Affected Species of Concern

3.1 Indiana Bat (*Myotis sodalis*)

Taxonomy and Morphology

The Indiana bat is a member of the family Vespertilionidae and in the genus *Myotis*. This genus is composed of more than 20 species distributed worldwide. The pelage of the Indiana bat is very fine and fluffy. The hair is bi-colored with the basal two-thirds black followed by a grayish band (specimens may have a cinnamon or slightly glossy tip). Membranes and ears are blackish-brown. The total length ranges from 75-102 mm (2.9-4.0 inches), tail length from 27-44 mm (1.0-1.7 inches), wingspread from 240-267 mm (9.4-10.5 inches), length of head and body from 41-49 mm (1.6-1.9 inches), ear from 10-15 mm (0.39-0.59 in. but does not extend past end of nose when laid forward), forearm from 36-41 mm (1.4-1.6 inches), and hind foot from 7-11 mm (0.27-0.43 in) with hairs that do not extend beyond the toes. The weight ranges from 5-11 grams. The length of maxillary tooth-row ranges from 5.2-5.6 mm and a complete sagittal crest is usually present in adults. Dentition is as follows: I 2/3, C 1/1, P 3/3, M 3/3. This species differs from other myotines by the presence of an obviously keeled calcar (not always evident in dried study skins).

Reproduction

Mating typically occurs from late August to early October when females arrive at the winter hibernacula, but a limited amount of mating has been observed to occur in the spring (April) after arousal from hibernation. Their mating behavior occurs during periods of 'swarming'. Swarming occurs over a several week period and consists of large numbers of the bats flying in and out of cave entrances from dusk to dawn. Mating occurs during the latter part of the period. Males generally arrive at the hibernacula earlier than females and most roost in nearby upland forest trees, but a minor number may roost in the caves during the day throughout the swarming period. During swarming, males remain active over a longer period of time at cave entrances than do females, probably to mate with the females as they arrive. After mating, females enter directly into hibernation. Ovulation takes place after arousal in the spring and pregnancy is achieved via delayed fertilization from sperm stored during autumn mating. Females migrate and form nursery colonies under exfoliating bark of dead or living trees. After grouping into nursery colonies (have not been observed to be greater than 100 individuals), females give birth to a single young between late June and early July. Young become volant in 25-37 days. The time interval for young to become volant is dependent on weather, particularly the temperature. Mortality between birth and weaning has been observed to be approximately 8 percent. Mothers have been observed moving non-volant young to warmer roost spots. Apparently, first flights of the young are tandem flights with the mother. Young female bats can mate in their first autumn and have offspring the following year, whereas males may not mature until the second year.

Habitat

The Indiana bat has two distinct annual habitats: winter hibernacula in caves and summer roosting sites located in forested areas along or near waterways. Preferred hibernation sites have the following characteristics: medium to large limestone caves with pools present, shallow passageways, mean mid-winter temperatures between 3-6 degrees C (early studies identified a preferred mid-winter temperature range of 4-8 degrees C / 39-46 degrees F, but more recent examination of long-term data suggests that the slightly lower and narrower range of 3-6 degrees C / 37-43 degrees F may be ideal for the species; IBRT, 1999), and relative humidity greater than 66 percent. Hibernating individuals characteristically form large, compact clusters of as many as 5,000 individuals - averaging 500 to 1,000 bats per cluster, which may move to cooler or warmer areas of cave during winter. After arousal from hibernation, migration to the summer habitat ensues. Although there have been a number of studies of summer habitat of the Indiana bat, such a small percentage of the total population has been observed that the information known to date presents more generalities than specifics.

Summer roosts typically are not found in forests with less than 10-30 percent canopy cover or in old fields with less than 10 percent canopy cover. In Missouri, primary maternity roosts occur in standing dead trees exposed to direct sunlight (Callahan et al., 1997). Maternity colonies select multiple roosting sites within their home range, divided into primary and alternative sites. Each colony may have 1-3 primary roosts and numerous more alternate roosts. The roost trees used by each colony are typically not widely dispersed (observed less than 1.5 km radii). Primary and alternate roost trees are similar with the exception of location (open vs. interior) and status (living vs. dead). Trees used as primary roosts can be characterized as dead, located in the open, have relatively large diameter trunks, and on average have 75 percent of their bark attached (Callahan et al., 1997). Alternate roosting sites may be living or dead, tend to have slightly smaller diameter trunks than primary, are located in the interior of the forest, and appear to be used during periods of inclement weather. Colonies move to the interior / alternate roosting trees during prolonged days of precipitation, cold, or heat. Live trees seem to be the preferred alternate roosting sites during prolonged precipitation or cold while dead trees the preferred alternate roosting sites during periods of high temperatures. Selection of multiple roosting sites of differing characteristics infers separate, specific thermodynamic advantages for each chosen roost. It is suggested that as many as 30 percent of roost trees may deteriorate in any given year with most primary roost trees lasting only 6-8 years (Humphrey and Cope, 1977).

Diet

Several studies have been conducted on the foraging habits of this species in several areas of its range. These studies have shown variations in the bat's primary diet, foraging behavior, and foraging habitat. Studies in Missouri have found the largest proportion of diet throughout the summer was from lepidopterans (moths), often in excess of proportional availability (Brack and LaVal, 1985). Several orders of aquatic insects were eaten to a lesser extent and were found to correlate to the amount of lunar illumination. Both riparian and non-riparian foraging areas were present near the cave but riparian area was smaller than non-riparian area and the bats tended to forage upstream where stream sections narrowed and wooded areas became denser. In eastern Missouri, foraging occurred almost exclusively under the forest canopy on ridges and hillsides. Studies in Indiana found the bulk of the diet to come from the insect orders Lepidoptera, Diptera, and Coleoptera but with a higher percentage of diet coming from aquatic insects than the Missouri populations. This discrepancy is attributed to the likely difference in foraging habitat resulting from inter-specific competition with gray bats, which feed almost exclusively over water along riparian corridors (LaVal et al., 1977). In southern Michigan, it was found that

Lepidopterans generally did not account for more than 14 percent of diet. The primary diet was composed of aquatic insects in the orders Trichoptera and Diptera (Kurta and Whitaker, 1998). The diet of the Indiana bat may be more related to habitat and availability with the implication that diets may be regional and based on the particular habitat selected by the colony (wetland, floodplain, or upland).

Distribution

The Indiana bat has been found in 27 states throughout much of the eastern United States. Based on the 2005 winter census taken at hibernacula, the total known Indiana bat population was estimated to number about 457,000 bats (USFWS, 2007). This represents an overall decline since population surveys began in the 1960s but an increase from the population lows in the 1990s when the population was estimated to have experienced a decline of 60 percent. The most severe declines have occurred in two states: Kentucky, where 180,000 bats were estimated lost between 1960 and 1997; and Missouri, where an estimated 250,000 Indiana bats may have been lost between 1980 and 1997. Significant hibernacula are classified into "Priority Sites" (P1, P2, P3, or P4). The Priority Sites have recently been reclassified by the USFWS within the 2007 draft Indiana Bat Recovery Plan. P1 sites are "essential to recovery" and have current or historical observed numbers of 10,000 or more. In 2005 there were P1 hibernacula in 7 states (IL, IN, KY, MO, NY, TN, and WV). Currently, Illinois has only one P1 site. In 2005 more than 90 percent of Indiana bats hibernated in 5 states (IL, IN, MO, NY, and KY) and nearly half in Indiana alone. The top ten P1 sites in 2005 accounted for 71.6 percent of the total population. P2 sites are those which currently have or had documented 1,000-10,000 Indiana bats. P3 sites are those which have or had documented 50-1,000 Indiana bats. P4 sites are considered the "least important to recovery and long-term conservation" and have or had documented less than 50 Indiana bats. Burton Cave is classified as a P4 site.

Ecology

The Indiana bat is one of the most gregarious of the myotines, often forming extremely dense hibernating clusters. This species of bat will periodically arouse from hibernation during the winter. This is likely an adaptation to a specific hibernating strategy given the energy cost of arousal. Observations of numerous hibernacula have produced three distinct hibernating strategies within morphologically different caves: there are hibernacula with relatively high temperatures which require no intra-cave movements; those with intermediate temperatures, which require at least one intra-cave movement to colder parts of the cave; and those with relatively cold temperatures, which require at least two intra-cave movements (Clawson et al., 1980). The third form (coldest temperatures but requiring two movements) is the riskiest but appears to be the most physiologically rewarding in the form of fat reserves used. Movement to colder areas of the cave allows for more efficient hibernation, but typically locates the bat where, in the presence of a severe cold front, subfreezing temperatures will exist. Locating in warmer, stable temperatures eliminates the threat of freezing but requires more fat reserves, thus a late arriving spring may result in much higher post-hibernation mortality. Under these warmer conditions, observed cluster size is decreased. Conversely, mean cluster size was observed to increase under the first and second strategy (it is assumed that large cluster size results in buffering and more energy efficient arousal). Data from a known Indiana bat hibernaculum indicates that most place lower metabolic activity as highest priority and locate to hibernacula requiring two intra-cave movements (Clawson et al., 1980).

Although certain migration patterns may be inferred from limited band returns, their interpretation should be done with caution. The sparse band recovery records, all of which are from the Midwest, indicate that females and some males migrate north in the spring upon emergence from hibernation, although there also is evidence that movements may occur in other directions (IBRT, 1999). However, summer habitats in the eastern and southern United States have not been well investigated; it is possible that both sexes of Indiana bats occur throughout these regions. Very little is known about Indiana bat summer habitat use in the southern and eastern United States, or how many Indiana bats may migrate to form maternity colonies there. Additional work is especially needed to better understand Indiana bat summer distribution.

