United States Department of the Interior

FISH AND WILDLIFE SERVICE
3817 Luker Road
Cortland, NY 13045

February 2, 2012

Colonel Noel T. Nicolle
Armor, Garrison Commander
Department of the Army
U.S. Army Installation Management Command
Headquarters, United States Army Garrison, Fort Drum
10000 10th Mountain Division Drive
Fort Drum, NY 13602

Dear Colonel Nicolle:

The enclosed document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion regarding the effects of activities conducted at the Fort Drum Military Installation (Fort Drum) located in the Towns of Antwerp, Champion, LeRay, Philadelphia, and Wilna, Jefferson County, and the Town of Diane, Lewis County, New York, on the Federally-listed endangered Indiana bat (*Myotis sodalis*).

In accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), the U.S. Army initiated formal consultation with the Service through your September 2011 Biological Assessment for activities on Fort Drum between 2012-2014.

After reviewing the current status of the Indiana bat, the environmental baseline for the action area, the effects of the proposed activities on Fort Drum (2012-14), and the cumulative effects, the Service has concluded that the action, as proposed, is not likely to jeopardize the continued existence of the Indiana bat. Critical habitat for the Indiana bat has been designated at a number of locations throughout its range; however, this action does not affect any of those designated critical habitat areas and no destruction or adverse modification of that critical habitat is expected.

Should you have any questions, please contact Ms. Robyn Niver of this office at (607) 753-9334.

Sincerely,

David A. Stilwell

David A. Stilwell
Field Supervisor

Enclosure

cc: NYSDEC, Watertown, NY (Wildlife; Attn: A. Ross)
NYSDEC, Albany, NY (Wildlife Diversity; Attn: C. Herzog)
Army, Fort Drum, NY (J. Corriveau, J. Wagner)
COE, New York, NY (J. Connell)
FWS, Hadley, MA (G. Smith)

BIOLOGICAL OPINION

on the

EFFECT OF PROPOSED ACTIVITES ON THE FORT DRUM MILITARY INSTALLATION (2012-2014)

IN THE TOWNS OF ANTWERP, CHAMPION, LERAY, PHILADELPHIA, AND WILNA, JEFFERSON COUNTY
AND
THE TOWN OF DIANE, LEWIS COUNTY, NEW YORK

ON THE FEDERALLY-ENDANGERED INDIANA BAT (*Myotis sodalis*)

Submitted to the
U.S. Army Garrison Fort Drum

February 6, 2012

Prepared by:
Robyn Niver
U.S. Fish and Wildlife Service
New York Field Office
3817 Luker Road
Cortland, NY 13045
(607) 753-9334

TABLE OF CONTENTS

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

INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) based on our review of the U.S. Army Garrison at Fort Drum's (Army) proposed activities (2012-2014) on the Fort Drum Military Installation (Fort Drum) located in the Towns of Antwerp, Champion, LeRay, Philadelphia, and Wilna, Jefferson County, and the Town of Diane, Lewis County, New York, and their effects on the Indiana bat (*Myotis sodalis*) in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The Army's September 15, 2011, request for formal consultation was received on September 22, 2011, along with the Biological Assessment (BA) on the proposed activities on the Fort Drum Military Installation, Fort Drum, New York (2012-2014), for the Federally-endangered Indiana bat (*Myotis sodalis*) (Army 2011) (Appendix A). On December 1, 2011, the Army modified the proposed action by removing the use of graphite smoke operations from the list of 2012-2014 anticipated activities.

The Service completed consultation with the Army for similar activities proposed on Fort Drum (2009-2011) and issued a biological opinion for activities conducted during that period on June 3, 2009 (Service 2009a). This opinion provides a fresh analysis of activities proposed on Fort Drum between 2012-2014. Two new categories of activities are included in this analysis (small wind energy development and the Army Compatible Use Buffer Program [ACUB]) while one proposed action has been removed (graphite smoke operations). In addition, there is new information regarding the Indiana bats' use of suitable habitat on Fort Drum, as well as revised project descriptions (e.g., reduced scale, new conservation measures) for previously considered actions.

Many activities that occur on Fort Drum also involve actions by other Federal agencies, such as the U.S. Army Corps of Engineers (Corps) engineering and construction activities, Corps Section 404 of the Clean Water Act permitting, and U.S. Air Force training. Other branches of the Armed Services or Federal agencies may also periodically conduct training on Fort Drum. In accordance with 50 CFR § 402.07, the Army is taking the consultation lead for all activities on Fort Drum. Any activities covered by the Corps permit(s) or conducted by other agencies will not result in any impacts to Indiana bats beyond those addressed in this consultation. Therefore, the Service intends to provide a copy of this BO to the Corps and the Army can provide copies to the other agencies to demonstrate that the Army has fulfilled its obligations to consult with the Service. The Army will inform the other agencies of their responsibilities to comply with all applicable measures in this BO.

This BO is based on information provided in the BA, numerous meetings, telephone conversations, and electronic mail exchanges among the Service, Army, and others. A complete administrative record of this consultation is on file at the Service's Cortland, New York, Field Office.

CONSULTATION HISTORY

The following comprises the consultation history for activities proposed on Fort Drum between 2012-2014. Since many of the activities were also addressed in the BO for 2009-2011 activities,

the reader can refer to that BO for past coordination. This history begins at the issuance of our 2009 BO.

On **March 24, 2009**, the Service issued a BO for take of Indiana bat associated with the Army's activities 2009-2011.

On **April 9, 2009**, the Service received a request from the Army to revise Term and Condition #17.

On **May 28, 2009**, the Service attended a biennial review of the ACUB program.

On **June 1, 2009**, the Service issued an amendment to the 2009 BO to Fort Drum. We revised term and condition #17 and fixed some minor typographical errors.

On **February 12, 2010**, the Service received the Army's 2009 annual report in accordance with the 2009 BO.

On **June 22, 2010**, the Service received a letter from the Army regarding the Army's position that consultation was not required for ACUB-related activities.

On **July 13, 2010**, the Service sent a letter of response to the Army regarding the need for consultation for ACUB-related activities.

On **August 27, 2010**, the Service and Army met to discuss implementation of the 2009 BO.

On **February 14, 2011**, the Service received the Army's 2010 annual report in accordance with the 2009 BO.

On **March 29, 2011**, the Service and Army met to discuss implementation of the 2009 BO.

On **April 29, 2011**, the Service and Army met to discuss the ACUB program (e.g., near-term parcels, roles of the Service, funding outlook)

On **June 23, 2011**, the Service attended a biennial review of the ACUB program.

On **June 23, 2011**, the Service and Army met to discuss development of a biological assessment for 2012-2014 activities on Fort Drum.

On **September 22, 2011**, the Service received the Army's September 15, 2011, request for initiation of formal consultation for 2012-2014 activities on Fort Drum and the enclosed BA (dated September 2011).

On **November 2, 2011**, the Service sent the Army a letter confirming that adequate information was provided to initiate formal consultation.

In **November 2011**, the Service and Army exchanged electronic mails regarding specific clarifications (e.g., lighting for wind turbines and distance to roosts for various activities) for the BA.

On **December 1, 2011**, the Army modified the proposed action to remove the use of graphite smoke operations as an anticipated 2012-2014 activity.

On December 28, 2011, the Service sent the Army a letter concurring that several categories of activities (see below) are not likely to adversely affect the Indiana bat.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

As defined in the ESA Section 7 regulations (50 CFR 402.02), "action" means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The "action area" is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The direct and indirect effects of the actions and activities must be considered in conjunction with the effects of other past and present Federal, State, or private activities, as well as the cumulative effects of reasonably certain future State or private activities within the action area.

This BO evaluates two categories of activities (wind energy development and smoke operations) that are anticipated to occur on Fort Drum between 2012-2014. Many other activities are not anticipated to result in adverse effects to Indiana bats (construction, forest management, Army Compatible Use Buffer easements, military training [except smoke and obscurants], mechanical vegetation management, prescribed fire, pesticide application, wildlife management/vertebrate pest control, and outdoor recreation). The Service sent a concurrence letter to the Army on December 28, 2011 (incorporated by reference), for those activities. The Service is not implementing a traditional tiered programmatic consultation approach as sufficient information was provided to analyze impacts for the majority of activities proposed over the next three years. However, we anticipate that some projects may not fit the description provided during this consultation or the recently completed informal consultation and will require individual consultation. In addition, new information on Indiana bat activity in the Training Area may trigger the need for further consultation for certain activities. Finally, the Service will review the Army's annual report to determine if the projects were consistent with the parameters within the BA and BO.

The following project background and area descriptions are summarized from the BA. Additional information on Fort Drum background and description can be found in the BA and is incorporated by reference.

Project Description

Fort Drum is the largest military installation in the northeastern United States. It is home of the 10th Mountain Division-Light Infantry and serves as the primary training facility for National Guard and Army Reserve units throughout the region.

Fort Drum officially encompasses 107,265 contiguous acres (43,408 ha) in northern New York State (approximate center: 44° 7' N 75° 35' W) (Figure 1). While the official acreage is 107,265 acres, according to the most recent Geographic Information System coverages, the total acreage is actually 109,024. The installation is 10 miles (16 km) wide and 20 miles (32 km) long. Approximately 83% of Fort Drum is located in the Towns of Antwerp, Champion, LeRay, Philadelphia, and Wilna, Jefferson County, and the Town of Diane, Lewis County, New York (Figure 2).

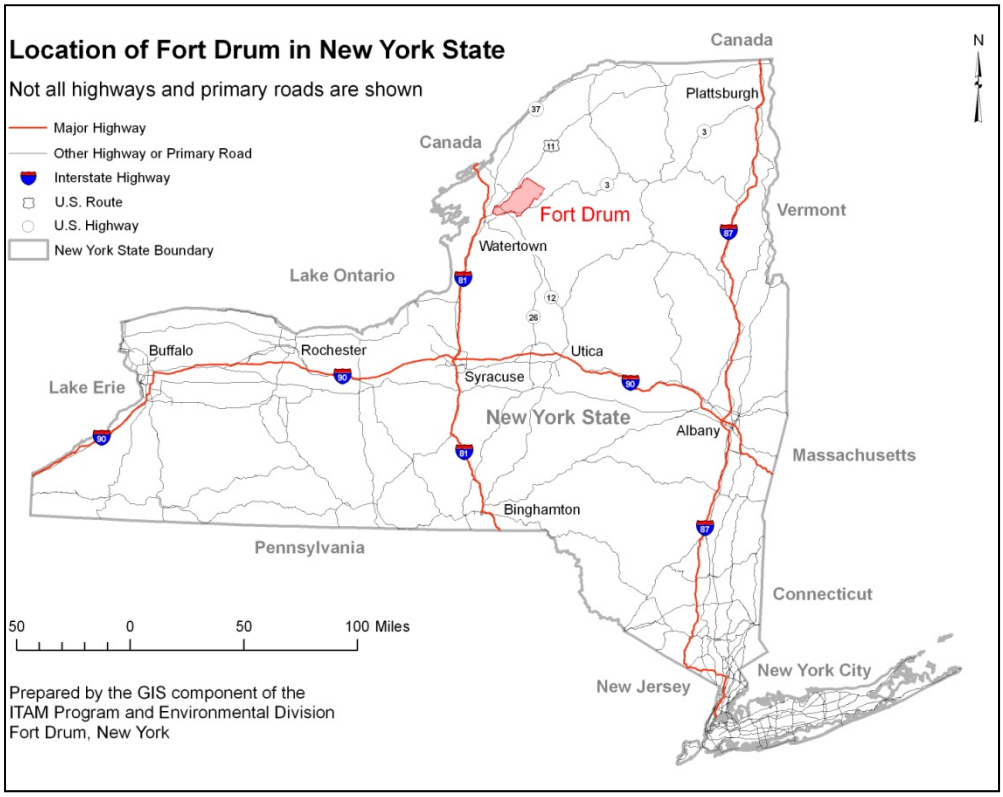

Figure 1. Fort Drum location in New York.

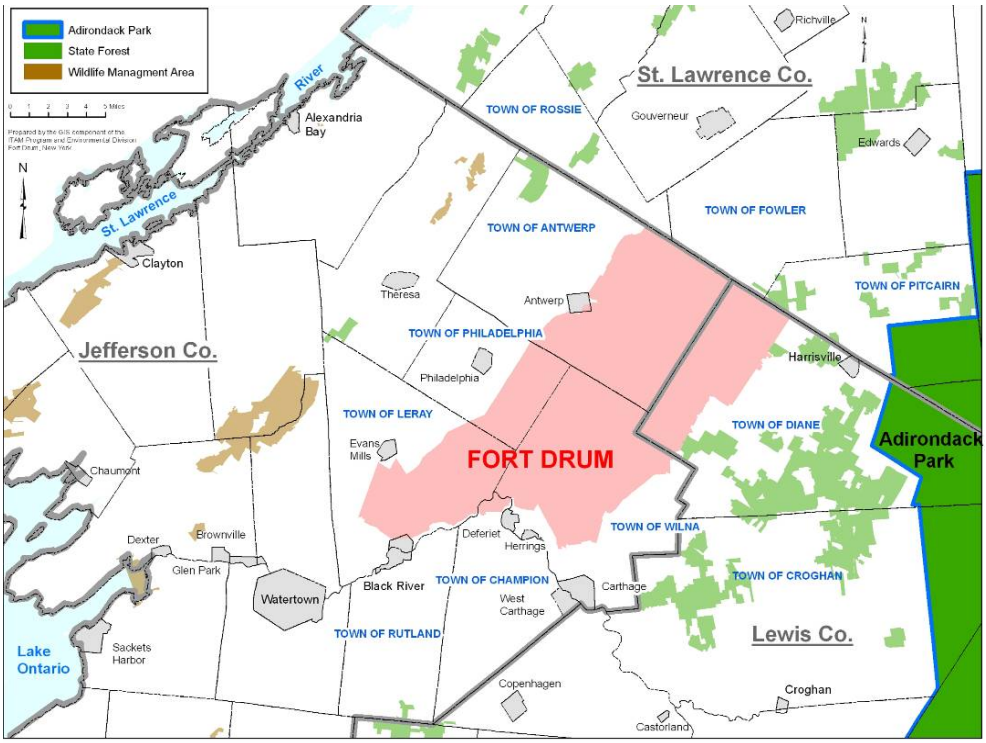

Figure 2. Fort Drum Towns and Counties.

Fort Drum is comprised of the Cantonment Area, Wheeler-Sack Army Airfield (WSAAF), and the Training Area (including ranges, maneuver area, and the Main Impact Area) (Figure 3). The Cantonment Area and the area surrounding WSAAF consist of administrative offices, housing, maintenance, and troop support facilities. The Cantonment Area (west of Route 26) and areas surrounding the WSAAF are in the southwestern part of the installation and the areas experiencing most of the current and future development. The Training Area is approximately 96,000 acres (38,850 ha) and where the majority of field training and firing of weapons occurs. The Training Area is divided into 18 numeric training areas (TAs) which is further subdivided into 70 alpha-numeric subtraining areas. The Main Impact Area covers 16,951 acres (6,860 ha). Due to the presence of dud and unexploded ammunition, the Main Impact Area is generally off-limits to all personnel. The 2,463 acres (997 ha) TA20 was historically used as an impact area, but it has been surface-cleared of unexploded ordnance. Personnel are permitted in TA20.

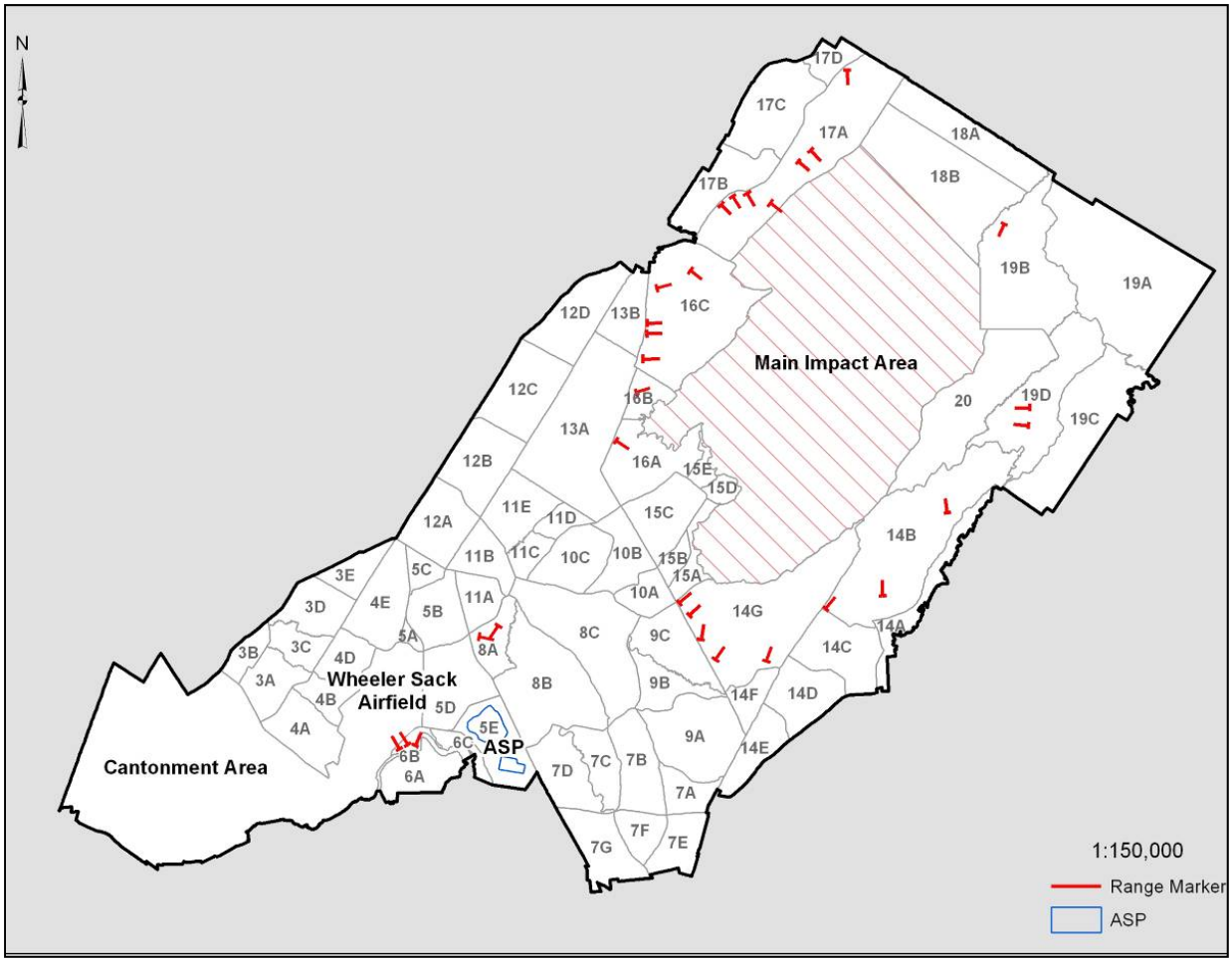

Figure 3. Current map of Fort Drum, including Cantonment Area, Wheeler Sack Airfield, Ammunition Supply Point, Main Impact Area, and Range and Maneuver Areas.

Forest comprises 74,514 acres (30,155 ha) or 68% of Fort Drum. Approximately 28,052 acres (11,352 ha) are deciduous or mixed-deciduous forest (> 6 in diameter at breast height [DBH]); the remainder consists of conifers, early successional tree species, saplings, or is unknown. Unknown habitat of 16,178 acres (6,547 ha) includes areas that are unsafe to survey (e.g., Main Impact Area). Of the 74,514 acres (30,155 ha) of forests, 67,651 acres (27,377 ha) are classified as upland forests while 6,863 acres (2,777 ha) are wetland forests.

There are eight primary lakes and ponds totaling more than 400 acres (162 ha) of surface area on Fort Drum. Two ponds, Remington Pond and Conservation Pond, are impounded creeks created by dams. There are two rivers and approximately eight primary streams running through Fort Drum totaling approximately 91.9 miles (147.9 km). Minor streams and tributaries are widespread throughout the installation. Wetlands are prevalent throughout the installation and comprise approximately 20% of the land area on Fort Drum. Approximately 91% of all wetlands on Fort Drum are palustrine.

Proposed Activities

In their BA, the Army outlined activities that may adversely or beneficially affect the Indiana bat. The Army included conservation measures to minimize potential adverse impacts of various activities as part of their project description. The Service has analyzed the effects of the proposed actions considering that the projects will be implemented as proposed (including all conservation measures). The Army also included a list of "beneficial actions" that they often implement during their actions to minimize environmental impacts. Because the Army was unclear as to how often these beneficial actions may be implemented, the Service did not take those efforts into account when analyzing impacts to the Indiana bat. This BO addresses whether implementation of all activities are likely or not likely to jeopardize the continued existence of the Indiana bat.

As stated above, the Army determined several categories of activities (including implementation of conservation measures) may affect, but are not likely to adversely affect the Indiana bat and the Service provided a concurrence letter for those categories on December 28, 2011. However, the Army determined that small wind energy development and military training smoke and obscurants may adversely affect the Indiana bat. These activities will be discussed further below in addition to a list of general conservation measures that are not specific to any project category.

A. Small wind energy development

Fort Drum considered any wind energy development projects utilizing turbines that have a total overall height at or below 150 feet (45.72 m; including rotor blades) as "small wind development". Large wind energy development includes turbines over that height.

To determine if small wind turbines could provide a valuable alternative energy option for Fort Drum and other Army installations with limited environmental or mission impacts, Fort Drum has developed a small wind study with the U.S. Army's Engineer Research and Development Center – Cold Regions Research and Engineering Laboratory (EDRC-CRREL).

Fort Drum is currently proposing to construct two small wind turbines, one vertical axis and one horizontal axis, to study the operation of the wind turbines and determine feasibility of employing these types of systems at Fort Drum. If these types of turbines are found to be suitable for use with no or limited negative environmental consequences, they may be established at more locations on Fort Drum during the next 3 years. However, depending on the proposed location, additional consultation may be required with the Service. The current proposed action only includes the installation, operation, and maintenance of the two test turbines.

The two turbines will be placed in TA4A (Figure 4). Approximately 2.5 ac (1 ha) of sparse grassland will be cleared to support this activity. The horizontal axis turbine will have a tower height of 100 ft (30.5 m) and a rotor diameter of 22 ft (6.7 m) with an overall height of 112 ft (34 m). The vertical axis turbine will have a tower height of 40 ft (12.1 m), with an overall height of 55 ft (16.8 m-overall height includes Federal Aviation Administration clearance lights). Both turbines will be equipped with a programmable brake that can automatically stop

rotation of the blades at specific times or during specific wind speeds. Both turbines will also be established on tilt-type monopoles with no guy wires.

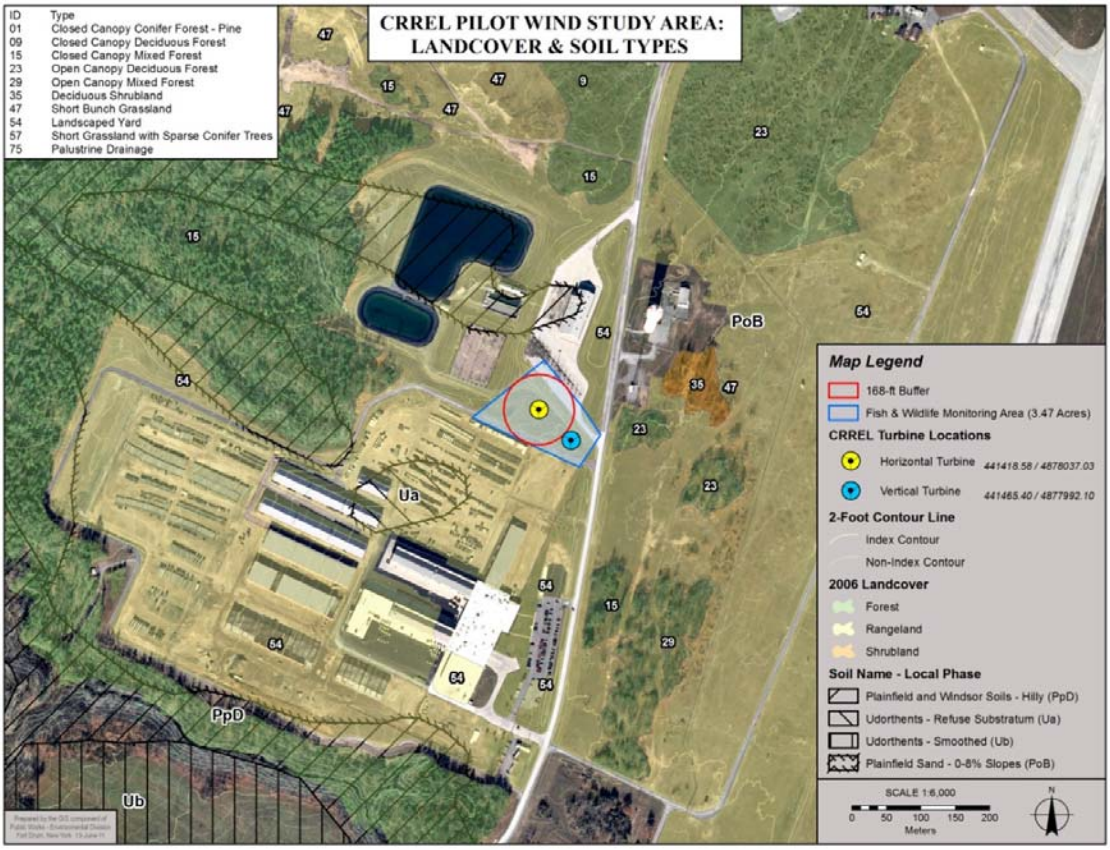

Figure 4. Proposed small wind study location in Training Area 4 on Fort Drum Military Installation.

To test the efficacy of these types of turbines, they will be run 365 days a year, 7 days a week, or as suitable when appropriate wind is present. This would include the time of year Indiana bats may be present on the property and at the project site. Large wind projects have documented at least three Indiana bat mortality events associated with the operation of the turbines (Good et al. 2011, Service 2011a).

Therefore, the small wind turbine site will be monitored daily during 2012 for bat mortality events while the turbines are in operation from April 15 - October 15. The site will be cleared and graveled (or otherwise made suitable for unimpeded monitoring) under the turbines out to a radius of one-and-a-half times the height of the horizontal axis turbine (168 ft, 51.2 m), and one time the height of the vertical axis turbine (55 ft, 16.8 m). The turbines will be placed far enough apart from one another and in such a manner as to be able to readily determine which turbine caused any potential mortality. All mortality monitoring protocols will be modeled from previously established methodology, will be developed in cooperation with the Service, and will be ready for implementation prior to turbine operation. If any myotid bats are killed during the

operation of the turbines, the turbine will be braked to restrict operation to only the times when bats would not be present on the site (e.g., during the day or from October 15 - April 15).

B. Military training smoke and obscurants

The only type of training activity the Army determined had the potential to result in any adverse impacts to Indiana bats was the use of smokes/obscurants. All other military training activities and any associated conservation measures are not likely to adversely affect Indiana bats and are discussed in Appendix A.

Local Training Areas Activities

Local Training Areas (LTA) are located primarily within the Cantonment Area (Figure 5). The two largest LTAs are within the boundaries of the Bat Conservation Area (BCA). LTAs provide units with an area near their barracks and administrative buildings where low intensity training can be conducted. Unlike the Training Area where all activities are coordinated through Range Control, utilization of the LTAs is not centrally managed, but activities are regulated by *Fort Drum Regulation 350-6 Assignment and Operational Use of Local Training Areas* (FD Reg 350-6). Examples of military training typically conducted in LTAs include field exercises, air operations in approved landing and pickup zones (i.e. open fields), and/or foot and wheeled maneuvers.

