Final Integrated Natural Resources Management Plan

Naval Support Activity Crane, Indiana

Natural Resources Office
NAVFAC Midlant, PWD Crane

From: Miller, Brady J CIV USN NAVFAC MIDLANT NOR (USA)
To: "scott_pruitt@fws.gov"
Cc: "King, Andrew"
Subject: Concurrence Request for Review of Operation and Effect on NSA Crane INRMP
Date: Friday, February 19, 2021 1:44:00 PM
Attachments: NSA Crane Final INRMP with 2020 INRMP Review Updates (Attachment 1).pdf
NSA Crane INRMP Operation and Effect Signature Page USFWS v2 (Attachment 2).pdf

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Dear Scott,

The Sikes Act and Department of Defense (DoD) instruction require that DoD Integrated Natural Resources Management Plans (INRMPs) be reviewed no less than every five years for "operation and effect". An operation and effect review determines whether an INRMP is being implemented to meet Sikes Act requirements and contributes to the conservation and rehabilitation of natural resources on the installation. Naval Support Activity (NSA) Crane's most recent INRMP was completed in 2010.

Annual reviews of the INRMP are also prescribed by the Sikes Act and have occurred each year with U.S. Fish and Wildlife Service and Indiana Department of Natural Resources staff, most recently on September 15, 2020. Andy King of your agency's Bloomington office participated in that annual review. A review for operation and effect was also started at the 2020 meeting and the attendees agreed that the current INRMP is meeting the Sikes Act requirements and is contributing to the conservation and rehabilitation of natural resources on the installation.

The updated NSA Crane INRMP is provided as Attachment (1). Please note that updates agreed on at the annual review meetings since 2010 have been incorporated in the INRMP. The mission of NSA Crane has not changed significantly since the current INRMP was written and the natural resource objectives remain unchanged.

We respectfully request your concurrence by April 9, 2021 that the updated INRMP continues to contribute to the conservation and rehabilitation of NSA Crane natural resources.

Please document your concurrence by signing the NSA Crane INRMP Operation and Effect Signature Page, Attachment (2), and providing it back by email to me at brady.j.miller@navy.mil.

If you have any questions or comments please feel free to contact me at any time by telephone (812) 854-6656 or email brady.j.miller@navy.mil. Thank you for your assistance in ensuring our country's military readiness and continued stewardship of natural resources.

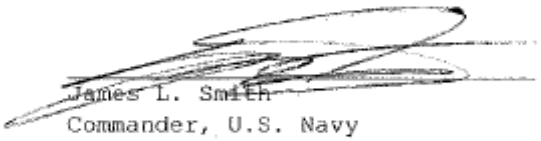
Sincerely,

Brady Miller
Natural Resources Manager, NSA Crane
NAVFAC ML PWD Crane
300 Hwy 361
Crane, IN 47522

Integrated Natural Resources Management Plan for
Naval Support Activity Crane
2021 Review for Operation and Effect

The 2010 Naval Support Activity Crane Integrated Natural Resources Management Plan has been reviewed for operation and effect, and as updated through yearly annual reviews, is sufficiently meeting Sikes Act requirements and is contributing to the conservation of natural resources on the installation.

Approving officials:



6 APR 21

James L. Smith
Commander, U.S. Navy
Commanding Officer
Naval Support Activity Crane

Date

OSMON.TRENT.D.1230328680 Digitally signed by OSMON.TRENT.D.1230328680 Date: 2021.02.19 12:25:51 -05'00'

Trent Osmon
Installation Environmental Program Director
Naval Support Activity Crane

Date

MILLER.BRADY.J.1258483401 Digitally signed by MILLER.BRADY.J.1258483401 Date: 2021.02.12 15:29:50 -05'00'

Brady Miller
Natural Resources Manager
Naval Support Activity Crane

Date

SCOTT PRUITT Digitally signed by SCOTT PRUITT Date: 2021.02.26 10:39:58 -05'00'

Scott Pruitt
Field Supervisor
U.S. Fish and Wildlife Service

Date

Attachment (2)

From: Miller, Brady J CIV USN NAVFAC MIDLANT NOR (USA)
To: "AWuestefeld@dnr.IN.gov"
Cc: Johnson, Scott (SJohnson@dnr.IN.gov)
Subject: Concurrence Request for Review of Operation and Effect on NSA Crane INRMP
Date: Friday, February 19, 2021 1:56:00 PM
Attachments: NSA Crane Final INRMP with 2020 INRMP Review Updates (Attachment 1).pdf
NSA Crane INRMP Operation and Effect Signature Page INDNR v2 (Attachment 2).pdf

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Dear Amanda,

The Sikes Act and Department of Defense (DoD) instruction require that DoD Integrated Natural Resources Management Plans (INRMPs) be reviewed no less than every five years for "operation and effect". An operation and effect review determines whether an INRMP is being implemented to meet Sikes Act requirements and contributes to the conservation and rehabilitation of natural resources on the installation. Naval Support Activity (NSA) Crane's most recent INRMP was completed in 2010.

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We respectfully request your concurrence by April 9, 2021 that the updated INRMP continues to contribute to the conservation and rehabilitation of NSA Crane natural resources.

Please document your concurrence by signing the NSA Crane INRMP Operation and Effect Signature Page, Attachment (2), and providing it back by email to me at brady.j.miller@navy.mil.

If you have any questions or comments please feel free to contact me at any time by telephone (812) 854-6656 or email brady.j.miller@navy.mil. Thank you for your assistance in ensuring our country's military readiness and continued stewardship of natural resources.

Sincerely,

Brady Miller
Natural Resources Manager, NSA Crane
NAVFAC ML PWD Crane
300 Hwy 361
Crane, IN 47522

Integrated Natural Resources Management Plan for
Naval Support Activity Crane
2021 Review for Operation and Effect

The 2010 Naval Support Activity Crane Integrated Natural Resources Management Plan has been reviewed for operation and effect, and as updated through yearly annual reviews, is sufficiently meeting Sikes Act requirements and is contributing to the conservation of natural resources on the installation.

Approving officials:

09APR21
Date

James L. Smith
Commander, U.S. Navy
Commanding Officer
Naval Support Activity Crane

OSMON.TRENT.D.1230328680 Digitally signed by OSMON.TRENT.D.1230328680 Date: 2021.02.19 12:24:59 -05'00'

Date

Trent Osmon
Installation Environmental Program Director
Naval Support Activity Crane

MILLER.BRADY.J.1258483401 Digitally signed by MILLER.BRADY.J.1258483401 Date: 2021.02.19 12:07:35 -05'00'

Date

Brady Miller
Natural Resources Manager
Naval Support Activity Crane

2/24/21
Date

Amanda Wuestefeld
Director
Division of Fish and Wildlife
Indiana Department of Natural Resources

Attachment (2)

Integrated Natural Resources Management Plan
Naval Support Activity Crane, Indiana

Approval

This Integrated Natural Resources Management Plan meets the requirements of Public Law 105-85, the Sikes Act Improvement Act of 1997 (16 U.S.C. 670 *et seq.*) as amended.

Tilghman D. Payne
Admiral, U.S. Navy
Commander
Navy Region Midwest
Great Lakes, Illinois

T. D. Payne

Date 11/1/10

John E. Shassberger
Commander, U.S. Navy
Commander
Naval Support Activity Crane
Crane, Indiana

John E Shassberger

Date 3/10/10

Steven J. Andrews
Natural Resources Manager, NSA Crane
NAVFAC Midwest PWD Crane
Crane, Indiana

Steven J Andrews

Date 2/22/2010

Charles M. Wooley
Acting Regional Director
U.S. Fish and Wildlife Service, Region 3
Fort Snelling, Minnesota

Charles Wooley

Date 2/18/10

Robert E. Carter, Jr.
Director
Indiana Department of Natural Resources
Indianapolis, Indiana

Robert E Carter Jr

Date 1/5/2010

United States Department of the Interior

IN REPLY REFER TO

FISH AND WILDLIFE SERVICE
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, Minnesota 55111-4056

February 2, 2010

FWS/AF

Commander John E. Shassberger
Commanding Officer
Naval Support Activity Crane
300 Highway 361
Code PRC42, Bldg. 3245
Crane, Indiana 47522-5001

Dear Commander Shassberger:

This letter and the enclosed signature page are provided in response to your request for U.S. Fish and Wildlife Service (Service) concurrence on the Integrated Natural Resource Management Plan (INRMP) for the Naval Support Activity Crane facility in Crane, Indiana.