Most summer captures of reproductively active Indiana bats (pregnant or lactating females or juveniles) have been made between April 15 and August 15 in areas generally north of the major cave areas (IBRT, 1999). Unglaciated portions of the Midwest (southern Missouri, southern Illinois, southern Indiana), Kentucky, and most of the eastern and southern portions of the species' range appear to have fewer maternity colonies per unit area of forest. However, such conclusions may be premature, given the lack of search effort in these areas. Anecdotal evidence suggests that the Indiana bat may, in fact, respond positively to habitat disturbance. Maternity roosts have been found where hog lots have killed overstory trees and removed understory trees in Illinois, Indiana, and Missouri (IBRT, 1999). Maternity colonies, including the first maternity roost discovered in Indiana, have been discovered when a tree was cut down and the bats moved to another tree. These observations suggest that the Indiana bat may be a more adaptable species than previously thought. Conceptually, at least in the western part of the species' range, the Indiana bat may have been a savanna species. The following facts support this contention: Indiana bats prefer large trees in the open or at edges, they seem to prefer open canopies and fragmented forest landscapes, and they seem to prefer forest with an open understory.

Indiana bats have strong site fidelity to summer colony areas, roosts, and foraging habitat. Females have been documented returning to the same roosts from one year to the next. Male Indiana bats also have been recaptured when foraging in habitat occupied during prior summers. The Indiana bat may be more adaptable with regard to roosts than previously believed. It has been suggested that the reproductive success of local populations may be dependent on previously used summer roosts, but recent studies have shown that Indiana bats know of and occupy a number of roost sites within a maternity colony area (USFWS 2007). Colonies are known to move from one roost to another within a season to respond to changes in environmental conditions (temperature and precipitation), and when a particular roost becomes unavailable.

Foraging occurs in and around the tree canopy of flood plain, riparian, and upland forest. In riparian areas, Indiana bats primarily forage around and near riparian and flood plain trees. Within flood plain forests where Indiana bats forage, canopy closures range from 30 to 100%. Excellent foraging habitat has been characterized as woody vegetation with a width of at least 30m on both sides of a stream (IBRP, 1999). Streams, associated flood plain forests, and impounded bodies of water are preferred foraging habitats for pregnant and lactating Indiana bats, some of which may fly up to 2.5 km (1.5 mi) from upland roosts. Foraging also occurs over clearings with early successional vegetation (e.g., old fields), along the borders of croplands, along wooded fencerows, and over farm ponds in pastures. The extent of foraging area used by an Indiana bat maternity colony has been reported to range from a linear strip of creek vegetation 0.8 km (0.5 mi) in length, to a foraging area 1.2 km (0.75 mi) in length. Foraging air space ranges from 2 - 30 m (6 - 100 ft) above ground level. Most Indiana bats caught in mist nets are captured over streams and other flyways at heights greater than 2 m (6 ft; IBRP, 1999).

Humphrey and Cope (1977) produced the most definitive research into survivorship rates of the Indiana bat to date, but due to the difficulty in sampling their resulting percentages likely underestimate true survival rates, thus values should be considered minimum survival rates rather than average survival rates. Analysis of 4 banded unaged cohorts found that the first year, year 0, after banding had the highest mortality rate (this is assumed an expected high mortality of the young of the year and old). From year 1-6, there was a fairly stable survival rate (~76 percent for females and ~70 percent for males) and then from year 7 on, a new constant lower survival rate was reached (66 percent for females, up to 10 years, and 36 percent for males). The oldest of the cohorts survived to nearly 15 years of age.

3.2 Gray Bat (*Myotis grisescens*)

Taxonomy and Morphology

The gray bat is a member of the family Vespertilionidae and is in the genus Myotis. This genus is composed of more than 20 species distributed worldwide. The gray bat is considered the most cave-dependent mammal in the United States. The gray bat is the largest species in the genus *Myotis* in the eastern United States. This species is most commonly confused with *M. lucifugus*, *M. sodalis*, *M. austroriparius*, and *M. keenii*. Distinguishing characteristics include uniformly colored fur (all other species of *Myotis* have bi- or tri-colored hair). Additionally, the wing membrane is attached at the base of the foot at the ankle, not at the base of the first toe. Adults grow to 3 inches in length with a wingspan 10-12 inches and typically weigh 8-11 grams. Following late summer molt (July-August), dorsal fur is uniformly dark gray but tends to bleach to chestnut brown or russet. Males and females are similar in size and color; however, reproductive females tend to have more pronounced russet color prior to summer molt (USFWS, 2004).

Reproduction

Females become sexually mature in their second year (Tuttle, 1975). Mating occurs when males arrive at the winter hibernacula (females generally arrive a few weeks earlier than males). Females immediately enter hibernation after copulation while males continue to feed for several more weeks before entering hibernation. The sperm is stored by the female throughout the winter months and they become pregnant after emerging from hibernation. Females emerge from their winter hibernaculum in late March or early April and migrate to warmer caves to form maternity colonies. Birth is given to a single young in late May or early June. Growth rates of young are positively correlated with colony size (other environmental factors such as size and structure of maternity cave and porosity of limestone can affect growth). In a large colony, young will typically become volant (fly) in 20-25 days, whereas young in smaller colonies may take 30-35 days. Young in severely reduced colonies may die before learning to fly. The growth rate connection to colony size relates to the reduced energy demand required for thermoregulation. Lactating females have increased metabolisms and need to maintain higher body temperatures, larger colony sizes reduce the amount of energy required. Growth and survival rates in volant young are inversely proportional to the distance from roosting sites to nearest over-water foraging area. Although mothers continue to nurse young after they become volant, young are apparently left to learn to hunt on their own. Survival rates the first year are between 55-85 percent in undisturbed colonies and 57-66 percent in disturbed colonies. Mean annual survival rates in adults appear constant at 70 percent for males and 73 percent for females (Elder and Gunier, 1981). Mortality is highest for both juveniles and adults during the spring migration, when fat reserves are lowest.

Habitat

The gray bat inhabits caves at all times of the year, although requirements for winter and summer caves differ. Winter / hibernating caves are generally deep vertical pits which contain a large volume below the lowest entrance thus acting as a cold sink to trap air (MDOC, 2004). Temperatures in winter caves remain stable between 42-52 degrees (F). Summer / maternity caves are more variable in size and structure, but generally have entrances lower than roosting areas and have domed ceilings which can trap warm air. High humidity appears to be a requirement and streams are typically present in preferred maternity caves. Temperatures range from mid-50 to 80 degrees (F) with relative humidity greater than 80 percent. Although temperature and humidity ranges are variable from site to site, these two parameters are highly stable within each site. There is generally no discernable air movement at the selected roosting site. Non-reproductive females, juveniles, and males are not as selective in their summer roosting sites and form smaller bachelor colonies separate from maternity colonies (bachelor colonies may be present in same cave but in a 'non-preferred' area). A small percentage of this non-reproducing part of the population, however, will exist within a maternity colony. Bachelor colonies, as a result of selecting 'less-desirable' sites, tend to be cooler or have more variable temperature and humidity levels and individuals in most bachelor colonies tend to become torpid during the day. Undisturbed maternity colonies generally remain active and do not enter torpor. A single record exists for a maternity colony of gray bats using a barn (Gunier and Elder, 1971). Bachelor colonies can select sites up to 2 miles away from foraging areas but maternity colonies are generally not more than a mile from foraging areas. The gray bat has been observed to forage within forests but over-water areas along forested sections of streams and reservoirs are preferred. Forest corridors and buffers appear to play a crucial role in selection of colony sites and foraging areas for the protection they provide against predators such as the screech owl. Gray bats have been observed to fly a much longer distance in order to stay along fencerows or any clump of trees between roosting and foraging areas. In addition to providing cover against predation, forested areas provide 'rest-stops' for newly-volant young as they learn to fly and hunt. Former preferred foraging habitats have been reported abandoned when areas become deforested (NatureServe, 2004).

Diet

Species is insectivorous but preferred diet is unknown. Gray bats have been observed in areas that have large populations of mayflies, which are assumed to be a major source of food.

Distribution

The range of the gray bat is primarily limited to Alabama, Kentucky, Tennessee, Missouri, and northern Arkansas. Nine winter caves are known to harbor approximately 95 percent of the total population during hibernation; one cave alone harbors 50 percent (NatureServe, 2004). Because of the specific roost and habitat requirements, fewer than five percent of available caves are suitable for occupation by this species. This results in patchy distribution of the species within its range.

Ecology

This species was originally estimated to have a life expectancy of 10 years but more recent studies predict they can live for nearly 40 years (NatureServe, 2004). The oldest known specimen was 16 years old. Individuals are extremely loyal to migration routes, home ranges, and colonies (USFWS, 1982). Upon emerging from winter hibernation, individuals migrate to summer sites, selecting numerous temporary colony sites along the way (these sites may be used for several days or more). Within the home range of a colony, there may be several potential roosting sites. If a colony is disturbed, individuals may move to a different, generally less preferred, site. Some areas may only contain one suitable site, which if made unsuitable (man-made or otherwise) could result in the loss of an entire colony. Disturbance is the single biggest threat to this species. A single disturbance of a maternity colony at the wrong time could result in the death of thousands of young. Each disturbance during hibernation burns a 20-30 day supply of fat (USFWS, 1982). The total population of this species is estimated to be at 50 percent of historical (prior to 1960's) numbers. Numerous local populations have been extirpated or reduced by greater than 80 percent. Greatly reduced colony sizes can ultimately result in the loss of the entire colony due to increased mortality rates of young in smaller colonies. Most of the important known colony sites are currently protected and populations appear stable or increasing. No new roosting sites have been recorded in caves that have not been historically occupied; however, there are several instances of maternity colonies becoming established in large storm sewers in major municipalities (NatureServe, 2004).