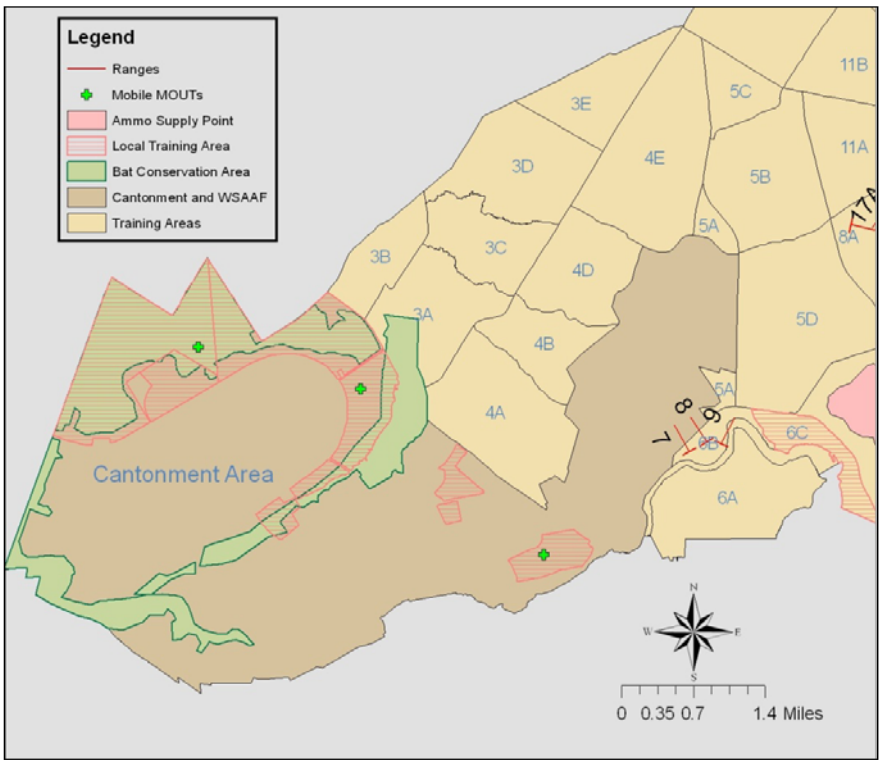

Figure 5. Local Training Areas on Fort Drum.

Smoke/Obscurants

Smoke/obscurants are used to conceal military movements and help protect troops and equipment in combat conditions. They can be used throughout the Training Area as part of another military operation, or as part of an independent training scenario. Although they would be primarily used during the day, smoke/obscurants may be deployed at night.

For the purposes of this BO smoke/obscurants are classified into three categories: Category 1) smoke operations - operations that utilize fog oil and/or graphite flakes to produce large amounts and sustained smoke; Category 2) colored smoke, smoke grenades, and smoke pots (aka pyrotechnics) - items that typically utilize terephthalic acid (TPA) to produce smoke; and Category 3) smoke munitions - those items that typically utilize white phosphorous (WP) for signaling, screening, and incendiary purposes.

Category 1

Although Category 1 smoke operations have not been utilized on Fort Drum in the past 5+ years, this type of training could occur on approximately 30,000 ac (12,140 ha) of the Training Area. Smoke training would be rotated regularly among multiple areas to minimize impacts to any one area of the installation. A typical training exercise that uses smoke/obscurants and smoke generators would normally last from 1 to 4 hours. Smoke generators may generate smoke from fixed locations or during mobile operations covering up to several hundred acres or more. Smoke dispersion is variable depending on means of dispersing smoke (i.e., fixed or static) and weather conditions (i.e., wind). Refer to Appendix A for representative examples of fog oil dispersion from static and mobile smoke training areas in Pasquill atmospheric stability category E (3D/International 1997).

Fog oil (i.e., Standard Grade Fuel #2) and graphite could be used to generate smoke. However, Fort Drum revised the project description to remove consideration of graphite smoke operations as an anticipated activity between 2012-2014. Therefore, we only considered the use and potential impacts of fog oil for Category 1 operations on Fort Drum.

Potentially up to 200 days of training could be conducted using fog oil each year. In those 200 days, approximately 270 generator-hours (number of hours each generator would operate annually x number of generators used on installation) would produce fog oil smoke per year. Approximately 22,120 gallons of fog oil per year could be used on Fort Drum to produce fog oil smoke. The actual amounts of fog oil that would be used annually will likely never reach these established upper threshold quantities given the recent past history on Fort Drum.

Category 2

TPA is used in Category 2 floating or ground smoke pots, and in smoke grenades. TPA is ignited and burned to produce smoke. The primary combustion products of TPA are carbon monoxide, carbon dioxide, sulfur dioxide, benzene, toluene, and formaldehyde. It is used alone, or in combination with fog oil to fill in incomplete fog oil screens. Refer to Appendix A for an

example of observed concentrations of TPA at varying distances (Pasquill Category B). TPA can be used within Training Areas and LTAs.

Category 3

Category 3 WP is used for signaling, screening, and incendiary purposes, and is usually dispersed by explosive munitions. WP is used only on the Range facilities and in the Main Impact Area. WP flame produces a hot, dense white smoke composed of particles of phosphorus pentoxide, which are converted by moist air into phosphoric acid. WP ignites when it is exposed to air and may cause burns. Smoke typically lasts up to 15 min.

The Army has proposed the following conservation measures to minimize potential adverse effects to Indiana bats from smoke/obscurants.

Conservation Measures for Smoke/Obscurants (from BA)

1. a) No Category 1 smoke operation will be conducted within 1,000 m of the installation boundary, public roads, Cantonment Area, ammunition supply point, or WSAAF in accordance with *Fort Drum Regulation 350-4 Range Regulation* and *Fort Drum Regulation 350-6 Assignment and Operational Use of Local Training Areas (LTAs)*. This restriction currently protects all known Indiana roosts and the majority of the known maternity use area (i.e., roosting and core foraging area) from close proximity smoke exposure (Figure 6).

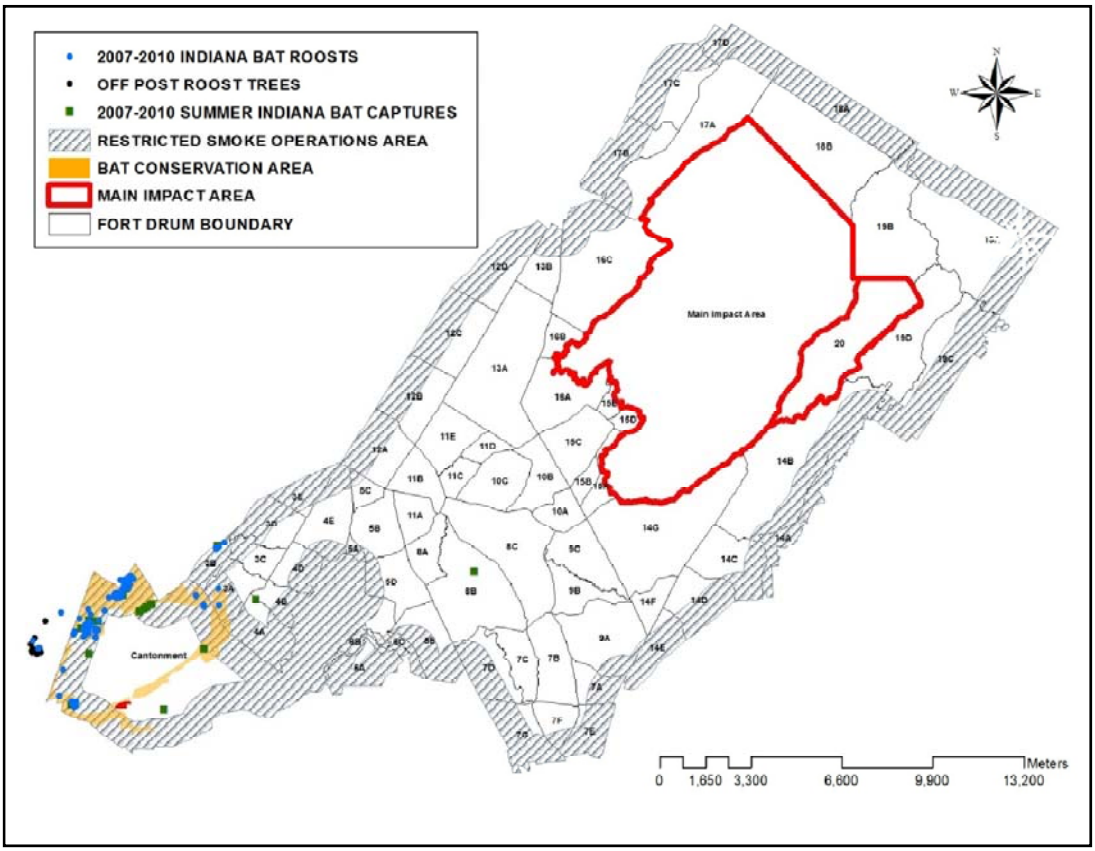

Figure 6. Buffer (1000 m) around Fort Drum Military Installation where smoke operations are prohibited per Fort Drum Regulation 350-4.

b) In the Training Area, Category 1 smoke and obscurants must be used >100 m from any known Indiana bat maternity roost areas between April 16 - October 15. This will help to protect Indiana bat roosts into the future. The 100 m buffer serves to minimize the effects of smoke and obscurants by providing distance between the roost and the densest amount of the smoke/obscurants. Training missions will be aware of maternity areas via the National Environmental Policy Act (NEPA) process and will be directed to avoid these areas.

c) Category 1 smoke operations must also be rotated among training areas to minimize impacts to any one area.

d) The use of Category 2 smoke (aka pyrotechnics) may be used in the Training Areas at any time within 1,000 m of the installation boundary, but will not be used within 100 m of any known Indiana bat maternity roost areas between April 16 - October 15.

e) Category 2 smoke may not be used within 100 m of any forested areas within the LTAs between April 16 - October 14. The prior time of year restriction identified in *Fort Drum Regulation 350-6 Assignment and Operational Use of Local Training Areas (LTAs)* was April 16 - September 30, however, because of the new information about the temporal use of Fort Drum by Indiana bats, this restriction has been modified. Approval from Range Control and NEPA review is required prior to any use of Category 2 smoke, and these reviews will help ensure that Category 2 smoke use is in accordance with this conservation measure.

f) Category 2 smoke may be periodically used at three mobile Military Operations Urban Terrain structures (MOUTs) within the LTAs (one mobile MOUT is in an open area of the BCA and one is in an open area near the BCA) during April 15 - October 15. Only infrequent use of colored smoke is expected to be used in around the mobile MOUTs. The closest known roost tree to the mobile MOUTs is approximately 575 m away. With the exception of the Category 2 colored smoke used at the mobile MOUTS, no other smoke or obscurant may be used in the BCA. Currently, all known maternity roosts are found within the BCA or within 1,000 m from the installation boundary.

2. In the Training Area and LTAs, the cutting of trees and tree removal are prohibited without approval by Fort Drum's Forest Management Program in accordance with current Environmental Guidelines. If approved, actions will be in accordance with all conservation measures in *Section 2.3 Forest Management* of the BA. In general, this is a relatively rare military training action. No female roosts, including roosts identified in the future, will be felled for training for the lifespan of the roost. No tree felling will occur in the BCA for training purposes.

3. In the LTAs, vehicular traffic is restricted to open grassy areas within easy access of the road in accordance with *Fort Drum Regulation 350-6 Assignment and Operational Use of Local Training Areas*. Vehicles are not permitted to cross streams, ditches, wetlands, or dense vegetation in order to reach grassy areas without prior NEPA review, thus minimizing impacts to natural habitats.

4. In the LTAs, petroleum, oil, and lubricant operations are prohibited in accordance with *Fort Drum Regulation 350-6 Assignment and Operational Use of Local Training Areas.* This helps to minimize the risk of accidental water/ground contamination.

5. Fort Drum will abide by the Fort Drum Integrated Wildland Fire Management Plan (Fort Drum 2005) which includes fire danger ratings, unless under special circumstances that are approved by the commander. Military activities that may spark fires will not be conducted during moderate to high danger ratings in order to prevent unintentional wildfires. This will protect Indiana bats from smoke exposure and from roost

destruction. Burn bans are most likely implemented during the summer months when reproductive Indiana bats are present on Fort Drum.

6. In the Training Area, smoke and obscurants must be used > 100 m from known Indiana bat maternity roost areas (including roosts identified in the future) between April 16 - September 30; the use of smoke and obscurants must be rotated among training areas to minimize impacts to any one area. The 100 m buffer serves to minimize the effects of smoke and obscurants by providing distance between the roost and the densest amount of smoke/obscurants. Training missions will be aware of maternity roost trees via the Record of Environmental Consideration (REC) process (See Appendix C of BA) and will be directed to avoid these areas. By minimizing the concentration of smoke around maternity roosts, it will reduce the risk of Indiana bats (including pups) from abandoning roosts. The rotation of smoke/obscurants between areas reduces impacts to any one area, thus minimizes the Indiana bats' risk to chronic exposure.

   No smoke operation will be conducted within 1,000 m of the installation boundary, public roads, Cantonment Area, ammunition supply point, or WSAAF in accordance with *Fort Drum Regulation 350-4 Range Regulation*. The one exception is the use of colored smoke at three mobile MOUTs within the LTAs (one mobile MOUT is in an open area of the BCA and one is in an open area near the BCA). Only infrequent use of colored smoke is expected to be used in around the mobile MOUTs. **With the exception of the colored smoke used at the mobile MOUTS, no other smoke or obscurant may be used in the BCA**. Currently, all known maternity roosts are found within the BCA or within a 1,000 m from the installation boundary.

Non-project Specific Conservation Measures

Section 3 of the BA provides a full description of these measures and are summarized here.

Bat Conservation Area

A 2,202-acre (891 ha) BCA has been established on Fort Drum for the benefit of Indiana bats (Figure 7). The majority of the BCA occurs in undeveloped portions of the Cantonment Area (2,051 acres (830 ha)) and follows Pleasant Creek northward into Training Areas 4A and 3A (151 acres (61 ha)). These areas were selected for the BCA in order to provide protection for the majority of known Indiana bat roosting and foraging areas based on mist-netting and radio-tracking efforts (Environmental Solutions and Innovations, Inc. [ESI] 2008a, 2008b) and past acoustical surveys. The BCA now contains 95% (113 out of 120) of all roosts identified on Fort Drum in the past five years (2007-2011). Three of the roosts not found in the BCA are located within 20 m of the boundary of the BCA; four are located in Training Area 3B. In addition, five roosts are located off Fort Drum within approximately 1,000 m of the BCA.

The BCA is an important area for Indiana bats on Fort Drum and in the adjacent Town of LeRay. Indiana bats that have been captured off-post (Fort Drum-I-81 connector project - Service 2008, Eagle Ridge housing project - ESI 2006) were noted to roost on Fort Drum for multiple days. In

addition, Indiana bats captured and roosting on Fort Drum regularly went off-post into the Town of LeRay to forage (ESI 2008b, U.S. Forest Service [USFS] 2011).

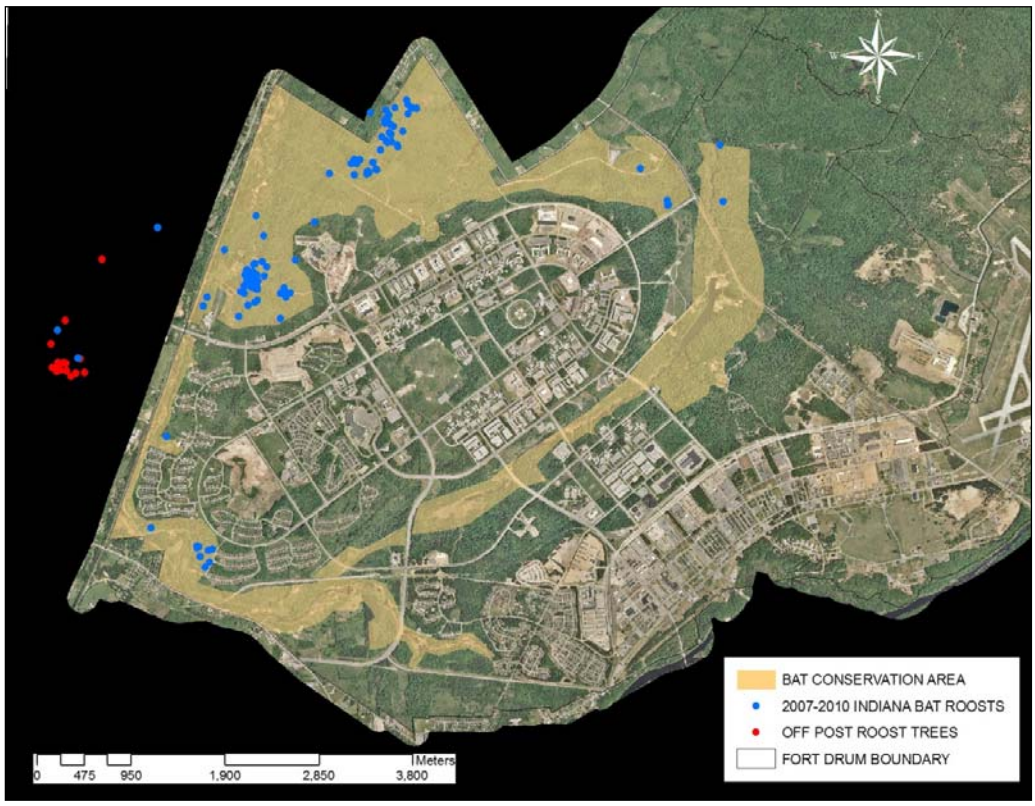

Figure 7. Bat Conservation Area.

The Army's intention for the BCA is to not prohibit all actions in the identified areas, but to protect known roosting and foraging habitat from permanent loss to the greatest extent possible. Many activities that currently occur will continue to be conducted within the BCA. The following discusses in detail permitted and restricted activities within the BCA.

1. Roost Tree Protection. No roost trees identified within the boundaries of the BCA will be felled. This includes roost trees identified in the future.

2. Construction. The primary activity not allowed in the BCA is construction activities resulting in the permanent loss of natural habitat. No permanent facility will be constructed within the BCA with the exception of some additional facilities (e.g., cabins, picnic shelters, parking lots, a campground, etc.) that may impact up to 8 ac (3 ha) in and around Remington Park. Remington Park is located along the Pleasant Creek corridor of the BCA. The construction of park facilities is included in *Section 2.1 Construction* of the BA. Conservation measures in *Section 2.1 Construction* will also apply. Construction of temporary facilities, primarily for training purposes, may be constructed within the BCA if the impacts to habitats are minimal. Temporary structures are defined as structures that are easy to assemble and disassemble, and easy to move.

If construction of other permanent structures must occur within the BCA in the future, further consultation with the Service is required.

Although currently not expected to occur within the next three years, the potential exists for the Installation Restoration Program (IRP) to remove trees in order to access contaminated ground water sites in response to a contamination episode. Individual consultation will occur with the Service and trees would only be removed during the October 15 - April 15 tree clearing window if in a non-emergency situation.

By restricting construction within the BCA, habitat connectivity, water sources, and suitable roost and foraging sites are maintained for the known maternity colony in the spring and summer and for individuals associated with the maternity colony in the fall. The BCA provides habitat for all sexes and ages of bats.

3. Military Training. Relatively low impact military training (e.g., land navigation and small unit tactics) is conducted in the northern portion of the BCA within LTAs. No live fire is allowed; however, weapons that fire the equivalent of paintball rounds are used. Occasionally artillery (with blanks) and other simulated explosives are also used. Current training allowed in the Cantonment Area will continue which may include construction of small temporary buildings (e.g., mock villages for urban warfare training) as long as no trees or large areas of natural habitat are removed.

   Category 2 smoke may not be used within 100 m of any forested areas within the LTAs between April 16 - October 14 to minimize impacts to roosting Indiana bats. The prior time of year restriction identified within *Fort Drum Regulation 350-6 Assignment and Operational Use of Local Training Areas (LTAs)* was April 16 - September 30; however, because of the new information about the temporal use of Fort Drum by Indiana bats, this restriction has been modified. Approval from Range Control and NEPA review is required prior to any use of Category 2 smoke in the LTAs, and these reviews will help ensure that Category 2 smoke use is in line with this conservation measure. See *Section 2.2 Military Training* of the BA for more information on impacts.

   Category 2 smoke may be periodically used at three mobile MOUTs within the LTAs (one mobile MOUT is in an open area of the BCA and one is in an open area near the BCA) during April 15 - October 15. Only infrequent use of colored smoke is expected to be used in around the mobile MOUTs. The closest known roost tree to the mobile MOUTs is approximately 575 m away. With the exception of the Category 2 colored smoke used at the mobile MOUTS, no other smoke or obscurant may be used in the BCA. Currently, all known maternity roosts are found within the BCA or within a 1,000 m from the installation boundary.

4. Vegetation Management. Limited tree removal is expected as part of required maintenance activities for the perimeter fence and/or utilities (Refer to *Section 2.4 Vegetation Management* of the BA). This is expected to be no more than 20 ac (8 ha). Hazard trees may also be removed for safety concerns along roadways, trails, or parking areas. Conservation measures in *Section 2.4 Vegetation Management* will apply.

Spraying of herbicides will continue to be conducted along the perimeter fence and utility line corridors to manage vegetation. Conservation measures in *Section 2.6 Pesticides* will also apply.

5. Recreation. Most of the BCA is currently used for recreational purposes. The primary recreational use is physical training by soldiers, hiking and cross-country skiing throughout an extensive trail system, and archery hunting during the big game season.

   There are currently plans to improve the trail system – both in quantity and quality. Any new trails will avoid trees and wetlands if at all possible – if trees > 4 in DBH must be removed, only the minimum required will be removed during the October 15 - April 15 tree clearing window.

6. Natural Resources Management. The management of natural resources is expected to continue throughout the BCA including the control/eradication of invasive species using pesticides, biocontrol, and physical removal, as well as, surveys, inventories, and research. In the future, there may be potential to create or enhance wetland and/or stream mitigation sites (one wetland mitigation site is already located within the BCA) and future forest management activities may occur. Mitigation and forest management activities will be addressed in future consultations, biological assessments, and/or management plans.

Monitoring & Research

The Army has participated in multiple on-site studies to assess Indiana bats' use of suitable habitat on Fort Drum. The Army will continue to monitor the presence of the Indiana bat maternity colony and will continue the 2011 Anabat sampling project into 2012. This will be primarily accomplished through monitoring areas around the known maternity colony with Anabat detectors and mist net efforts.

The Army will continue to assist with white-nose syndrome (WNS)-related or other bat research when requested and/or funding/staff are available.

Outreach Efforts

The Army has participated in and facilitated several outreach efforts including publishing articles in local outlets, cooperating with local media, and participating in community and school events. See Appendix A for specific details and examples.

Future plans consist of including relevant information pertaining to Indiana bats in the new Fort Drum Environmental Handbook which will be made available to all users – civilian employees and soldiers on Fort Drum. An information paper and/or pamphlet will be developed regarding the Indiana bat on Fort Drum and will be made available on the Fish & Wildlife Management Program web site. Efforts are underway to create a poster to integrate the Indiana bat with 10th

Mountain Division Soldiers under the common theme of "We Own the Night" similar to the successful U.S. Marine Corps "We're Saving A Few Good Species" posters.

Action Area

The "action area" includes all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). It is the entire area within which direct and indirect project-associated environmental effects are anticipated to occur (e.g., earth disturbance, habitat alterations, noise). Consequently, the action area typically extends some distance beyond the project footprint.

The Service agrees with the action area described in the BA and provides additional rationale below. When determining the action area, we considered the area where all direct and indirect effects of implementing and sustaining the mission of Fort Drum may impact the Indiana bat.

The Action Area includes all of Fort Drum proper, with some exceptions related to the Main Impact Area. Although the Main Impact Area in Fort Drum's Training Area is considered in some of the proposed actions, no human access is allowed into the area. Radio telemetry studies over the past five years have not revealed any Indiana bats in this area and, therefore, it is presumed that the species is not present and consequently, will not be adversely affected by the proposed activities. The Fort Drum action area also includes those lands currently, or proposed to be, part of the ACUB program (i.e., those areas Fort Drum has third party interest in).

Finally, because Indiana bats from the Glen Park hibernaculum are known to utilize Fort Drum, as well as lands adjacent to Fort Drum in the Town of LeRay and north (see the **Environmental Baseline**), these areas were also considered as part of the Action Area. However, although impacts (specifically lighting pollution and noise) from the Army's actions may affect the Indiana bat off the installation in these areas, there is currently no way to accurately determine those impacts on any roosting or foraging Indiana bats. In addition, we would not anticipate any unique impacts to bats located off Fort Drum from those considered in the BA and this BO. Finally, bats from the same maternity colony use Fort Drum and the off-post lands in the immediate vicinity of Fort Drum. We would expect the greatest likelihood of exposure to any stressors and the highest level of frequency and duration of exposure to these stressors while the bats are on Fort Drum proper.

Figure 8 shows the known Indiana bat use within and adjacent to the Action Area during the spring/summer (April 15 - August 15). Figure 9 shows the known Indiana bat use within and adjacent to the Action Area during the fall (August 15 - October 15). These areas will most likely continue to be used by Indiana bats after emergence from the hibernaculum, during the reproductive season, and during fall swarming. Fall swarming activity is expected to occur within 10 miles (and up to 20 miles) from the hibernaculum during the late summer and fall months (Figure 9). There are no known hibernacula on Fort Drum; therefore, no winter use is expected to occur on the installation.

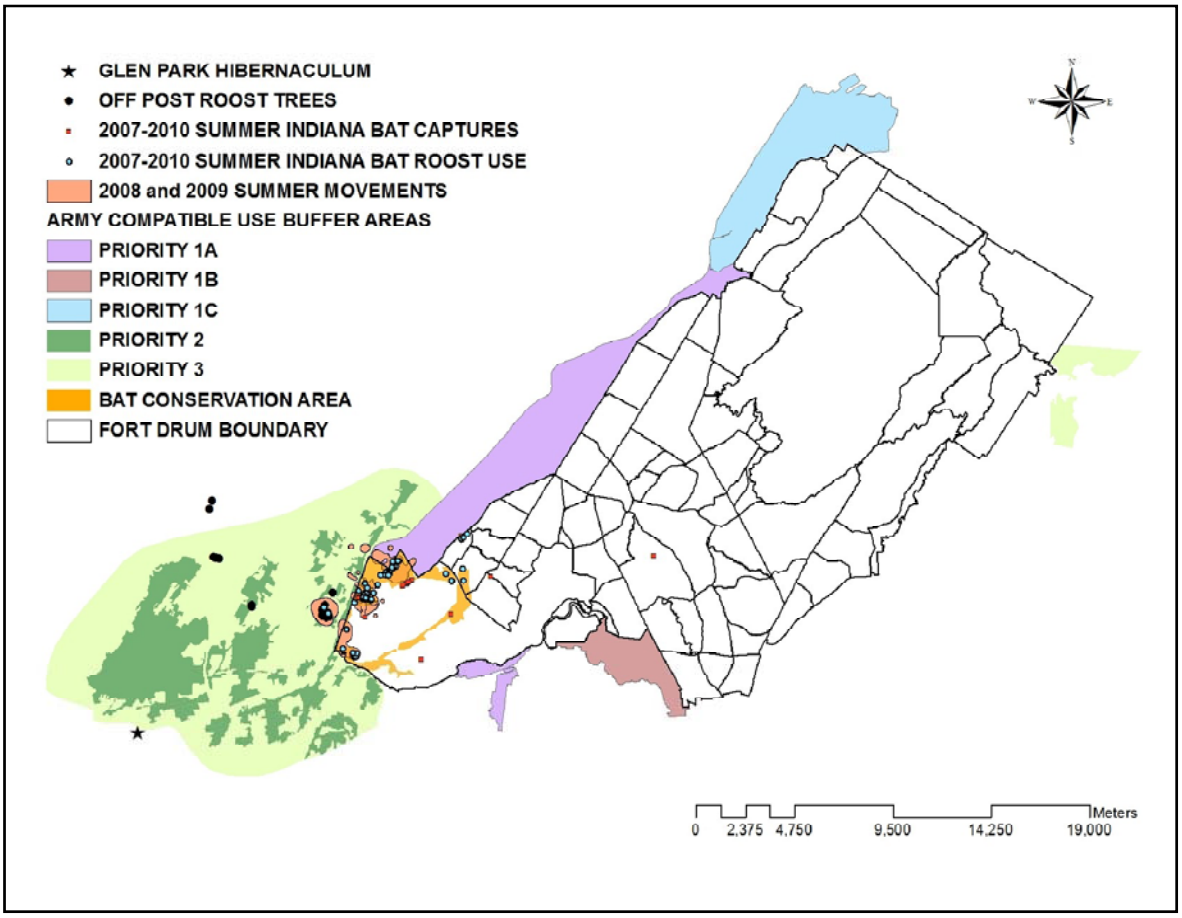

Figure 8. Indiana bat spring and summer activity on and around Fort Drum.