We fully support the recommendations of our Bloomington Ecological Services Field Office and concur with this INRMP. We appreciate your efforts to conserve natural resources on military lands while fulfilling the military mission, and your willingness to work collaboratively with the Service. Please contact Mr. Aaron Woldt, Region 3 Sikes Act Coordinator, at (612) 713-5110, if we can be of further assistance.

Sincerely,

Charles M. Wooley
Acting Regional Director

cc: ARD, Ecological Services
ARD, National Wildlife Refuge System
ARD, Migratory Birds and State Programs
ARD, Fisheries
Aaron Woldt, USFWS R3 Sikes Act Coordinator

Executive Summary

This Integrated Natural Resources Plan (INRMP) is Naval Support Activity (NSA) Crane's plan of action for the conservation and management of natural resources entrusted to the U.S. Navy. The plan is for ten years (2010-2019), but the goal and philosophy of sustainable management of natural resources to support the military mission covers a broader period of time. NSA Crane is committed to making sound management decisions regarding the natural resources which compose the installation to support the military mission and the needs of the region.

This INRMP was prepared in accordance with direction found in "Integrated Natural Resources Management Plan Guidance for Navy Installations 2006: *How to Prepare, Implement and Revise Integrated Natural Resource Management Plans (INRMP)*". The Sikes Act Improvement Act (SAIA) of 1997 requires the Secretary of each military department to prepare and implement an INRMP for each military installation in the United States, utilizing an ecosystem management approach (16 United States Code 670a through o). Allowing for multiple uses of installation lands, conservation of natural resources, sustainable yield, and maintaining biological integrity are requirements under Department of Defense Instruction 4715.3 and the Department of the Navy's Environmental and Natural Resources Program Manual (OPNAVIST 5090.1). SAIA requires that this INRMP reflects cooperation and mutual agreement between NSA Crane, the United States Fish and Wildlife Service (USFWS), and the Indiana Department of Natural Resources (INDNR) regarding the management of natural resources at NSA Crane.

It is NSA Crane's mission to provide shore support to fleet, fighter, and family to enable Commanders to focus on their mission. To accomplish this mission, NSA Crane must have a functional ecosystem that allows for efficient operations to occur on the installation. Outlining strategies and goals to conserve and enhance the natural resources of NSA Crane is the principal objective of this INRMP.

NSA Crane is located within Martin, Greene, and Lawrence Counties, in southwest Indiana. The installation is approximately 25 miles southwest of Bloomington, Indiana, 71 miles southwest of Indianapolis, Indiana, and 75 miles northwest of Louisville, Kentucky. NSA Crane is a 62,467 acre (97.6 square miles) contiguous block of land, except for 461 acres at the Glendora Test Facility in Sullivan County. It is bordered primarily by rural farmland and forest.

Approximately 83 percent (51,578 acres) of the installation is forested, classified as Central Hardwoods Forest, consisting of rolling, mature, second-generation forests, composed primarily of oak-hickory and mixed hardwoods. Woodlands make up the dominant ecosystem on NSA Crane, and thus represent an important resource management at NSA Crane; open fields, bottomlands, and stream valleys comprise remaining ecosystems. Numerous waterbodies dot the landscape of NSA Crane, most principally the 820 acre Lake Greenwood, located on the northern portion of the installation and used for potable water, flood control, and recreation.

While no federally designated critical habitat is found on NSA Crane, the federally endangered Indiana bat and federally threatened northern long-eared bat have been documented on the installation. Additionally, several species of flora and fauna listed by the INDNR as endangered, rare, or species of concern have been documented on the installation. The conservation of these rare species is an important component of this INRMP, and NSA Crane is committed to working with the USFWS and INDNR to preserve habitat for these species on the installation.

This INRMP is organized into five primary sections. ***Overview*** discusses the purpose of the INRMP, the policies and goals on which it is founded, a history of the installation, and the mission of NSA Crane. ***Current Conditions and Use*** describes the existing physical and biological conditions at NSA Crane.

Environmental Management Strategy and Mission Sustainability provides an overview of the natural resources management philosophy underlying this INRMP and its relationship to the military mission of NSA Crane. ***Program Elements*** provides a discussion of the natural resource related programs and projects which have management objectives under this INRMP, including goals and objectives that will be used to address, identify, and achieve the management objectives. ***Implementation*** describes how the goals and objectives of this INRMP will be achieved and implemented during the lifecycle of this plan and beyond.

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Acronyms and Abbreviations

BRAC	Base Realignment and Closure
CAAA	Crane Army Ammunition Activity
CATEX	Categorical Exclusion
CNIC	Commander Naval Installations Command
CSREES	Cooperative State Research, Education, and Extension Service
DoD	Department of Defense
EA	Environmental Assessment
EIS	Environmental Impact statement
ESA	Endangered Species Act
ESQD	Explosives Safety Quantity Distance
FEMA	Federal Emergency Management Agency
FIRMS	Flood Insurance Rate Maps
FONSI	Finding of No Significant Impact
GIS	Geographic Information Systems
INDNR	Indiana Department of Natural Resources
INRMP	Integrated Natural Resources Management Plan
IPSAWG	Invasive Plant Species Assessment Working Group
ISSG	Invasive Species Specialist Group
MAPS	Monitoring Avian Productivity and Survivorship
NAD	Naval Ammunition Depot
NAVSEA	Naval Sea Systems Command
NEPA	National Environmental Policy Act
NMFWA	National Military Fish and Wildlife Association
NRCS	Natural Resources Conservation Service
NSA	Naval Support Activity
NSWC	Naval Surface Warfare Center
NWI	National Wetlands Inventory
MODC	Missouri Department of Conservation
MWR	Morale, Welfare, and Recreation Department
OIC	Officer-in-Charge
PWD	Public Works Department
SAIA	Sikes Act Improvement Act
SHPO	state Historic Preservation Office
SSURGO	Soil Survey Geographic Database
TSI	Timber Stand Improvement
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
WNS	White-Nose Syndrome

1.0 Overview

1.1 Introduction

The Navy commitment to natural resources management is reflected by Navy actions, which focus on responsible management of Navy lands to ensure long-term natural resource productivity, and to help the Navy achieve its mission. This Navy commitment to natural resources management is emphasized in Naval Operations Instruction OPNAVINST 5090.1 (*Environmental and Natural Resources Program Manual),* which requires that INRMPs be developed and maintained for all Navy installations with significant natural resources.

The Navy believes that military activities generally can be compatible with the conservation of sensitive biological resources. NSA Crane will continue its well-established program of managing and conserving its natural resources in support of the military mission.

The INRMP outlines steps required to meet DoD, U.S. Navy, and NSA Crane legal and other obligations to provide for the stewardship of the natural resources on NSA Crane, while enabling the accomplishment of the military mission. The INRMP has been developed through cooperation with appropriate regulatory agencies. This plan will not resolve all existing and/or future environmental issues. It does, however, provide the guiding strategy, personnel, and means to minimize and work toward resolution of such issues.

1.2 Purpose

This INRMP guides implementation of the natural resources program on NSA Crane from 2010 through 2019 and beyond as updated and appropriate. The program manages NSA Crane land and natural resources and helps ensure compliance with environmental laws and regulations. The INRMP helps ensure the maintenance of quality lands to accomplish NSA Crane's critical military mission on a sustained basis and to ensure that natural resources conservation measures and military activities are integrated and consistent with federal stewardship requirements.

1.3 Scope

This plan applies to organizations internal and external to NSA Crane that are involved with, or interested in, the management or use of NSA Crane lands and natural resources. Provisions of the INRMP apply to each organization, command, and tenant unit at NSA Crane, contractors (government and private), private groups, dependents, and individuals who either directly or indirectly use the installation's natural resources, as well as units and outlying detachments of personnel assigned or attached to the installation. This INRMP is an integral part of the NSA Crane Master Plan.

1.4 Goals and Objectives

The implementation of this INRMP is intended to be a dynamic, multidisciplinary process. To provide direction, recognize target management actions, and construct the framework for measuring success of this INRMP, the following goals have been established:

- Provide for the conservation, enhancement, and rehabilitation of land and water resources of the installation while supporting the military mission.

- Maintain or increase the diversity and populations of plants and animals under the stewardship of the Department of the Navy through habitat maintenance, enhancement, or rehabilitation activities on NSA Crane that do not detract from the military readiness of the installation.

- Enhance the quality of life of Navy personnel by providing high-quality, accessible, outdoor recreational opportunities that do not degrade the natural resources or detract from the military mission.