3.3 Short-eared owl (*Asio flammeus*)

Taxonomy and Morphology

Short-eared owls are in the family Strigidae (Typical Owls) and in the genus Asio (Eared owls). This genus has 6 other species worldwide. Short-eared owls are medium-sized owls with long wings and short tails. Females are slightly larger than males. Typical body length of 34-42 cm wing spans of 95-110 cm. Birds have ear tufts at the top of the facial disk and a dark patch at the base of the primaries. Back and upper wing are tawny brown to buff with heavy streaking. Underside is much lighter with bold, vertical brown streaking on the breast. Mature males are bright white on the underwing, while mature females show somewhat more buff coloration; however, it is difficult to sex or age in the field. Females are generally darker than males but young birds are also darker than older ones, thus a young male may be darker than an old female. Both sexes have a distinct, black carpal bar and dark wingtips. Juveniles possess full adult plumage by October of the first year (NatureServe, 2009b).

The bird is generally silent but does vocalize in courtship (a low, repeated, hooting: "voo, hoo, hoo, hoo," or in conjunction with defensive behavior or annoyance: "yaps" or "barks"). Adult owls may squeal while feigning injury during broken-wing acts to distract intruders from nests or young. Both young and adults will clack their bills when annoyed or in defense (NatureServe, 2009b).

Reproduction

Short-eared owls generally breed from early April to late August (Dechant, 2001). They arrive at breeding grounds from April to early May and immediately establish territories and begin courtship. In some areas of the species' distribution where the nesting and wintering grounds overlap, nesting may occur as early as late March. There is little evidence of multiple broods in a single season, but individuals may re-nest if the first clutch is destroyed. Nests are constructed on the ground in a bowl-shaped depression lined with grasses and downy feathers. Eggs are typically laid by mid-May in clutches of 4-7 and incubated 24-29 days, hatching asynchronously. After 3-4 days, the hatchlings begin to beg for food and begin wandering around the nest after two weeks. Young Short-eared owls can typically fly 24-27 days after hatching.

Habitat

Short-eared owls require large, open grassland or wetland habitat. In Illinois, nests were found in blocks as small as 70 acres, but it is believed that small blocks will only be used if there is an adjacent expanse of contiguous grassland (Dechant, 2001). The owls generally nest on the ground in dry upland grasslands. Nests may be fully concealed by dense vegetation or poorly concealed in open fields, but they are usually located in vegetation 30-60 cm tall. The habitat of the Short-eared owl's primary prey, the vole, requires grassland with ample residual vegetation consistent with periodic disturbance (fire, mowing) at 2-5 year intervals. Fragmented openland habitat either from fire disturbance or man-made fragmentation increases the likelihood of nest predation by skunks, raccoons, foxes, and coyotes; therefore, management strategies recommend leaving the large majority of the habitat undisturbed as refuge for the target species and its prey (Dechant, 2001).

Diet

The majority of the species' diet consists of small mammals, primarily voles, though with a smaller percentage of various bird species. The vole is such a major part of the diet that key population characteristics such as nest productivity and habitat utilization have been directly linked to vole abundance (NatureServe, 2009b).

Distribution

The Short-eared owl is one of the most widely distributed owls in the world (Doan, 1999). It occurs on every continent except Australia and Antarctica. In North America, the Short-eared owl breeds from northern Alaska and Canada, south to central California and east to

Maryland. The range of non-breeding residents extends across the southern half of the continental U.S. and into northern Mexico.

Ecology

Forage primarily by flying low, typically into wind, and dropping down onto prey, sometimes after brief hover similar to northern harriers. When not on foraging flights hovering over vegetation, the owls may occasionally hunt from low perches. From fence posts or shrubby vegetation, they will scan open areas, spot prey, and fly out to capture it. Short-eared owls are attracted to areas with abundant food resources, and may breed opportunistically and sporadically in such areas. When they do find areas of especially abundant resources they may breed in large numbers and produce super-normal clutches (NatureServe, 2009b).

Unlike most owls that nest in holes or take over the abandoned nests of crows or other birds, the short-eared owl is unique within Strigidae family by building a ground nest. Females build the nests which may be lined with grass, leaves, twigs or feathers. Nests generally do not last long after the young have dispersed. Between four and nine eggs are typically laid. Two broods may be raised if the nest is destroyed or depredated (NatureServe, 2009b).

Nest predators of the Short-eared owl include raccoons, foxes, coyotes, and mustelids (skunks). The populations of these predators have been augmented by the man-made increase in other food sources for these species. Predation from domestic animals is also concern. Mortality from collisions with trains, automobiles, and structures like radio antennas have been reported, but are not considered as major a threat as habitat loss.

Probably the most diurnal of owls and may be observed from late afternoon until the following dawn. Habitat is useful in separating short-eared owls from long-eared owls (*Asio otis*) as the latter is predominantly a woodland dweller. Short-eared owls can often be found roosting alongside Northern Harriers and may compete negatively with barn owls (NatureServe, 2009b). Short-eared owls show associations with species other than the vole.

3.4 Upland Sandpiper (*Bartramia longicuda*)

Taxonomy and Morphology

The Upland Sandpiper is in the family Scolopacidae (Sandpipers), which contains 27 genera of sandpipers. The genus Bartramia is monotypic, representing only one species. The Upland Sandpiper averages 27.9-32.5 cm in size (NatureServe, 2009c). Breeding adults are a mottled brown, black, and white, with a long neck and tail and yellow legs. The head is round with large black eyes and bill that is relatively small for a sandpiper. Females are slightly larger than males, though the plumage is alike. In flight, it shows a pale inner wing and a darker outer wing and has a shrill, squeaky flight call described as "quip-ip-ip-ip-ip-ip." The song is described as a long series of mellow notes, starting with a gurgling rising trill, ending with a long descending whistle.

Reproduction

Upland Sandpipers arrive at breeding grounds in early spring, by mid-April on average with arrival dates being relatively consistent. Most birds arrive paired and nesting begins about two weeks after arrival. Multiple "nests" are scraped into the ground, though only one is ever used, and may be completely unlined. Nesting pairs will usually lay 4 eggs (range 2-7), which will hatch by mid-June. A second hatching peak occurs in early July, probably do to renesting. Within 24 hours of hatching, broods are moved to brood-rearing fields. The average distance moved ranges from 50-500 m. Estimates of nesting success in the Northern Plains range from 63-100 percent while studies in Jasper County, Illinois calculated a 48 percent success rate (NatureServe, 2009c).

Habitat

The Upland Sandpiper is a shorebird of the grassland. Generally, this species prefers dry grasslands with low-moderate forb cover, moderate grass cover, low woody cover, high litter cover, and little bare ground (Dechant, 2002). Vegetation is usually 10-40 cm highs, but sandpipers avoid vegetation higher than 70 cm. In general, the species forages within shorter vegetation (<30 cm), and nests and rears broods in taller vegetation (10-63.5 cm). The species often uses native and tame grasslands, wet meadows, haylands, pastures, and planted cover (CRP lands, highway/railroad ROW, and grassy areas of airports). Some trees and woody vegetation are tolerated as long as the canopy remains open and grasses dominate.

The species is highly sensitive to habitat fragmentation, requiring areas greater than 75 acres. Occurrence and population size are correlated to field or patch size and inversely correlated to perimeter-area ratio.

Diet

Upland Sandpipers are ground gleaners, meaning they forage while walking. Their diet consists mostly of insects, including weevils and other beetles, grasshoppers, and crickets. Small amounts of grass seeds are also consumed.

Distribution

Upland Sandpipers breed from north-central Alaska across central Canada, south into eastern Washington and Oregon, Idaho, Colorado, Oklahoma, and Texas, and east into Missouri, southern Illinois, northern Kentucky, southern Ohio, West Virginia, central Virginia, and Maryland. Historically, the range extended further south.

This species is a long-distance, neotropical migrant. Wintering grounds extend across South America, from northern Brazil south to central Argentina. The highest concentrations occur in Argentina and Uruguay.

Ecology

The Upland Sandpiper is the most territorial of the sandpipers, often using its shrill flight call ("quip-ip-ip-ip") as a warning to intruders. Because the species nests semi-colonially, the territoriality serves to divide up the habitat into usable patches. Densities of 0.6-6.1 ha/nest have been documented and suggest loose grouping (NatureServe, 2009c). Adjacent to the nesting semi-colonial nesting site is a feeding area that is also shared communally. Breeding densities of up to 20 pairs/ sq mi have been recorded. Brood parasitism by Brown-headed Cowbirds is infrequent. Documented rates of brood parasitism range from 0-5%. Upland Sandpipers are not suitable hosts because their young are precocial.

Due to the construction of nests on the ground, Upland Sandpipers are vulnerable to nest predators. Common predators include coyotes, skunks, minks, raccoons, badgers, and domestic animals. The nests are also vulnerable to mowing and livestock trampling. Adults and juveniles alike are susceptible to predation by crows, raptors, and owls. Pesticides that reduce the abundance of prey species may threaten the species as well, though there is no evidence that ingestion of pesticides in prey tissue is harmful. The primary threat to the species is from habitat destruction due to changes in agricultural practices, grassland fragmentation and urbanization, and natural forest succession. No clear pattern of preference for native versus tame vegetation over the breeding range of the Upland Sandpiper is discernible. In central Wisconsin and central Minnesota, Upland Sandpipers were found nesting in tame vegetation; study areas, however, may have contained little or no native vegetation. In Illinois, Upland Sandpipers preferred stands of Kentucky bluegrass (*Poa pratensis*) and other tame grass species as opposed to tallgrass prairie, and preferred older (>5 yr) plantings of tame grasses and forbs (NatureServe, 2009c).