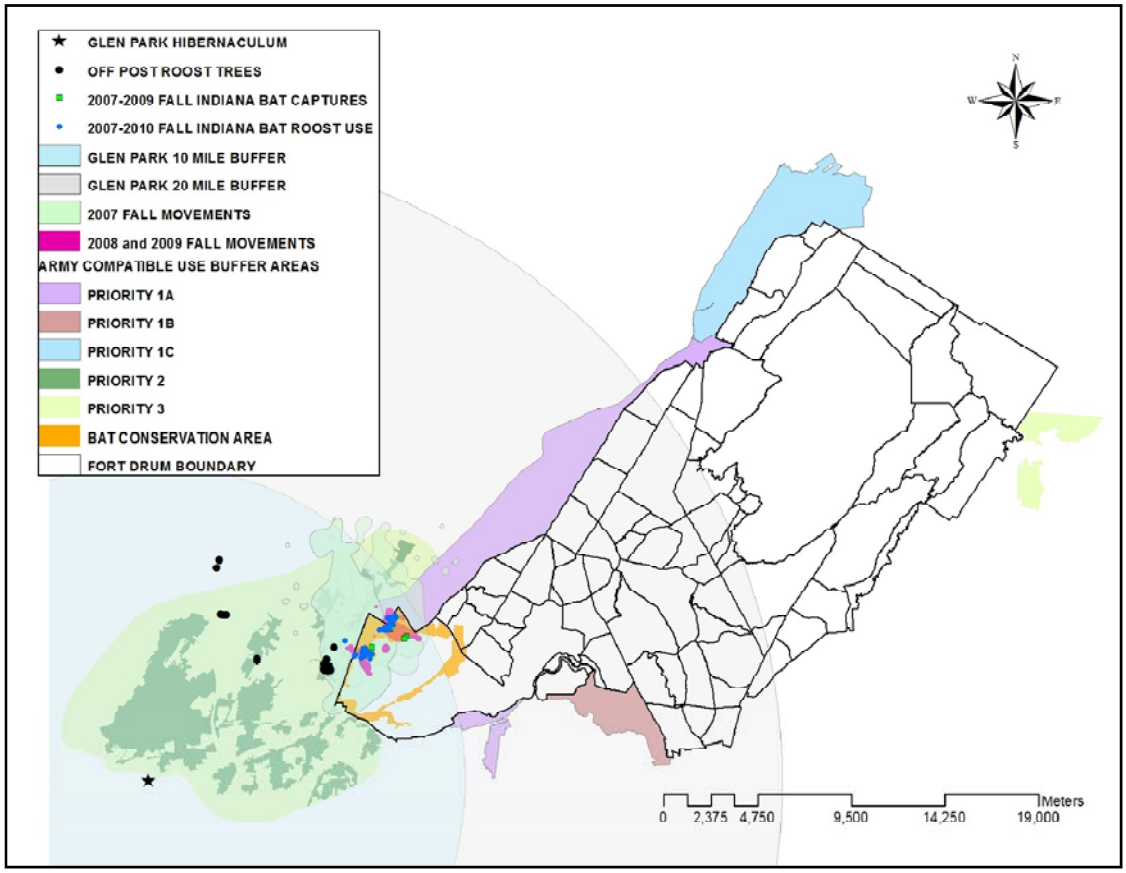

Figure 9. Indiana bat fall activity on and around Fort Drum.

STATUS OF THE SPECIES

Species Description

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates in caves and mines in the winter and summers in wooded areas. It is a medium-sized bat, having a wing span of 9 to 11 inches and weighing only one-quarter of an ounce. It has brown to dark-brown fur and the facial area often has a pinkish appearance. The Indiana bat closely resembles the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). It is distinguished from these species by its foot structure and fur color. The Indiana Bat Draft Recovery Plan (Service 2007) provides a comprehensive summary of the description of the species and is incorporated by reference.

Listing Status

The Indiana bat was officially listed as an endangered species on March 11, 1967 (Federal Register 32[48]:4001), under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U.S.C. 668aa[c]). The ESA subsequently extended full legal protection from unauthorized take to the species.

Critical Habitat

Critical habitat was designated for the species on September 24, 1976 (41 FR 14914). Thirteen hibernacula, including 11 caves and two mines in six states, were listed as critical habitat. There is no designated critical habitat for the Indiana bat in the State of New York.

Recovery Plan Status

The Service has published a recovery plan (Service 1983) that outlines recovery actions. Briefly, the objectives of the plan are to: (1) protect hibernacula; (2) maintain, protect, and restore summer maternity habitat; and (3) monitor population trends through winter censuses. An agency draft of a revised recovery plan was provided for public review and comment in the Federal Register on April 9, 1999, but has not yet been finalized. A newly revised draft recovery plan was noticed in the Federal Register for public review and comment on April 16, 2007 (Service 2007).

Life History

The Indiana bat is a migratory bat, hibernating in caves and mines in the winter (typically October through April) and migrating to summer habitat (Figure 10). Although some Indiana bat bachelor colonies have been observed (Hall 1962, Carter et al. 2001), males and non-reproductive females typically do not roost in colonies and may stay close to their hibernacula (Whitaker and Brack 2002) or migrate long distances to their summer habitat (Kurta and Rice 2002). Some reproductive females have been documented to migrate up to 357 miles (Winhold and Kurta 2006) to form maternity colonies to bear and raise their young, though others have been found to form maternity colonies within only a few miles of their hibernacula (Army 2011). Both males and females return to hibernacula in late summer or early fall to mate and store up fat reserves for hibernation. By mid-November, male and female Indiana bats have entered hibernation. They typically emerge in April, at which time they again migrate to summer habitat. The Indiana Bat Draft Recovery Plan (Service 2007) provides a comprehensive summary of Indiana bat life history and is incorporated by reference.

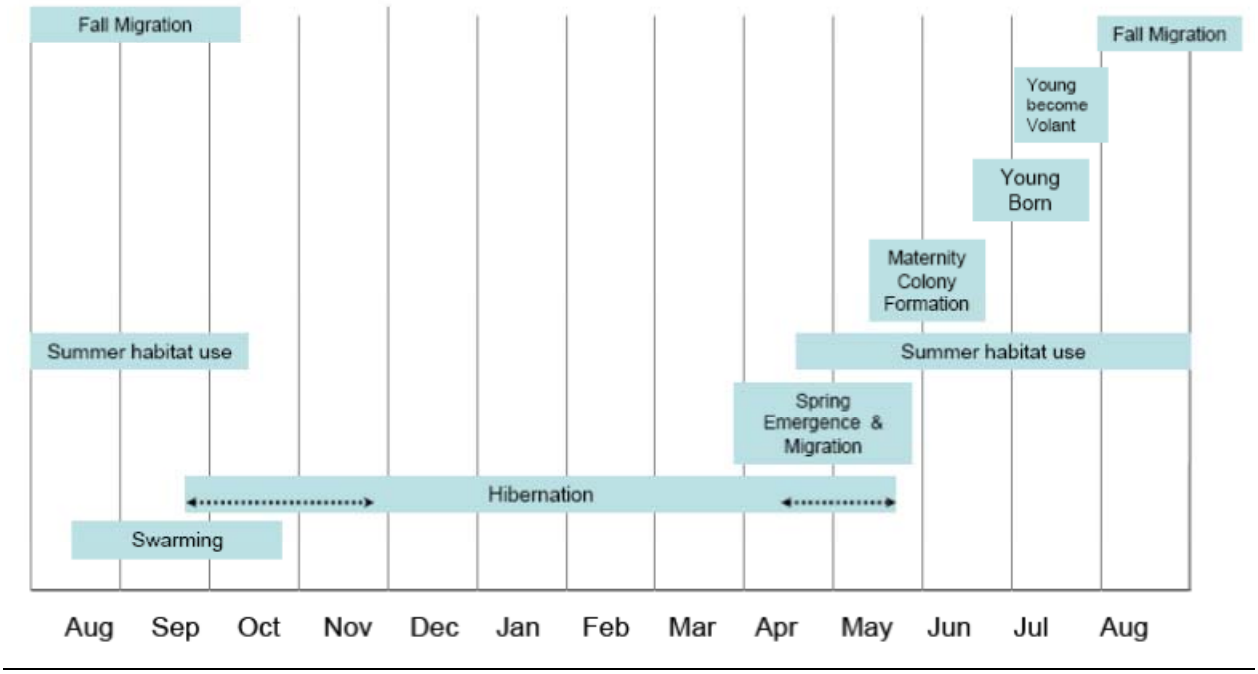

Figure 10. Indiana bat annual chronology (Service 2007).

Survival and Reproduction

The average life span of the Indiana bat is 5 to 10 years, but banded individuals have been documented living as long as 14 and 15 years (Humphrey and Cope 1977). No estimates of age structure have been made for winter populations, or for the population as a whole, due in part to the lack of an accurate technique for aging individuals once they are adults. To date, published estimates of the lifespan of the Indiana bat are based on survival after banding, from bats captured in winter. Using winter sampling of unknown-age bats over a 23-year period, Humphrey and Cope (1977) estimated annual survival. While they were unable to quantify survival rates following weaning, they speculated that the lowest survival occurred in the first year after marking. Female survivorship in an Indiana population was 76% for ages 1 to 6 years and 66% for ages 6 to 10 years. Male survivorship was 70% for ages 1 to 6 years and 36% for ages 6 to 10 years. Following 10 years, the survival rate for females dropped to only 4 percent (Humphrey and Cope 1977).

Female Indiana bats, like most temperate members of the family Vespertilionidae, give birth to one young each year (Mumford and Calvert 1960, Humphrey et al. 1977, Thomson 1982). The proportion of female Indiana bats that produce young is not well documented. At a colony in Indiana, 23 of 25 female Indiana bats produced volant young during one year and 28 females produced at least 23 young the following year (Humphrey et al. 1977). Based on cumulative mist-netting captures over multiple years, Kurta and Rice (2002) estimated that 89% of adult females in Michigan maternity colonies were in reproductive condition (pregnant, lactating, or post-lactating). Reproductive rates of the closely related little brown bat often exceed 95% (i.e., 95% of females give birth), but location and environmental factors (e.g., amount of rainfall and temperature) can lead to lower rates (Kurta and Rice 2002, Barclay et al. 2004). Racey (1982)

notes that a particular ratio of fat to lean mass is normally necessary for puberty and the maintenance of female reproductive activity in mammals. He suggests further that the variation in the age of puberty in bats is due to nutritional factors, possibly resulting from the late birth of young and their failure to achieve threshold body weight in their first autumn. Once puberty is achieved, reproductive rates frequently reach 100% among healthy bats of the family Vespertilionidae and young, healthy female bats can mate in their first autumn as long as their prey base is sufficient to allow them to reach a particular fat to lean mass ratio.

The sex ratio of the Indiana bat is generally reported as equal or nearly equal based on early work by Hall (1962), Myers (1964), and LaVal and LaVal (1980). Humphrey et al. (1977) observed a nearly even sex ratio (nine females, eight males) in a sample of weaned young Indiana bats. However, differential survival in adults has been suggested (Humphrey and Cope 1977, LaVal and LaVal 1980).

Food Habits

The Indiana bat feeds primarily on aquatic and terrestrial insects. Diet varies seasonally and variations exist among different ages, sexes, and reproductive status (Service 1999). Numerous foraging habitat studies have been completed for the Indiana bat. These studies found that Indiana bats forage in closed to semi-open forested habitats and forest edges located in floodplains, riparian areas, lowlands, and uplands. Forested habitats are very important for foraging bats, but old fields and agricultural areas seem to also be somewhat important habitats in studies completed in Indiana (Service 2007). At a study site near the Indianapolis International Airport, Sparks et al. (2005) found Indiana bats spending nearly 51% of their time foraging over agricultural fields with movements focused on a riparian corridor. Indiana bats, using open habitats for foraging at other sites, are probably utilizing forest-field edges and crowns of large scattered trees within the open canopy habitats.

Drinking water is essential, especially when bats actively forage. Throughout most of the summer range, Indiana bats frequently forage along riparian corridors and obtain water from streams. However, ponds and water-filled road ruts in the forest uplands are also very important water sources for Indiana bats.

Habitat Characteristics and Use

In this section we provide summaries of habitat characteristics and use by Indiana bats. The Indiana Bat Draft Recovery Plan (Service 2007) provides more comprehensive summaries and is incorporated by reference.

During winter, Indiana bats are restricted to suitable underground habitats known as hibernacula. The majority of hibernacula consist of limestone caves, especially in karst areas of east central United States, but abandoned underground mines, railroad tunnels, and even hydroelectric dams can provide winter habitat throughout the species' range (Service 2007). In New York, the largest and most rapidly growing populations of Indiana bats occured in abandoned underground mines (Hicks and Novak 2002) (although see **Threats** section for new information).

Hibernacula with stable and/or growing populations of Indiana bats have stable low temperatures that allow the bats to maintain a low metabolic rate and conserve fat reserves through the winter.

Spring emergence occurs when outside temperatures have increased and insects (forage) are more abundant (Richter et al. 1993). In New York, spring emergence studies have consistently shown that Indiana bats emerge once evening temperatures remain higher than 50ºF after April 15. Some bats may remain in close proximity to the cave for a few days before migrating to summer habitats. This activity is known as spring staging. Others head directly to summer habitat. Migration distances range from a few miles to over 300 miles (Winhold and Kurta 2006). Some males spend the summer near their hibernacula (Whitaker and Brack 2002), while others disperse longer distances. Males roost individually or in small groups. In contrast, reproductive females form larger groups, referred to as maternity colonies, in which they raise their offspring.

The average maternity colony size is 50 to 80 adult females (Whitaker and Brack 2002). This colony size is within the range (or close to) observed during various studies in New York. For example, emergence counts at roost trees that were located by tracking radio-tagged Indiana bats have ranged from 0 to 140 bats in central New York (Hicks and Newman 2007), 0 to 69 bats in southeastern New York in 2005 (New York State Department of Environmental Conservation [NYSDEC] unpublished data), 0 to 43 bats in the Lake Champlain Valley (Britzke et al. 2006), and 0 to 27 bats in Jefferson County in 2005 (Hicks et al. 2006). These studies were conducted early in the season and it is likely that exit counts may have been higher had we conducted them later in May or into early June. In addition, we generally did not attempt to estimate maternity colony size by conducting emergence counts concurrently at multiple roosts. This was done during studies for the St. Lawrence Wind Project and at least 46 adult female Indiana bats were documented during concurrent exit counts in June 2008 (Sanders Environmental Inc. [SEI] 2008a). It is assumed that all bats observed emerging from a roost are Indiana bats (Belwood 1996; Service 2007).

Non-reproductive females and males may roost individually or in small groups, but occasionally are found roosting with reproductive females. While Indiana bats primarily roost in trees, some colonies have been found in artificial roost sites (e.g., buildings, bat boxes) (Service 2007).

Home range size may vary between seasons, sexes, and reproductive status of the females (Lacki et al. 2007). Menzel et al. (2005) tracked seven female and four male Indiana bats from May to August in Illinois. No significant differences in home ranges between males and females were observed and home range estimates were subsequently grouped to obtain a mean summer home range of 357 acres. Watrous et al. (2006) calculated a mean home range of 205 acres for 14 female Indiana bats in Vermont. Without site-specific data, the Service generally considers the potential home range for an Indiana bat to include all suitable habitat within 2.5 miles of documented roost(s) (Service 2011a), recognizing the area of actual use may be just a portion of that.

Very little research has focused on the use of travel corridors by Indiana bats. Most information pertaining to bat movements and travel corridors is incidental to other portions of a study and/or general observations. However, Murray and Kurta (2004) showed that Indiana bats increased

commuting distance by 55% to follow tree-lined paths rather than flying over large agricultural fields, some of which were at least 0.6 mile (1 km) wide. In addition, data collected from a residential development in northern New York showed use of linear features (i.e., hedgerows and tree-lined fence rows) by Indiana bats (Environmental Solutions and Innovations, Inc. 2006). Apparently suitable, but distant forest patches may not be available to Indiana bats unless they are connected by a wooded corridor; however, we do not know the maximum size of an opening Indiana bats may cross.

Indiana bats exhibit strong site fidelity to their traditional summer colony areas and foraging habitat, that is, they return to the same summer range annually to bear their young (Kurta et al. 2002, Service 1999). Several monitoring studies have documented female Indiana bats returning to the same area to establish maternity colonies from year-to-year (Humphrey et al. 1977; Gardner et al. 1991a, b; Callahan et al. 1997; Kurta and Murray 2002; Butchkoski and Hassinger 2002; Gardner et al. 1991a, Gardner et al. 1996), and to the same roost tree as long as that tree is available. Traditional summer sites that maintain a variety of suitable roosts are essential to the reproductive success of local populations. It is not known how long or how far female Indiana bats will search to find new roosting habitat if their traditional roost habitat is lost or degraded during the winter. If they are required to search for new roosting habitat in the spring, it is assumed that this effort places additional stress on pregnant females at a time when fat reserves are low or depleted and they are already stressed from the energy demands of migration and pregnancy.

Gumbert et al. (2002) differentiated between roost tree and roost area fidelity in Indiana bats, and found that bats are faithful to both areas and particular trees within those areas. Indiana bats also show a high degree of fidelity to foraging ranges. Kurta and Murray (2002) documented recapturing 41% of females when mist netting within the same area in subsequent years. Indiana bat maternity colonies in Illinois, Indiana, Michigan, and Kentucky have been shown to use the same roosting and foraging areas year after year (Gardner et al. 1991b; Humphrey et al. 1977; Kurta and Murray 2002; Kurta et al. 1996, 2002). Roosting/foraging area fidelity may serve to maintain social interactions between members of the population. Bats using familiar foraging and roosting areas are thought to have decreased susceptibility to predators and increased foraging efficiency, as well as the ability to switch roosts in case of emergencies or alterations surrounding the original roost (Gumbert et al. 2002).

Indiana bat roost trees have been described as either primary or alternate depending on the number of bats in a colony consistently occupying the roost site. Maternity colonies use a minimum of eight to 25 trees per season (Callahan et al. 1997, Kurta et al. 2002), and the primary and alternate roost trees tend to be clustered into roosting areas (Kurta et al. 1996, Kurta 2005). At sites with an abundance of suitable roosting habitat, roost trees tend to be more tightly clustered, with the distance between roosts as small as 1 meter (Kurta et al. 1996). However, where roosting habitat is sparse and fragmented, the maximum distance between roost trees used by the same colony has been reported to be 3.6 miles (Kurta et al. 2002).

In Missouri, Callahan (1993) defined primary roost trees as those with exit counts of more than 30 bats on more than one occasion; however, this number may not be applicable to small-to-moderate sized maternity colonies. Kurta (2005) summarized summer habitat information from

11 states and found most exit counts at primary roosts are at least 20-100 adults with a typical maximum of 60-70 adults in a primary roost at any given time. Primary roost trees are almost always located in either open canopy sites or in the portion of a tree that is above the canopy cover of the adjacent trees (Callahan et al. 1997, Kurta et al. 2002). Alternate roost trees can occur in either open or closed canopy habitats and may be used when temperatures are above normal or during precipitation. Shagbark hickories are good alternate roosts because they are cooler during periods of high heat and tight bark shields the bats from rain (Service 1999). On average, Indiana bats typically switch roosts every two to three days. Switching behavior is influenced by reproductive condition of the female, roost type, weather conditions, and time of year (Kurta et al. 2002, Kurta 2005).

Despite the ephemeral nature of their roost trees, as long as adequate roosting opportunities are available in the general area, bats are probably not dependent on the continued suitability of a specific tree. There is evidence that colonies are able to relocate to other suitable roosting areas within the colony's home range after the loss of a roost tree. In Michigan, the focal point of a colony's maternity activity shifted 1.24 miles over a three-year period after the primary roost tree fell down. The area that they shifted to had been previously used by a single radio-tracked female for roosting during the summer prior to loss of the roost tree (Kurta et al. 2002). This is consistent with a number of other situations, where the bats moved to nearby roosts but retained the same commuting corridors and foraging areas once a primary roost tree of a maternity colony had been lost (Humphrey et al. 1977).

After grouping into maternity colonies, reproductively active females give birth to a single offspring in June or early July (Humphrey et al. 1977). This life history strategy (forming colonies) reduces thermoregulatory costs, which in turn, increases the amount of energy available for birthing and raising of young (Barclay and Harder 2003). There are no documented occurrences in which a female Indiana bat has successfully given birth and raised a pup alone without the communal benefits, particularly thermoregulation, offered by establishment of a maternity colony. Studies by Belwood (2002) show asynchronous births among members of a colony. This results in great variation in size of juveniles (newborn to almost adult size young) in the same colony. In Indiana, lactating females have been recorded from June 10 to July 29 (Whitaker and Brack 2002). Young Indiana bats are capable of flight within a month of birth. Young born in early June may be flying as early as the first week of July (Clark et al. 1987), others from mid- to late July.

When young become capable of flight (early to late July), roosting behavior is similar to that in early summer. However, the maternity colony begins to disperse and use of primary maternity roosts diminishes, even though bats stay in the area prior to migrating back to their respective hibernacula. Bats become less gregarious and the colony utilizes more alternate roosts, possibly because there is no longer the need for the adult females to cluster to assist with thermoregulation and nurture the young.

This colonial roosting behavior is well documented for Indiana bat females at maternity colonies. Barclay and Kurta (2007) suggested four potential explanations for female aggregation (establishment of maternity colonies) in the summer: 1) roosts are limited; 2) foraging efficiency – members of a colony communicate regarding good foraging areas; 3) anti-predator mechanism;

and 4) thermoregulation. Although there are probably many advantages to colonial roosting, the most important factor for Indiana bats is probably its thermoregulatory benefits (Humphrey et al. 1977; Kurta et al. 1996). Pups and adults in late pregnancy are poor thermoregulators (Speakman and Thomas 2003), and pre- and post-natal growth is controlled by metabolism and body temperature (Racey 1982). In the absence of clustering, the strict thermal conditions needed to support pre-natal and post-natal growth would not exist. Thus, colonial roosting is a life history strategy adopted by Indiana bats (like many other temperate zone bats) to improve their reproductive success (Barclay and Harder 2003). While there may be a loss of these communal benefits below a threshold colony size, it remains an important component of Indiana bat behavior (Racey and Entwistle 2003, Callahan 1993, Gardner et al. 1991b).

Status and Distribution

Because the vast majority of Indiana bats form dense aggregations or "clusters" on the ceilings of a relatively small number of hibernacula (i.e., caves and mines) each winter, conducting standardized surveys of the hibernating bats is the most feasible and efficient means of estimating and tracking population and distribution trends across the species' range. Collectively, winter hibernacula surveys provide the Service with the best representation of the overall population status and relative distribution that is available.

For several reasons, interpretation of the census data must be made with some caution. First, winter survey data have traditionally been subdivided by state due to the nature of the data collection. As described below, each state does not represent a discrete population center. Nevertheless, the range-wide population status of the Indiana bat has been organized by state thus far. However, data is also summarized by the four proposed Indiana bat recovery units which do cross state boundaries to give a broader biological perspective of the status of the species. Second, as will be further discussed, available information specific to the "reproductive unit" (i.e., maternity colony) of the Indiana bat is limited. While winter distribution of the Indiana bat is well documented, relatively little is known as to the size, location, and number of maternity colonies for the Indiana bat. As described below, it is estimated that the locations of more than 90% of the estimated maternity colonies rangewide remain unknown.

Additionally, the relationship between the majority of wintering populations and summering populations is not clearly understood. For example, while it is known that individuals of a particular maternity colony typically come from one to many different hibernacula, the source (hibernacula) of most, if any, of the individuals in a maternity colony is not known. In New York, most maternity colonies are clearly linked to their wintering populations as they were located during spring emergence radio tracking projects. Figure 11 illustrates the range-wide distribution of known hibernacula and maternity colonies by county. As discussed above, the county distribution of hibernacula is expected to be better represented and more complete than that of the species' summer distribution.

There is limited information on the historic distribution of Indiana bats. However, paleontological evidence suggests that prehistoric abundance of Indiana bats may have exceeded our current population estimates, as well as historic estimates, by an order of magnitude (Service

2007). A summary of prehistoric and historic distribution and abundance can be found in the Indiana Bat Draft Recovery Plan (Service 2007).

Current Abundance

The Service compiled winter hibernacula survey information from 2011 to develop the most recent range-wide population estimate of 424,708 Indiana bats. Winter counts ranged from 509,962 in 1981 down to 328,617 in 2001, back up to 467,947 in 2007, and down to 415,512 in 2009. The 2011 rangewide survey results document a 2.2% species increase from 2009 primarily driven by increases in Kentucky and Indiana. However, when examining the species at the regional and proposed recovery unit level, there has been a continued steep decline in the northeast since 2007. Table 1 provides a detailed breakdown of the range-wide population estimates by Indiana Bat Recovery Unit from 2003 to 2011 (Service 2012).

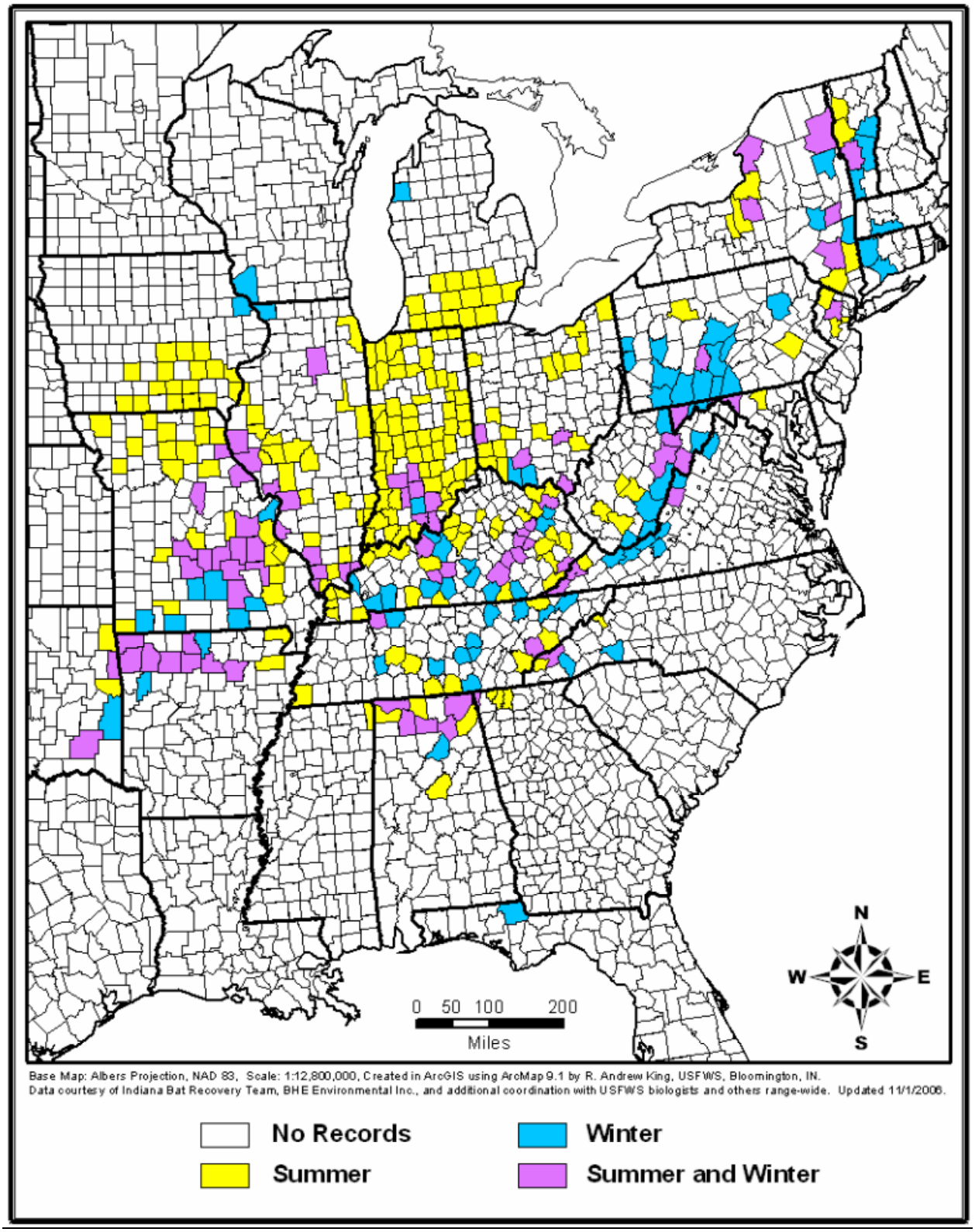

Figure 11. Distribution of counties with known summer and winter records of the Indiana bat as of publication of the Indiana Bat Draft Recovery Plan (Service 2007).