- Foster and promote natural resource stewardship among DoD personnel, their dependents, and the public by providing opportunities to participate in natural resource conservation, education, and rehabilitation activities on NSA Crane.

From these goals, a variety of management objectives and projects specific to the needs of NSA Crane have been developed. The management objectives are components of the four goals outlined above and represent measurable targets to be used to quantify the success of this INRMP. Ecosystems are dynamic, and may exhibit responses to management actions different than those expected. A process of adaptive management will be used to compare the responses exhibited by the natural resources to management projects against the desired response towards reaching the objective for that management project. Modification of the management objectives and projects may be needed to reach the desired goal. For example, a change in management actions may become necessary because of an unforeseeable and large - scale disturbance (e.g., fires, large storm events, or droughts) to the natural resources. An adaptive management approach allows for changes in short and long-term objectives from possible large-scale changes in the conditions of the natural resources to reach the goals of this INRMP.

1.5 Responsibilities

1.5.1 NSA Crane

NSA Crane provides the land, facilities, and other services to support the military mission at the installation. As such, NSA Crane is the land manager of the installation.

1.5.1.1 Officer-in-Charge

The Officer-in-Charge (OIC), NSA Crane is responsible for implementing policies and instructions of the Department of the Navy. This includes responsibility for management of natural resources as summarized below.

- Acting as a trustee for natural resources, developing and maintaining an effective conservation program, and using technical assistance from NAVFAC Midlant.
- Integrating natural resources requirements into the day-to-day decision-making process.
- Requesting funding to support implementation of this INRMP.
- Ensuring preparation and implementation of this INRMP, as required by the Sikes Act.
- Appointing an installation Natural Resources Manager whose duties include ensuring that the Officer-in-Charge is informed of the status of natural resources and its programs, including potential or actual conflicts between mission requirements and natural resources mandates.
- Ensuring that information copies of applications, decision documents, or proposals to create or fill wetlands are forwarded to the Chief of Naval Operations to help the Navy meet the “no overall net loss of wetlands” policy compliance (See “Wetlands: No-Net-Loss” text box below).
- Ensuring incorporation of soil and water conservation measures and landscaping in preliminary engineering, design, and construction of facilities and inclusion of these costs as a specific item in

new project investigations and reports.

- Reviewing non-excess land to identify areas that may be suitable for agricultural outleasing or commercial forestry.
- Seeking the aid of and coordinating natural resources management with federal, state, and local agencies.
- Coordinating proposals for new and continuing actions that affect natural resources with managers of natural resources.
- Documenting the presence of threatened or endangered species to identify habitat for these species (surveys shall include the presence and distribution of proposed threatened and endangered species).
- Requesting NAVFAC Midlant support to consult under the Endangered Species Act with the USFWS, when required.
- Taking action to avoid adverse impacts of new construction on wetlands.
- Ensuring that actions affecting natural resources are given proper consideration in the environmental review and public notification process.
- Maintaining records to monitor and evaluate natural resources and providing information to agencies and the public.
- Ensuring that natural resources management principles are integrated with environmental protection programs.

Wetland: No-Net-Loss

The purpose of Executive Order 11990 “Protection of Wetlands” issued in 1977 is to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands". To meet these objectives, the order requires federal agencies, in planning their actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided. The goal of “no-net-loss” of wetlands was first set out by President George H.W. Bush during his 1988 presidential campaign, and was announced as an administration policy at an EPA press conference in January, 1989. The concept was originally developed by the National Wetlands Policy Forum, a stakeholder panel brought together by the Conservation Foundation. The results of the Forum were published in 1988 and called for a short-term goal of no overall net loss of wetlands, and a longer term goal of achieving a net gain of the nation’s wetlands. The goal did not just apply to the extent of wetlands acreage in the country, but also to the functions and values of those wetlands, a much more difficult goal to achieve and to measure. The goal of no-net-loss was embraced and expanded on by President Bill Clinton. His administration’s Clean Water Action Plan for the first time articulated an administration goal of achieving a net gain of wetlands. This Action Plan set a goal of attaining a net increase of 100,000 acres per year by 2005.

President George W. Bush’s administration also embraced the goal of no-net-loss of wetlands and developed a 2002 National Wetlands Mitigation Action Plan to ensure a net gain of wetlands acreage. When military activities result in the destruction of a wetland or adverse impact to a wetland, the military may make payments to a wetland mitigation banking program that may be in lieu of mitigating wetland impacts through the creation of a wetland on federal property. In this process, wetlands are supposed to be restored, improved, or created. Wetlands banking projects are eligible for federal funding support. The "bank" holding the funds has an account manager, which may be an inter-agency committee that determines wetland "credits" based on the quality or capacity of the newly created or restored wetlands.

1.5.1.2 NAVFAC Midlant PWD Crane

The Public Works Officer at NAVFAC Midlant PWD Crane will maintain an organization with the resources needed to accomplish the INRMP and is responsible for management of natural resources at NSA Crane as part of the installation's overall environmental program. The Public Works Officer, acting through its Natural Resources Manager, is responsible for preparation and implementation of this INRMP. This is the direct vehicle for accomplishment of many of the above responsibilities of the Officer-in-Charge.

The Natural Resources Manager and installation foresters carry out responsibilities for the integrated management of natural resources on NSA Crane addressed in this INRMP. The cultural resources manager and natural resources volunteer assist in implementation.

1.5.1.3 Morale, Welfare, and Recreation Department

The Director of the Morale, Welfare, and Recreation (MWR) Department establishes procedures and governs various aspects of installation morale, welfare, and recreation activities. Responsibilities associated with this plan include those listed below.

- Managing the marina, campgrounds, and boat docks on Lake Greenwood.
- Conducting fishing and other outdoor recreation tournaments.
- Outdoor equipment rental.
- Sell NSA Crane fishing and hunting permits to authorized participants.

1.5.1.4 Explosives Safety and Fire Departments

The Explosives Safety and Fire Departments manage fire and safety responsibilities. Responsibilities include those listed below.

- All aspects of explosives safety, fire and emergency services, and chemical and explosives analysis.
- Providing advice and assistance to the NSA Crane commander and managers.
- Investigating and recommending countermeasures for accidents and injuries.
- Serving as technical advisor for explosive safety.
- Recommending land use alternatives based on DoD and Navy explosives safety standards.

1.5.1.5 Other Installation Organizations

Implementation of this INRMP will require assistance from other directorates and organizations. Such organizations include the commanders of major subordinate organizations and commanders of tenant units and activities (i.e., Crane Army Ammunition Activity).

1.5.2 Other Defense Organizations

1.5.2.1 Commander Naval Installations Command

The Commander Naval Installations Command (CNIC) is responsible for providing command supervision of the NSA Crane natural resources program. CNIC administers environmental budgeting to

include cultural resources projects, preparation of this INRMP, and some natural resources management projects.

1.5.2.2 NAVFAC Midlant

NAVFAC Midlant provides technical supervision of NSA Crane natural resources program. Specifically, NAVFAC Midlant administers funding and provides staffing assistance as needed to CNIC.

1.5.2.3 U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers, Louisville, Kentucky assists the NSA Crane natural resources program by performing research projects, such as a dam breach study of Lake Greenwood, and wetland delineations on the installation.

1.5.3 Other Federal Agencies

1.5.3.1 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS), Region 3, has an Ecological Services Field Office in Bloomington, Indiana that provides technical advice for management of natural resources on NSA Crane, particularly involving endangered and threatened species. OPNAVINST 5090.1, Chapter 12, provides guidance to be followed by NSA Crane when dealing with the USFWS for endangered species management.

The USFWS is a signatory cooperator in implementation of this INRMP in accordance with the Sikes Act. This INRMP replaces the *Cooperative Agreement for the Protection, Development, and Management of Fish and Wildlife Resources at Crane Division, Naval Surface Warfare Center* (1977). The USFWS also has responsibilities under the Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act. Furthermore, the USFWS provides fisheries management services for Lake Greenwood and other impoundments on the base. This work is performed by the by the Carterville Fishery Resources Office.

1.5.3.2 Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) provides technical planning and assistance upon request as personnel and resources allow. The NRCS performs inspections of Boggs Creek and Seed Tick reservoirs and designed ponds for wildlife watering facilities. NRCS will be considered for technical assistance, particularly concerning wetlands, during implementation of this Plan.

1.5.3.3 U.S. Forest Service

The U.S. Forest Service (USFS) assists NSA Crane primarily by providing gypsy moth traps to the installation and professional interaction concerning forest pests. The USFS periodically makes forest training sessions available to installation personnel and professional interaction occurs regularly. NSA Crane has also been available to the USFS for research projects in the past.