3.5 Northern Harrier (*Circus cyaneus*)

Taxonomy and Morphology

The Northern Harrier is in the family Accipitridae (Hawks, Eagels, Kites) and in the genus Circus. There are 13 species within the genus worldwide and all are harriers. Northern Harriers are slim-bodied hawks, with long wings and tails, and slender legs. The species is strongly sexually dimorphic; females are 50% heaver and 12.5% larger than males. Coloration is dimorphic as well; males are gray above, lighter below with black wingtips, whereas females are brown above and buffy with brown streaks below. Both sexes have a distinctive white rump patch. The species is distinguished from similar-looking species by narrower wings and slimmer tail. The face also has an owlish appearance due to a facial ruff that has the same structure and function to that found in owls. The species exhibits a characteristic flight low to the ground, in a slow, buoyant manner maintained by a series of distinctive heavy flaps with wings held at an angle.

Reproduction

Males arrive at the breeding grounds between late March and early April, females follow 5-10 days later. Nest construction begins by late April to early May, which may take several days to 2 weeks to complete. The male usually starts the nest, but the female takes over and finishes construction. The nest is built on the ground in dense vegetation. Males are not monogamous, though the number of females in a male's harem is associated with prey availability (Simmon et al., 1986). Often, only one of the females successfully produces young because the male typically favors only one mate and her nestling with food. About 5 (range 4-9) eggs are laid and incubated by the female for 31-32 days. The hatchlings are also brooded exclusively by the female, with the male passing food to the female. Young harriers can fly 30-35 days after hatching.

Habitat

Northern Harriers prefer relatively open habitats consisting of dense, tall vegetation and abundant residual vegetation. They are found in native and tame vegetation in wet or dry grasslands, lightly-grazed pastures, and fallow fields. Most nests are found in undisturbed wetlands or grasslands dominated by thick vegetation as nest success may be lower in cropland and fallow fields. In a study in Illinois, nest placement was determined less by whether the dominant grass was native or tame than it was by whether the field was idle or disturbed by mowing, fire, harvesting, or grazing.

Diet

Voles and other small mammals are the primary prey of Northern Harriers, though other mammals, birds, and occasionally reptiles and frogs are taken (MacWhirter and Bildstein, 1996). Insects compose only a small portion of the diet and are most frequently taken by juveniles. Changes in vole abundance are closely followed by corresponding changes in harrier numbers and productivity.

Distribution

The distribution of breeding Northern Harriers extends across most of Alaska and Canada, except the extreme northern extents (NatureServe Explorer, 2009d). The range is bounded to the south by a line that extends southwest from northern Virginia, across southern Texas to southern California. Wintering grounds extend across the southern half of the U.S. into Mexico and Central America.

Ecology

Undisturbed area is needed for nesting (though not for hunting; Slater and Rock, 2005). Nests are heavily concealed in dense vegetation in the upland. Because the nests are at ground level, they are vulnerable to predation by coyotes, skunks, minks, domestic dogs, and other raptors. Nests have been trampled by white-tailed deer and livestock. Mowing or harrowing may cause adults to abandon or destroy nests. Conversely, there are nests built over wet areas and the most successful of those nests are less concealed. This may be due to the decreased risk of predation, trampling, etc. There is a tradeoff in nest site selection between reducing predation pressure by choosing wet sites and the desire to reduce transit times to dry areas where vole abundance is higher. In a study that compared the two factors, females appeared to prefer the wetter sites even though prey habitat was farther away. No known records of brood parasitism by Brown-headed Cowbirds exist.

As with many grassland species, harriers are rarely found in tracts smaller than 250 acres. The reliance on undisturbed, dense vegetation with dense residual growth suggests that the species is particularly sensitive to fire and would require unburned within partially burned grasslands as refuge for nesting. Nests may be found in smaller tracts, but the studies that document fragmented habitat suggest that the individuals were reliant on the surrounding matrix of larger contiguous grasslands. In Missouri, studies documented nesting densities ranging from 1 nest per 125-300 acres.

Aside from habitat destruction from fragmentation or forest succession, Northern Harriers have faced other threats. The effects of pesticides known as organochlorides are well-documented in the U.S. The toxins cause eggshell thinning, reproductive failure, and death. Declines in both breeding and migrating harriers and the occurrence of behavioral changes coincided with heavy use of DDT at multiple sites across the U.S (Laughlin and Kibbe, 1985; Dowhan and Craig, 1976; Dunne and Sutton, 1986). There are few studies on the long term effects of DDT and other biocides. Shooting by humans, once common, is no longer a serious threat in the U.S (Bildstein, 1988). Deaths from collisions with automobiles and overhead wires have been documented (Watson, 1977).

3.6 Loggerhead Shrike (*Lanius ludovicianus*)

Taxonomy and Morphology

The Loggerhead Shrike is a medium-sized passerine, weighing on average around 50 g (1.8oz). Ranging from eight to ten inches long with a wingspan of around 12 inches, it is about the same size as an American Robin (*Turdus migratorius*). The Loggerhead shrike has a dark-bluish-gray back, black wingtips, a white breast, and a dark tail with white edges. The face is marked conspicuously by a black mask that extends from the black beak and encircles the eyes. Also notable is the raptor-like, slightly hooked beak; though unlike a true raptor, the shrike lacks talons (Lee, 2001).

Reproduction

Loggerhead Shrikes are some of the earliest nesting passerines, arriving at their breeding grounds between mid-March and mid-April. Nests are often built in well-hidden limb crotches close to the trunk in thorny or brushy trees (e.g. Osage orange; Kridelbaugh, 1982; Evers, 1994). On average, 4-6 eggs are laid between April and June, which the female incubates for about two weeks. Both parents feed and care for the chicks for an additional 3-4 weeks.

Habitat

Lanius ludovicianus is a species of open pastures, fields, or meadows that are interspersed with or bordered by trees, hedgerows, electrical wires, and/or fences. In Illinois, most nests are found in tree lines containing Osage orange, honey locust, and red cedar (Smith, 1991). Trees with thorns or thorn-like structures are key habitat features as this species commonly impales its prey near prominent perches. Territories average 15-20 acres.

Diet

In spring and summer, insects are abundant and are the primary food source for shrikes (Bent, 1950; Kridelbaugh, 1982). When insects become scarce in fall and winter, shrikes switch to small mammals. Having relatively weak feet and lacking talons, shrikes rely on exhausting, beating, and impaling their prey. They impale their prey on thorns, barbed wire, and other sharp objects; then, once dead, will pick the prey apart into bite-size pieces. The impaled prey is often not consumed entirely, so half-eaten impaled corpses often litter the territory of a breeding pair.

Distribution

Loggerhead shrikes breeding grounds range from Washington and southern Canada, south to California and Florida, and east across Missouri, southern Illinois, western Kentucky, and western Tennessee (NatureServe, 2009e). Historical ranges extended further into the northern Midwest, into the Mid-Atlantic States, and into New England. The species is no longer found in New England states and disappearing in the Mid-Atlantic and Midwest (Bartgis, 1992).

Ecology

In the early to mid-1900s, farms were relatively small and diverse which created ideal habitat for shrikes. As agriculture production intensified and became more uniform (i.e. conversion to strictly row crops), farms expanded into native grasslands and also eliminated the hedgerows and wind breaks that bordered smaller farms, thereby eliminating large areas of former shrike habitat. A contributing factor of the intensification was the dramatic emphasis on pesticide use. Pesticides have been blamed for reducing the shrike's insect-prey populations and potentially for the effects of pesticide accumulation in the shrike's tissues to toxic levels (Yosef, 1994). Organophosphates and their metabolites, the suspect class of toxins, were prohibited in the 1970's, but shrike populations have not shown a corresponding benefit. In Illinois, shrike populations decline at a rate of 5.4 percent per year as determined by Breeding Bird Surveys, 1966-1998 (Pruitt, 2000). Shrikes can still be found statewide but most recorded nesting locations are isolated and non-persistent (Smith, 1991). Preservation of hedgerows and large, open grasslands are the primary management recommendations (Pruitt, 2000).

4.0 Identification of the Source of Negative Affect

The proposed project will result in the construction of two wind turbines. The construction of the wind turbines will not destroy or degrade any habitat used by any of the species of concern described within this plan. The potential for impact is limited to the physical risk posed by the individual turbines/towers.

Altamont Pass, California was one of the first commercial generating wind plants / wind farms in North America. Wind turbines began being built in Altamont Pass after the energy crisis occurred in the 1970's. As the wind farm was being developed, a significant number of raptor deaths were found to be occurring from collisions with the spinning turbine blades (Weller, 2007). Environmental studies began to be conducted based on the concerns about the observed avian fatalities, especially populations of golden eagles (*Aquila chrysaetos*), at Altamont Pass; however, research beyond California was relatively limited until the mid-1990's when wind resource areas began to be developed nationally.

Turbine technology has evolved since the 70's and the newer generations of wind turbines are more efficient, significantly larger, but have slower spinning rotors. The most common generators at Altamont Pass are 18 meter tall downwind turbines which spin at 60 revolutions per minute (rpm) and many have blade tips within 9 meters of the ground. In contrast, current generators are more than twice as tall, have 3-8 times the same rotor swept area, and spin at significantly slower speeds (less than 20 rpm). Studies have shown the new generation turbines produce far less fatalities than the older units (Erickson, 2002); however, fatalities still occur.

It is estimated that 200-500 million birds die annually from collisions with manmade structures (Erickson 2002). Of the total fatalities, it is calculated that only 0.01-0.02 percent (or 1-2 out of every 10,000) are a result of a collision with a wind turbine. Passerines (i.e. songbirds) are apparently the most vulnerable, as they comprise 80 percent of the fatalities found at wind turbines. Excluding California, raptors accounted for only 2 percent of avian fatalities nationally at wind farms. American kestrels/sparrow-hawks (*Falco sparverius*) are the most common raptors observed and impacted. Based on a synthesis of data collected, the national annual average per-turbine mortality rate is 2.19 birds (1.83 excluding California). No bald eagle (*Haliaeetus leucocephalus*) or falcon fatalities have been documented at a wind turbine in the United States (Erickson, 2002). The combination of slower blade rotations and raised hub height on the new generation turbines has dramatically reduced the number of fatalities. In the process of conducting avian studies at wind farms with the build out of wind resource areas in the 1990's; however, researchers began noting numerous bat fatalities.