U.S. Fish & Wildlife Service

2011 Rangewide Population Estimate for the Indiana Bat (*Myotis sodalis*) by Recovery Unit

Estimates are primarily based on winter surveys conducted in January and February of 2011 at known Priority 1 & 2 hibernacula throughout the species' range. Additional data from Priority 3 and 4 hibernacula were included when available.

NOTE: The USFWS considers these population estimates to be the best available data for this species. However, we also recognize that some of these data contain an undeterminable, but potentially significant and varible degree of error from one year to the next. Bat population estimation error is attributable to multiple factors including variable detectability of bats roosting within different hibernacula settings, some unknown number of bats using unknown/undocumented winter roost sites, and biologists using somewhat different survey techniques in different states. Bat biologists began widely using digital photography as a primary winter survey technique in 2007 and 2009 because it improves overall accuracy and reduces surveyor-associated error over traditional techniques. The USFWS generally has increased confidence in the accuracy of the population estimates subsequent to the use of digital photography. The USFWS asks data users to be cognizant of the limitations of these population data and to take proper precautions when interpreting and presenting population trends through time.

IBat Recovery Unit	State	2003	2005	2007	2009	2011	% Change from 2009	% of 2011 Total
Ozark-Central	Illinois	43,647	55,090	53,823	53,342	55,956	4.9%	13.2%
	Missouri	17,752	16,102	15,895	13,688	13,647	-0.3%	3.2%
	Arkansas	2,228	2,067	1,829	1,480	1,206	-18.5%	0.3%
	Oklahoma	5	2	0	0	13	0.0%	0.0%
	Total	63,632	73,261	71,547	68,510	70,822	3.4%	16.7%
Midwest	Indiana	183,337	206,610	238,068	213,170	222,820	4.5%	52.5%
	Kentucky	49,544	65,611	71,250	57,325	70,329	22.7%	16.6%
	Ohio	9,831	9,769	7,629	9,261	9,870	6.6%	2.3%
	Tennessee	3,246	3,221	2,929	1,663	1,690	1.6%	0.4%
	Alabama	265	296	258	253	261	3.2%	0.1%
	SW Virginia	430	202	188	217	307	41.5%	0.1%
	Michigan	20	20	20	20	20	0.0%	0.0%
	Total	246,673	285,729	320,342	281,909	305,297	8.3%	71.9%
Appalachian	West Virginia	11,443	13,417	14,745	17,965	20,358	13.3%	4.8%
	E. Tennessee	6,556	8,853	5,977	11,058	11,096	0.3%	2.6%
	Pennsylvania	931	835	1,038	1,031	518	-49.8%	0.1%
	Virginia	728	567	535	513	556	8.4%	0.1%
	North Carolina	0	0	0	1	1	0.0%	0.0%
	Total	19,658	23,672	22,295	30,568	32,529	6.4%	7.7%
Northeast	New York	32,529	41,745	52,779	34,045	16,052	-52.9%	3.8%
	New Jersey	644	652	659	416	5	-98.8%	0.0%
	Vermont	472	313	325	64	3	-95.3%	0.0%
	Total	33,645	42,710	53,763	34,525	16,060	-53.5%	3.8%
Rangewide Total:		**363,608**	**425,372**	**467,947**	**415,512**	**424,708**	**2.2%**	100.0%
	2-yr. Net Change:	61,764	42,575	-52,435	9,196			
	2-yr. % Change:	17.0%	10.0%	-11.2%	2.2%			

Compiled by Andy King (andrew_king@fws.gov), U.S. Fish and Wildlife Service, Bloomington, Indiana, Ecological Services Field Office from data gathered from bat biologists throughout the species' range.

For additional information regarding the Indiana bat go to...
http://www.fws.gov/midwest/Endangered/mammals/inba/index.html

Revised 1-4-2012

Table 1. Indiana bat winter counts by Recovery Unit.

Categorization of Hibernacula

In the Indiana Bat Draft Recovery Plan (Service 2007), Indiana bat hibernacula are assigned priority numbers primarily on the basis of winter population sizes and to protect essential hibernation sites across the species' range.

Priority 1 (P1): Essential to recovery and long-term conservation of Indiana bat, Priority 1 hibernacula typically have (1) a current and/or historically observed winter population ≥ 10,000 Indiana bats and (2) currently have suitable and stable microclimates (e.g., they are not considered "ecological traps" as defined below). Priority 1 hibernacula are further divided into one of two subcategories, "A" or "B," depending on their recent population sizes. Priority 1A (P1A) hibernacula are those that have held 5,000 or more Indiana bats during one or more winter surveys conducted during the past 10 years. In contrast, Priority 1B (P1B) hibernacula are those that have sheltered ≥ 10,000 Indiana bats at some point in their past, but have consistently contained fewer than 5,000 bats over the past 10 years.

Priority 2 (P2): Contributes to recovery and long-term conservation of Indiana bat. Priority 2 hibernacula have a current or observed historic population of 1,000 or greater, but fewer than 10,000 and an appropriate microclimate.

Priority 3 (P3): Contribute less to recovery and long-term conservation of Indiana bat. Priority 3 hibernacula have current or observed historic populations of 50-1,000 bats.

Priority 4 (P4): Least important to recovery and long-term conservation of Indiana bat. Priority 4 hibernacula typically have current or observed historic populations of fewer than 50 bats.

High Potential (HP): A special designation given to P2, P3, or P4 hibernacula that are deemed capable of supporting 10,000 or more Indiana bats in the future if (1) an appropriate microclimate is restored (or created in the case of some mines) and/or (2) the site is protected from disturbance. These sites typically have no recorded direct observations of significant numbers of Indiana bat (i.e., at least none that can be readily confirmed; they differ from a P1B site in this respect). Instead most "high-potential" hibernacula have one or more forms of indirect evidence indicating previous use by large numbers of *Myotis* and/or Indiana bat (e.g., anecdotal historic accounts and/or paleontological evidence such as bones, mummified remains, ceiling staining, etc.). As of October 2006, two caves had been designated as having HP – Mammoth Cave in Kentucky and Rocky Hollow Cave in Virginia.

Ecological Trap (ET): A hibernaculum having a history of repeated flooding or severe freezing events that have resulted in the mortality of most hibernating Indiana bats. Hibernacula with other environmental conditions that pose a severe and/or imminent threat to the majority of hibernating bats may also be designated as "ecological traps" by the Service (e.g., threat of catastrophic collapse). As of October 2006, three caves had been preliminarily designated as ETs – Bat Cave (Shannon Co.) in Missouri (freezing), Hailes Cave in New York (flooding), and Clyfty Cave in Indiana (flooding). These preliminary designations were made based on the

recommendations of Indiana bat experts familiar with these caves and on the history of Indiana bat mortality in these caves. The designations will be reevaluated when procedures for evaluation and designation of hibernacula as ETs are developed.

Current Winter Distribution

The following is a summary from the Indiana Bat Draft Recovery Plan and 5-year review (Service 2007, Service 2009a); additional information from the Plan is incorporated by reference. As of October 2008, the Service has winter records of extant winter populations (i.e., positive winter occurrence since 1995) of the Indiana bat at approximately 281 different hibernacula located in 19 states (Figure 11). Likewise, based on the 2005 winter surveys, there were a total of 23 Priority 1 hibernacula in seven states – Illinois (n=1), Indiana (n=7), Kentucky (n=5), Missouri (n=6), New York (n=2), Tennessee (n =1), and West Virginia (n=1). A total of 53 Priority 2 hibernacula are known from the aforementioned states, as well as Arkansas, Ohio, Pennsylvania, and Virginia. A total of 150 Priority 3 hibernacula have been reported in 16 states. A total of 213 Priority 4 hibernacula have been reported in 23 states.

Winter surveys in 2010-2011 found hibernating Indiana bats dispersed across 16 states. However, over 80% of the estimated range-wide population hibernated in three states – Indiana (52.5%), Kentucky (16.6%), and Illinois (13.2%) (Service 2012).

For more information on wintering bat distribution, abundance, and potential genetic variation, see the Indiana Bat Draft Recovery Plan (Service 2007).

Current Summer Distribution

Summer distribution of the Indiana bat occurs throughout a wider geographic area than its winter distribution (Figure 10). Most summer occurrences are from the upper Midwest including southern Iowa, northern Missouri, much of Illinois and Indiana, southern Michigan, Wisconsin, western Ohio, and Kentucky. In the past decade, many summer maternity colonies have been found in the northeastern states of Pennsylvania, Vermont, New Jersey, New York, West Virginia, and Maryland. Maternity colonies extend south as far as northern Arkansas, southeastern Tennessee, and southwestern North Carolina (Britzke et al. 2003, Service 2007). Non-reproductive summer records for the Indiana bat have also been documented in eastern Oklahoma, northern Mississippi, Alabama, and Georgia.

Maternity Colonies

The first Indiana bat maternity colony was not discovered until 1971 in east-central Indiana (Cope et al. 1974). As of publication of the Indiana Bat Draft Recovery Plan (Service 2007), we have records of 269 maternity colonies in 16 states that are considered locally extant. Of the 269 colonies, 54% (n=146) have been found since 1997, mostly during mist-netting surveys. In the northeast (e.g., Pennsylvania, New York, Maryland, Vermont), many maternity colonies have been located through the use of radio-telemetry, as females have been tracked from hibernacula to summer habitat. Because maternity colonies are widely dispersed during the summer and difficult to locate, it is presumed that all the combined summer survey efforts have found only a small fraction of the maternity colonies that are thought to exist (see below).

The total number of maternity colonies that exist rangewide is not known, but can be estimated based on population estimates derived from winter hibernacula surveys. Based on a range-wide population estimate of 467,947 bats in 2007 (pre-WNS), and assuming a 50:50 sex ratio and average maternity colony size of 50 to 80 adult females (Whitaker and Brack 2002), there were 3,802 (±877) maternity colonies across the landscape. Using the same set of assumptions, there were 3,450 (± 797) colonies in 2011, representing a loss of about 352 colonies. However, this simple mathematical approach fails to incorporate regional variations in the decline, the possible effects of WNS, and the social structure of maternity colonies. A decline in hibernating populations due to WNS may manifest itself first as a reduction in the size of maternity colonies, then the loss of whole colonies if the number of surviving colony members is too small to allow the colony to persist. For example, in areas where WNS is just beginning to move through, maternity colonies are likely to be affected – at least initially – only by the loss of members from WNS-affected hibernacula. However, in areas where WNS has affected bat populations for multiple years, resulting in very high mortality rates, entire maternity colonies have probably been eliminated because all the hibernating populations that supported those colonies have been decimated. If the resulting reduction in colony size is substantial, the colony may collapse because so few females remain to form the social clustering that is characteristic of the species and likely contributes to its survival and successful recruitment of young. However, other maternity colonies may stabilize at smaller sizes and eventually rebound. For example, the Army continues to document the presence of an Indiana bat maternity colony that is associated with Glen Park (a WNS-affected hibernaculum). This colony has been tracked since 2007 on Fort Drum and one lactating adult female was captured in 2011 documenting continued reproduction of this colony (Army, unpublished data). Maximum exit counts from a single tree were 16 (Army, unpublished data). Regardless of how one estimates the number of maternity colonies, the declining hibernating population translates to a declining summer population.

Adult Males

Male Indiana bats are found throughout the range of the species, but in summer are most common in areas near hibernacula (Gardner and Cook 2002). Because they typically roost solitarily in the summer, they are less likely to be detected by mist-netting than adult females, which tended to occur in high-density maternity colonies. However, males may also roost with maternity colonies.

Reasons for Listing/Threats

From 1965-2001, there was an overall decline in Indiana bat populations, with winter habitat modifications having been linked to changes in populations at some of the most important hibernacula (Service 2007). Most of these modifications were human-induced for either commercialization of the cave, control of cave access, or for mining. Improper gating and other structures have rendered many historical hibernacula unavailable to Indiana bats. Other documented threats involving hibernacula include human disturbance, vandalism, indiscriminate collecting, handling, and/or banding of hibernating bats, flooding of caves for reservoirs, and destruction by limestone quarries. Natural alterations of hibernacula can include flooding, entrance and passage collapse, and blocked sinkholes that can all alter the temperature regime

within the cave and even prevent entry by bats. Natural and human-induced changes to hibernacula can alter the climate required by Indiana bats that adversely affects the population.

Summer habitat modification is also suspected to have contributed to the decline of bat populations; however, it is difficult to quantify how forest management or disturbance may affect Indiana bats. Forests used by foraging and roosting Indiana bats during spring, summer, and autumn have changed dramatically from pre-settlement conditions. Forests have been fragmented in areas, fire has been suppressed, and much of the vegetation in flatlands (i.e., prairie) has been converted for agricultural purposes (Service 1999). Summer habitat can include small woodlots connected by hedgerows or extensive forests. The removal of such habitats is occurring rapidly in some portions of the Indiana bat's range due to urban development, mining, and other infrastructure, including roadways and utility corridors.

In addition, environmental contaminants (e.g., insecticides, metals) are considered a potential threat to Indiana bats (Service 2007). Documentation of adverse effects to bats from environmental contaminants is difficult. However, additional research should improve our knowledge of the effects of chemical contaminants on bats. More recently, climate change has been suggested as a cause of population shift from southern to northern hibernacula (Clawson 2002). Collisions with man-made objects (e.g., wind turbines, communication towers, and vehicles) also pose a potential risk for Indiana bats (Good et al. 2011).

Due to the species' low reproductive potential (i.e., ≤1 pup produced per adult female per year), threats that increase mortality or decrease recruitment are of particular concern. In cases where threats have been reduced (e.g., hibernacula have been properly gated to preclude disturbance), increases in population size have been noted. However, any increases in the population are expected to be gradual because biologically the species is not capable of responding through an increased reproductive rate (e.g., in response to low population densities or the amelioration of threats).

White-nose Syndrome

Prior to the current WNS epizootic, significant disease outbreaks affecting populations of Indiana bats or other North American bat species were not known. Since the 2007 Recovery Plan, WNS has emerged as an unprecedented threat to hibernating bat species in North America.

The following highlights some of the emerging information surrounding WNS. WNS was first documented at four sites in eastern New York in the winter of 2006-07, but photographic evidence emerged subsequently of apparently affected bats at an additional site, Howe's Cave, collected the previous winter in February 2006. WNS was named for a white, powdery fungus observed on the muzzles, ears, and/or wings of most infected bats as they hibernated. This previously unknown fungus, *Geomyces destructans,* is considered the causal agent of the cutaneous infection associated with WNS (Gargas et al. 2009). The origin of this cold-loving fungus (does not grow at or above 24ºC) remains unknown (Gargas et al. 2009), but its uniquely curved conidia (i.e., asexual spores) are morphologically identical to those of a *Geomyces* sp. observed growing on noses of some hibernating bat species in several European countries since

the 1980s (Martínková et al. 2010; Puechmaille et al. 2010) and preliminary DNA analyses indicate that the European fungus may be the same species (J. Foster, pers. comm., 2011). Cryan et al. (2010) found that damage to bat wings caused by *G. destructans* is sufficient to cause direct mortality and *G. destructans* has been conclusively shown to be the single causative pathogen (Lorch et al. 2011).

Behavioral changes are characteristic of WNS affliction. Service and state biologists in the WNS-affected areas have observed a general shift of animals from traditional winter roosts to colder areas, or to roosts unusually close to hibernacula entrances. There has also been a general lack of responsiveness by affected bats to human activity during hibernation. Animals have been regularly observed flying across the mid-winter landscape, and on occasions, carcasses of little brown bats by the hundreds to thousands have been found outside affected hibernacula with more found inside (USGS 2011). Hibernating bats with WNS apparently rouse much more frequently than normal (Reeder et al. 2010). Frequent arousal of bats leads to depletion of stored fat reserves before the end of winter. However, recent studies have documented that body mass index of bats entering hibernation has no relationship to WNS-related mortality (Reeder 2012).

The primary vector for transmission is believed to be bat-to-bat, but human-assisted transmission from WNS-affected hibernacula to unaffected hibernacula remains a possibility given results of cave sediment and field gear searches for *G. destructans* (Okoniewski et al. 2010; USGS 2009). In March 2009, the Service issued a cave advisory recommending that people refrain from entering caves and mines in WNS-affected and adjacent states.

Six bat species have been confirmed with WNS to date including the little brown bat, Northern long-eared bat, Indiana bat, eastern small-footed bat (*M. leibii*), tricolored bat (*Perimyotis subflavus*), and big brown bat (*Eptesicus fuscus*). *Geomyces destructans* has been detected on three additional hibernating bats, gray bat (*M. grisescens*), cave bat (*M. velifer*), and southeastern bat (*M. austroriparius*), but no evidence of clinical fungal infection was found and no mortality has been reported for these species (USGS 2010; Virginia Department of Conservation and Recreation 2010).

WNS has been confirmed in over 160 bat hibernacula in 16 states (Connecticut, Indiana, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Vermont, Virginia, and West Virginia), as well as four Canadian provinces. However, this quickly changes during a given winter and updated information on WNS is being maintained on the National WNS webpage at http://whitenosesyndrome.org. The annual distribution of WNS appears to be expanding rapidly from the initially affected hibernacula in western Albany/eastern Schoharie Counties, New York. The initial five sites where WNS was found in 2006 and 2007 were all within 15 km of a point that has come to be defined as the "epicenter." By April 2008, all of the hibernacula surveyed within 130 km of the epicenter were affected by WNS, and the farthest extent of the affliction reached approximately 200 km to a site near Watertown, New York. By the winter of 2008/09, affected sites had been discovered as far as 900 km from the epicenter, and by the winter of 2009/10, WNS had been confirmed 1300 km from the epicenter (Figure 12).

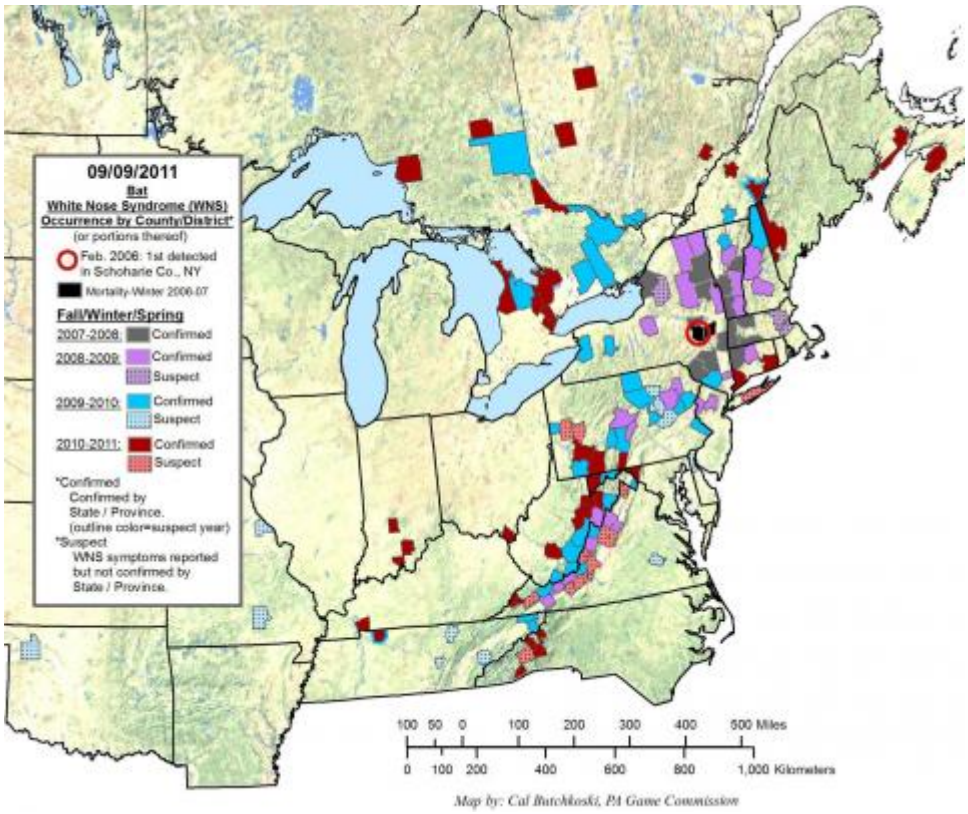

Figure 12. Distribution of counties affected by White-nose syndrome (WNS) as of September 9, 2011 (http://whitenosesyndrome.org).

Despite all of the unanswered questions about WNS, there are now four years of population monitoring data that provide valuable insight into the effects of WNS. Considering WNS has been affecting hibernating bat populations for the longest in New York (since February 2006), data from that state may provide the best indication of the effects of this disease on bats, including Indiana bats. By 2010, all known Indiana bat hibernacula in New York have been documented with WNS. However, the apparent effects of WNS on Indiana bats varied between affected hibernacula.

Overall mortality rates (primarily of little brown bats) have ranged from 21% to 100% at sites in the northeast where data have been collected for at least two years (Turner et al. 2011). While little brown bats appear to be the most affected of the cave-wintering bat species in the Northeast, Indiana bats have also been greatly impacted by WNS. It is important to note, however, that most of the affected species do not form large clusters in the winter, as little brown bats and Indiana bats do, and so they are not easily counted. Therefore, we have poor baseline estimates for other species at most sites by which to compare post-WNS abundance estimates.

New York's Indiana bat population estimates from the last five range-wide survey periods were: 2001 – 29,763; 2003 – 32,529; 2005 – 41,745; 2007 – 52,779 bats; 2009 – 34,045; and 2011 – 16,052 bats. The average increase between surveys between 2001 and 2007 was 21% (every two years). In sharp contrast, surveys conducted at New York's hibernacula during early 2008 (post-WNS) estimated the population at 31,206 Indiana bats (a drop of ~21,500 bats), which is a 40%

decrease from the previous year's estimate. From a broader perspective, the loss of 21,573 Indiana bats from WNS in 2008 in New York represented a loss of approximately 4.6% of the 2007 total population estimate for the species. In summary, since New York's high count in 2007, we have lost approximately 36,727 Indiana bats (69.6%).

Impacts to Indiana bats are inconsistent between affected hibernacula. When comparing the most recent counts to the last count conducted prior to signs of WNS at any given site (generally 2005 or 2007 counts), the following is a summary of what has been observed in New York at the larger sites (NYSDEC unpublished data):

Hailes Cave – 100% decline from 685 bats in 2005 to 0 every year since
Williams Preserve Mine – 99% decline from 13,014 in 2007 to 122 in 2011
Williams Lake Mine – 98.9% decline from 1,003 in 2007 to 11 in 2011
Glen Park – 77.5% decline from 1,928 in 2007 to 433 in 2011
Williams Hotel Mine – 73.7% decline from 24,317 in 2007 to 6,389 in 2011
Jamesville – 91.4% decline from 2,932 in 2007 to 251 in 2011
Barton Hill Mine – 13.7% increase from 9,393 in 2007 to 10,678 in 2010 and 30.7% decline to 7,398 in 2011

In summary, WNS has now been documented in winter sites in at least 16 states and four Canadian provinces, and the degree of impact to bats varies greatly by site and species. Based on observations of continued mass-mortality at several sites, we anticipate the loss of Indiana bats to continue in the Northeast/mid-Atlantic regions as well as the Midwest in future winters. In addition, we anticipate that WNS will continue to radiate out to new sites, however, the potential for climate, or some other environmental factor, to influence the spread of WNS, or the severity of its impact on affected bats, is unknown. Given the evidence to date, it is abundantly clear that WNS presents a significant threat to the species.

Previous Incidental Take Authorizations

Because of the level of population monitoring conducted on this species, we believe that we should be able to evaluate the overall impact of past projects through our annual counts. However, the impacts of WNS now confound this assessment.

All BOs previously issued by the Service involving the Indiana bat have concluded that the proposed actions were not likely to jeopardize the continued existence of the species. These formal consultations have involved a variety of action agencies including: (a) the USFS for activities implemented under various Land and Resource Management Plans on National Forests in the eastern United States, (b) the Federal Highway Administration (FHWA) for various transportation projects, (c) the Corps for various water-related projects, and (d) the Department of Defense for operations at several military installations. Additionally, an incidental take permit has been issued under Section 10 of the ESA to an Interagency Taskforce for expansion and related development at the Indianapolis Airport in conjunction with the implementation of a Habitat Conservation Plan (i.e., Six Points Road Interchange HCP). A table of all previous consultations can be found at http://www.fws.gov/midwest/endangered/mammals/inba/inbaBOs.html.

It is important to note that in many of these consultations, survey information was lacking. Consequently, the Service relied on a host of factors in helping the Federal agency determine whether Indiana bats were likely to be present. To ensure the Federal agency and Service met the mandate of the Section 7(a)(2), if the best available information suggested that Indiana bats may be present, the assumption was often made that one or more maternity colonies occurred within the action area.

Nearly all National Forests within the range of the Indiana bat have requested formal consultation at the programmatic level. Approximately 95% of previously authorized habitat loss on National Forests has not been a permanent loss. Rather, it has been varying degrees of temporary loss (short-term and long-term) as a result of timber management activities. Conservation measures implemented by the USFS as part of the proposed action, as well as reasonable and prudent measures provided by the Service to minimize the impact of the annual allowable take for each of the National Forests, have ensured an abundance of available remaining Indiana bat roosting and foraging habitat on all National Forests, and the persistence of any known or newly discovered maternity colonies.

The remaining incidental take statements have been issued to other Federal agencies (e.g., FHWA, Corps, Department of Defense). Unlike those issued for National Forest Land and Resource Management Plans, many of these projects were certain to affect habitat known to be occupied by Indiana bats. To minimize adverse effects on Indiana bats due to the permanent or temporary loss of habitat, the action agencies agreed to implement various conservation measures. These typically included minimization of project footprints; seasonal tree cutting restrictions to avoid direct effects on female Indiana bats and young; protection of known primary and alternate roost trees with appropriate buffers; retention of adequate roosting and foraging habitat to sustain critical life history requirements of Indiana bats in the future; permanent protection of habitat; and habitat enhancement or creation measures to provide future roosting and foraging habitat.

Take has often been authorized in the form of harm through a species surrogate (i.e., acres of forest) because of the difficulty of detecting and quantifying take of Indiana bats. This is due to the bat's small body size, widely dispersed individuals under loose bark or in tree cracks/crevices, and the unknown spatial extent and density of much of the summer population. Where more detailed information about Indiana bats is available (e.g., via telemetry studies), incidental take statements have included an estimate of the number of Indiana bats that are likely to be impacted.