1.5.4 State Agencies

The Indiana Department of Natural Resources (INDNR) is responsible for management of most fish and wildlife within the state, including those on federal lands. INDNR provides oversight for hunting and fishing on the installation and assists in managing nongame fish and wildlife.
INDNR is a signatory cooperator in implementation of this INRMP. This INRMP replaces the *Cooperative Agreement for the Protection, Development, and Management of Fish and Wildlife Resources at Crane Division, Naval Surface Warfare Center* (1977).

The State Historic Preservation Office (SHPO) is within the INDNR, administers the state historic preservation program, and is responsible for overseeing the implementation of the National Historic Preservation Act. The SHPO serves as a repository for the location of archeological sites within the installation. The SHPO works closely with the cultural resources manager in recording site information and providing consultation for site protection and mitigation.

1.5.5 Universities

Regional universities have provided specialized expertise to help manage natural resources on NSA Crane. Purdue University has been involved in research projects on the installation for over 50 years. Indiana University has performed research, and Ball State University has been involved primarily with health issues, such as tick studies, on the installation. NSA Crane will continue to encourage universities to assist with its natural resources programs in the future.

1.5.6 Municipalities

Communities adjacent to or in proximity of NSA Crane are positively affected by natural resources management on the installation. NSA Crane provides opportunities for general public hunting. In addition, surrounding counties are impacted positively by distributions of funds from timber sales on the installation. There are no significant conflicts between natural resources management on NSA Crane and surrounding communities. NSA Crane management enhances surrounding wildlife populations with animals moving off-installation, which offers more consumptive and nonconsumptive opportunities.

1.5.7 Other Interested Parties

General public interest in natural resources management at NSA Crane is moderately high, in part due to the outstanding resources available (i.e., white-tailed deer hunting and fishing). The Indiana Deer Hunters Association, Kentucky/Indiana Chapter of Paralyzed Veterans of America, Crane Bass Club, and the Girl Scouts and Boy Scouts of America are local and regional organizations that have demonstrated an interest in or provided assistance to the management of natural resources on NSA Crane. The installation receives numerous visits from professional organizations, such as the Society of American Foresters, and tours by the Audubon Society and school groups from local and regional institutions.

1.6 Authority

Navy installations are required to implement and maintain an integrated natural resources program to manage such natural resources under the installation's administration by Department of Defense Instruction (DODI) 4715.3, the Environmental and Natural Resources Program Manual (OPNAVINST 5090.1), and the Sikes Act Improvement Act (SAIA) (16 United States Code 670a through o). Multiple-use, protection and enhancement of natural resources, sustainable yield, and maintaining biological integrity using an ecosystem management approach are requirements under DODI 4715.3 and OPNAVINST 5090.1. SAIA requires military installations having significant natural resources to prepare INRMPs for the conservation and rehabilitation of these resources. The INRMP is to provide for

integrated fish and wildlife management, land and forest management, wetland enhancement and protection, public access and sustainable use of the natural resources, and enforcement of natural resource laws and regulations without interfering with the military readiness or mission of the installation. Under SAIA, the INRMP is to reflect cooperation and mutual agreement between NSA Crane, USFWS, and state agencies. For the case of NSA Crane, the relevant state agency is the Indiana Department of Natural Resources. NSA Crane must prepare and implement an INRMP to facilitate the natural resources management program in compliance with these laws and regulations.

The Sikes Act (16 USC 670 *et seq*.) states: "*The Secretary of Defense shall carry out a program to provide for the conservation and rehabilitation of natural resources on military installations. To facilitate the program, the Secretary of each military department shall prepare and implement an integrated natural resources management plan for each military installation. It requires that each INRMP shall, where appropriate and applicable, provide for:*

- *Fish and wildlife management, land management, forest management, and fish and wildlife-oriented recreation.*
- *Fish and wildlife habitat enhancement or modifications.*
- *Wetland protection, enhancement, and restoration where necessary for support of fish or wildlife.*
- *Integration of and consistency among the various activities conducted under the plan.*
- *Establishment of specific natural resources management objectives and time frames for proposed actions.*
- *Sustained use by the public of natural resources to the extent such use is not inconsistent with the needs of fish and wildlife resources management.*
- *Public access to the military installation that is necessary or appropriate for sustained use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources, subject to requirements necessary to ensure safety and military security.*
- *Enforcement of natural resource laws and regulations.*
- *No net loss in the capability of military installation lands to support the military mission of the installation.*
- *Such other activities as the Secretary of the military department considers appropriate".*

The Sikes Act also requires or provides for:

- Regular review of the INRMP and its effects, not less often than every five years.
- Provisions for spending hunting and fishing permit fees exclusively for the protection, conservation, and management of fish and wildlife, including habitat improvement and related activities in accordance with the INRMP.
- Exemption from procurement of services under Office of Management and Budget Circular A-76 and any of its successor circulars.
- Priority for contracts involving implementation of this INRMP to state and federal agencies having responsibility for conservation of fish or wildlife.

Furthermore, an installation must prepare an INRMP when:

- The installation supports federally listed species and/or designated critical habitat.
- The installation contains substantial wetland areas.
- The Installation maintains large areas (i.e., 50 or more acres) used for military readiness purposes, which require care (i.e., actions to prevent soil erosion).

1.7 Military Mission

NSA Crane Military Mission

"To provide shore support to fleet, fighter, and family to enable Commanders to focus on their mission"

NSA Crane tenant personnel are involved in projects supporting virtually every ship, submarine, aircraft, missile, or other system fielded by the United States Navy (Crane NSWC, 1999). NSA Crane employs approximately 214 individuals (Andrews, 2008).

Naval Surface Warfare Center (NSWC) Crane Division is one of the major tenants of NSA Crane. NSWC Crane provides comprehensive support for complex military systems spanning development, deployment and sustainment in three mission areas: Electronic Warfare/Information Operations, Special Missions, and Strategic Missions. NSWC Crane Division employs approximately 2,989 individuals (NSWC Crane, 2008).

The Crane Army Ammunition Activity (CAAA) has been a major tenant of NSA Crane since 1977. The CAAA mission is to produce and renovate conventional ammunition and ammunition-related components; perform industrial manufacturing and engineering and product assurance operations; receive, store, ship, and demilitarize and dispose of conventional ammunition; and conduct surveillance functions of the conventional ammunition and related missions at NSA Crane. CAAA employs approximately 650 individuals (NSWC Crane, 2008).

1.7.1 NSA Crane Support Capabilities

Open space land provided by NSA Crane is essential to the installation military mission. The importance of open space is due to explosive safety quantity distance (ESQD) requirements associated with ammunition production and storage areas. A specified ESQD arc is placed around each production and storage area and is required primarily for safety reasons. ESQD arcs restrict other uses and access to such areas. These ESQD "buffer areas" provide most of the installation open space.

Open space land is also important for the installation demilitarization mission. Open space provides options for siting of a specific demilitarization site for the detonation of bombs, rockets, bulk explosives, propellants, and ammunition and related components. Open space land also provides options for the amount and type of buffer area surrounding the demilitarization site. Open space land provides options to locate and establish other operations, such as landfills, decontamination sites, sludge application areas, etc. Natural resources management is an important aspect of maintaining NSA Crane open space.

Vegetation plays an important role at NSA Crane for both the military mission and environmental protection. Vegetation is important in maintaining installation open space as well as essential to control erosion. NSA Crane will control erosion using vegetation to continue to comply with water quality requirements. The Navy recognizes the need to minimize damage to vegetation, lest the military environment be compromised and problems, such as soil erosion, make it unsuitable for future use.

1.7.1.1 Post Population and Military Units

Major tenant activities on NSA Crane include those listed below.

- Naval Surface Warfare Center, Crane Division

- Crane Army Ammunition Activity
- Explosive Ordnance Disposal
- Defense Reutilization and Marketing Office
- U.S. Coast Guard
- Defense Commissary Agency Detachment Crane
- NAVFAC Midlant, PWD Crane
- Great Lakes Industrial Hygiene
- Defense Automated Printing Service
- Fleet Industrial and Supply Center

1.7.2 Effects of the Military Mission of Natural Resources

Compared to most of the surrounding area, NSA Crane has retained much of the landscape's natural character, acting as a refuge for plants, animals, and natural communities. Much of the land at NSA Crane is undeveloped and unoccupied. Nonetheless, threats to these resources may arise from military activities.