Researchers generally presupposed bats would have a low vulnerability to colliding with wind turbines based on their ability to navigate around tightly spaced objects (even moving objects). As avian studies continued to document bat fatalities, the focus of studies began to shift to impacts to bat populations. A synthesis of the information collected nationally provides relatively consistent results: migratory tree roosting species are the most likely to be killed (hoary, eastern red, and silver-haired bat), fatalities occur almost exclusively during the fall migratory period (mid-July to mid-September), fatalities do not tend to be concentrated at specific turbines (i.e. same relative probability of observed fatalities at any turbine within a wind farm), and the highest number of fatalities tend to occur on nights with wind speeds below 6 meters per second (mps). Although the data collected are consistent, the reason is not entirely understood.

The 'Anabat®' audio monitoring system has been used with many of the studies to determine bat activity at turbine sites. Use of the Anabat® system has found no avoidance behavior demonstrated at turbine areas or any significant difference between use of airspace in turbine and non-turbine sites (Jain, 2005). Additionally, studies have identified resident bat populations immediately surrounding wind farms and actively foraging around turbine areas. The presence of bats around turbines through much of the year with no fatalities has produced numerous hypotheses; however, there are more questions than answers remaining and the resulting fatalities may be a combination of several factors.

The presence of a fatality spike of migratory species in the fall has created some confusion for researchers as there is not a corresponding spike in the spring. Studies have not been able to conclusively determine, but it is believed that bat species migrating over long distances may do so relying on sight rather than echolocation. Bats exhibit differences between seasonal migratory behaviors as spring migration tends to occur slowly and sporadically with individuals meandering their way to the northern feeding ranges, while fall migration tends to occur in large waves of individuals over a short period of time. It is theorized that some species may not be using echolocation during fall migration which results in them being more susceptible to impacts with spinning turbine blades or other tall objects within their flight path. A study at a tall building in Chicago found 50 dead eastern red bats over one year with only 2 occurring outside of the fall migration period (Erickson, 2002).

Field studies have also observed that bat activity around the turbines increases during the fall migratory period. A current working theory supposes that the migratory tree roosting bats are exhibiting a roosting behavior which triggers them to search for the tallest available tree snag during fall migration. The species most impacted are generally solitary and the behavior may be an adaptation for selecting a location with the highest probability of meeting sexual partners. This triggered behavioral response results in mistaking turbines for dead tree snags. Studies using infrared cameras have documented bats investigating and landing on all parts of the towers. While not a confirmed behavior for the bat species, males of other species which display a similar 'roosting' behavior often tend to exhibit territorial behavior. This territorial behavior would trigger increased activity of the males at the roost site which increases the risk of being struck by the spinning blades. The roosting behavior theory is partially supported from the evidence that adult males are disproportionately impacted over juveniles or females.

Seasonally the highest number of fatalities occurs during the fall migratory period but within that period peak fatalities occur on calm nights with wind speeds of less than 6 mps. Current turbines are generally designed to 'freewheel' or spin under very low wind speeds without generating electricity. While the blades may be spinning at slow rpm's during this period, the blade tips may still be moving at speeds exceeding 100 mph. Bat activity tends to increase as winds speeds decrease. This is a direct reflection of the behavior of their prey as insect activity decreases as wind speed increases. It is theorized that the correlation between low wind speed and increased fatalities could be a reflection of concentrated bat activity and possibly a change in foraging behavior (potentially taking higher risks to increase fat reserves) at the turbines during the fall migratory period.

The national annual average of bat fatalities is 3.4 per turbine (AWEAABC, 2004). The national averages indicate that bats are more likely to be killed than birds by the turbines. Bat fatalities have been found not to be limited to striking the turbines or being struck by the spinning blades. Necropsies performed on bat carcasses collected during studies have found pulmonary barotrauma to be a leading cause of death (Baerwald, 2008). Barotrauma results from decompression of living tissue during a rapid change in air-pressure, which in turn can cause internal hemorrhaging. Vortices of extremely low air pressure occur around the edges of the rotating blades. Pulmonary barotrauma can occur as a bat enters one of these vortices, effectively causing the air sacs within the lungs to explode. The anatomy of bird lungs is significantly different and does not leave them very susceptible to pulmonary barotraumas. Searches typically find bird carcasses twice as far from the turbines as bat carcasses; whether it is related to this phenomenon or not is unknown.

5.0 Measures Proposed to Minimize Harm to Species of Concern

5.1 Proposed Alternatives

Only two alternatives were studied for the analysis of proposed impacts: The construction and no-action alternatives.

The no-action alternative would not result in the installation of two wind turbines for electrical generation. The Adams Electric Cooperative would continue to use the existing electrical capacity. This alternative would result in the removal of any potential harm to any of the species of concern by not constructing the turbines; however, this alternative would not promote the use of alternative renewable wind energy.

The construction alternative would result in the installation of two wind turbines for electrical generation. One turbine will be located in the northeast 1/4 of Section 3 of Payson Township in Adams County, Illinois; the other turbine will be located in the southwest 1/4 of Section 13 of Mt. Sterling Township in Brown County, Illinois. The wind turbines selected for use at each site include one AWE 900 kilowatt ("kW") wind turbine (or comparable unit) mounted on a 75-meter hub-height tower. The rotors are 54 meters which results in a 108 meter diameter blade arc.

5.2 Minimization Proposed Within Selected Alternative

The turbines are located within agricultural fields and their construction will not require tree clearing or any other form of disturbance to any high quality natural habitat. The construction of the access roads will remove a few isolated trees but will not create any substantive habitat degradation. The potential negative impacts to the species of concern are limited to physical harm posed by striking the tower or being struck by the spinning blades while in flight. Minimization of impacts is centered on the selected location and construction material of the turbines:

- Turbines are located within agricultural fields away from forest edges, perennial waterways, and bluff lines that could be considered 'high risk' locations.
- The base of the tower will be fenced and maintained in gravel to discourage vegetative growth that could encourage small mammal populations from migrating into the area which would in turn promote use of area by avian predators.
- The towers are not guyed to reduce potential for fatal strikes.
- The support structures are solid towers and not a lattice network to discourage nesting or perching.
- The turbine blades are situated upwind rather than downwind from the generator to limit risk of fatality if perching on the generator does occur.

5.3 Mitigation Proposed Within Selected Alternative

The potential for a 'take' to occur is, at this time, limited to the risk of being maimed or fatally injured by the operation of the turbines. The construction of the towers will not destroy or degrade any habitat used by the species of concern; therefore, no direct replacement or enhancement of habitat will be included as part of the mitigation plan.

The national annual average per-turbine mortality rate for birds is 2.19 (1.83 excluding California) and 3.4 for bats. However, none of the species of concern have been documented as a fatality at a wind turbine. Of the six species of concern (Indiana bat, gray bat, short-eared owl, upland sandpiper, northern harrier, and loggerhead shrike), the Indiana bat has the highest risk of being 'taken' based on their life history profile: Bat fatalities are almost exclusively limited to migratory tree roosting species and the Indiana bat is categorized as such. The mitigation being proposed is a mixture of monitoring, operational protocols, and monetary donations.

Monitoring

The Payson turbine was constructed late summer of 2009 and the Mt. Sterling site will be constructed in 2010. An intensive two (2) year monitoring program will be initiated in 2010 to establish a baseline for fatalities caused by the turbines. The study will be completed to assess the overall impacts/ fatalities caused by the turbines and will not be limited to only identifying fatalities of any of the species of concern. The study will help establish whether the turbines are below, at, or above the national average for per turbine fatalities. The study will serve to identify whether any species of concern are being impacted and assist in developing an overall risk assessment for the turbines. A detailed monitoring plan will be developed before a final implementing agreement is reached to allow time for additional coordination between AEC and the IDNR. A rough outline has been created to begin the process and is as follows:

> Post-construction monitoring will consist of fatality searches twice a week from May through September of 2010 and 2011. AEC will partner with John Wood's Community College (located in Quincy) to conduct field surveys. Sharon DeWitt of JWCC will be the primary field supervisor and will arrange for one to two students to assist in conducting the field

purchases which would serve to provide or expand habitat for endangered species. A donation would be provided for each 'take' that occurs.

5.4 Adaptive Management Plan

Studies are ongoing across the nation regarding the impacts of wind turbines on avian and bat species. As technological advances continue to improve the efficiency of wind electrical generation and the scientific community continues to gather information improving the understanding between the interaction of wind turbines and those negatively affected species, new knowledge will be discovered on how to best minimize and mitigate negative impacts. Additionally, the wind turbines as they presently exist are not anticipated to produce significant numbers of fatalities from the species of concern or otherwise. An Adaptive Management Plan shall remain intact between AEC and the IDNR through the duration of the implementing agreement of the HCP to address any unforeseen events. An adaptive management plan will allow alterations in the mitigation methods. Committing to an adaptive management plan allows AEC and the IDNR to accommodate the uncertainties which may occur through the mitigation process. There are no specific alternative measures identified at this time; however, the plan ensures coordination of new mitigation policies should they be deemed warranted by changing national policies or impacts found to be above those anticipated.

5.5 Assurance of Funding

Appropriate methods to guarantee funding of the Habitat Conservation Plan will be identified in consultation with the Illinois Department of Natural Resources, and will be included in the final version of this document. Standard practices will be followed as identified in the Final Implementing Agreement. The Draft Implementing Agreement is provided in Appendix A.

6.0 Reference Material

The following reference material has been separated by topic

Wind turbines:

American Wind Energy Association and American Bird Conservancy. 2004. Proceedings of the wind energy and birds/bats workshop: understanding and resolving bird and bat impacts. Unpublished report, Resolve, Inc.