While the above biological opinions contained detailed effects analyses and estimated the amount of incidental take anticipated, this was not the case for the biological opinion issued to the Office of Surface Mining (OSM) in 1996. In that opinion, the Service determined that surface coal mining activities conducted pursuant to the Surface Mining Control and Reclamation Act of 1977 would not jeopardize the continued existence of any Federally-listed species. The opinion did not quantify incidental take, but directed OSM and State regulatory authorities to coordinate project reviews with the Service to develop and implement species-specific protective measures. With regard to the Indiana bat, such measures were recently standardized across the species range for coal mining activities (Service 2009c). These national

guidelines provide for seasonal restrictions on tree cutting, and either reforestation of a portion of the mined lands or off-site conservation of forest habitat. Hundreds of acres of known Indiana bat habitat, and thousands of acres of potential habitat, are lost annually due to coal mining. The cumulative effects of this habitat loss are not known, although in some cases an attempt is made to assess effects on individual maternity colonies or hibernating populations and to quantify take. State regulatory authorities have been charged with coordinating with the Service, integrating species-specific protective measures into mining permits, quantifying and tracking incidental take, and ensuring that Federally-listed species, including the Indiana bat, are not jeopardized. Due to the disparate levels of project coordination and record-keeping from state-to-state, as well as sporadic integration of species-specific protective measures in mining permits, it is not known how much Indiana bat habitat has been lost rangewide over the past 14 years (since 1996), or how many maternity colonies and hibernating populations have been harmed or lost due to coal mining activities.

Two biological opinions (i.e., Great Smoky Mountains National Park, and Laxare East and Black Castle Contour Coal Mining project) and their associated incidental take statements anticipated the loss of a maternity colony. However, the other biological opinions did not anticipate losses of this magnitude. Required monitoring for at least four formal consultations (Camp Atterbury, Fort Drum Military Installation, Newport Military Installation, and Indianapolis Airport) has confirmed that the affected colonies persisted through the life of the project and continue to exist today. These monitoring results indicate that the conservation measures to avoid and minimize the impacts of Federal projects appear to be effective. Only with long-term monitoring will we be able to determine the true effectiveness of those conservation measures, and be able to judge whether our assumptions about project effects are accurate. However, the effects of WNS may confound monitoring, making it difficult to discern whether population declines have resulted from WNS or some aspect of the project.

There have been three previous projects with incidental take authorization for the Indiana bat in New York State – Adams Fairacre Farms commercial development in Dutchess County, the Fort Drum Connector highway project in Jefferson County, and 2009-2011 activities on Fort Drum Military Installation in Jefferson County.

Species Recovery

The first Indiana bat recovery plan was completed and approved in October 1983 (Service 1983). An agency draft of a revised plan was published in 1999 (Service 1999), but was never finalized. A revised draft recovery plan was published in 2007 (Service 2007), and although this plan has not been finalized, it represents the most complete synthesis of research, life history, status, and threat information, and therefore, serves as a source of the best available information for the species.

The 2007 plan outlines the strategy and actions necessary to recover the species. As explained in the recovery plan and discussed below, recovery units are designed to preserve sufficient representation, redundancy, and resiliency to ensure the long-term persistence of Indiana bat. It is important to note that recovery planning and implementation are ongoing and evolving processes. For example, WNS was not a threat at the time of the release of the 2007 plan, but is

now the primary threat being addressed by the Service. Generally speaking, we need to address persistent threats (such as WNS), and maintain viable maternity colonies, safe passage between summer and winter areas, and protected winter populations.

Recovery Units

In consideration of the conservation needs of the Indiana bat, the Service has proposed the use of recovery units to establish and focus recovery efforts. Recovery units are management sub-units that are geographically identifiable and essential to the recovery of the entire listed entity. Indiana bat recovery units have been delineated to conserve genetic and demographic robustness, and ensure this wide-ranging species continues to survive and recover within its historic range. The Service's proposed delineation of recovery units relied on a combination of preliminary evidence of population discreteness and genetic differentiation, differences in population trends, and broad-level differences in macrohabitats and land use. When recovery units delimitations suggested by these factors were geographically close to state boundaries, the recovery units borders were shifted to match the state boundaries in order to facilitate future conservation and management. The Indiana Bat Draft Recovery Plan proposes four recovery units for the species – Ozark-Central, Midwest, Appalachian Mountains, and Northeast (Figure 13) (Service 2007).

The proposed project is located within the Northeast Recovery Unit, which made up 3.8% of the range-wide Indiana bat population in 2011. Between 2001 and 2007, the hibernating population in this recovery unit increased from 30,343 to 53,763. However, in 2009, numbers decreased to 34,525 and in 2011 down to 16,060 with populations in this recovery unit expected to continue to decline over the next several years due to WNS, which has been documented throughout most of this recovery unit.

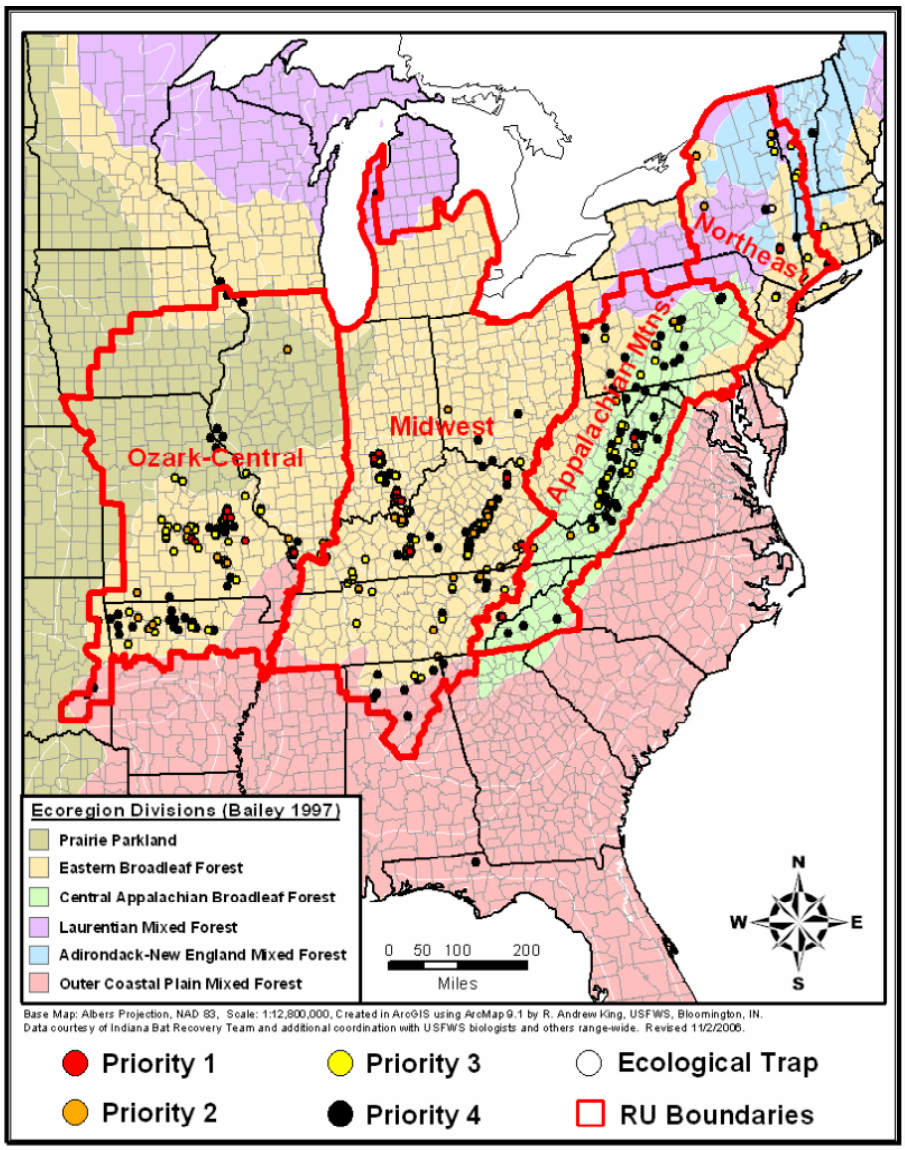

Figure 13. Proposed Indiana bat Recovery Units (Service 2007).

Range-wide Trend

A 5-year review of the Indiana bat's status was completed and published in September 2009 (Service 2009a). In light of the ongoing threat of WNS, the Service changed the "degree of threat" to the Indiana bat from "moderate" to "high." The high category means "extinction is almost certain in the immediate future because of a rapid population decline or habitat destruction", whereas the moderate category means "the species will not face extinction if recovery is temporarily held off, although there is continual population decline or threat to its habitat". Prior to emergence of the WNS threat, the Service considered the Indiana bat to have a "high" recovery potential (i.e., biological/ecological limiting factors and threats were well understood and intensive management was not needed and/or recovery techniques had a high probability of success). The Service now considers the Indiana bat to have a "low" recovery potential, because WNS is poorly understood and we currently have very limited ability to alleviate this threat. Consequently, the Recovery Priority Number for the Indiana bat was changed from "8" to "5", reflecting a species that currently faces a high degree of threat and has a low recovery potential.

The overall population distribution has not changed, however, the abundance of Indiana bats in the Northeast has declined significantly and the threat to the species from WNS remains at a high level. Recovery efforts are primarily focused on the WNS investigation at this time. When we consider the positive trends observed over the last several range-wide hibernacula counts (prior to WNS) along with the newly gathered information on WNS, we have concerns about the status of the species. As of the fall of 2011, the Service considers the 1-year trend (2010 to 2011) (annual required reporting metric) to be declining.

ENVIRONMENTAL BASELINE

Under Section 7(a)(2) of the ESA, when considering the "effects of the action" on Federally-listed species, the Service is required to take into consideration the environmental baseline. The environmental baseline includes past and ongoing natural factors and the past and present impacts of all Federal, State, or private actions and other activities in the action area (50 CFR 402.02), including Federal actions in the area that have already undergone Section 7 consultation, and the impacts of State or private actions that are contemporaneous with the consultation in process. As such, the environmental baseline is "an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including critical habitat), and ecosystem, within the action area (Service and National Marine Fisheries Service [NMFS] 1998, page 4-22)." The environmental baseline is, therefore, a "snapshot" of the species' health at a given point in time, but it does not include the effects of the proposed action.

Status of the Species in New York

Hibernating Population

In New York, winter counts ranged from 22 Indiana bats in 1981 (Hailes Cave only) to 52,779 in 2006-2007 (NYSDEC unpublished data). In that span, new sites or new sections of sites were

discovered and added to the surveys. In addition, in 2004-2005, the survey methodology in New York of taking photographs and counting bats back at the office was modified with enhanced digital photography imaging which greatly increased the quality of images and improved accuracy (C. Herzog, pers. comm.). The same digital photography methods have been used since that time resulting in high confidence in the survey results for sections of sites we can safely survey. Numbers have declined since 52,779 in 2007 to 16,052 in 2010-2011 (Service 2012).

Summer Population

Potential summer habitat occurs throughout much of New York. At least 39 documented maternity colonies have been indentified in nine counties including Cayuga, Columbia, Dutchess, Essex, Jefferson, Onondaga, Orange, Oswego, and Ulster. Many of these colonies have been located by tracking females as they emerge from hibernation to their spring roosting areas using radio telemetry. Each documented roost tree was recorded using a Global Positioning System handheld unit. Many of the radio transmitter batteries lasted into "summer" season (after May 15, or approximately 30 days) documenting the use of these sites by potential colonies. Many sites had large exit counts in spring either before or after May 15 and many sites were documented as colonies by subsequent mist-netting and radio telemetry efforts (Service unpublished data).

Critical Habitat

There is no Federally-designated critical habitat for the Indiana bat in the State of New York.

Threats

The primary threats to Indiana bats in New York at this time are WNS, energy development (wind power, natural gas), and residential and commercial development that fail to incorporate measures to maintain suitable Indiana bat habitat, and avoid and minimize impacts to maternity colonies and swarming bat populations.

Status of the Species within the Action Area

The identified action area includes the roosting and foraging habitat used by one maternity colony. We expect that bats from this colony are wintering at the nearby Glen Park hibernaculum given the close proximity. Studies in New York to date have documented localized dispersal between hibernacula and summer habitat (see discussion below). In addition, the action area is used in the fall, and likely the spring, by Indiana bats that hibernate in the nearby Glen Park Cave. Therefore, the status of the documented maternity colony, assumptions regarding the potential maternity colony, and the status of the nearby hibernating population are examined below.

Winter Hibernation

There are two hibernacula in Jefferson County, both of which are on privately owned lands (NYSDEC data). Glen Park is a Priority 2 hibernaculum with a maximum all-time population estimate of 3,129 bats in 1999 and recent counts of 2,264 – 2001; 1,704 – 2003; 2,065 – 2005; 1,908 – 2007; 1,247 – 2008; 1,719 – 2009; 509 – 2010; and 433 – 2011. Glen Park Commercial Cave is a Priority 4 hibernaculum with a maximum all-time population estimate of 32 bats and a maximum population estimate of zero since 2000 (Hicks and Novak 2002). Glen Park Commercial Cave is no longer routinely surveyed. WNS was first documented at Glen Park in January 2008. The status of the wintering population is clearly declining but perhaps there has been a leveling off of impacts between 2010 and 2011 given the slower rate of observed decline.

Glen Park Cave is located approximately 6.5 miles west of Fort Drum. The NYSDEC monitors Indiana bat use of the hibernacula by conducting biennial mid-winter counts. See **Status of the Species** Section for additional information.

Spring/Summer

The following is a summary of spring emergence and mist-netting field work conducted in and around the Action Area.

NYSDEC/Service Spring Emergence Study

In April 2005, 32 Indiana bats (30 females and 2 males) were captured at Glen Park Cave prior to spring emergence and fitted with radio transmitters (Hicks et al. 2006). Twenty-four females and two males were successfully tracked to at least one roost tree, and most were tracked for the life of the transmitters (3-4 weeks) all of which remained within 20 miles of their hibernaculum. Eight maternity colonies (conservative estimate) were identified during this project, although none on Fort Drum. Three of these were subsequently verified by additional mist-netting and radio-tracking studies (see below).

Eagle Ridge

During the summer (August 8-13) of 2006, four Indiana bats (three adult males and one post-lactating female) were captured during mist-netting associated with a residential housing project (Eagle Ridge) in the Town of LeRay, Jefferson County (Environmental Solutions and Innovations, Inc. 2006). Each bat was tracked for a minimum of six days after capture and eighteen day-roosts were located. Two of these roosted on Fort Drum (approximately 2.2 miles east of the project) and all four foraged in and around the Cantonment Area.

Fort Drum Connector

A total of seven mist-net sites were surveyed for the Indiana bat within and adjacent to the proposed FHWA/New York State Department of Transportation Fort Drum Connector project corridor from July 10-18, 2007. Additional project detail can be found in the Service's 2008 BO for the project (Service 2008) or the project BA (Gress Engineers, Inc. and FMSM Engineers,

Inc. 2007). Five reproductive female Indiana bats were captured during mist-net surveys. Radio-transmitters were attached to five adult female Indiana bats from July 10-18, 2007, so roost sites could be located. The five Indiana bats captured during this survey were tracked to 12 different diurnal roost trees located in six different areas. The distance between capture sites and roost sites, used by five Indiana bats captured during this survey, ranged from 0.08 to 4.00 miles (0.13 to 6.44 km).

Emergence counts were conducted at each tree to determine the number of bats occupying the roost on a given day. With the exception of five roost trees, biologists conducted three emergence counts on every roost tree documented during this survey. Emergence counts at roost trees ranged from 0 to 74 bats. Emergence count efforts at the Bonny Road tree produced counts of 74, 66, and 10 individuals on July 15, 16, and 22, respectively. This tree was also used by an Indiana bat tracked during a separate study in 2007 and we assume there is a maternity colony (Perch Lake WMA South maternity colony) associated with roosts in this area.

The roost tree near Perch Lake accounted for the second highest number of bats with 45, 28, and 19 individuals on July 16, 21, and 26, respectively. Emergence counts at one of the Knowlesville trees resulted in 32, 22, and 21 individuals on July 12, 14, and 16, respectively. Two other trees at Knowlesville were used by 14 and 10 bats, respectively. The Knowlesville trees are in very close proximity (< 0.75 mile) to previous roosts documented during the 2005 NYSDEC spring emergence study (Perch Lake maternity colony); the Perch Lake and Knowlesville roosts are within 2.5 miles of each other. This reconfirms the presence of at least one maternity colony in this area.

The three trees located adjacent to the Fort Drum Connector Route were all used by only one or two bats during emergence counts, which indicate their status as alternate roosts. The A-1 roost is within 1 mile of the Fort Drum roosts, within 2.5 miles of multiple roosts on the installation, and within 0.75 mile of multiple roosts documented during netting and tracking of four Indiana bats associated with the Eagle Ridge housing project (see above). Two bats tracked during this project spent all or most of their time on the military installation.

Fort Drum

The following information is summarized from the BA which is incorporated by reference.

As stated above, Indiana bats were first documented on Fort Drum in the summer of 2006.

From 2007-2011, mist net surveys were conducted at 323 sites on Fort Drum following Service guidelines. Of the 323 sites, 246 sites were surveyed once, while the remaining 77 sites were surveyed two or more times. In the summer of 2007, 1,369 bats were captured, of which 18 were Indiana bats (11 adult females, 2 adult males, 3 juvenile females, 2 juvenile males; ESI 2008a). Seventeen Indiana bats were captured in the Cantonment Area and one in Training Area (TA) 4. Ten of the 11 female Indiana bats were considered reproductive (i.e., pregnant, lactating, or post-lactating) and ten Indiana bats (7 adult females, 1 adult male, and 2 juvenile females) were radio-tagged and tracked to roosts. In 2008, mist net surveys were concentrated in the Training Area and captured 380 bats, including two Indiana bats (1 adult male and 1 adult female) in

Training Area 3 (Copperhead 2009). Both were radio-tagged and tracked to roosts in the Cantonment Area and TA3 and TA4. In 2009, 394 bats were captured in the Training Area; however, no Indiana bats were captured. Additionally, drastic drops in other myotine bats were first noted. In 2010, 648 bats were captured, of which two were Indiana bats (one adult male and one juvenile female). The adult male was captured in the Cantonment Area near the known maternity colony, however, the juvenile female was captured in TA8, marking the first time an Indiana bat had been captured outside the Cantonment Area or the adjacent TA3 or TA4. However, this bat was subsequently tracked back to roosts in the known maternity colony, approximately 8 mi (13 km) away (ESI 2011). In 2011, 456 bats were captured, including one Indiana bat (lactating female) (Fort Drum, unpublished data). This female was radio-tagged and tracked to roosts in the Cantonment Area. Therefore, all bats captured in the Training Area during surveys following Service mist-netting protocols have been tracked back to roosts within the known maternity area in the Cantonment Area.

In 2008 and 2009, a more extensive project was initiated with the U.S. Forest Service and West Virginia University (WVU) to capture and intensively radio-track Indiana bats in the Cantonment Area to determine foraging areas and roost locations during spring, summer, and fall. Mist netting was opportunistically selected. Between May 13 to the beginning of October in 2008, 12 Indiana bats (5 adult females, 3 adult males, 2 juvenile males, and 2 juvenile females) were captured, and 12 were radio-tagged and tracked. One adult female was originally captured in the summer of 2007. Two bats (1 adult male and 1 juvenile female) remained on Fort Drum until October 2. In 2009, 4 Indiana bats (3 adult females and 1 juvenile male) were captured and subsequently tracked. All bats used the known maternity use area in the Cantonment Area and foraged within the Cantonment Area, BCA, and lands adjacent to Fort Drum in the Town of LeRay.

Fort Drum has abundant potential roosting habitat for bats with forested land and snags common throughout the installation. In 2008, 2009, 2010, and 2011 (ESI 2010, ESI 2011, USFS 2011, Fort Drum, unpublished data), Indiana bats on Fort Drum demonstrated site fidelity by returning to several of the same areas – and in some cases the same roost trees – that had been previously identified.

Portions of Fort Drum's Cantonment Area appear to be important areas for Indiana bats since Indiana bats from both on- and off-post studies have been observed to repeatedly use the areas for roosting and foraging (ESI 2006, Service 2008, ESI 2008a, ESI 2011, USFS 2011). Within and immediately adjacent to the Cantonment Area on lands in the Town of LeRay, Indiana bats can be found in distinct clusters of activity (Figures 14 and 15) with documented roost switching and forage overlap by individual Indiana bats between these activity clusters (ESI 2008a, ESI 2008b, USFS 2011). These clusters of activity and associated roosts make up the known maternity colony on Fort Drum.

As of September 2011, 64 summer maternity roosts (those used by adult and juvenile females and juvenile males spring-August 15) have been located on Fort Drum (ESI 2006, ESI 2008a, Copperhead 2009, ESI 2011, USFS 2011). Confirmed roosts on Fort Drum have been primarily located in standing dead or dying trees or within dead tree limbs. The average diameter (measured in DBH) for summer maternity roost trees on Fort Drum is approximately 14.1 in

DBH (35.8 cm) with a range of 3.9-31.5 in DBH (9.9-80.0 cm). Although other projects (e.g., Interstate 81 Connector) have identified individual Indiana bats roosting both within and outside the boundaries of the BCA, all but six roosts found from Fort Drum-initiated projects have been located inside the BCA.

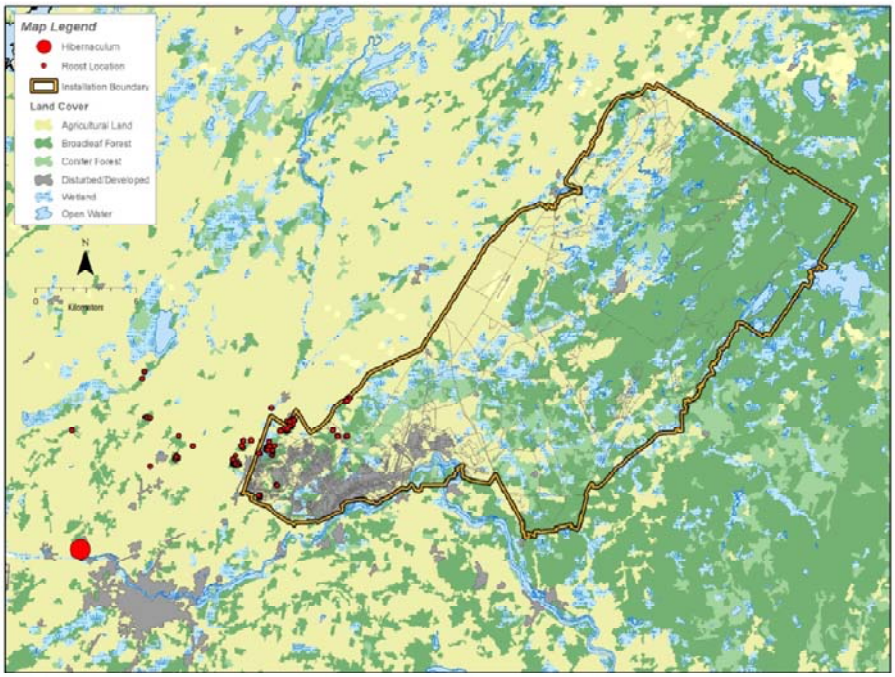

Figure 14. Known Indiana bat roost locations within and adjacent to Fort Drum.

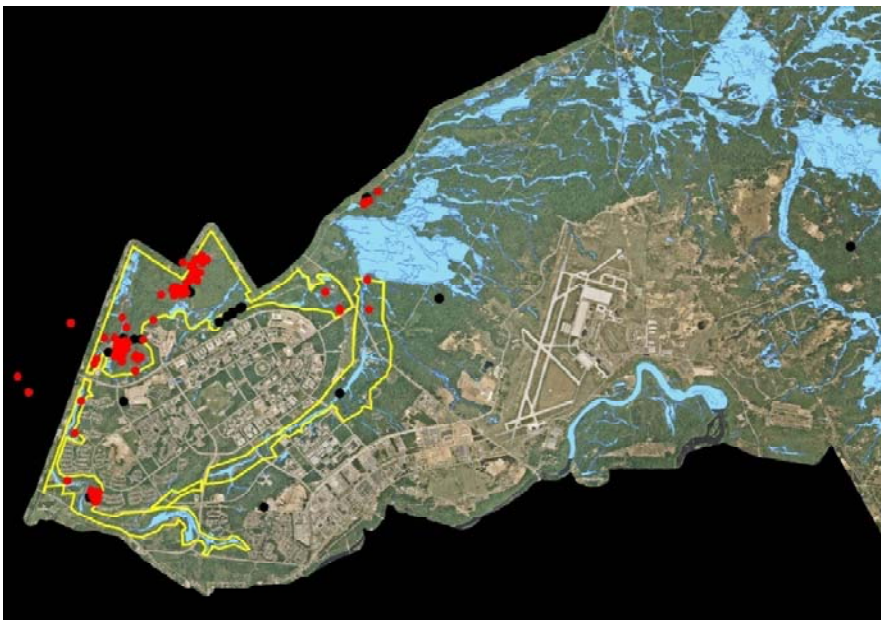

Figure 15. Known Indiana bat capture locations (black circles) and roost locations (red circles) from 2007 – 2010 on Fort Drum.

Existing data suggest that one maternity colony is present on Fort Drum. As discussed above, emergence counts at roost trees that were located by tracking radio-tagged Indiana bats across New York have ranged from 0 to 140 bats. The largest number of Indiana bats ever emerging from a roost on Fort Drum in a single night was 64 in 2008 (USFS 2011). Based on this information, it had previously been assumed that between 75-100 Indiana bats were present within this known maternity colony; however, due to impacts from WNS, this colony size has most likely decreased in size. Observed Indiana bat exit counts at individual roosts have declined post-WNS with 13 bats leaving a single roost in 2009, 12 bats in 2010, and 25 bats leaving a roost in 2011 (ESI 2011, USFS 2011, Army unpublished data). Based upon these data, we currently assume a maternity colony size of 25-50 Indiana bats.

We do not anticipate that Indiana bats frequently use the Main Impact Area for either roosting or foraging given the concentrated activity within the BCA and routine noise and fire from live fire within the Main Impact Area. Therefore, we do not anticipate any adverse effects to Indiana bats from activities conducted within the Main Impact Area.

Summary of Jefferson County Maternity Colonies

A minimum of 11 maternity colonies have been documented in Jefferson County (eight initially during the 2005 spring emergence study and three additional by a combination of other netting and telemetry work) (Table 2). One of these is located within the Action Area.

As of 2011, there are 433 Indiana bats remaining in the Glen Park winter population. Assuming a 50:50 sex ratio, 216 females are present for a total of 4-8 maternity colonies (25-50 adult females/colony). Drawing from empirical, albeit limited datasets, it is a reasonable prediction that some WNS impacted maternity colonies will become functionally extinct (i.e., no longer persist as reproductive unit on the landscape), while others may decrease in size to a lower level and stabilize or eventually rebound to pre-WNS levels. There is no post-WNS data for any of the maternity colonies besides the Fort Drum colony (and one year post-WNS for the St. Lawrence/Cape Vincent colony) to know whether 11 colonies are still on the landscape in small numbers or whether we have 4-8 remaining colonies. Future studies to reassess the presence of colonies across New York are needed.

Colony Number	Colony Name	Studies Verifying
1.	Conklin/Black Creek Maternity Colony	Hicks et al. 2006, Stantec Consulting 2008
2.	Morris Track Maternity Colony	Hicks et al. 2006, Stantec Consulting 2008
3.	Mitchell Maternity Colony	Hicks et al. 2006
4.	Perch Lake Maternity Colony	Hicks et al. 2006, Gress Engineers, Inc. and FMSM Engineers, Inc. 2007
5.	Cady Road Maternity Colony	Hicks et al. 2006
6.	Fralic Maternity Colony	Hicks et al. 2006
7.	Minkler Maternity Colony	Hicks et al. 2006
8.	Holmdale Maternity Colony	Hicks et al. 2006
9.	Perch Lake WMA South	Gress Engineers, Inc. and FMSM Engineers, Inc. 2007, Stantec Consulting 2008
10	Fort Drum	ESI 2006, Gress Engineers, Inc. and FMSM Engineers, Inc. 2007, Fort Drum 2007, ESI 2008 a,b, ESI 2010, ESI 2011, USFS 2011
11.	St. Lawrence/Cape Vincent	SEI 2007 a, b, c, SEI 2008 a, b

Table 2. Jefferson County, New York, maternity colony summary.