1.7.2.1 Past and Current Military Mission Impacts on Natural Resources

Lands of NSA Crane were originally used for small farms. Initial development of the installation with its buildings, roads, railroads, magazine areas, and associated infrastructure was the primary and most significant impact that the military mission has had on NSA Crane natural resources. Development of these facilities altered the existing landscape and enabled a return of a significant portion of the installation to a more forested landscape, as the lands were no longer utilized for agriculture.

Along with development came impacts associated with noise, primarily due to vehicles, trains, production, and the most significant noise producer, the demolition of surplus ammunition and waste explosives. This impact has been addressed through implementation of an Installation Compatible Use Zone to mitigate noise levels.

Development also brought the requirement for disposal of waste materials. NSA Crane operates a domestic wastewater treatment plant, a hazardous waste storage facility, an Ordnance Burning/Ordnance Demolition facility, and a solid waste landfill, which are all permitted appropriately (NORTHDIV, undated).

Development continues today, but at a much lower level. Due to modernization of techniques, equipment, etc., as well as more stringent environmental laws and regulations, the impacts of development are significantly different and much more controlled than in the past. Siting new mission-related projects can be challenging to natural resources personnel, as natural areas often appear to be ideal for many such projects. However, through coordination between mission planners and land managers, alternative sites are often identified and many times are better suited to mission requirements. This type of coordination has allowed both new missions and healthy natural resources as a whole to coexist on NSA Crane.

Erosion and subsequent siltation was a problem for the installation when the Navy first assumed ownership of the land. The urgency and scale of construction of the installation added to the problem. Area streams and lakes where heavily burdened with silt and sedimentation from previous land practices and from the construction of ammunition igloos, buildings, and infrastructure. The sheer number of acres involved with initial construction made this undertaking the most significant event with regard to erosion and siltation in NSA Crane history. More recently, erosion and siltation problems have been much more localized. Specific areas, such as construction sites and the demilitarization range, have inherent erosion

and siltation problems, but they are at a scale much more manageable than that associated with initial installation construction.

Water pollution has been an inherent risk for NSA Crane. Production areas generate contaminated waste water. NSA Crane operates a Class D industrial wastewater treatment plant where effluent quality is monitored. The treatment plant must meet established limitations to control discharges of industrial wastewater pollutants into the sewer system and to control any interference with the operation of the Crane Sewage Treatment Plant. Treatment processes include equalization with concurrent diffused aeration, hydrosieve separation of coarse particles, rotating biological contactors, aerobic digestion, clarification and sand filtration, and disinfection (NSWC Crane, 1994). Treated industrial wastewater and sanitary sewage effluent are discharged to Boggs Creek, which eventually discharges into the East Fork of the White River.

NSA Crane is considered a "major source" of air pollution under the Clean Air Act Amendments of 1990 (SOUTHDIV, 1994). The installation is classified by the U.S. Environmental Protection Agency as an attainment area for six criteria pollutants regulated by the Clean Air Act: ozone, sulfur dioxide, carbon monoxide, lead, particulate matter, and nitrogen dioxide (Crane NSWC, 1996). NSA Crane has been issued several air quality permits by the Indiana Air Pollution Control Board, a division of the Indiana Department of Environmental Management. Air quality, particularly the burning of munitions, potentially could affect the endangered Indiana bat on NSA Crane.

Management of some biological resources has been affected by the installation military mission. Security and safety requirements of the military mission have limited the degree of public access to resources, such as white-tailed deer hunting. Resource use, in general, is limited for this reason. Other management activities, such as timber harvest, are also affected by mission schedules and activities.

1.7.2.2 Future Military Mission Impacts on Natural Resources

It is difficult to quantify the effects of future military missions on natural resources at NSA Crane. If basic mission, land area, and intensity of missions remain unchanged, mission impacts on natural resources will remain similar to those today. NSA Crane's primary mission and geographic footprint are not likely to change. However, this may not be true for mission intensity.

The Department of Defense is being forced to make do with less in terms of both quantity and quality of training lands. Effective training resources must be managed so as to not exceed the optimum training carrying capacity of sites and ensure the long-term use of the resource. Now that Base Realignment and Closure (BRAC) is a reality within DoD, other military missions may look toward NSA Crane to fulfill their future training needs. Training, such as basic training, land navigation, etc., potentially could be accommodated at NSA Crane, but heavy equipment, armored, and gun unit training likely could not. Even routine activities such as foot training could impact resources by trampling vegetation, impacting the endangered Indiana bat, dispersing wildlife, causing erosion, etc. New missions would need to be closely scrutinized to determine their compatibility with the current mission and resources of NSA Crane.

1.7.3 Effects of Natural Resources or Their Management on the Military Mission

Relatively few restrictions are imposed on the military mission due to natural resources needs at NSA Crane. Restrictions are generally those that are associated with regulatory and legal compliance, such as the Endangered Species Act, the Clean Water Act, and the National Environmental Policy Act. Overall, management of natural resources has enhanced the ability of NSA Crane to perform its mission. By virtue of being a military installation, most resources at NSA Crane have retained values often lost in areas less

protected. Wetlands and the many functions they provide, such as acting as a filtration system and water retention area, may have been lost without NSA Crane establishment. Natural systems often enhance the military mission.

1.7.3.1 Soils

Soils on NSA Crane are generally well-drained and erodible if denuded of vegetative cover. Consequently, intensive soil disturbing activity can damage areas and expose them to serious erosion. Many areas of the installation experienced severe erosion damage in the past, but vegetation management practices have been very successful in stabilizing soils. Restrictions associated with soils are essentially nonexistent with exception of soils being taken into account when siting new projects or construction. If soils at one location are an issue for project development, an alternative location can often be found.

1.7.3.2 Water

Protection of surface waters and downstream users of water is important for NSA Crane. Water protection is achieved in part by the protection of areas along the shores of ponds, lakes, and stream banks on NSA Crane. Protection of such areas, particularly at Lake Greenwood, does not hinder the ability of NSA Crane to perform its military mission.

1.7.3.3 Biological Resources

NSA Crane has become locally well known as a military installation that provides high quality outdoor recreation, especially white-tailed deer hunting and fishing. Security and safety issues are of concern when allowing the military community, as well as the general public, access to areas that would otherwise be off-limits. Procedures for allowing access have been developed and implemented. In general, these procedures require extra effort by NSA Crane, particularly for the deer hunts. To allow deer hunts to occur, NSA Crane increases security controls, curtails some mission-related functions, and takes additional steps to ensure the security of the military mission. NSA Crane has adapted the management of its natural resources in support of the military mission and is proving that they are not mutually exclusive.

1.8 Stewardship and Compliance

The Navy believes that military activities, including the military mission of NSA Crane, can be compatible with the conservation of sensitive biological resources. As a principal regional land manager, NSA Crane is committed to the responsible stewardship of its land. The Navy believes that responsible stewardship will enhance both the natural resources that comprise NSA Crane as well as the installation's military mission.

There are numerous positive effects of the military mission on natural resources. The most general and most significant on NSA Crane is commitment to natural resources management, including minimization and mitigation of military mission damage. This natural resources commitment is beneficial for both natural resources in general and people who use natural resource products.

The presence of NSA Crane continues to preserve native ecosystems by preventing development and ensuring that land uses are conducted in a manner that protects the environment. Natural resource considerations and safety demands associated with the production and storage mission, such as Explosive Safety Quantity Distance arcs, limit the extent of other potentially damaging land uses including development.

NSA Crane shall implement proper stewardship of the land entrusted to the care of the Navy with the following strategies:

- Use adaptive ecosystem management strategies to protect, conserve, and enhance native fauna and flora.
- Monitor and manage soils, water, vegetation, and wildlife on NSA Crane with a consideration for all biological communities and human values associated with these resources.
- Provide human-valued products of renewable natural resources when such products can be produced in a sustainable fashion without significant negative impacts on the military mission or other natural resources.
- Provide professional enforcement of natural resource-related laws.
- Involve the surrounding community in the NSA Crane natural resources program.
- Ensure the NSA Crane natural resources program is coordinated with other agencies and conservation organizations with similar interests.

Implementation of stewardship objectives outlined above cannot be implemented without compliance to laws and regulations which govern the management of natural resources at NSA Crane. At NSA Crane, compliance with laws and regulations pertaining to the management of natural resources include the following strategies:

- Manage natural resources within the spirit and letter of environmental laws, particularly the Sikes Act upon which this Integrated Natural Resources Management Plan is predicated.
- Protect, restore, and manage sensitive species and wetlands.
- Use procedures within the National Environmental Policy Act to make informed decisions that include natural resource considerations and mitigation.
- Ensure the NSA Crane natural resources program is consistent with the protection of cultural and historic resources and the Integrated Cultural Resources Management Plan (NSA Crane, 2013).
- Implement this INRMP within the framework of Navy policies and regulations.
- Protect and manage threatened and endangered species in accordance with the Endangered Species Act.
- Allow access to NSA Crane's natural resources within DoD explosives safety guidelines.