Arnett, Edward B., Kent W. Brown, et al. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. Journal of Wildlife Management. Volume 72, Number 1: pp61-78.

Arnett, E. B., M. Schirmacher, M. M. P. Huso, and J. P. Hayes. 2009. Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. An annual report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

Arnett, E. B., technical editor. 2005. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

Baerwald, E.F., G.H. D'Armours, B.J. Klug, and R.M.R. Barclay. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology. Volume 18, Issue 16: pR695-R696.

Erickson, W., G. Johnson, D. Young, et al. 2002. Synthesis and comparison of baseline avian and bat use, raptor nesting and mortality information from proposed and existing wind developments. Unpublished document, West, Inc., Prepared for the Bonneville Power Administration.

Horn, Jason W., Edward B. Arnett, and Thomas H. Kunz. 2008. Behavioral Responses of Bats to Operating Wind Turbines. Journal of Wildlife Management. Volume 72, Number 1: pp123-132.

Horn, Jason W., Edward B. Arnett, Mark Jensen, and Thomas H. Kunz. 2008. Testing the effectiveness of an experimental acoustic bat deterrent at the Maple Ridge wind farm. Unpublished Report prepared for: The Bats and Wind Energy Cooperative and Bat Conservation International, Austin, Texas.

Howe, Robert W., William Evans, and Amy T. Wolf. November 2002. Effects of wind turbines on birds and bats in northeastern Wisconsin. Report submitted to Wisconsin Public Service Corporation and Madison Gas and Electric Company.

Gardner, J. E., J. E. Hofmann, and J. D. Garner. 1986. Progress Report: 1986 investigations of *Myotis sodalis* (Indiana bat) distribution, abundance, habitat use, and status in Illinois. Unpublished Report, Illinois Natural History Survey, Champaign Illinois.

Gardner, J. E., J. E. Hofmann, and J. D. Garner. 1987. Progress Report: 1987 investigations of *Myotis sodalis* (Indiana bat) distribution, abundance, habitat use, and status in Illinois. Unpublished Report, Illinois Natural History Survey, Champaign Illinois.

Gardner, J. E., J. E. Hofmann, and J. D. Garner. 1989. Progress Report: 1988 investigations of *Myotis sodalis* (Indiana bat) distribution, abundance, habitat use, and status in Illinois. Unpublished Report, Illinois Natural History Survey, Champaign Illinois.

Garner, J. D. and J. E. Gardner. 1992. Determination of summer distribution and habitat utilization of the Indiana bat (*Myotis sodalis*) in Illinois. Final Report: Project E-3, Illinois Natural History Survey, Champaign, Illinois.

General notes. 1977. Spring and autumn swarming behavior in the Indiana bat, Myotis sodalis. Journal of Mammalogy 58(1): 93-95.

Hassell, M. and M. Harvey. 1965. Differential homing in Myotis sodalis. American Midland Naturalist 74(2): 501-503.

Humphrey, S., A. Richter and J. Cope. 1977. Summer habitat and ecology of the endangered Indiana bat, Myotis sodalis. Journal of Mammalogy 58(3): 334-346.

Humphrey, S. and J. Cope. 1977. Survival rates of the endangered Indiana bat Myotis sodalis. Journal of Mammalogy 58(1): 32-36.

Indiana Bat Recovery Team. 1999. Indiana bat (Myotis sodalis) revised recovery plan – agency draft. United States Fish and Wildlife Service, Region 3, Ft. Snelling, Minnesota.

Johnson, S., V. Brack and R. Rolley. 1998. Overwinter weight loss of Indiana bats (Myotis sodalis) from hibernacula subject to human visitation. American Midland Naturalist 139(2): 255-261.

Kurta, A., D. King, J.A. Teramino, J.M. Stribley and K.J. Williams. 1993. Summer roosts of the endangered Indiana bat (Myotis sodalis) on the northern edge of its range. American Midland Naturalist 129(1): 132-138.

Kurta, A. and J. Whitaker Jr. 1998. Diet of the endangered Indiana bat (Myotis sodalis) on the northern edge of its range. American Midland Naturalist 140(2): 280-286.

Kurta, A., J. Kath, E.L. Smith, R. Foster, M.W. Orick and R. Ross. 1993. A maternity roost of the endangered Indiana bat (Myotis sodalis) in an unshaded, hollow, sycamore tree (Platanus occidentalis). American Midland Naturalist 130(2): 405-407.

Kurta, A. and J. Teramino. 1994. A novel hibernaculum and noteworthy records of the Indiana bat and eastern pipistrelle (Chiroptera: Vespertiliondae). American Midland Naturalist 13(4): 410-413.

Kurta, A. and R. Foster. 1992. A bat survey along Panther and Cox Creeks, Cass County, Illinois, with emphasis on the Endangered Indiana Bat (*Myotis sodalis*). Unpublished Report.

Kurta, A. and S. Murray. 2002. Philopatry and migration of banded Indiana bats (Myotis sodalis) and effects of radio transmitters. Journal of Mammalogy 83(2): 585-589.

LaVal, R., R. Clawson, M. LaVal and W. Caire. 1977. Foraging behavior and nocturnal activity patterns of Missouri bats, with emphasis of the endangered species Myotis grisescens and Myotis sodalis. Journal of Mammalogy 58(4): 592-599.

Missouri Department of Conservation. 2004. Endangered species guidesheet – Indiana bat (Myotis sodalis). http://mdc.mo.gov/nathis/endangered/endanger/graybat/

Missouri Fish and Wildlife Information System. Indiana Bat. 2002. http://www.conservation.state.mo.us/cgi-bin/mofwis/detail/0500038.htm

Missouri Natural Heritage Program. 2004. Missouri species and communities of conservation concern checklist. Missouri Department of Conservation. Jefferson City, Missouri.

Missouri Natural Heritage Program. 2000. Missouri animals of conservation concern. Missouri Department of Conservation. Jefferson City, Missouri.

NatureServe. 2004. Comprehensive Report – Myotis sodalis. NatureServe Explorer; An online encyclopedia of life [web application]. Version 4.1. NatureServe Arlington, Virginia. http://www.natureserve.org/explorer

Raesly, R. and E. Gates. 1987. Winter habitat selection by north temperate cave bats. American Midland Naturalist 118(1): 15-31.

U.S. Fish and Wildlife Service (USFWS). 2007. Indiana Bat (Myotis sodalis) Draft Recovery Plan: First Revision. U.S. Fish and Wildlife Service, Fort Snelling, MN. 258 pp.

Other Species of Concern:

Bartgis, R. 1992. Loggerhead shrike, Lanius ludovicianus. Pages 281-297 in K. J. Schneider and D.M. Pence, eds. Migratory nongame birds of management concern in the northeast. U.S. Fish and Wildlife Service, Newton Corner, Massachusetts. 400 pp.

Bent, A.C. 1950. Life histories of North American wagtails, shrikes, vireos, and their allies. U.S. National Museum Bulletin. 197.

Bildstein, K.L. 1988. Northern Harrier. Pages 251-303 in R.S. Palmer, ed. Handbook of North American Birds. Vol. 4 Diurnal Raptors (Part 1). Yale University Press, New Haven, Connecticut.

Busbee, E.L. 1977. The effects of dieldrin on the behavior of young loggerhead shrikes. Auk 94:28-35.

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, A. L. Zimmerman, and B. R. Euliss. 2003. Effects of management practices on grassland birds: Loggerhead Shrike. Northern Prairie Wildlife Research Center, Jamestown, ND. Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/literatr/grasbird/losh/losh.htm (Version 12AUG2004).

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, and B. R. Euliss. 1998 (revised 2002). Effects of management practices on grassland birds: Northern Harrier. Northern Prairie Wildlife Research Center, Jamestown, ND. 15 pages.

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, and B. R. Euliss. 2003. Effects of management practices on grassland birds: Short-eared Owl. Northern Prairie Wildlife Research Center, Jamestown, ND. Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/literatr/grasbird/seow/seow.htm (Version 12DEC2003).

Dechant, J. A., M. F. Dinkins, D. H. Johnson, L. D. Igl, C. M. Goldade, B. D. Parkin, and B. R. Euliss. 1999 (revised 2003). Effects of management practices on grassland birds: Upland Sandpiper. Northern Prairie Wildlife Research Center, Jamestown, ND. 34 pages.

Doan, N. 1999. "Asio flammeus" (On-line), Animal Diversity Web. Accessed March 18, 2009 at http://animaldiversity.ummz.umich.edu/site/accounts/information/Asio_flammeus.html.

Dowhan, J.J. and R.J. Craig. 1976. Rare and endangered species of Connecticut and their habitats. Connecticut Geological and Natural History Survey, Hartford, Connecticut. 135 pp.

Dunne, P. and C. Sutton. 1986. Population trends in coastal raptor migrants over ten years of Cape May Point autumn counts. Peregrine Observer 10:3-7.

Evers, D. C. 1994. Birds: Species Accounts. Pp. 85-221 in D.C. Evers, ed. Endgangered and Threatened Wildlife of Michigan. University of Michigan Press, Ann Arbor, Michigan.

Kleen, V.M., L. Cordle, and R.A. Montgomery. 2004. The Illinois Breeding Bird Atlas. Illinois Natural History Survey Special Publication No. 26. xviii+459pp.

Kridelbaugh, A.L. 1982. An ecological study of loggerhead shrikes in central Missouri. M.S. thesis, University of Missouri, Columbia.

Laughlin, S. B. and D.P. Kibbe, eds. 1985. The Atlas of Breeding Birds of Vermont. University Press of New England, Hanover, Vermont. 456 pp.

Lee, Y. 2001. Special animal abstract for Lanius ludovicianus migrans (migrant loggerhead shrike). Michigan Natural Features Inventory. Lansing, Michigan. 6pp.