Non-reproductive Females and Males

Some male Indiana bats likely remain in and around Glen Park Cave during the summer. Non-reproductive females and males are less colonial than either reproductively active females or juveniles. Although there is little information available, male Indiana bats in the action area appear to have similar roosting preferences as females.

Fall Swarming

Because of Fort Drum's proximity to a Priority 2 hibernaculum, the potential exists for Indiana bats to use part of the installation for swarming. Indiana bats have been recorded using areas between 0.2-20.0 mi (0.32-32.0 km) from winter hibernacula during fall swarming (Service 2007).

A fall study in 2007 observed the presence of roosting and foraging Indiana bats (*n*=3) in the Cantonment Area as late as October 12 (ESI 2008a). Roosts that were located in the fall were approximately 7.7-9.5 mi (12.4-15 km) from the Glen Park hibernaculum. One tagged Indiana bat (juvenile female) was present on Fort Drum until October 10 when it flew to the Glen Park hibernaculum. The other two bats were also present on Fort Drum after October 1, but the signal was lost before it could be determined when the bats left Fort Drum for the hibernaculum. In total, 29 roost trees (2 partially dead, 2 live, and 25 dead trees) were located within the

Cantonment Area of Fort Drum during the autumn survey. Fourteen new roosts were located after October 1. In 2008, 11 new roost trees were identified in the Cantonment Area after August 15 (unpublished data). In addition, two juvenile Indiana bats (1 male, 1 female) were tracked in 2008 and were observed foraging and roosting on Fort Drum after October 1. Habitat use during the fall swarming period probably varies somewhat from year to year due to weather conditions, prey availability, and the proximity and quality of available roosts.

The Service recognizes that fall Indiana bat activity may last until November 15 across the range of the species (Service 2011a). However, at the northern edge of the species range average early November temperatures are not suitable for insect and bat activity. Therefore, in New York, the Service uses October 31 as the general date for end of bat activity absent additional site-specific information. The Army has proposed using October 15 as the date after which reduced activity by Indiana bats is anticipated based on their site-specific studies to date, as well as refined temperature information for their area.

The Army has presented an argument that fall swarming activities are mostly completed on Fort Drum by October 15 of any given year primarily based on the drop in temperatures experienced in this area of northern New York. Over an 11 year period from 2000-2010, the average minimum temperature on Fort Drum from October 1 - October 15 was 44ºF (6.7ºC), with 18 out of a possible 165 days (or on average 1.6 out of every 15 days) during that period dropping to or below freezing at night. Conversely, during the same period in 2000-2010, from October 16 - October 31, the average minimum temperature was 38ºF (3.3ºC), with 54 of a possible 176 days (or on average 4.9 out of every 16 days) during the period dropping to or below freezing. Additionally, from November 1 - November 15, the average minimum temperature on Fort Drum was 33.8ºF (1ºC), with 80 of a possible 165 days (or on average 7.3 out of every 15 days) during the period dropping to or below freezing (Fort Drum, unpublished data). Insect activity is greatly reduced at these lower temperatures, and bats would have great difficulty maintaining fat resources previously acquired if they routinely stayed active and on the landscape after October 15. The Service concurs with the Army's analysis that Indiana bats are unlikely to occur on Fort Drum after October 15 in any given year. However, if new information becomes available regarding warmer fall temperatures in the Action Area or new information about bat use in the fall, this window will need to be reconsidered.

Factors Affecting the Species' Environment within the Action Area

In order to ensure the consideration of all potential direct, indirect, and cumulative effects of the proposed action on the Indiana bat, the Army and Service determined that the action area under consideration includes Fort Drum, lands adjacent to Fort Drum in the Town of LeRay and north, those lands currently, or proposed to be, ACUB program, and Indiana bat swarming habitat on Fort Drum within approximately 20 miles of Glen Park Cave. Additional description of the action area is provided in the **Action Area** section above.

Numerous land use activities that affect the Indiana bat and that likely occur within the action area include hunting and other outdoor recreation, agriculture, timber harvest, and residential and commercial development associated with expansions at Fort Drum. Many of these are private actions, but many involve Corps permits pursuant to Section 404 of the Clean Water Act for

impacts to waters of the United States. The Service is unaware of any quantifiable information relating to the extent of private timber harvests within the action area. The Service is actively involved with reviewing most, if not all, development projects within the Town (regardless of other Federal [e.g., Corps] involvement). We are working with the Town and developers to conserve and connect suitable Indiana bat habitat whenever possible and hope to work with other towns in the area in a similar fashion.

There have been two previous projects with incidental take authorization for the Indiana bat in the vicinity of the Action Area, the 2009 BO for 2009-2011 Fort Drum activities, and the Fort Drum Connector highway project, located partially within the Action Area. The Fort Drum Connector BO was issued on June 27, 2008, and authorized harm of a small percentage of Indiana bats known to winter in the Glen Park Cave and who travel, roost, forage, and swarm within the action area and a small percentage of Indiana bats associated with three maternity colonies that are traveling, roosting, and foraging within the action area as a result of the removal of 36 acres of forest and 4,181 linear feet (1,274 m) of hedgerows, and the degradation of remaining forest patches (~102 acres) directly along the project corridor. This impact was anticipated in the first spring/summer after tree removal has occurred (spring 2010) and foraging patterns/range may be shifted. Alternative foraging areas are available in the Action Area and likely used (little foraging data are available) and limited impacts are anticipated in subsequent years. In addition, after several years, new tree plantings will provide additional commuting corridors and foraging opportunities for Indiana bats (Service 2008). We also anticipated mortality of a small number (< 10) of Indiana bats throughout the life of road operation.

In addition to land activities, WNS has affected Indiana bats in the action area. As stated in the **Status of the Species** section, WNS has been documented at Glen Park Cave. Overall, the status of the species in the Action Area is declining.

EFFECTS OF THE ACTION

"Effects of the action" refers to the direct and indirect effects of an action on listed species or critical habitat, together with the effects of other activities interrelated and interdependent with that action which will be added to the environmental baseline. The ESA defines indirect effects as those caused by the proposed action and that are later in time, but are still reasonably certain to occur (50 CFR §402.02). Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

There are activities within two categories proposed on Fort Drum between 2012 and 2014 that may result in adverse effects to Indiana bats – small wind energy development and military training smoke and obscurants.

This section includes an analysis of the direct and indirect effects of the proposed actions on the species and/or critical habitat and its interrelated and interdependent activities. While analyzing direct and indirect effects of the proposed action, the Service considered the following factors (which are discussed in greater detail later in the document):

Proximity of the action: As stated in the environmental baseline, one maternity colony is known to occur in the action area.

One Indiana bat hibernaculum (Glen Park Cave) is located approximately 6.5 miles west of Fort Drum. No designated critical habitat for the Indiana bat is located within the Action Area.

Suitable roosting and foraging for the Indiana bat occur within and adjacent to the project area. These habitats likely support summer roosting, maternity, and/or fall swarming periods of Indiana bats within the project area.

Distribution: Small wind turbine operation and smoke/obscurants may have direct effects on Indiana bats associated with one maternity colony on Fort Drum. Activities during the fall may also expose a small number of swarming Indiana bats associated with the Glen Park hibernaculum.

Timing: Indiana bats may be exposed to stressors associated with small wind turbine operation and smoke/obscurants during the spring, summer, or fall.

Nature of the effect: Indiana bats exposed to spinning turbine blades may be killed or injured as a result of collision or barotrauma (Grodsky et al. 2011). Smoke/obscurants could result in a range of effects from: a) minor injury; b) alteration and/or modification of normal Indiana bat behaviors (e.g., reproduction effects and sheltering behaviors); to c) mortality. Additional details are discussed below.

Frequency and duration: Small wind turbine operations will occur throughout the year; however, should ANY myotids be killed or injured from the turbines, operations will be restricted to periods when Indiana bats will no longer be exposed to any risk of collision or barotrauma.

Category 1 Smoke - A typical training exercise that uses smoke/obscurants and smoke generators would normally last from one to four hours.

Potentially up to 200 days of training could be conducted using fog oil each year. In those 200 days, approximately 270 generator-hours (number of hours each generator would operate annually x number of generators used on installation) would produce fog oil smoke per year.

Category 2 Smoke - Colored smoke can be used day of the year. Smoke typically lasts up to two minutes.

Disturbance intensity: Approximately 22,120 gallons of fog oil per year could be used on Fort Drum to produce fog oil smoke. The actual amounts of fog oil that would be used annually will likely never reach these established upper threshold quantities given the recent past history on Fort Drum. Although Category 1 smoke operations have not been utilized on Fort Drum in the past 5+ years, this type of training could occur on approximately 30,000 ac (12,140 ha) of the Training Area. Smoke training would be rotated regularly among multiple areas to minimize impacts to any one area of the installation.

Disturbance severity: A maximum of one Indiana bat could be injured or killed from collision with turbine blades or barotrauma. This is unlikely given that operations will be restricted to avoid periods when Indiana bats are not active should any myotid injuries or death be observed.

The likelihood of Indiana bats being exposed to any smoke/obscurants is very low given that smoke/obscurant deployment is away from the areas of Fort Drum with frequent Indiana bat activity. However, Indiana bats may periodically explore other parts of Fort Drum and it is possible that a few individuals may happen to be within close proximity to smoke/obscurant deployment. We anticipate minor injury to Indiana bats (e.g., irritation of respiratory systems) from exposure to smoke/obscurants or flushing prior to even that level of injury. Should a pup be left behind during the flushing, it may be killed due to inhalation of the smoke.

Analyses of Effects of the Action

A. Small Wind Study

As discussed in the Project Description, two turbines (overall height of 55-112 ft) will be placed in Training Area 4A. No Indiana bat habitat will be impacted by the construction of the turbines. We do not anticipate any impacts to Indiana bats from the minimal noise or human disturbance from maintenance of these two turbines as they will be similar in nature to routine activities occurring on Fort Drum. Therefore, we are analyzing potential impacts to Indiana bats from the operation of these turbines.

In order to test the efficacy of these types of turbines, they will be run 365 days a year, 7 days a week, when appropriate levels of wind are present. This would include the time of year Indiana bats may be present on the property and at the project site.

The turbines will be located approximately 2.7 km (1.7 miles) from the nearest documented Indiana bat roosts on Fort Drum. There are no documented movements of Indiana bats through the project area, but this is within the home range of the maternity colony and is directly between a documented mist-net capture of a juvenile in 2010 and known roosting areas. The turbines will be located approximately 200-275 meters from the nearest forest edge, but this location is not sufficiently far enough from Indiana bat habitat to avoid the chance of exposing Indiana bats to spinning turbine blades (Service 2011a). Therefore, we must consider the potential for collision or barotrauma from the two turbines.

While large wind projects have documented at least three Indiana bat mortality events associated with the operation of the turbines in the fall of 2010 and 2011 (Good et al. 2011, Service 2011b), there is limited available research on impacts of small wind turbines on bats. Barclay et al. (2007) compiled wind turbine and fatality data for 33 sites (21 of which adjusted fatality estimates for searcher efficiency and scavenger removal) across Canada and the United States and found that fatality rates of bats were relatively low (0-3.43 annual estimated bat fatalities/turbine) at short turbines (<65 m high), but bat fatalities increased exponentially with turbine height at or above 65 meters (1.19-42.7 annual estimated bat fatalities/turbine). There was no relationship between fatalities and rotor-swept area. Daily carcass monitoring (at sunrise) was conducted from May 25, 2007 - July 7, 2008, at a 10 kW (120-foot) turbine at the

Tom Ridge Environmental Center in Erie, Pennsylvania, and no bat carcasses were found (Anderson 2009). The report cites a similar lack of any observed bat carcasses at 6 other similar sites in Pennsylvania. In addition, no bat mortality was observed during fall 2010 and spring 2011 monitoring of a 20 kW turbine (115 feet) and 50 kW turbine (167 feet) at the Woodland Dunes preserve in Manitowac, Wisconsin (Knickelbine and Sontag 2011).

Given the proposed height of the two turbines, we anticipate similar bat fatalities as observed to date at the Pennsylvania and Wisconsin sites. Therefore, the risk of the two turbines impacting Indiana bats appears quite low (likely discountable risk). However, given the turbine locations, additional monitoring is necessary to fully inform our assessment of risk. Therefore, the small wind turbine site will be monitored in the morning daily during the year of installation for bat mortality events while the turbines are in operation from April 15 - October 15. The site will be cleared and graveled (or otherwise made suitable for unimpeded monitoring) under the turbines out to a proposed radius of one-and-a-half times the height of the horizontal axis turbine (168 ft, 51.2 m), and one time the height of the vertical axis turbine (55 ft, 16.8 m). Evidence suggests that >80% of bat fatalities fall within half the maximum distance of turbine height to ground (Erickson et al. 2003). The Army and Service will finalize post-construction monitoring protocols prior to turbine installation. The turbines will be placed far enough apart from one another and in such a manner as to be able to readily determine which turbine caused any potential mortality.

Both turbines will be equipped with a programmable brake that can automatically stop rotation of the blades at specific times or during specific wind speeds. Both turbines will also be established on tilt-type monopoles with no guy wires. If any myotid bats are killed during the operation of the turbines, the turbine will be braked to restrict operation to only the times when bats would not be present on the site (either during the day or at any time from October 15 - April 15). In summary, given the lack of observed bat carcasses at other small wind turbine locations, we do not anticipate any bats will be killed by the two turbines proposed on Fort Drum, but if any myotid fatality does occur, we do not expect more than one to be found on any given survey. If one is found, the turbines will have restricted operations. Therefore, the maximum number of Indiana bats we anticipate to be impacted by the two turbines is one.

B. Military Training Smoke and Obscurants

Guelta and Balbach (2005) found that fog oil smoke can penetrate tree cavities; while Indiana bats generally use cracks, crevices, and bark rather than cavities, we assume that smoke can also enter those spaces. We assume that other types of smoke can also reach roosting Indiana bats which may expose volant and non-volant individuals to potentially harmful chemicals via inhalation, ingestion, or through the skin. The smoke itself may force Indiana bats to abandon the roost, and smoke exposure can have harmful effects (acute or chronic, depending on dosage and exposure).

As discussed in the Project Description, the Army has classified smoke/obscurants into three categories of use on Fort Drum.

Category 1

Fog oil exercises are primarily conducted during daylight hours while Indiana bats are roosting; however, the BA stated that there is potential for use of smoke at night. The National Research Council (1997) conducted a review of research on the effects of fog oil on animals and found fog oil has low potential for acute toxicity (dermal exposure), little potential for acute lethality from ingestion, and may cause slight to moderate irritation after a single exposure directly to the skin. Fog oil has very low oral toxicity (3D/International Inc. 1996). Given this, bats would need to ingest large quantities to cause any impacts. Bats are not anticipated to ingest fog oil during foraging or drinking because fog oil does not persist in soil, sediment, or surface water (3D/International Inc. 1996). Direct exposure of Indiana bats to large amounts of fog oil, which would subsequently be ingested while grooming, would not be expected because we do not anticipate repeated exposure of any individual Indiana bat to fog oil. We anticipate Indiana bats would flush during fog oil deployment (see below). Inhalation is the most likely path of exposure of fog oil for Indiana bats.

Direct Effects to Roosting Bats

Given current restrictions, the closest a smoke operation could occur to a known Indiana bat roost is approximately 550 meters away in Training Area 3A. However, the likelihood that a smoke operation would occur there is extremely low for the following reasons: if unfavorable wind and weather conditions develop, smoke produced in that area would travel into the restricted smoke operation area (i.e., WSAAF, the Cantonment Area, or public highways). Therefore, it is more likely that smoke operations would occur in areas far enough away from these restricted areas as to not cause conflicts. Thus, the closest smoke operation to the known roost areas would more likely be greater than 7,000 meters away. In summary, the likelihood of Indiana bats being exposed to any fog oil is low, but not impossible. For the remainder of this discussion, we consider the effects of deployment at 7,000 meter distances. Should fog oil deployment occur in areas closer than 7,000 meters to the known roost areas, further consultation will be needed.

Inhalation effects from a given smoking exercise are predicted to be transitory, at most 2 hours in duration (Getz et al. 1996). The concentration of fog oil aerosols and rates of deposition are dynamic and highly dependent on local conditions such as the length of the military training exercise, distance from the source (i.e., generator), wind currents, temperature, humidity, local terrain, and precipitation. Some studies (Driver et al. 1993) have attempted to model the complex atmospheric conditions that affect fog oil smoke dispersion and deposition and determine estimates of fog oil concentrations in the atmosphere that could result from a typical smoke operation. Other studies have attempted to develop more realistic estimates of fog oil by sampling concentrations of fog oil in the field at various distances from the source. Table 3 (Table 2.6 in the BA) summarizes both types of studies.

Table 3. Estimates of fog oil concentrations resulting from typical smoke screening operations at given distances from the source.

Study	Distance from source (meters)	Average (mg/m3)	Range (mg/m3)	Maximum (mg/m3)
Lilegren et al. 1988[A]	100	7.7		
	200	3.6		
	400	2.6		
Policastro et al. 1989[A]	25	116		
	100	8		
	200	3		
Driver et al. 1993[B] (30 min release)	100	64.3	27-120	
	200	51.8	7-140	
	400	27.9	1.8-93	
	1000	6.9	1.6-24	
Driver et al. 1993[B] (300 min release)	100	64		
	200	29		
	400	8.7		
	1000	1.6		
Getz et al. 1996 (120 min release)	100	64	25-102	
	200	56	8-105	
	500	46	1.3-90	
	1000	13	0.8-25	
U.S. Army 1997[B]	100	3.8		13.5
	250	3.5		12.7
	500	2.7		11.2
	1,000	1.2		4.3
Department of the Army 1997 (30 min release)	100		0-14	
	1000		0.1-1	

A- Results from studies conducted in the field
B- Results from modeling

Table is summarized from Getz et al. 1996 and ENSR 1999.

Studies (summarized in Getz et al. 1996) have examined acute and chronic exposure concentrations to small mammals (e.g., mice, guinea pigs, hamsters, and rats). Although limited in scope and applicability, these studies do provide some estimates of impact, should Indiana bats be exposed to fog oil at various concentrations. Single 4-hour exposures of 200 mg/m^3 of S.A.E. motor oil smoke to mice and 1-hour exposure of 10-250 mg/m^3 of light lubricating oil smoke to guinea pigs resulted in minor respiratory irritation (Getz et al. 1996). Additionally, Driver et al. (2002) exposed red-winged blackbirds (*Agelaius phoeniceus*) to concentrations up to 400 mg/m^3 that resulted in no adverse affects to the birds. Similarly, exposure to brown-headed cowbirds (*Molothrus ater*) of cogenerated aerosols of graphite flake and fog oil concentrations of 100 and 120 mg/m^3 for 30 minutes a day for 4 consecutive days and exposure of red-winged blackbirds to cogenerated aerosols of 285 mg/m^3 and 300 mg/m^3 for 30 minutes a

day for 4 consecutive days did not result in any acute effects (mortality, clinical pathology, gross lesions, or behavioral deficits) (Driver et al. 2005).

The concentrations discussed above were 2-4 times greater than the modeled concentrations at 100 meters from the source of deployment and 12-50 times greater than the observed concentrations of fog oil at 100 meters from the source of deployment. Therefore, we would not anticipate any risk of acute toxicity from fog oil inhalation even as close as 100 meters from deployment. When considering that the Army has stated that deployment is far more likely at 7,000 meters from the known roosting area, it is also unlikely that fog oil would reach sufficient levels to result in any chronic, sublethal effects for individuals in the known colony.

Overall, we find that Indiana bats in the known roosting areas are unlikely to be exposed to concentrations of fog oil that will result in any direct effects.

It is possible that currently unknown roost sites may be discovered. In order to protect additional bats in these locations from high concentrations of fog oil, the Army has developed a conservation measure that will limit smoke operations within 100 meters of known maternity roost trees during the time of year Indiana bats are present on the installation (April 16 - October 14). By minimizing the concentration of smoke around maternity roosts at this time, it will reduce the risk of Indiana bats from abandoning roosts and/or non-volant pups. As discussed above, at this distance, Indiana bats (including pups) are unlikely to suffer acute effects; however, prolonged and repeated exposure to fog oil may cause adverse pulmonary and systemic effects which could reduce fitness and fecundity of Indiana bats (3D/International 1997a). The rotation of smoke/obscurants between areas will help minimize the Indiana bats' risk to chronic exposure to the point where adverse effects are not anticipated.

Although no adverse affects are anticipated to bats within the known roosts within the Cantonment Area and Training Areas 3 and 4, and future roosts will be protected as they are found, bats in currently unidentified roosts may be adversely affected by fog oil. Given that over five years, there have been only a small number of roosts (six known roosts, of which two were used by females) found in the Training Area 3 and some captures in Training Areas 3 and 4, the likelihood that unknown maternity roosts are present in additional Training Areas is low, but not discountable. Small numbers of Indiana bats may periodically use alternate roosts in the Training Area where fog oil deployment may occur. Indiana bats roosting in close proximity (<100 meter) to fog oil operations would be exposed to higher concentrations. Dickinson et al. (2009) found that radio-tracked northern long-eared bats, an Indiana bat surrogate, flushed shortly (within 10 minutes) after prescribed fire ignition within 20 meters of roosts in the Daniel Boone National Forest in Kentucky on a warm spring day. Deployment of fog oil smoke near roosts would most likely cause adult Indiana bats to similarly flush from the roost with minor or no direct injury. However, if there are non-volant pups present that the adults fail to move, these pups could be killed directly by the fog oil exposure, or indirectly by the adults abandoning the roost. If Indiana bats flush during the day, that would pose additional risk of predation for the adults.

Direct Effects to Foraging Bats

We agree with the assessment provided in the BA and summarized here. Most known foraging typically occurs within the Cantonment Area, the BCA, and off post. Given current restrictions, the closest a smoke operation would occur to these known foraging areas is approximately 2000 meters away in Training Area 3A. However, as discussed above, the likelihood that a smoke operation would occur there is extremely low. Thus, the closest smoke operation to the known foraging areas would more likely be greater than 8,000 meters away.

It is not expected that smoke operations would be conducted during hours that Indiana bats will be active for foraging; however, if they were conducted when Indiana bats are foraging, bats have the ability to avoid the smoke and chemicals and are anticipated to forage in adjacent areas, thus limiting exposure. We do not anticipate any short term displacement (should it occur) to rise to the level of an adverse effect to Indiana bats given the vast amount of suitable (and documented) foraging area available on Fort Drum. In addition, should Indiana bats continue to forage in the general vicinity of fog oil deployment, at temperatures between 0-40°C, volatization of fog oil exposed to air will result in a 30-40% decrease in fog oil mass within an hour, and 80-90% reduction within a week (Driver et al. 1993). Therefore, it would not be expected that Indiana bats in the known foraging area would have large amounts of fog oil deposited on their skin and fur to be ingested while grooming. Given all these considerations, the likelihood that there will be adverse effects to foraging Indiana bats from fog oil ingestion or inhalation is discountable.

Indirect Effects

As stated above, at temperatures between 0-40°C, 30-40% of fog oil evaporates in the air within an hour, and 80-90% evaporates within a week (Driver et al. 1993). Retention of fog oil may vary by soil type (Driver et al. 1993). Chemicals known to occur in fog oil did not appear in soil samples, or were generally present in the same concentrations at exposure and control sites from Fort McClellan, Alabama (3D/Environmental 1996). For the few chemicals where significant differences were observed between exposure and control sites, the control site had greater concentrations of most chemicals. Similarly, snow core samples were taken along roadways in Fairbanks, Alaska, and at Fort Greely, Alaska, during fog oil training. Total petroleum hydrocarbon concentrations in the urban snow samples were 450 times greater than the maximum total petroleum hydrocarbon concentration measures in snow exposed to fog oil training (Douglas et al. 2006). Overall, the chemical concentrations detected at Fort McClellan were very low and indicate no fog oil hydrocarbons are concentrating in the soil (3D/Environmental 1996). There was also no statistically significant difference in concentrations of fog oil hydrocarbons sampled from vegetation or insects at Fort McClellan (3D/Environmental 1996). Fog oil is biodegraded by microorganisms and is soluble in water where it undergoes chemical degradation (3D/International, Inc. 1997a). Impacts to localized (<0.1 km) insect populations may occur if insects are coated with fog oil; however, the volatile nature of fog oil aerosols suggests that impacts would be attenuated rapidly (Driver et al. 1993). Given the amount of suitable foraging habitat available, and the anticipated highly localized,

short-term impacts to insect populations, we do not anticipate any indirect effects to Indiana bats from fog oil.

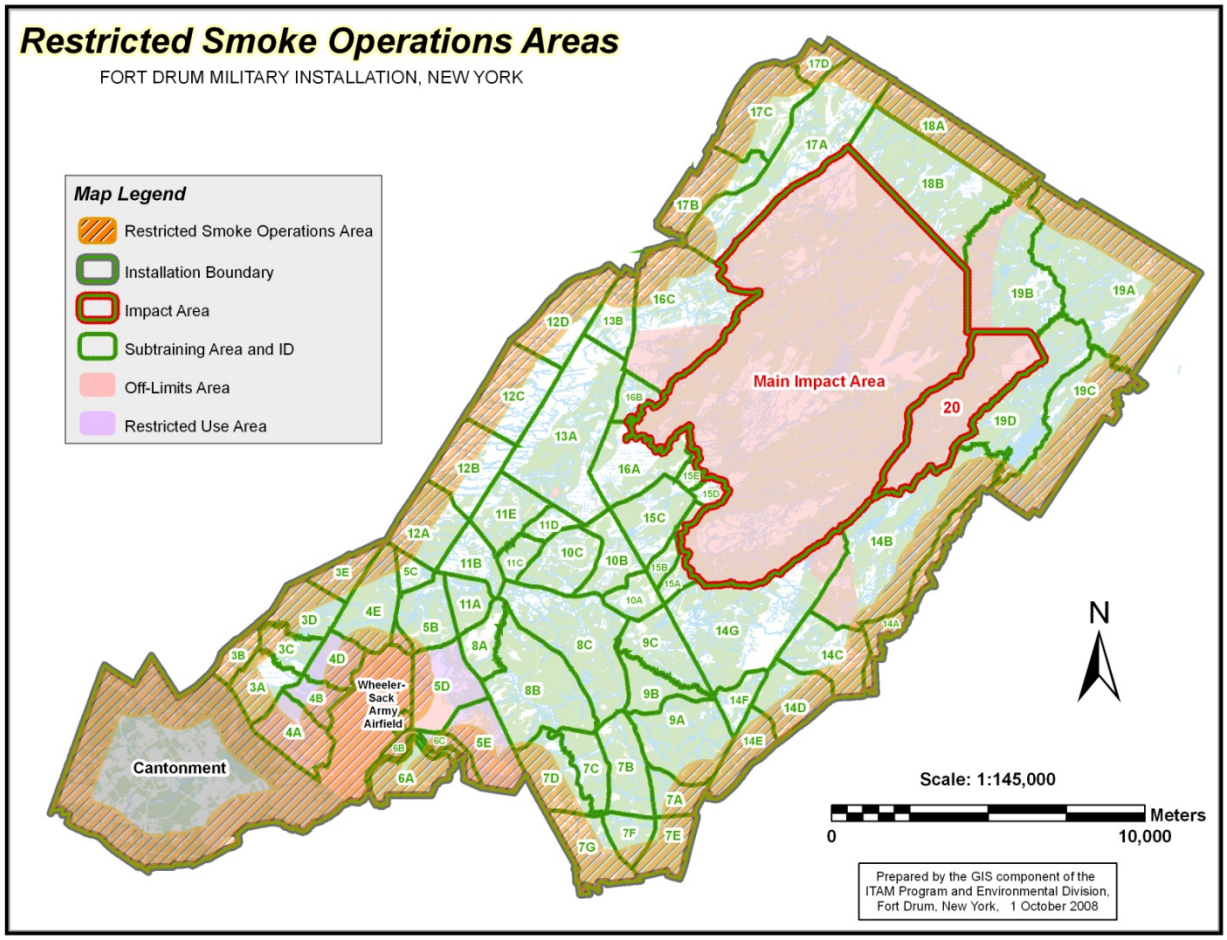

Figure 16. Buffer (1000 m) around Fort Drum where smoke operations are prohibited per Fort Drum Regulation 350-4 Range Regulation.