1.9 Review and Revision Process

Section 101(b) (2) of SAIA requires that each plan be reviewed "on a regular basis, but not less often than every five years." NSA Crane recognizes that natural resource management is a dynamic process and that this INRMP will need to be evaluated and revised frequently. Consistent with Navy and DoD guidance, NSA Crane intends to review the INRMP annually in cooperation with the USFWS and INDNR and revise the INRMP when necessary. The continuous involvement of the USFWS, INDNR, and the public is expected to assist in future reviews and revisions.

The review process is facilitated by the web-based Metrics Builder tool on the Natural Resources Data Call station website. The Metrics Builder provides the means to evaluate performance in seven areas:

- INRMP Implementation

- Partnerships/Cooperation and Effectiveness
- Team Adequacy
- INRMP Impact on the Installation Mission
- Status of Federally Listed Species and Critical Habitat
- Ecosystem Integrity
- Fish and Wildlife Management and Public Use

During the reviews, natural resource management objectives, planned actions, and proposed actions will be reviewed with the appropriate managers to document progress, identify additional actions required or desired, and revise implementation schedules and priorities. As part of the review process, USFWS and INDNR will be involved in the evaluation of processes, results, and implementation of established milestones and timelines for specific projects and programs, as well as a review of ecosystem, species, and habitat goals established in conservation management plans. New projects, data, understanding of natural processes and species, and lessons learned from completed and ongoing projects and practices will be incorporated as appropriate following these INRMP reviews.

1.10 Commitment of U.S. Fish and Wildlife Service and Indiana Department of Natural Resources

This document was prepared in partnership and cooperation with the U.S. Fish and Wildlife Service (USFWS) and the Indiana Department of Natural Resources (INDNR), representing the federal and state Sikes Act cooperating agencies, respectively.

Revision of this INRMP, as required by the Sikes Act, has been accomplished in cooperation with USFWS and INDNR. This cooperation ensured that the INRMP reflected mutual agreement of these parties concerning conservation, protection, and management of fish and wildlife resources on NSA Crane.

1.11 Management Strategy

Management of NSA Crane natural resources will support sustainable military use through the application of an integrated approach to ecosystem management. Ecosystems are dynamic, and may exhibit responses to management actions different than those expected. A process of adaptive management will be used to compare the responses exhibited by the natural resources to the management projects against the desired response towards reaching the objective for that management project. Modification of the management objectives and projects may be needed to reach the desired goal. An adaptive management approach allows for changes in short and long-term objectives from possible large-scale changes in the conditions of the natural resources to reach the goals of this INRMP.

The Department of Defense has developed *A Department of Defense (DoD) Biodiversity Management Strategy* (The Keystone Center, 1996). Biodiversity refers to the variety and variability among living organisms and the environment in which they occur. Biodiversity has meaning at various levels including ecosystem diversity, species diversity, and genetic diversity. This Strategy identifies five reasons to conserve biodiversity on military lands:

- Sustain natural landscapes required for the training and testing necessary to maintain military readiness.
- Provide the greatest return on the Defense investment to preserve and protect the environment.
- Expedite the compliance process and help avoid conflicts.

- Engender public support for the military mission.
- Improve the quality of life for military personnel.

The Keystone Center Report, (1996) notes that the challenge is "*to manage for biodiversity in a way that supports the military mission"*. This strategy identifies the INRMP as the primary vehicle to implement biodiversity protection on military installations. The model process developed within the strategy includes the principles listed below.

- Support the military mission.
- Use joint planning between natural resources managers and military operations personnel.
- Integrate biodiversity conservation into INRMP and other planning protocols.
- Involve internal and external stakeholders up front.
- Emphasize the regional (ecosystem) context.
- Use adaptive management.
- Involve scientists and use the best science available.
- Concentrate on results.

The Department of Defense (DoD Instruction 4715.3, *Environmental Conservation Program*) describes ecosystem management as, "*a process that considers the environment as a complex system functioning as a whole, not a collection of parts, and recognizes that people and their social and economic needs are a part of the whole*". The Department of Defense goal with regard to ecosystem management is, "*To ensure that military lands support present and future training and testing requirements while preserving, improving, and enhancing ecosystem integrity. Over the long term, that approach shall maintain and improve the sustainability and biological diversity of terrestrial and aquatic (including marine) ecosystems while supporting sustainable economies, human use, and the environment required for realistic military training operations*." Principles and guidelines to achieve this goal include:

- Maintain and improve the sustainability and native diversity of ecosystems.
- Administer with consideration of ecological units and time frames.
- Support sustainable human activities.
- Develop a vision of ecosystem health.
- Develop priorities and reconcile conflicts.
- Develop coordinated approaches to work toward ecosystem health.
- Rely on the best science and data available.
- Use benchmarks to monitor and evaluate outcomes.
- Use adaptive management.
- Implement through installation plans and programs.

NSA Crane will use ecosystem management to guide its program in the next ten years and beyond.

2.0 Current Conditions and Use

2.1 Installation Information

2.1.1 Location

NSA Crane is located in south-central Indiana approximately 75 miles southwest of Indianapolis, Indiana, 71 miles northwest of Louisville, Kentucky, and 25 miles southwest of Bloomington, Indiana (Figure 2.1). The communities of Crane, Elnora, Odon, Loogootee, Shoals, Oolitic, Mitchell, and Bedford are within approximately 15 miles of the installation (Figure 2.2). NSA Crane is a 62,467 acre (97.6 square miles) contiguous block of land within Martin, Greene, and Lawrence counties, except for 461 acres at the Glendora Test Facility in Sullivan County. Approximately half (32,000 acres) of NSA Crane was transferred from the Department of Agriculture and the Indiana State Park and Forest Division to the Navy through an Executive Order issued by President Franklin D. Roosevelt in 1940. The remainder of NSA Crane was purchased from private individuals.

The 461-acre Glendora Test Facility in Sullivan County, Indiana (Figure 2.3) was purchased in the early-1990s from the Amax Coal Company who operated a strip mine on the site. NSA Crane has allowed a 100-acre pit (over 100 feet deep) to fill with water and uses the pit to test Navy weapons systems. The facility is composed of land and water resulting from reclamation of a surface coal mine. Final reclamation was completed in 1992. Terrestrial habitats consist primarily of grasslands and a small scrub/shrub area. Aquatic habitats include the test pit and three smaller bodies of water.

In 2006, a biological survey was conducted at Glendora by the Indiana Department of Natural Resources, Division of Nature Preserves, to determine the status of threatened, endangered, and special concern vertebrate animal and plant species. A total of 121 small mammals representing 6 species were trapped. The assemblage of animals trapped represented low biodiversity, due to the fact that the property is small and has rather uniform habitat. However, the assemblage of trapped species was considered interesting because it may resemble that of the earlier prairie habitat typical of the historic regional landscape (INDNR, 2006). Additionally, the survey documented a total of 43 bird species and a total of 7 reptile and amphibian species (INDNR, 2006).

No federally listed species were observed at Glendora during the 2006 surveys. State listed species observed at the property included the state endangered Henslow's sparrow and the state endangered crawfish frog. INDNR management recommendations for the property included maintenance of existing habitats, minimal use of pesticides, and more detailed surveys of the property (INDNR, 2006).

Lands managed by INDNR in the vicinity of NSA Crane include Martin state Forest, Mt. Calvary Wildlife Management Area, Indian Creek Wildlife Management Area, Bluffs of Beaver Bend Nature Preserve, and Jug Rock Nature Preserve. Additionally, Hoosier National Forest, managed by the U.S. Forest Service, is located approximately six miles to the east of NSA Crane. Local parks in the vicinity of NSA Crane include West Boggs Creek County Park, approximately two miles to the southwest of the installation (Figure 2.2).