MacWhirter, R. and K. Bildstein. 1996. Northern Harrier. The Birds of North America 210:1-25

Pruitt, L. 2001. Loggerhead Shrike. Status Assessment, U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 169 pp.

NatureServe *a*. 2009. Comprehensive Report – Ammodramus henslowii. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

NatureServe *b*. 2009. Comprehensive Report – Asio flammeus. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

NatureServe *c*. 2009. Comprehensive Report – Bartramia longicauda. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

NatureServe *d*. 2009. Comprehensive Report – Circus cyaneus. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

NatureServe *e*. 2009. Comprehensive Report – Lanius ludovicianus. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

Simmons, R., B MacWhirter, P. Barnard, and G.L. Hansen. 1986. The influence of microtines on polygyny, age, and provisioning of bredding northern harriers: a 5-year study. Canadian Journal of Zoology 64:2447-2456.

Slater, G.L. and C. Rock. 2005. Northern Harrier (Circus cyaneus): A Technical Conservation Assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/northernharrier.pdf [Mar 2009].

Smith, E.L. 1991. Factors influencing distribution and abundance of the Loggerhead Shrike (Lanius ludovicianus migrans) in southcentral Illinois. M.S. thesis. Eastern Illinois University. Charleston, Illinois. 45 pp.

Watson, D. 1977. The hen harrier. T.E.A.D. Poyser, Limited, Berkhamsted, Hertfordshire, England. 307 pp.

Yosef, R. 1994. Evaluation of the global decline in the true shrikes (family Laniidae). Auk 111:228-233.

Misc document references:

Illinois Endangered Species Protection Board. 2009. The 2009 Endangered and Threatened Species List. (www.dnr.state.il.us/espb/index.htm) Illinois Department of Natural Resources.

Woods, A.J., and James M. Omernik. 2006. Descriptions of the Level III and IV Ecoregions of Illinois. ftp://ftp.epa.gov/wed/ecoregions/il/il_eco_desc.pdf

Leighton, M.M., G.E. Ekblaw, and L. Horberg. 1948. Physiographic Divisions of Illinois. Illinois State Geological Survey, Urbana, Illinois.

Wind, Thomas A. 2007. Technical Requirements Report for a wind energy system for Adams Electric Cooperative. Wind Utility Consulting, PC. [Payson Site]

Wind, Thomas A. 2007. Technical Requirements Report for a wind energy system for Adams Electric Cooperative. Wind Utility Consulting, PC. [Mt. Sterling Site]

IMPLEMENTING AGREEMENT

by and between

ADAMS ELECTRIC COOPERATIVE

and the

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

TO ESTABLISH A PROGRAM FOR THE CONSERVATION OF ENDANGERED SPECIES AT THE PROPOSED ADAMS ELECTRIC COOPERATIVE WIND TURBINE SITES.

The implementing Agreement ("Agreement") made and entered into as of the _______ day of ___________, 2009, by and among ADAMS ELECTRIC COOPERATIVE, and the ILLINOIS DEPARTMENT OF NATURAL RESOURCES (IDNR), hereinafter collectively called the "Parties", defines the Parties' roles and responsibilities and provides a common understanding of actions that will be undertaken for the conservation of the subject listed and unlisted species and their habitats during construction and operation of two (2) wind turbine sites located in Adams County and Brown County, Illinois.

The parties enter into this Agreement in accordance with Section 5.5 of the Illinois Endangered Species Protection Act [520 ILCS 10/5.5].

1.0 RECITALS

WHEREAS, the two wind turbine sites located in Adams and Brown County have been determined to pose a potential risk to the health of seven species listed as threatened or endangered by the State of Illinois: Indiana bat (*Myotis sodalis*), Gray bat (*Myotis grisescens*), northern harrier (*Circus cyaneus*), loggerhead shrike (*Lanius ludovicianus*), short-eared owl (*Asio flammeus*), upland sandpiper (*Bartramia longicuada*), and Henslow's sparrow (*Ammodramus henslowii*); and,

WHEREAS, the Adams Electric Cooperative, through consultation with the IDNR, and with the agreement of that agency, has developed a series of measures, described in the Habitat Conservation Plan, to conserve the subject species during project activities; and,

WHEREAS, procedures to obtain permits allowing incidental take of the species listed in the HCP pursuant to Title 17, Chapter 1, subchapter c, part 1080 also require a binding agreement committing the parties to implement specified conservation measures for those species;

THEREFORE, for and in consideration of the mutual covenants and conditions herein, the Parties hereto do hereby understand and agree as follows:

2.0 DEFINITIONS

The following terms as used in this Agreement shall have the meaning set forth below:

2.1 The term "Permit" shall mean an incidental take permit issued by IDNR to the Adams Electric Cooperative pursuant to Title 17(1)(c) part 1080.

2.2 The term "Permit Area" shall mean the location of the two turbine sites: the Payson turbine located in the northeast 1/4 of Section 3 of Payson Township in Adams County, Illinois, the Mt. Sterling turbine located in the southwest 1/4 of Section 13 of Mt. Sterling Township in Brown County, Illinois.

2.3 The term "Permittee" shall mean the Adams Electric Cooperative.

2.4 The term "Conservation Plan" shall mean the Habitat Conservation Plan prepared for the two wind turbines.

2.5 The term "Plan Species" shall mean the seven species identified in Section 1.0 of this Agreement.

2.6 The term "Unforeseen Circumstances" shall mean any significant adverse change in the population of a species or in the anticipated impacts of the project or other factors upon which the HCP is based, or any significant new information relevant to the HCP that was unforeseen by the Parties on the date hereof.

3.0 HABITAT CONSERVATION PLAN

Pursuant to the provision of Title 17(1)(c) part 1080 and the Illinois Endangered Species Act [520 ILCS 10/5.5], the Adams Electric Cooperative has prepared a Habitat Conservation Plan (HCP) and submitted it to the IDNR with a request that IDNR issue a Permit to allow subject listed species to be incidentally taken, as the term is defined in Title 17(1)(c) part 1080, within Permit Area as depicted and described in Section 2 of the HCP. The HCP proposed a program of conservation for the subject listed species.

4.0 INCORPORATION OF HCP

The HCP and each of its provisions are intended to be, and by this reference are, incorporated herein. In the event of any direct contradiction between the terms of this Agreement and the HCP, the terms of this Agreement shall control. In all other cases, the terms of this Agreement and the terms of the HCP shall be interpreted to be supplementary to each other.

5.0 LEGAL REQUIREMENTS

In order to fulfill the requirements that will allow the IDNR to issue the Permit, the HCP provides measures that are intended to ensure that any take occurring within the Permit Area will be incidental; that the impacts of the take will, to the maximum extent practicable, be minimized and mitigated; that adequate funding for the HCP will be provided; and that the take will not appreciably reduce the likelihood of the survival and recovery of the Plan Species in the wild.

6.0 COOPERATIVE EFFORT

In order that each of the legal requirements as set forth in Paragraph 5.0 hereof are fulfilled, each of the Parties to this Agreement must perform certain specific tasks. The HCP thus describes a cooperative program by the IDNR and AEC to conserve the Plan Species.

7.0 TERMS USED

Terms defined and utilized in the HCP and implementing agreement shall have the same meaning when utilized in this Agreement, except as specifically noted.

8.0 PURPOSES

The purposes of the Agreement are:

8.1 To ensure the implementations of each of the terms of the HCP;

8.2 To contractually bind each Party to fulfill and faithfully perform the obligations, responsibilities, and tasks assigned to it pursuant to the terms of the HCP; and,

8.3 To provide remedies and recourse should any Party fail to perform its obligations, responsibilities, and tasks as set forth in this Agreement.

9.0 TERM

This Agreement shall become effective on the date that the IDNR issues the Permit requested in the HCP and shall remain in full force and effect for a period of 20 years.

10.0 FUNDING

10.1 Adams Electric Cooperative will provide the funds to carry out the terms identified in the HCP for takes within the Permit Area.

10.2 IDNR shall include in annual budget requests sufficient funds to fulfill its obligations under the HCP and its statutory requirements to protect the Plan Species.

11.0 RESPONSIBILITES OF THE PARTIES IN CONSERVATION PROGRAM IMPLEMENTATION

11.1 The Adams Electric Cooperative shall undertake those actions for conservation of the Plan Species as detailed in Section 3 of the HCP and summarized here during operation of the wind turbines.

a. Implement a monitoring program within the Permit Area. The persons overseeing the intensive surveys must be qualified biologists and an independent bat specialist must be used to confirm the species identification of bat carcasses found in the Permit Area. The IDNR must be provided and approve of those persons conducting the surveys.

b. Implement operation changes as needed, through coordination with IDNR, to the turbines for idling the blades during weather periods described in the HCP.

c. Implement those measures provided in the Conservation Plan for donations to not-for-profit organizations to offset any take within the Permit Area.

11.2 The IDNR agrees to undertake the following actions to implement the Conservation Plan

a. Upon issuance of the Permit, the IDNR shall monitor the implementation of the Permit, the Conservation Plan and the activities thereunder.

b. Provide assistance during Conservation Plan implementation as described below:

(1) Review credentials of any biologist(s) under consideration by the Adams Electric Cooperative to determine if qualified to undertake protection and monitoring actions for the Plan Species;

(2) Assist the Adams Electric Cooperative in the establishment of appropriate methodologies and monitoring procedures as described in Section 3 of the HCP;

(3) Assist the Adams Electric Cooperative with processing of any permits necessary to authorize designated project biologist(s) to undertake, collection, handling, monitoring, or other actions as identified in Section 3 of the Conservation Plan and as determined to be appropriate by the IDNR;

(4) Maintain open communication with the Adams Electric Cooperative and project representatives to assist with compliance procedures for the Plan Species;

(5) Assist the Adams Electric Cooperative in identifying organizations for providing donations to in the event a take occurs.