Category 2

The following information is from the BA. Overall data on the toxicity of colored smoke and TPA is limited; however, there is concern about effects regarding dermal and respiratory-tract sensitization (National Research Council 1999b). From the available information, it appears colored smoke has varying effects to small mammals dependent on color type and formulation (National Research Council 1999b). Some symptoms that were observed in mammals after a variety of exposure trials (e.g., ingestion, dermal application, inhalation) included reduced growth rate in juveniles, respiratory afflictions, and sensitization of skin. An Ecological Risk Assessment prepared by 3D/International (1997b) found there may be possible effects of inhalation of M18 colored smoke to Indiana bats from acute exposure (minor respiratory inflammation) and/or chronic exposure (slight decrease in body weight gain or minor respiratory irritation). Because the potential toxicity of colored smoke is unknown, it was recommended by

the Subcommittee on Military Smokes and Obscurants (National Research Council 1999b) that soldiers only use colored smoke for signaling and marking and not obscuring. This measure was to minimize exposing soldiers to colored smoke before appropriate acute toxicity and inhalation studies could be conducted. By using colored smoke as a signaling/marking tool, it will not be broadly dispersed, which also minimizes the risk of smoke exposure to Indiana bats. M18 colored smoke grenades have >98% burn efficiency indicating that nearly all chemical components are converted to smoke, leaving little residue that could end up on fur and possibly ingested (3D/International 1997a). An ecological risk assessment of M18 colored smoke grenades found that ingestion and dermal absorption were unlikely and inhalation is the most likely path of exposure of colored smoke for Indiana bats (3D/International 1997a).

Direct Effects to Roosting Bats

Based on recent information from the Training Area, Category 2 colored smoke has only been utilized around known Indiana bat areas on Fort Drum very infrequently (two times), and the closest use was approximately 365 meters of roosts (and 100 meters from the edge of the BCA). The second known deployment was 1,700 meters from the nearest known roost (and 700 meters from the edge of the BCA). However, unsafe concentrations (as determined during the ecological risk assessment) of colored smoke travel less than 30 meters of deployment (3D/International 1997a). Within the known maternity roosting area, it is unlikely that this would ever happen, because in the BCA (where 90% of known roosts are located), smoke will not be used within 100 meters of forested areas during the non-hibernation season except at one of the three MOUTs (Figure 17). In addition, the closest mobile MOUTs are approximately 575 and 875 meters from known maternity roosts. Therefore, we do not anticipate any direct effects to roosting bats from Category 2 smoke use at MOUTs. In the Training Areas, the Army does not use any Category 2 smoke within 100 meters of currently known roosts from April 15 - October 15. If any additional roosts are found in the Training Areas, a similar restriction will be applied. Finally, Category 2 smoke typically lasts only approximately two minutes in duration, making the likelihood of exposure extremely limited regardless of location of deployment. We agree with the Army's assessment that adverse effects to Indiana bats within the known roosting area from Category 2 smoke are unlikely.

Although no adverse affects are anticipated to bats within the known roosts within the Cantonment Area and Training Areas 3 and 4, and future roosts will be protected as they are found, bats in currently unidentified roosts may be adversely affected by colored smoke. Given that over five years there have been only a small number of roosts (six known roosts, of which two were used by females) found in the Training Area 3 and some captures in Training Areas 3 and 4, the likelihood that unknown maternity roosts are present in additional Training Areas is low, but not discountable. Small numbers of Indiana bats may periodically use alternate roosts in the Training Area where colored smoke deployment may occur. As discussed in the fog oil section, Dickinson et al. (2009) found that radio-tracked northern long-eared bats flushed shortly (within 10 minutes) after prescribed fire ignition within 20 meters of roosts in the Daniel Boone National Forest in Kentucky on a warm spring day. Given that colored smoke typically lasts only two minutes in duration, Indiana bats may or may not flush from roosts. If colored smoke or other smoke grenades are deployed within 30 meters of the unknown roosts, bats may inhale unsafe quantities of smoke, which could result in minor respiratory changes (3D/International

1997a). Therefore, based on the above discussion, we find that colored smoke operations may result in minor injury (e.g., respiratory irritation) to a small number of Indiana bats in unknown roosts in the Training Area.

While minor effects may occur from short-term exposure, effects from chronic exposure are not expected because Indiana bats are not anticipated to sustain repeated exposures of Category 2 smoke. This is because there is only a small probability that any Indiana bats will be in close proximity (<30 meters) to a given Category 2 smoke deployment. As Category 2 smoke operations may occur throughout the Training Area, we would not anticipate the same individual bat to routinely occur in close proximity to repeated deployments in different locations. In their Ecological Risk Assessment, 3D/International (1997a) similarly determined there would be no chronic effects from M18 colored smoke to Indiana bats.

Direct Effects to Foraging Bats

We agree with the assessment provided in the BA and summarized here. Most known foraging typically occurs within the Cantonment Area, the BCA, and off post. Although Category 2 colored smoke has only been utilized around these known Indiana bat foraging areas in the past, it has been infrequent (fewer than 10 times known). In the BCA, smoke will not be used within 100 meters of forested areas during the non-hibernation season, but could be used at the three MOUTs (Figure 17) between April 15 - October 15 (only one of which is located within the BCA and 100 meters from forested areas). However, Category 2 smoke typically lasts only approximately two minutes in duration, making the likelihood of exposure extremely limited even if bats were flying near the MOUTs. Further, if Category 2 smoke is deployed near where Indiana bats are foraging, bats have the ability to avoid these areas and are expected to forage in adjacent areas, thus limiting exposure. We do not anticipate any short term displacement (should it occur) to rise to the level of an adverse effect to Indiana bats given the vast amount of suitable (and documented) foraging area available on Fort Drum. Given these considerations, the likelihood that Category 2 smoke would have adverse affects to foraging Indiana bats is discountable.

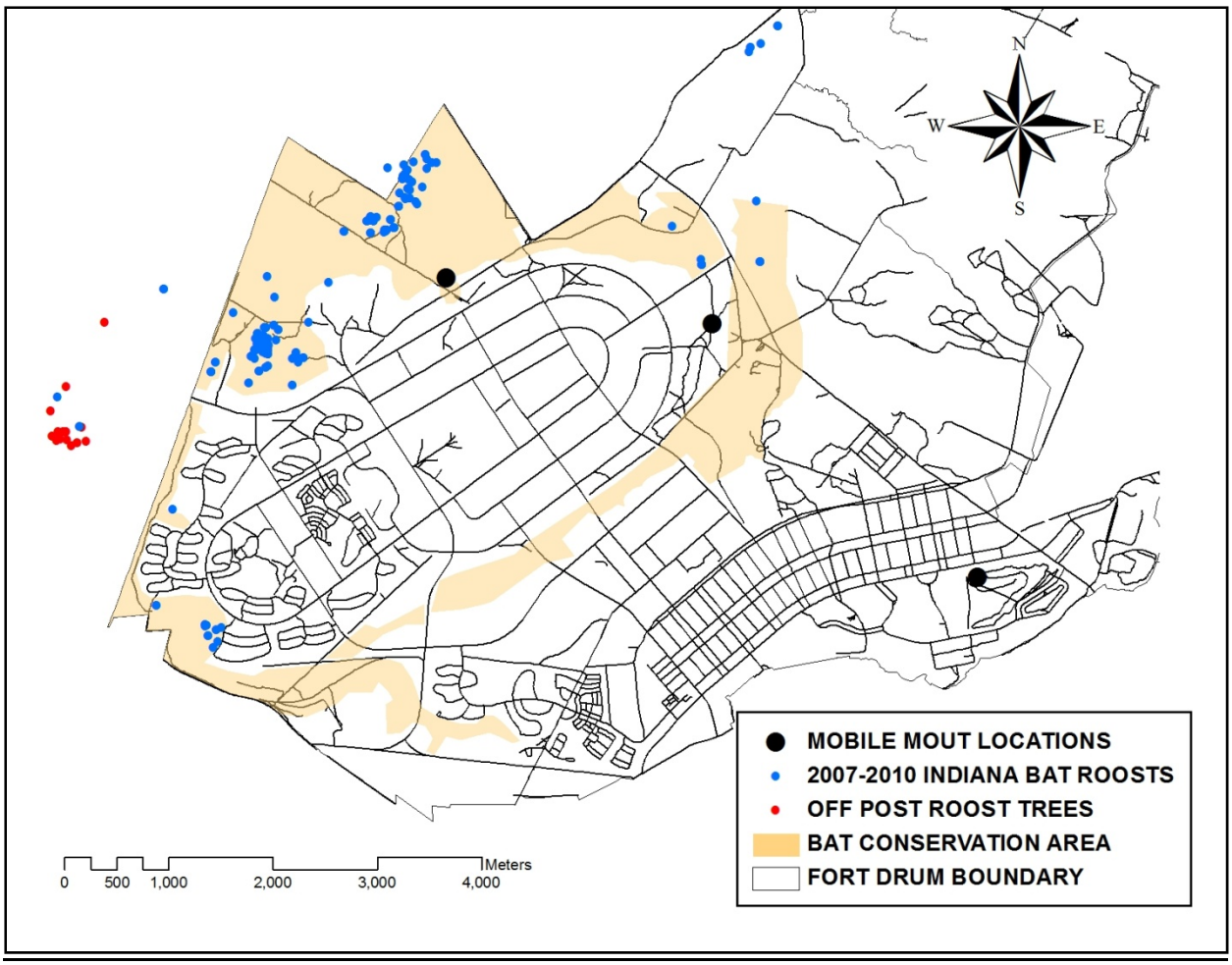

Figure 17. Mobile MOUT locations in the LTAs within the Fort Drum Cantonment Area.

Indirect Effects

We do not anticipate any indirect effects to Indiana bats from Category 2 smoke operations. Category 2 smoke deployments last two minutes in duration and no long term impacts after deployment are anticipated. Prey species are unlikely to be affected by exposure to terephthalic acid (TPA) in smoke through aquatic pathways (3D/International 1997b). The primary combustion products of TPA are carbon monoxide, carbon dioxide, sulfur dioxide, benzene, toluene, and formaldehyde and are released in a gaseous state. If small quantities enter groundwater or surface water systems, they will be biodegraded by microorganisms (3D/International 1997a). Given the amount of suitable foraging habitat available, and the anticipated highly localized, short-term (if any) impacts to insect populations, we do not anticipate any indirect effects to Indiana bats from Category 2 smoke operations.

Category 3

White phosphorous ignites when it is exposed to air. Smoke typically lasts up to 15 minutes. WP can result in severe burns if it comes into contact with the skin and it is highly toxic if

ingested (National Research Council 1999a). Inhalation studies of WP on mice, rats, and goats showed signs of respiratory tract irritation (National Research Council 1999a). Rats exposed to WP for 15 min/day, 5 days/week for 13 weeks at 1,740 mg/m^3 (H_3PO_4) resulted in the death of 32% of the rats within 6 weeks. LC_{50} for rats exposed to WP for 1 hour ranged from 1,300 to 4,800 mg/m^3. Reproduction and development of rats showed that higher WP exposure (1,742 mg/m^3 for 15 min/day, 5 days/week for 10 weeks) were associated with lower natal weights and had severe effects on survivability (National Research Council 1999a).

Direct Effects to Roosting Bats

Currently, the use of WP is restricted to the ranges or the Main Impact Area and is used infrequently. As noted above, Indiana bats are presumed to be absent from these areas. Although wind could disperse WP beyond these boundaries, there are currently no known roosts located within approximately 7.5 miles (12 km) of the ranges or the Main Impact Area and no Indiana bats have been captured within 3 miles (4.8 km) of the ranges or the Main Impact Area.

Because of the distance between the known roosting area of the colony and WP training sites, the infrequent and variable deployment of WP, and the limited likelihood that Indiana bats would be using the ranges or Main Impact Area, effects of WP on Indiana bats roosting within the known maternity colony are presumed to be discountable. Additionally, it is unlikely that WP smoke will drift and adversely affect the known roosts.

Although no adverse affects are anticipated to bats within the known roosts within the Cantonment Area and Training Areas 3 and 4, and future roosts will be protected as they are found, bats in currently unknown roosts may be adversely affected by WP Category 3 smoke. Given that over five years there have been only a small number of roosts (six known roosts, of which two were used by females) found in the Training Area 3 and some captures in Training Areas 3 and 4, the likelihood that unknown maternity roosts are present in additional Training Areas is low, but not discountable. However, while Indiana bats may roost in the Training Areas, we do not expect any Indiana bat activity within the primary zone of WP deployment (Main Impact Area) or routine Indiana bat activity near the ranges (given the distance from all roosts observed to date). In conclusion, direct effects to roosting Indiana bats from WP deployment are unlikely to occur.

Direct Effects to Foraging Bats

Currently, the use of WP is restricted to the ranges or the Main Impact Area and is used infrequently. Although wind could disperse WP out of those areas, there are currently no known foraging locations within approximately 12 km (~7.5 mi) of the ranges or the Main Impact Area. It is known that the Cantonment Area colony members utilize the Training Area; however, only 4 Indiana bats have been captured in the Training Area. No Indiana bats have been captured within 3 mi (4.8 km) of the ranges or the Main Impact Area.

Because of the distance between the known roosting area of the colony and WP training sites, the infrequent and variable deployment of WP, and the limited likelihood that Indiana bats would be using the ranges or Main Impact Area, effects of WP on Indiana bats foraging within the known

maternity colony are presumed to be discountable. It is unlikely WP smoke will drift and adversely affect the foraging bats

If Indiana bats are foraging in the Training Area and encounter a Category 3 smoke deployment, there is a possibility that bats could be exposed to potentially harmful chemicals. However, bats are anticipated to avoid these areas, thus limiting exposure. We do not anticipate any short term displacement (should it occur) to rise to the level of an adverse effect to Indiana bats given the vast amount of suitable (and documented) foraging area available on Fort Drum. There are large areas of suitable foraging habitat throughout the Training Area. As such, Category 3 smoke may affect, but should not adversely affect Indiana bats as they forage in unknown areas in the Training Area.

Indirect Effects

We do not anticipate any indirect effects to Indiana bats from WP. WP smoke lasts 15 minutes and no long term impacts after deployment are anticipated. Given the amount of suitable foraging habitat available, and the anticipated highly localized, short-term (if any) impacts to insect populations, we do not anticipate any indirect effects to Indiana bats from Category 3 smoke operations.

CUMULATIVE EFFECTS

Cumulative effects include the combined effects of any future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation under Section 7 of the ESA.

As stated in the **Environmental Baseline** section, hunting and other outdoor recreation, agriculture, timber harvest, and residential and commercial development are reasonably certain to occur within the action area. Many of these are private actions, but many involve Corps permits for impacts to waters of the United States or are activities conducted on Fort Drum and authorized by the Department of Army. The Service is unaware of any quantifiable information of private timber harvests within the action area. The Service is engaged with the Town of LeRay and developers to conserve and connect suitable Indiana bat habitat whenever possible and hope to work with other towns in the area in a similar fashion.

CONCLUSION

After reviewing the current status of the Indiana bat, the environmental baseline for the action area, the effects of the proposed activities on Fort Drum (2012-2014), and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Indiana bat. Critical habitat for the Indiana bat has been designated at a number of locations throughout its range; however, this action does not affect any of those designated critical habitat areas and no destruction or adverse modification of that critical habitat is expected.

Because of our analysis, we do not believe that the proposed action "would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the Indiana bat by reducing the reproduction, numbers, or distribution of the Indiana bat (50 CFR 402)." For the proposed action to "reduce appreciably" the Indiana bat's survival and recovery, the proposed action would have to impede or stop the process by which the Indiana bat's ecosystems are restored and/or threats to Indiana bat are removed so that self-sustaining and self-regulating populations can be supported as persistent members of native biotic communities (Service and NMFS 1998, page 4-35). We do not believe the proposed project impedes or stops the survival and recovery process for the Indiana bat because:

While analyzing the effects of the proposed action, we identified the life stages that would be exposed to the stressors associated with the proposed action, and analyzed how those individuals would respond upon exposure to the stressors. From this analysis, we determined that:

1) There is no designated critical habitat for the Indiana bat within the Action Area, and thus, none will be adversely affected.

2) No hibernating bats nor their hibernacula will be exposed to the project stressors as there are no hibernacula within the vicinity of the Action Area.

3) Indiana bats during the spring-fall period will be exposed to various project stressors and are likely to adversely respond to some of them. As stated in the environmental baseline, we believe that one maternity colony and an unknown number of adult males occur in the Action Area.

Turbine operation is expected to occur year-round, posing an ongoing risk of death or injury to Indiana bats occurring in the Action Area during the spring, summer, and fall swarming periods when bats are active. As a result of the proposed conservation measures, we anticipate that a maximum of one Indiana bat may be killed from the proposed operation of two small wind turbines.

The majority of maternity roosts (all but two) are located in areas far from any likely deployment of smoke and obscurants; however, we considered the possibility for exposure to Indiana bats at currently unknown alternate roost sites in close proximity to deployment locations. If this should occur, we anticipate minor respiratory effects and possibly harassment of a small number of Indiana bats that may flush during daylight and temporarily or permanently abandon their roosts (which may have pups). In addition, mortality of pups is possible from inhalation of the chemical smoke.

As we have concluded that individual Indiana bats are likely to experience reductions in their annual or lifetime reproductive success, we need to assess the aggregated consequences of the anticipated reductions in fitness (i.e., reproductive success and long-term viability), of the exposed individuals on the population(s) to which these individuals belong. The level of anticipated take is not expected to measurably decrease the reproductive potential of the maternity colony or its associated winter population at Glen Park because we generally do not anticipate lethal take. However, we recognize the potential for lethal take of one adult and a very

small number of pups. Indiana bat colonies should be able to sustain the worst-case losses discussed above.

As reductions in the maternity colony's and associated wintering population fitness are unlikely to occur, we do not anticipate a reduction in the likelihood of both survival and recovery of the Northeast regional population (proposed Northeast Recovery Unit) or the species as a whole. In fact, we find that many of the proposed actions of the Army, including the proposed conservation measures (e.g., protection of 2,202 acres within the BCA, implementation of light minimization measures across Fort Drum), are likely to result in benefits to the species. No component of the proposed action is expected to result in harm, harassment, or mortality at a level that would reduce appreciably the reproduction, numbers, or distribution of the Indiana bat. While we recognize that the status of the species is uncertain, we considered the environmental baseline, and the intensity, frequency, and duration of the project impacts, and found that the proposed project is unlikely to greatly decrease the reproduction, numbers, or distribution of the Indiana bat.

INCIDENTAL TAKE STATEMENT

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

The measures described below are non-discretionary, and must be undertaken by the Army so that they become binding conditions of any funding, permits, and/or approvals, as appropriate, issued to any other Federal agencies or contractors on Fort Drum for the exemption in Section 7(o)(2) to apply. The Army has a continuing duty to regulate the activity covered by this incidental take statement. If the Army 1) fails to require Army personnel, other Federal agencies, or contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, authorization, or funding document; and/or 2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Army must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement (50 CFR §402.14(I)(3)).

AMOUNT OR EXTENT OF TAKE ANTICIPATED

We anticipate one dead or injured Indiana bat due to impacts from small wind turbine operation and harassment to mortality of a small number Indiana bats associated with smoke and obscurant operations.

The Service anticipates incidental take of the Indiana bat from smoke and obscurant operations will be difficult to detect for the following reasons:

1. The individuals are small and occupy summer habitats where they are difficult to find;

2. Indiana bats form small (i.e., 25-100 individuals), widely dispersed maternity colonies under loose bark or in the cavities of trees, and males and non-reproductive females may roost individually which makes finding the species or occupied habitats difficult; and

3. Finding dead or injured specimens during or following project implementation is unlikely.

As discussed in the BA and above, 120 total roosts (64 summer maternity roosts) have been documented on Fort Drum to date. All but seven of these have been found in the BCA. Three of these were female roosts in the Cantonment Area in locations where smoke cannot be deployed. The remaining four documented roosts outside the BCA were male roosts in the Training Area. Four additional roosts associated with Army studies have been documented outside of Fort Drum. All known roosts have measures to protect bats from smoke impacts. In addition, of the 38 Indiana bats captured during protocol surveys, 34 were captured in the Cantonment Area, two in TA 3, one in TA 4, and one in TA 8. All bats captured in the Training Area were subsequently radio-tracked back to roosts in the known maternity colony use area. Finally, most documented foraging is within the BCA or off-post to the north and west of Fort Drum.

We would continue to expect similar concentrated Indiana bat activity within the BCA (e.g., ~95% of roosts) in the future. Indiana bats have been documented to have strong fidelity to roosts and roosting areas (Gardner et al. 1991b; Gumbert et al. 2002; Humphrey et al. 1977; Kurta and Murray 2002; Kurta et al. 1996, 2002). On Fort Drum, there is little repeated use of individual roosts as most of the roosts on Fort Drum are dead (with limited roost life expectancy), but there is high fidelity to roosting areas (C. Dobony, pers. comm.). Therefore, we anticipate a small percentage of the colony (<5% of 30-50 adult females) or small numbers of bats (1-3) to be in any previously undiscovered roosts located away from the core roosting area.

When considering the acreage available for smoke operations (approximately 80,000 acres), the likelihood that any previously undiscovered roosts would be in the same exact area as a smoke operation is very low.

We anticipate harassment of a small percentage of Indiana bats associated with one documented maternity colony (<5% or 1-3 bats) and/or a similar small number (1-3) of Indiana bats known to winter in the Glen Park Cave and who travel, roost, forage, and swarm within the action area

and/or that are traveling, roosting, and foraging within the Action Area as a result of the deployment of smoke and obscurants. "Harass," as defined within the definition of "take" in the ESA, means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include but are not limited to, breeding, feeding, or sheltering. "Harm," as defined within the definition of "take" in the ESA, means an act that actually kills or injures wildlife. Such acts may include significant habitat loss and/or alteration where the act actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. If the bats exposed to smoke operations in the summer are lactating females and abandon their pups, up to 3 pups could be injured or killed.

Because of the difficulty in monitoring/detecting this level of take, the Service has decided that it is appropriate to use the number of deployment days (between April 15 and October 15) for Category 1 smoke and obscurant activity. So long as they do not deploy in areas closer than 7,000 m or during greater number of days than anticipated in the BA, we do not expect the Army will exceed this level of impact. However, should the Army observe any bats flushing from trees during any smoke and obscurant activities, the Army will report that information to the Service.

EFFECT OF THE TAKE

In this BO, the Service determined that this level of anticipated take is not likely to result in jeopardy to the Indiana bat or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measure(s) are necessary and appropriate to minimize impacts of incidental take of the Indiana bat:

1. The Army will ensure that the described proposed project components, including all conservation measures, will occur as planned and documented in the 2011 BA.

2. The Army will conduct additional measures to accomplish intended conservation benefits as described in the BA. These measures are either in addition to or clarifications of those included as conservation measures.

3. The Army must monitor its activities associated with the proposed project to determine if the Terms and Conditions of this BO are being implemented adequately in order to ensure that take is minimized and provide an annual report of those activities to the Service.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of Section 9 of the ESA, the Army (and other Federal agencies where denoted) must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. The Army Environmental Division shall provide annual training to all project personnel that are directly or indirectly responsible for actions conducted on Fort Drum on the terms of this BO and all conservation measures described in the BA. This Term and Condition is associated with Reasonable and Prudent Measures 1-3.

2. The Army shall ensure that all appropriate/applicable conservation measures and Terms and Conditions are included in contracts for work conducted on Fort Drum. This Term and Condition is associated with Reasonable and Prudent Measures 1-3.

3. The Army shall ensure they maintain a valid NYSDEC permit for the handling of Indiana bats. This Term and Condition is associated with Reasonable and Prudent Measures 1-3.

4. Should any female Indiana bats be captured during mist-netting associated with ongoing research with Virginia Tech, the Army shall attach radio transmitters to those females and track them for the life of the transmitter. Should any females roost in the Training Area (outside TA3 and 4), further consultation is needed. The Term and Condition is associated with Reasonable and Prudent Measures 2 and 3.

5. The Army shall monitor the presence of the known Indiana bat maternity colony annually. The Army will coordinate with the Service on monitoring methods by February 15th of the survey year. This Term and Condition is associated with Reasonable and Prudent Measures 1-3.

6. The Army shall not cut/remove any current or future identified female roosts for any purpose (except emergency situations where life or property is imminently threatened) without additional consultation with the Service. Additionally, a buffer will be placed around all female roosts to protect the roost from disturbance and to maintain a semblance of a natural environment for Indiana bats. The size and shape of a buffer will be determined on a case by case basis by the Army's Fish and Wildlife Management Program in consultation with the Service. Factors that will be considered will include surrounding landscape, habitat connectivity, distance to other roosts, distance to known foraging areas, and any other issue important to Indiana bats. This Term and Condition is associated with Reasonable and Prudent Measures 1-3.

7. The Service and NYSDEC shall have access to future Indiana bat on-post monitoring projects. All access shall be coordinated with the Army's Environmental Division. This Term and Condition is associated with Reasonable and Prudent Measures 2 and 3.

8. The Army shall provide an annual report summarizing the likely to adversely affect activities described in this BO by February 15 of the following year. The report shall also summarize whether any conservation recommendations were implemented. The Army shall also provide an annual report in accordance with our December 28, 2011, concurrence letter. This Term and Condition is associated with Reasonable and Prudent Measures 1-3.

9. The Army shall provide an annual report summarizing any Indiana bat field work (e.g., mist-netting, Anabat, and radio telemetry activities) by February 15 of the following year. This Term and Condition is associated with Reasonable and Prudent Measures 1-3.

10. The Army may request an extension, for the Service's consideration, to the time limitations in meeting the requirements outlined in all terms and conditions. An extension request shall be provided to the Service in writing within one year from the completion date of this BO and clearly identify the additional timeframe needed. This Term and Condition is associated with Reasonable and Prudent Measures 1-3.

11. The Army and any other Federal agency working on Fort Drum shall make all reasonable efforts to educate personnel to report any sick, injured, and/or dead bats (regardless of species) located on Fort Drum during construction, operations, maintenance, or monitoring activities immediately to the Army's Environmental Division. Due to the number of soldiers and other military and support personnel, it is not expected nor required to educate all personnel working on Fort Drum, but those most likely to come across bats during the course of normal working conditions will receive this training. Environmental staff will subsequently report to the Service's New York Field Office (NYFO) (607-753-9334) and the NYSDEC, and/or New York State Health Department. No one, with the exception of trained Army Garrison staff or researchers contracted to conduct bat monitoring activities, should attempt to handle any live bat, regardless of its condition. If needed, NYFO and/or NYSDEC will assist in species determination for any dead or moribund bats. Any dead bats believed to be Indiana bats will be transported on ice to the NYFO or NYSDEC. If an Indiana bat is identified, NYFO will contact the appropriate Service law enforcement office. In addition, Fort Drum Environmental Division Staff will make all reasonable efforts to immediately report any dead suspected Indiana bats found outside Fort Drum but within the Action Area. In the extremely rare event that someone has been bitten by a bat, please keep the bat in a container and contact the Jefferson County Public Health Service at 315-786-3770. This Term and Condition is associated with Reasonable and Prudent Measure 3.

In conclusion, one Indiana bat may be killed or injured from operations of wind turbines and up to six Indiana bats may be harassed or harmed (possibly leading to mortality of up to three pups) during Category 1 and/or Category 2 smoke and obscurant operations. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring re-initiation of consultation and review of the reasonable and prudent measures provided. The Army must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures and/or conservation measures.

CONSERVATION RECOMMENDATIONS

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

threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid the adverse effects of a proposed action on listed species or critical habitat, to help carry out recovery plans, or to develop information.

The Service has identified the following actions that, if undertaken by the Army, would further the conservation and assist in the recovery of the Indiana bat.