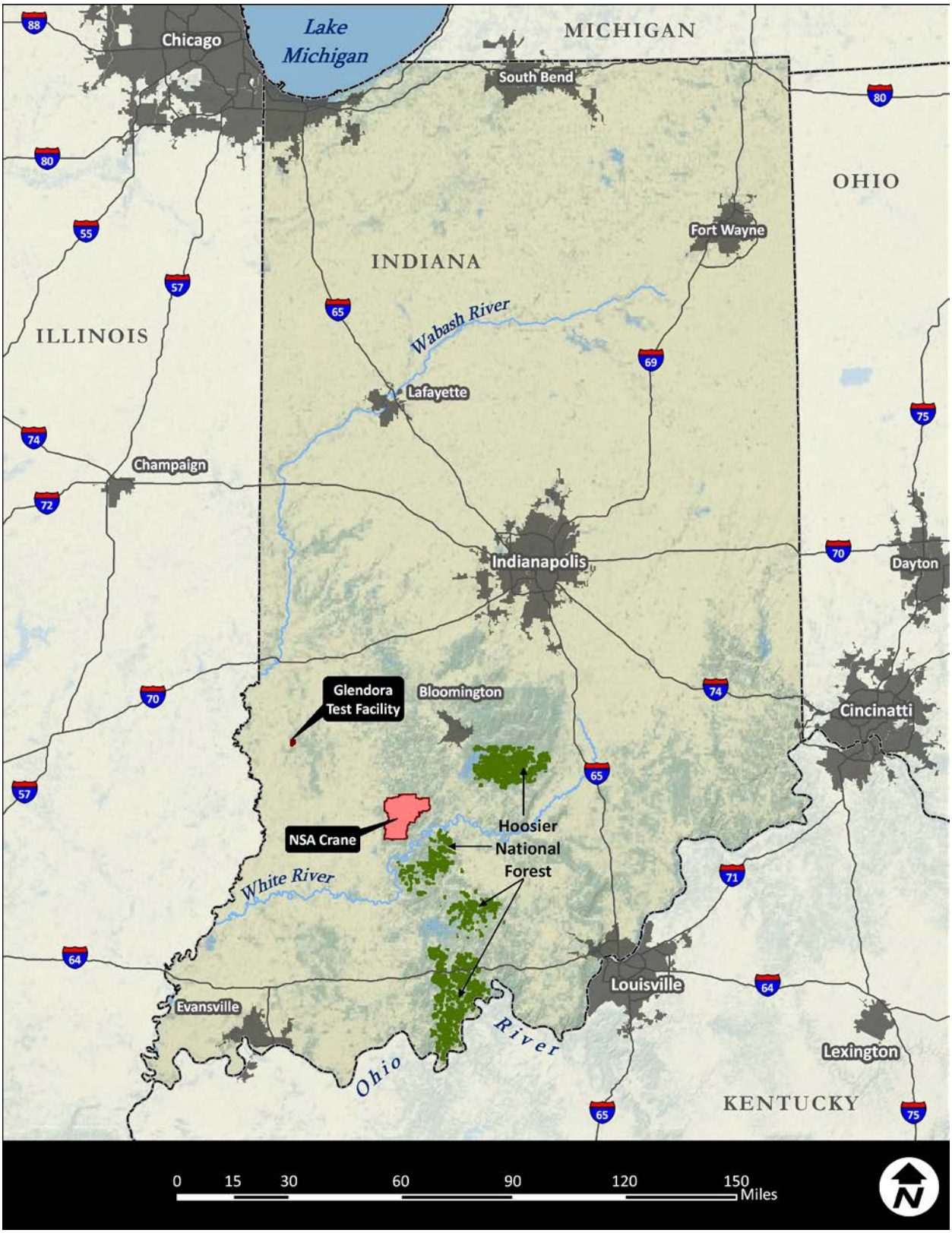

Figure 2.1: Regional Location, NSA Crane

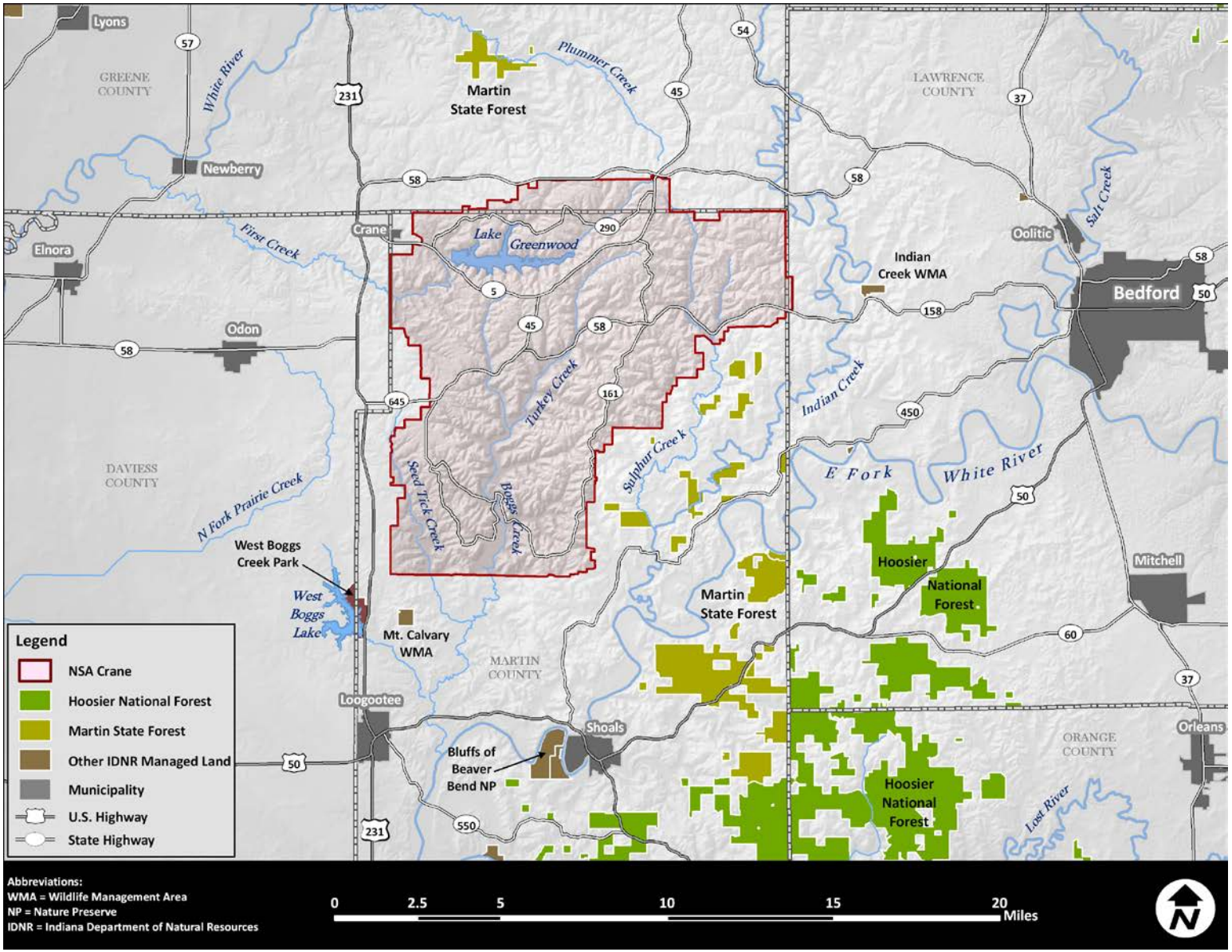

Figure 2.2: Project Location, NSA Crane

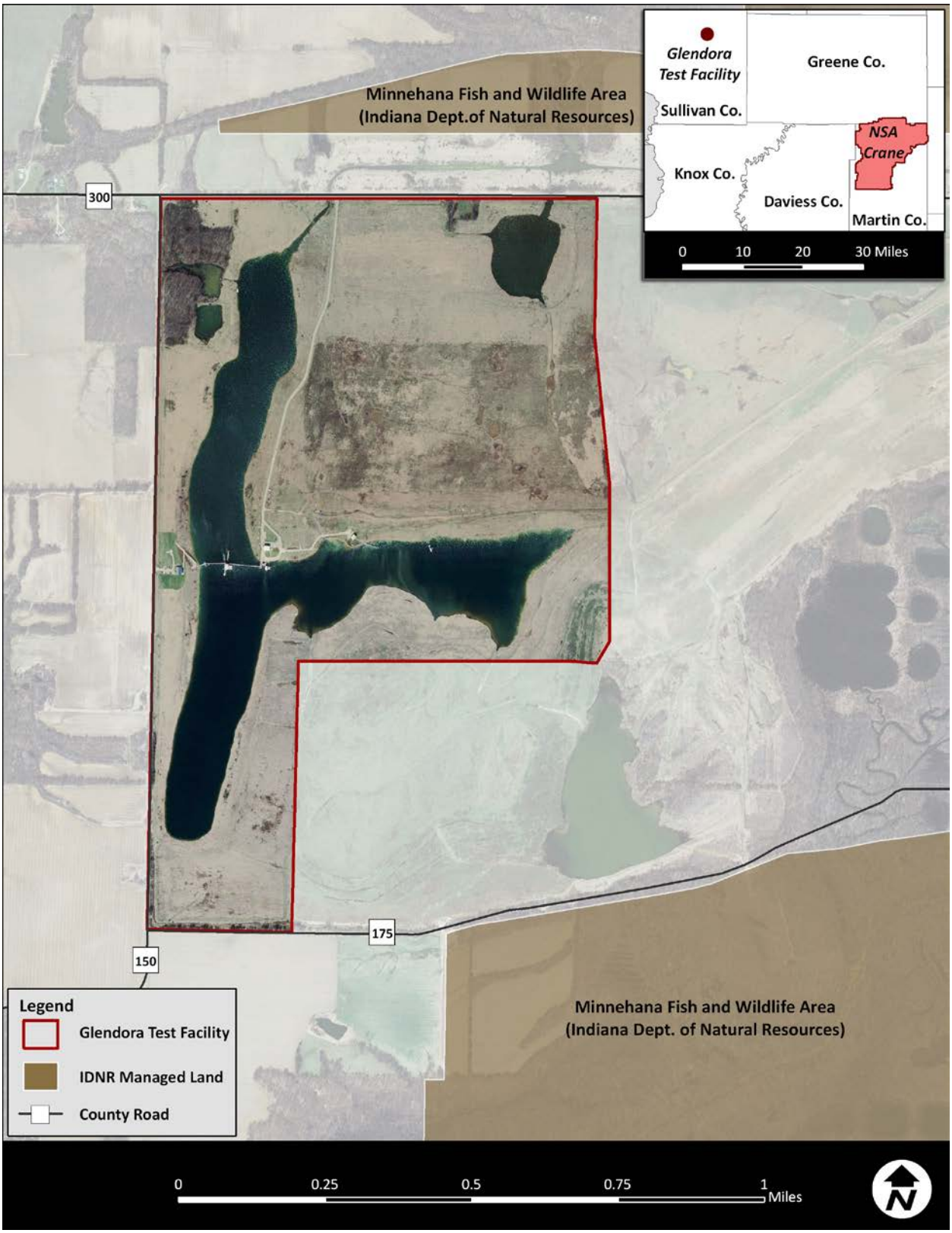

Figure 2.3: Glendora Test Facility

2.1.2 Training Opportunities

Currently, NSA Crane does not engage in significant advanced field training on the installation. However, the installation does allow for outside DoD entities to utilize NSA Crane land for training engagements. Such training activities which occur at NSA Crane are currently conducted by three separate entities.

1. Seabees – Seabees are the construction battalions of the U.S. Navy, and consist of Naval Reservists from the engineering corps. Currently, Seabees conduct monthly weekend training at NSA Crane, focusing on training for construction projects and minimal tactical training. Seabees training is conducted at Cranewood, as well as general construction training throughout the installation. This training involves approximately 50 reservists.

2. Golden Cargo Exercises – Colden Cargo is a national military exercise which trains Army reservists in the handling and transport of ammunition. Golden Cargo Exercises occur at NSA Crane once a year for a two week period, and involves training of approximately 300 Army reservists. Training occurs at Cranewood, as well as general ammunitions handling throughout the installation. Field exercises have occurred along designated tactical training routes in the past.