(6) Accept any injured listed species found during project activities, subject animals to be retained by IDNR for care, analysis, and disposition;

12.0 ISSUANCE OF THE PERMIT

12.1 Upon finding after opportunity for public comment with respect to the Permit application and the HCP that:

a. (Incidental Take) Any permitted taking of the subject listed species will be incidental to the carrying out of otherwise lawful activities; and,

b. (Minimize and Mitigate) The HCP and this Implementation Agreement will, to the maximum extent practicable, minimize and mitigate the impacts of such incidental taking; and,

c. (Adequate Funding) AEC will ensure that adequate funding for the HCP will be provided; and,

d. (No Likely Jeopardy) Any permitted taking of the subject listed species will not appreciably reduce the likelihood of the survival and recovery of the Plan Species in the wild; and,

e. (Other Measures) Any other measures set forth in the HCP and required by IDNR as being necessary or appropriate for the purposes of the HCP, including any measures determined by the Parties to be necessary to deal with Unforeseen Circumstances, will be fulfilled; IDNR shall issue a Permit allowing incidental take of listed Plan Species to the Adams Electric Cooperation. Such Permit shall be issued concurrently with the execution of the Agreement by the Parties, and it is specifically agreed that this Agreement shall not become effective nor binding upon the Parties hereto until and unless the Permit has been issued.

12.2 After issuance of the Permit, IDNR shall monitor the implementation thereof, including each of the terms of this Agreement and the HCP in order to ensure compliance with the Permit, the HCP and this Agreement. In addition, IDNR shall, to the maximum extent possible, ensure the availability of its staff to cooperate with and provide technical and research assistance to the Parties.

13.0 REMEDIES AND ENFORCEMENT

13.1 Except as set forth hereinafter, each Party hereto shall have all of the remedies available in equity (including specific performance and injunctive relief) and at law to enforce the terms of this Agreement and the Permit and to seek remedies and compensation for any breach hereof, consistent with and subject to the following:

a. (No Monetary Damages) None of the Parties shall be liable in damages to the other Parties or to the person for any breach of this Agreement, any performance or failure to perform a mandatory or discretionary obligation imposed by this Agreement or any cause of action arising from this Agreement. Notwithstanding the foregoing:

(1) Retain Liability – Each Party shall retain whatever liability it would possess for its present and future acts or failure to act without existence of this Agreement.

(2) Land Owner Liability – The Adams Electric Cooperative shall retain whatever liability it possesses as an owner of interest in land.

b. (Injunctive and Temporary Relief) The Parties acknowledge that the Plan Species are unique and that their loss as species would result in irreparable damage to the environment and that therefore injunctive and temporary relief may be appropriate in certain instances involving a breach of this Agreement.

13.2 The terms for suspension, revocation, or termination of the permit are as follows:

a. Suspension – In the event of any significant violation or breach of the Permit or this Agreement, IDNR may suspend the Permit; however, except where IDNR determines that emergency action is necessary to protect the Plan Species, it will not suspend the Permit without first:

(1) Requesting the Adams Electric Cooperative to take appropriate remedial, enforcement or management actions; and

(2) Providing the Adams Electric Cooperative notice in writing of the facts or conduct which may warrant the suspension and an opportunity for the Adams Electric Cooperative to demonstrate or achieve compliance with the Permit and this Agreement.

b. Reinstatement – In the event the Permit is suspended, as soon as possible, but not later than ten (10) working days after any suspension, IDNR shall consult with the Adams Electric Cooperative concerning actions to be taken effectively to redress the violation, and after consultation IDNR shall make a determination of the actions necessary to effectively redress the violation or breach. In making this determination IDNR shall consider the requirements of the terms of the Permit and of this Agreement and any comments or recommendations received during the consultations. As soon as possible, but not later than thirty (30) days after the conclusion of the consultations, IDNR shall transmit to the Adams Electric Cooperative written notice of the actions necessary to effectively redress the violation or breach. Upon full performance of the necessary actions specified by IDNR in its written notice, IDNR shall immediately reinstate the Permit. It is the intent of the Parties hereto that in the event of any suspension of the Permit all Parties shall act expeditiously to cooperate to rescind any suspension to carry out the objective of this Agreement.

c. Revocation or Termination – IDNR agrees that it will revoke or terminate the Permit for violation of the Permit or breach of this Agreement only if IDNR determines that:

(1) Such violation cannot be effectively redressed by other remedies or enforcement action; and,

(2) Revocation or termination is required to fulfill a responsibility of IDNR under the terms of the Agreement.

d. Terms of Revocation or Termination - IDNR agrees that it will not revoke or terminate the Permit without first:

(1) Requesting the Adams Electric Cooperative to take appropriate remedial action; and,

(2) Providing the Adams Electric Cooperative notice in writing of the facts or conduct which may warrant the revocation or termination and a reasonable opportunity (but not less than sixty (60) days) to demonstrate or achieve compliance with the Permit and this Agreement.

13.3 The limitation and the extent of enforceability are as follows:

a. No Further Mitigation for Permit Site – It is acknowledged that the purpose of this Agreement is to set forth the obligations and rights of the Parties hereto with respect to the HCP and to provide for the conservation of the Plan Species and the mitigation and compensatory measures required in connection with incidental taking of the listed Plan Species in the course of otherwise lawful activities within the Permit Area. Accordingly, except as otherwise required by law and/or provided under the terms of the HCP, including Unforeseen Circumstances, no further mitigation or compensations will be required by IDNR.

In the event that the status of a Plan Species changes (for example if a species should be delisted and is no longer considered threatened or endangered or a different species becomes listed) after the Permit has been issued and the HCP and Implementing Agreement have been approved by IDNR, adequate documentation shall be provided to support an amendment to this agreement.

b. Private Property Rights and Legal Authorities Unaffected – Except as otherwise specifically provided in this Agreement, nothing herein contained shall be deemed to restrict the rights of the Adams Electric Cooperative to manage the use of and exercise all of the incidents of land ownership over those lands and interests in lands constituting the Permit Area subject to such other limitations as may apply to such rights under the Constitution and laws of the United States and the State of Illinois. Furthermore, nothing herein contained is intended to limit the authority or responsibility of the State of Illinois to invoke the penalties or otherwise fulfill its responsibilities under the IESPA.

14.0 AMENDMENTS

14.1 (Amendment to the Implementation Agreement) Except as otherwise set forth herein, this Agreement may be amended only with the written consent of each of the Parties hereto.

14.2 (Amendments to the HCP) Material changes to the HCP proposed by the Adams Electric Cooperative after the effective date of the Permit, shall be processed by the IDNR as an amendment to the Permit in accordance with the IESPA and permit regulations at Title 17(1)(c) part 1080 and shall be subject to appropriate environmental review.

15.0 MISCELLANEOUS PROVISIONS

15.1 (No Partnership) Except as otherwise expressly set forth herein, neither this Agreement nor the HCP shall make or be deemed to make any Party to this Agreement the agent for or the partner of any other Party.

15.2 (Successors and Assigns) This Agreement and each of its covenants and conditions shall be binding on and shall inure to the benefit of the Parties hereto and their respective successors and assigns.

15.3 (Notice) Any notice permitted or required by this Agreement shall be delivered personally to the person set forth below or shall be deemed delivered personally to the person set forth below or shall be deemed delivered five (5) days after deposit in the United States mail, certified and postage prepaid, return receipt requested and addressed as follows or at such other address as any Party may from time to time specify to the other Party in writing.

Keith Shank
Illinois Department of Natural Resources
One Natural Resources Way
Springfield, IL 62702

Jim Thompson
Adams Electric Cooperative
P.O. Box 247
Camp Point, IL 62320

15.4 (Entire Agreement) This Agreement supersedes any and all other Agreements, either oral or in writing among the Parties hereto with respect to the subject matter hereof and contains all of the covenants and agreements among them with respect to said matters, and each Party acknowledges that no representation, inducement, promise or agreement, oral or otherwise, has been made by the other Party or anyone acting on behalf of the other Party and is not embodied herein.

15.5 (Attorney's Fees) If any action at law or equity, including any action for declaratory relief, is brought to enforce or interpret the provisions of this Agreement, each Party to the litigation shall bear its own attorney's fees and costs provided that attorney's fees and costs recoverable against the United States shall be governed by applicable Federal law.

15.6 (Elected Officials not to Benefit) No member of or delegate to Congress or the Illinois Legislature shall be entitled to any share or part of this Agreement, or to any benefit that may arise from it.

15.7 (Availability of Funds) Implementation of this Agreement by IDNR shall be subject to the availability of appropriated funds.

15.8 (Duplicate Originals) This Agreement may be executed in any number of duplicate originals. A complete original of this Agreement shall be maintained in the official records of each of the Parties hereto.

15.9 (Third Party Beneficiaries) Without limiting the applicability of the rights granted to the public pursuant to the provisions of 16 U.S.C. 1540(g), this Agreement shall not create the public or any member thereof as a third Party beneficiary hereof, nor shall it authorize anyone not a Party to this agreement to maintain a suit for personal injuries or property damages pursuant to the provisions of this Agreement. The duties, obligations and responsibilities of the Parties to this Agreement with respect to third Parties shall remain as imposed by general law.

16.0 ALTERATION OF DOCUMENTS

Any alteration of the HCP or associated document by any representative of AEC or the IDNR, at any time after an agreement has been reached between the two responsible parties with respect to HCP measures, conditions, or other contents, without express written notification and agreement by the other party to the HCP and the Implementing Agreement, shall subject any incidental take permit issued in accordance with any HCP or associated document subsequently found to have been altered with potential suspension or revocation pursuant to Section 13.0 of the Implementing Agreement, and shall entitle the injured party or parties to all remedies allowed by law or as otherwise appropriate.

IN WITNESS WHEREOF, THE PARTIES HERETO have executed this Implementing Agreement to be in effect as of the date last signed below.

Signatures