1. Assist with WNS investigations (No Recovery Actions specific to WNS in draft Recovery Plan but Action 3.5.1 addresses disease threats). For example, Fort Drum could:
    a. Monitor the status/health of the little brown bat colony at the LeRay mansion/bat houses;
    b. Collect samples for ongoing or future studies;
    c. Provide funding for off-post WNS research activities; and
    d. Allow staff to participate in off-post research projects.

2. Pursue additional acquisition of parcels or easements to protect Indiana bat roosting, foraging, and commuting habitat through the ACUB program (Recovery Actions 2.1-Manage habitat on private lands, 2.2-Conserve and manage Indiana bats and their habitat on Federal lands, 2.4.2-Identify and conserve foraging habitat, water sources, and travel corridors).

3. Conduct research on smoke/obscurant impacts to the Indiana bat (No Recovery Actions specific to this in draft Recovery Plan). As stated in Shapiro and Hohmann (2005), additional work on short-term and long-term exposure models is necessary. Research on potential impacts to insect populations is also recommended.

4. Assist with Recovery Action 3.3 (and related subactions) - conduct research on the summer habitat requirements and distribution of Indiana bats.

5. Evaluate potential to correlate available USFS foraging data with training activities to glean any information on Indiana bat response to night training exercises.

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

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the information presented with the September 15, 2011, request for initiation of formal consultation. As written in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law), and if (1) the amount or extent of incidental take is exceeded; (2) new information reveals the agency action may affect listed species or critical habitat in a manner or to an extent not considered in this BO; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or

critical habitat not considered in this BO; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

LITERATURE CITED

3D/International, Inc. 1996. Environmental Fate of Fog Oil at Fort McClellan, Alabama. Prepared for U.S. Army Corps of Engineers, Kansas City, Missouri.

3D/International, Inc. 1997a. Ecological Risk Assessment: Toxicological Effects of M18 Colored Smoke Grenades to Indiana Bats, Gray Bats, and Bald Eagles. Prepared for U.S. Army Corps of Engineers, Kansas City, Missouri.

3D/International, Inc. 1997b. Biological Assessment: Relocation of U.S. Army Chemical School and U.S. Army Military Police School to Fort Leonard Wood, Missouri. Prepared for U.S. Army Corps of Engineers, Kansas City, Missouri. 155 pp.

Anderson, K.W. 2009. A Study of the Potential Effects of a Small Wind Turbine on Bird and Bat Mortality at Tom Ridge Environmental Center Erie, Pennsylvania. A Report Prepared for Pennsylvania Department of Conservation and Natural Resources. Gannon University, PA.

Barclay, R.M.R. and L.D. Harder. 2003. Life histories of bats: life in the slow lane. Pp. 209-253 *in* T.H. Kunz and M.B. Fenton (eds)., Bat ecology. University of Chicago Press; Chicago, IL.

Barclay, R.M.R. and A. Kurta. 2007. Ecology and behavior of bats roosting in tree cavities and under bark. Pp. 17-59 *in* M.J. Lacki, J.P. Hayes, and A. Kurta (eds), Bats in forests: conservation and management. Johns Hopkins University Press, Baltimore, MD.

Barclay, R.M.R., J. Ulmer, C.J.A. MacKenzie, M.S. Thompson, L. Olson, J. McCool, E. Cropley, and G. Poll. 2004. Variation in reproductive rate of bats. Canadian Journal of Zoology 82:688-693.

Barclay, R.M.R, E.F. Baerwald, and J.C. Gruver. 2007. Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height. Canadian Journal of Zoology 85:381-387.

Belwood, J. 1996. An unusual *Myotis sodalis* nursery colony in Ohio. Bat Research News 37: 126-127.

Belwood, J.J. 2002. Endangered bats in suburbia: observations and concerns for the future. Pp.193-198 *in* A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, TX.

Blehert, D.S., A.C. Hicks, M. Behr, C.U. Meteyer, B.M. Berlowski-Zier, E.L. Buckles, J.T.H. Coleman, S.R. Darling, A. Gargas, R. Niver, J.C. Okoniewski, R.J. Rudd, and W.B. Stone. 2009. Bat White-Nose Syndrome: An Emerging Fungal Pathogen? Science 323:227.

Britzke, E.R., M.J. Harvey, and S.C. Loeb. 2003. Indiana bat, Myotis sodalis, maternity roosts in the southern United States. Southeastern Naturalist 2(2):235-242.

Britzke, E., A. Hicks, S. von Oettingen, and S. Darling. 2006. Description of spring roost trees used by female Indiana bats (*Myotis sodalis*) in the Lake Champlain Valley of Vermont and New York. American Midland Naturalist 155:181-187.

Butchkoski, C. and J.D. Hassinger. 2002. Ecology of a maternity colony roosting in a building. Pages 130-142 *in* A. Kurta and J. Kennedy, editors. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International, Austin, TX.

Callahan, E.V. 1993. Indiana bat summer habitat requirements. M.S. Thesis. University of Missouri, Columbia. 84 pp.

Callahan, E.V., R.D. Drobney, and R.L. Clawson. 1997. Selection of summer roosting sites by Indiana bats (*Myotis sodalis*) in Missouri. Journal of Mammalogy, 78:818-825.

Carter, T.C., G. Feldhamer, and J. Kath. 2001. Notes on summer roosting of Indiana bats. Bat Research News 42:197-198.

Clark, B.K., J.B. Bowles, and B.S. Clark. 1987. Summer status of the endangered Indiana bat in Iowa. American Midland Naturalist 118:32-39.

Clawson, R.L. 2002. Trends in population size and current status. Pp. 2-8 *in* A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, TX. 253 pp.

Cope, J.B., A.R. Richter, and R.S. Mills. 1974. A summer concentration of the Indiana bat, Myotis sodalis, in Wayne County, Indiana. Proceedings Indiana Academy of Science 83:482-484.

Copperhead. 2009. Summer 2008 bat survey and radiotelemetry study conducted at Fort Drum, Jefferson and Lewis counties, New York. Prepared by: J.A. Hawkins and M.W. Gumbert. Copperhead Environmental Consulting, Inc. Paint Lick, KY. 26 pp.

Cryan, P.M., C.U. Meteyer, J.G. Boyles, and D.S. Blehert. 2010. Wing pathology of white-nose syndrome in bats suggests life-threatening disruption of physiology. BMC Biology 8:135.

Dickinson, M.B., M.J. Lacki, and D.R. Cox. 2009. Fire and the endangered Indiana bat. *in* T.F. Hutchinson (ed.) Fire in eastern oak forests conference. Northern Research Station,

U.S. Department of Agriculture General Technical Report. Newton Square, Pennsylvania. NRS-P-46:1-154.

Douglas, T.A., J.B. Johnson, C.M. Collins, C.M. Reynolds, K.L. Foley, L.B. Perry, A.B. Gelvin, and S.E. Hardy. 2006. Assessing fog oil deposition to simulated plant surfaces during military training. U.S. Army Engineer Research and Development Center, Hanover, NH.

Driver. C.J., M.W. Ligotke, J.L. Downs, B.L. Tiller, T.M. Poston, E.B. Moore, Jr., and D.A. Cataldo. 1993. Environmental and health effects review for obscurant fog oil. Pacific Northwest Laboratory, Richland, WA.

Driver, C.J., M.W. Ligotke, H. Galloway-Gorby, G. Dennis, K.A. Reinbold and H.E. Balbach. 2002. Acute Inhalation Toxicity of Fog Oil Smoke in the Red-winged Blackbird, a Size specific Inhalation Surrogate for the Red-cockaded Woodpecker. ERDC/CERL Technical Report, TR-02-6, Engineer Research and Development Center, U.S. Army Construction Engineering Research Laboratory, Champaign, Illinois.

Driver, C., R. Fulton, J. Ollero, M. Clark, G. Dennis, B. Tiller, and H.E. Balbach. 2005. Inhalation toxicity of cogenerated graphite flake and fog oil smoke in the brown-headed cowbird and the red-winged blackbird, size-specific surrogates for the red-cockaded woodpecker. ERDC/CERL Technical Report, TR-05-5, Engineer Research and Development Center, U.S. Army Construction Engineering Research Laboratory, Champaign, Illinois.

ENSR. 1999. Final Biological Assessment for the Fielding of M56 and M58 Smoke Generators at Fort Lewis and Yakima Training Center. Prepared for the Department of Army, Fort Lewis, Washington.

Environmental Solutions and Innovations, Inc. (ESI). 2006. Mist net and radio-telemetry surveys for the Indiana bat (Myotis sodalis) on Clover Construction Management's proposed Eagle Ridge Townhouses Project, Jefferson County, New York. Final Report. Environmental Solutions and Innovations, Inc., Cincinnati, Ohio.

Environmental Solutions and Innovations, Inc. (ESI). 2008a. Fall Mist Net and Radio-telemetry Surveys for the Indiana bat (*Myotis sodalis*) on Fort Drum, Jefferson and Lewis Counties, New York. Environmental Solutions and Innovations, Inc., Cincinnati, Ohio.

Environmental Solutions and Innovations, Inc. (ESI). 2008b. Summer Mist Net and Radio-telemetry Surveys for the Indiana bat (*Myotis sodalis*) on Fort Drum, Jefferson and Lewis Counties, New York. Environmental Solutions and Innovations, Inc., Cincinnati, Ohio.

Environmental Solutions and Innovations, Inc. (ESI). 2010. Summer mist net surveys for the Indiana bat (*Myotis sodalis*) on Fort Drum Military Installation, Jefferson and Lewis Counties, New York. Prepared by: J. Timpone, A. Mann, and V. Brack, Jr. Environmental Solutions & Innovations, Inc. Cincinnati, OH. 55 pp.

Environmental Solutions and Innovations, Inc. 2011. Summer mist net surveys for the Indiana bat (*Myotis sodalis*) on Fort Drum Military Installation, Jefferson and Lewis Counties, New York. Prepared by: L. Winhold, A. Mann, and V. Brack, Jr. Environmental Solutions & Innovations, Inc. Cincinnati, OH. 79 pp.

Erickson, W.P., K. Kronner, and B. Gritski. 2003. Nine Canyon Wind Power Project Avian and Bat Monitoring Report. September 2002-August 2003. Prepared for the Nine Canyon Technical Advisory Committee and Energy Northwest by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming, and Northwest Wildlife Consultants (NWC), Pendleton, Oregon. October 2003. http://www.west-inc.com/reports/nine_canyon_monitoring_final.pdf

Fort Drum. 2005. Integrated Wildland Fire Management Plan, Fort Drum, New York. Prepared by: Directorate of Emergency Services. Fort Drum, New York. 75pp.

Gardner, J.E. and E.A. Cook. 2002. Seasonal and geographic distribution and quantification of potential summer habitat. Pp. 9-20 *in* A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, TX.

Gardner, J.E., J.D. Garner, and J.E. Hofmann. 1991a. Summary of *Myotis sodalis* summer habitat studies in Illinois: with recommendations for impact assessment. Report prepared for Indiana/Gray bat Recovery Team Meeting, Columbia, MO 28 pp.

Gardner, J.E., J.D. Garner, and J.E. Hofmann. 1991b. Summer roost selection and roosting behavior of *Myotis sodalis* (Indiana bat) in Illinois. Unpublished report to Region-3 U.S. Fish and Wildlife Service, Fort Snelling, MN. 56 pp.

Gardner, J.E., J.E. Hofmann, and J.D. Garner. 1996. Summer distribution of the Federally endangered Indiana bat (*Myotis sodalis*) in Illinois. Transactions of the Illinois State Academy of Science 89:187-196.

Gargas, A, M.T. Trest, M. Christensen, T.J. Volk, and D.S. Blehert. 2009. *Geomyces destructans* sp. nov. associated with bat white-nose syndrome. Mycotaxon 108:147-154.

Getz, L., K. Reinbold, D. Tazik, T. Hayden, and D. Cassels. 1996. Preliminary Assessment of the Potential Impact of Fog Oil Smoke on Selected Threatened and Endangered Species. CERL-TR-96/38. U.S. Army Corps of Engineers, Construction Engineering Research Laboratory, Champaign, IL.

Good, R.E., W. Erickson, A. Merrill, S. Simon, K. Murray, K. Bay and C. Fritchman. 2011. Bat monitoring studies at the Fowler Ridge Wind Energy Facility, Benton County, Indiana. Report prepared by Western EcoSystems Technology, Inc. for the Fowler Ridge Wind Farm. 143 pp.

Gress Engineers, Inc. and FMSM Engineers, Inc. 2007. A Biological Assessment of the Fort Drum Connector Route (Northern Alternative #4)(I-81 to Fort Drum North Gate) NYSDOT Region 7. Jefferson County, New York, Fort Drum Connector Route, Towns of LeRay and Pamelia. NYSDOT PIN #7804.26. Prepared for The New York Division of the Federal Highway Administration, Albany, NY and Region 7 of the New York State Department of Transportation, Watertown, NY.

Grodsky, S.M., M.J. Behr, A. Gendler, D. Drake, B.D. Dieterle, R.J. Rudd, and N.L. Walrath. 2011. Investigating the causes of death for wind turbine-associated bat fatalities. Journal of Mammology, 92(5):917-925.

Guelta, M. and H.E. Balbach. 2005. Modeling Fog Oil Obscurant Smoke Penetration into Simulated Tortoise Burrows and Bat Colony Trees. ERDC/CERL TR-05-31. U.S. Army Corps of Engineers, Construction Engineering Research Laboratory, Champaign, IL.

Gumbert, M.W., J. O'Keefe, and J. MacGregor. 2002. Roost fidelity in Kentucky. Pages 143-152 *in* A. Kurta and J. Kennedy, editors. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International, Austin, TX.

Hall, J.S. 1962. A life history and taxonomic study of the Indiana bat, *Myotis sodalis*. Scientific Publications No. 12. Reading Public Museum and Art Gallery, Reading, PA.

Hicks, A., C. Herzog, M. Cooper, and M. Clark. 2006. Indiana Bat (Myotis sodalis) Protection and Management in New York State. Fiscal Year April 1, 2005-April 1, 2006 Annual Report. New York Department of Environmental Conservation, Albany, New York.

Hicks, A. and D. Newman. 2007. Bat Management and Protection in New York State, Fiscal Year April 1, 2006-April 1, 2007. New York Department of Environmental Conservation, Albany, New York.

Hicks, A.C. and P.G. Novak. 2002. History, status, and behavior of hibernating populations in the northeast. Pp. 35-47 *in* A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, TX.

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

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

Knickelbine, J. and C. Sontag 2011. A study of bird and bat mortality at a small wind turbine site. Presentation at the 2011 Small Wind Conference. http://smallwindconference.com/?page_id=70

Kurta, A. 2005. Roosting ecology and behavior of Indiana bats (*Myotis sodalis*) in summer. Pp. 29-42 *in* K.C. Vories and A. Harrington (eds.), Proceedings of the Indiana bat and coal mining: a technical interactive forum. Office of Surface Mining, U.S. Department of the Interior, Alton, IL. Available at: http://www.mcrcc.osmre.gov/PDF/Forums/Bat%20Indiana/TOC.pdf.

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

Kurta, A. and H. Rice. 2002. Ecology and management of the Indiana bat in Michigan. Michigan Academician 33:361-376.

Kurta, A., K.J. Williams, and R. Mies. 1996. Ecological, behavioural, and thermal observations of a peripheral population of Indiana bats (*Myotis sodalis*). Pp. 102-117 *in* R.M.R. Barclay and R.M. Brigham (eds.), Bats and Forests Symposium. Research Branch, British Columbia Ministry of Forests, Victoria, BC, Canada.

Kurta, A., S.W. Murray, and D.H. Miller. 2002. Roost selection and movements across the summer landscape. Pp. 118-129 *in* A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, TX. 253 pp.

Lacki, M. J., S. K. Amelon, and M. D. Baker. 2007. Foraging ecology of bats in forests *in* M.J. Lacki, J.P. Hayes, and A. Kurta (eds), Bats in forests: conservation and management. Johns Hopkins University Press, Baltimore, MD.

LaVal, R.K. and M.L. LaVal. 1980. Ecological studies and management of Missouri bats, with emphasis on cave-dwelling species. Missouri Department of Conservation, Terrestrial Series 8:1-52.

Liljegren, J.C., W.E. Dunn, G.E. DeVaull, and A.J. Policastro. 1988. Field Measurement and Model Evaluation Program for Assessment of the Environmental Effects of Military Smokes: Field Study of Fog-Oil Smokes. AD-A205 344. Argonne National Laboratory, Argonne, Ill.

Lorch, J.M., C.U. Meteyer, M.J. Behr, J.G. Boyles, P.M. Cryan, A.C. Hicks, A.E. Ballman, J.T.H. Coleman, D.N. Redell, D.M. Reeder, and D.S. Blehert. 2011. Experimental infection of bats with Geomyces destructans causes white-nose syndrome. Nature, v. 480, no. 7377, p. 376-378.

Martinkova, N., P. Backor, T. Bartonicka, P. Blazkova, J. Cerveny, L. Falteisek, J. Gaisler, V. Hanzal, D. Horacek, Z. Hubalek, H. Jahelkova, M. Kolarık, L. Korytar, A. Kubatova, B. Lehotska, R. Lehotsky, R.K. Lucan, O. Majek, J. Mateju, Z. Rehak, J. Safar, P. Tajek, E. Tkadlec, M. Uhrin, J. Wagner, D. Weinfurtova, J. Zima, J. Zukal, and I. Horacek. 2010. Increasing incidence of Geomyces destructans fungus in bats from the Czech Republic and Slovakia. PloS ONE 5(11)

Menzel, J.A., W.M. Ford, M.A. Menzel, T.C. Carter, J.E Gardner, J.D. Garner, and J.E. Hofmann. 2005. Summer habitat use and home-range analysis of the endangered Indiana bat. Journal of Wildlife Management 69:430-436.

Mumford, R.E. and L.L. Calvert. 1960. *Myotis sodalis* evidently breeding in Indiana. Journal of Mammalogy 41:512.

Murray, S.W. and A. Kurta. 2004. Nocturnal activity of the endangered Indiana bat (*Myotis sodalis).* Journal of Zoology 262:197-206.

Myers, R.F. 1964. Ecology of three species of myotine bats in the Ozark Plateau. Ph.D. Dissertation. University of Missouri, Columbia, MO. 210 pp.

National Research Council. 1997. Toxicity of Military Smokes and Obscurants. Volume 1. National Academy Press, Washington, D. C.

National Research Council. 1999a. Toxicity of Military Smokes and Obscurants. Volume 2. National Academy Press, Washington, D.C.

National Research Council. 1999b. Toxicity of Military Smokes and Obscurants. Volume 3. National Academy Press, Washington, D.C.

Okoniewski, J.C., J. Haines, A.C. Hicks, K.E. Langwig, R.I. VonLinden, and C.A. Dobony. 2010. Detection of the conidia of *Geomyces destructans* in northeast hibernacula, at maternal colonies, and on gear – some findings based on microscopy and culture. *in* Abstracts of Presented Papers and Posters for 2010 White-nose Syndrome Symposium, Pittsburgh, Pennsylvania, May 25-27, 2010.

Puechmaille, S.J., P. Verdeyroux, H. Fuller, M. Ar Gouilh, M. Bekaert, E.C. Teeling. 2010. White-nose syndrome fungus (*Geomyces destructans*) in bat, France. Emerging Infectious Diseases 16:290-293.

Racey, P.A. 1982. Ecology of bat reproduction. Pp. 57-104 *in* T.H. Kunz (ed.), Ecology of bats. Plenum Press, New York, NY. 425 pp.

Racey, P.A. and A.C. Entwistle. 2003. Conservation ecology of bats: reproduction. Pp. 680-743 *in* T.H. Kunz and M.B. Fenton (eds.), Ecology of bats. University of Chicago Press, Chicago, IL.

Reeder, D. 2012. Susceptibility and Physiology of Bats with WNS. Page 8 *in* Abstract of Presented Papers for 2012 Northeastern Bat Working Group Meeting, Carlisle, Pennsylvania, January 11-13, 2012.

Reeder, D., G. Turner, A. Robbins, H. Barton, M. Ghannoum, A. Hicks, E. Buckles, S. Brownless, L. Grieneisen, S. Alfano, and H. Fischer. 2010. Mitigating White-nose syndrome: Results of Captive Treatment Trials, Behavioral Observations, Microclimate Variation, and Explorations of Immune Responses to WNS. Pages 20-21 *In* Abstracts of Presented Papers and Posters for 2010 White-nose Syndrome Symposium, Pittsburgh, Pennsylvania, May 25-27, 2010.

Richter, A.R., S.R. Humphrey, J.B. Cope, and V.W. Brack, Jr. 1993. Modified cave entrances: thermal effect on body mass and resulting decline of endangered Indiana bats (*Myotis sodalis*). Conservation Biology 7:407-415.

Sanders Environmental Inc. (SEI). 2007a. Report on Indiana Bat (*Myotis sodalis*): Night Time Radio Telemetry on Bats Captured Outside of Cape Vincent, New York, Jefferson County, New York, July and August, 2007. Sanders Environmental Inc., Centre Hall, Pennsylvania.

Sanders Environmental Inc. (SEI). 2007b. Report on Indiana Bat (*Myotis sodalis*): Roost Trees and Emergence Counts on bats captured outside of Cape Vincent, New York, Jefferson County, New York, July and August, 2007. Sanders Environmental Inc., Centre Hall, Pennsylvania.

Sanders Environmental Inc. (SEI). 2007c. Report on Indiana Bat (*Myotis sodalis*): Sampling at Six Sites on the Proposed Location of the Saint Lawrence Wind Farm, Jefferson County, New York, July and August, 2007. Sanders Environmental Inc., Centre Hall, Pennsylvania.

Sanders Environmental Inc. (SEI). 2008a. Report on Indiana Bat (*Myotis sodalis*): Sampling at Eleven Sites on the Proposed Location of the Saint Lawrence Wind Farm, Jefferson County, New York, June 2008. Sanders Environmental Inc., Bellefonte, Pennsylvania.

Sanders Environmental Inc. (SEI). 2008b. Report on Indiana Bat (*Myotis sodalis*): Sampling at Ten Sites on the Proposed Location of the Cape Vincent Wind Farm, Jefferson County, New York, June 2008. Sanders Environmental Inc., Bellefonte, Pennsylvania.

Shapiro, A. and M.G. Hohmann. 2005. Summary of threatened and endangered bat-related restrictions on military training, testing and land management. U.S. Army Corps of Engineers Engineer Research and Development Center. TR-05-13.

Sparks, D.W., J.O. Whitaker, Jr., and C.M. Ritzi. 2005. Foraging ecology of the endangered Indiana bat. Pp. 15-27 *in* K.C. Vories and A. Harrington (eds.), The Proceedings of the Indiana bat and coal mining: a technical interactive forum. Office of Surface Mining, U.S. Department of the Interior, Alton, IL.

Speakman, J.R. 1995. Chiropterian nocturnality. Symposia of the Zoological Society of London 67:187-201.

Speakman, J.R. and D.W. Thomas. 2003. Physiological ecology and energetics of Bats. Pp. 430-490 *in* T. H. Kunz and M.B. Fenton (eds.), Bat Ecology. University of Chicago Press, Chicago, IL.

Stantec Consulting. 2008. 2006-2007 Indiana bat telemetry studies at the proposed Horse Creek Wind Project in Jefferson County, New York.

Thomson, C.E. 1982. Myotis sodalis. Mammalian Species 163:1-5.

Turner, G.G., D.M. Reeder, and J.T.H. Coleman. 2011. A five-year assessment of mortality and geographic spread of white-nose syndrome in North American bats and a look to the future. Bat Research News 52(2): 13-27.

U.S. Army Garrison Fort Drum. 2011. Biological Assessment on the proposed activities on the Fort Drum Military Installation, Fort Drum, New York (2012-2014) for the Federally-endangered Indiana bat (*Myotis sodalis*).

U.S. Fish and Wildlife Service. 1983. Recovery Plan for the Indiana Bat. Twin Cities, MN.

U.S. Fish and Wildlife Service. 1999. Agency Draft Indiana Bat (*Myotis sodalis*) Revised Recovery Plan. Fort Snelling, MN.

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

U.S. Fish and Wildlife Service. 2008. Biological Opinion on the Proposed Construction, Operation, and Maintenance of the Fort Drum Connector Project (NYSDOT PIN 7804.26) for the Federally Endangered Indiana Bat. U.S. Fish and Wildlife Service, New York Field Office, Cortland, NY. 84 pp.

U.S. Fish and Wildlife Service. 2009a. Indiana Bat (*Myotis sodalis*) 5-year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Midwest Region, Bloomington, Indiana. 44 pp.

U.S. Fish and Wildlife Service. 2009b. Biological Opinion on the proposed activities on the Fort Drum Military Installation (2009-2011) for the Federally-endangered Indiana bat (*Myotis sodalis*). U.S. Fish and Wildlife Service, New York Field Office, Cortland, NY.

U.S. Fish and Wildlife Service. 2009c. Range-wide Indiana Bat Protection and Enhancement Plan Guidelines. 41 pp.

U.S. Fish and Wildlife Service. 2011a. Indiana Bat Section 7 and Section 10 Guidance for Wind Energy Projects document located at http://www.fws.gov/midwest/endangered/mammals/inba/WindEnergyGuidance.html

U.S. Fish and Wildlife Service. 2011b. Indiana bat fatality at Pennsylvania wind facility. Press Release. Pennsylvania Field Office. Available at: http://www.fws.gov/northeast/pafo

U.S. Fish and Wildlife Service. 2012. 2011 Rangewide Population Estimate for the Indiana Bat, Myotis sodalis. Available at: http://www.fws.gov/midwest/endangered/mammals/inba.html

U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. Endangered Species Consultation Handbook - Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act. Washington, D.C.

U.S. Forest Service. 2011. Fort Drum Military Installation Cantonment Area Indiana Myotis Survey. USDA, U.S. Forest Service Green Mountain Agreement #09-PA-11092000-106. Prepared by J.B. Johnson, J.W. Edwards, W.M. Ford, K. Cunningham, and J.L. Rodrigue. 61 pp.

U.S. Geological Survey (USGS), National Wildlife Health Center. 2009. Wildlife Health Bulletin #2009-03, Update on White-Nose Syndrome. 11 December 2009.

U.S. Geological Survey (USGS), National Wildlife Health Center. 2010. Wildlife Health Bulletin #2010-04, *Geomyces destructans* detected in Oklahoma Cave Myotis and Listed Missouri Gray Bats. 25 May 2010.

U.S. Geological Survey (USGS), National Wildlife Health Center. 2011. Revised case definitions for white-nose syndrome and winter 2010/2011 bat submission guidelines. Wildlife Health Bulletin #2011-01. U.S. Geological Survey, National Wildlife Health Center, Madison, WI. 1 February 2011.

Virginia Department of Conservation and Recreation (VDCR). 2010. White-Nose Syndrome Fungus Found on a Different Bat Species in Virginia. Press Release, 30 June 2010. <http://www.dgif.virginia.gov/news/release.asp?id=261> Accessed 25 Feb 2011.

Watrous, K.S., T.M. Donovan, R.M. Mickey, S.R. Darling, A.C. Hicks, and S.L. von Oettingen. 2006. Predicting minimum habitat characteristics for the Indiana bat in the Champlain Valley. Journal of Wildlife Management 70(5):1228-1237.

Whitaker, J.O., Jr. and V. Brack, Jr. 2002. Distribution and summer ecology in Indiana. Pp. 48-54 *in* A. Kurta and J. Kennedy (eds.), The Indiana bat: biology and management of an endangered species. Bat Conservation International, Austin, TX.

Winhold, L. and A. Kurta. 2006. Aspects of Migration by the Endangered Indiana Bat, *Myotis sodalis*. Bat Research News 47:1-11.

APPENDIX A

U.S. Army Garrison Fort Drum. 2011. Biological Assessment on the proposed activities on the Fort Drum Military Installation, Fort Drum, New York (2012-2014) for the Federally-endangered Indiana bat (*Myotis sodalis*). - *Available electronically*.

APPENDIX B

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