3. Navy Reservists NAVSEA – Limited to general training activities, such as security and working on small arms. Navy Reservists NAVSEA training occurs once a month for two days, involves less than 100 reservists, and generally occurs at Cranewood and other office/industrial locations.

Additionally, there is currently discussion of a proposal to allow Indiana National Guard training at NSA Crane. Training activities would consist of general field training, and would be conducted within the confines of restrictions due to sensitive natural resource areas.

Areas that may be considered potential opportunities for training are displayed on Figure 2.4.

2.1.3 Training Constraints

Generally, there are few potential areas which would act as natural resource related constraints to training opportunities. Such areas may include significant natural areas and unique communities (discussed further in this document in Section 2.3.2.1), buffered riparian areas potentially used by the federally endangered Indiana bat, and locations of documented special status species. The only area that would currently be off limits to training is an 8.5 acre great blue heron rookery which has been designated as a Navy Ecological Reserve. This reserve is located in a wet floodplain that is generally unsuitable for training or development.

Areas that may be considered potential constraints for training areas are displayed on Figure 2.4

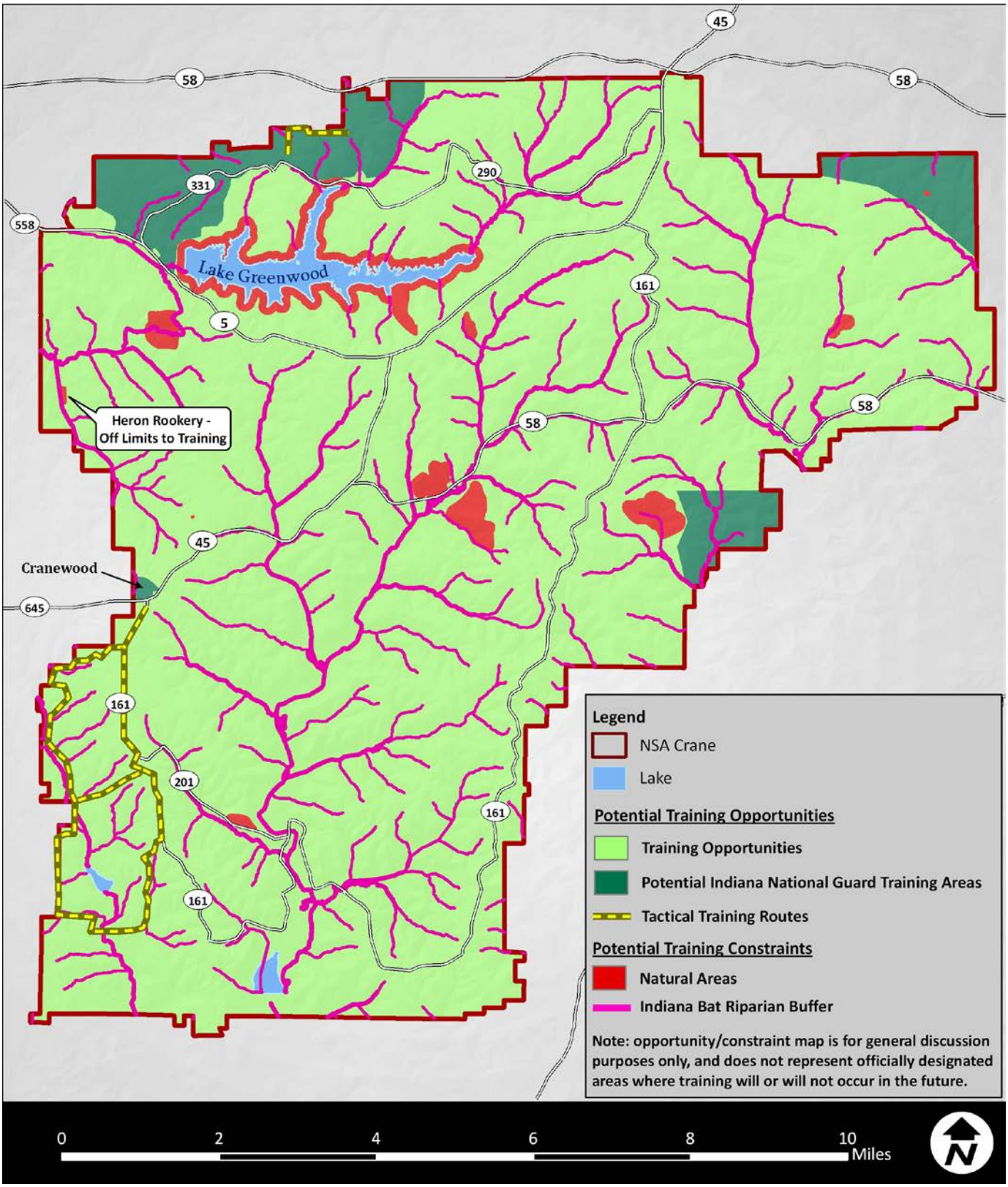

Figure 2.4: Potential Opportunities for and Constraints to Training Activities

2.1.4 Operations and Activities

As described in Section 1.7.2.1, operations and activities that may affect natural resources at NSA Crane were most prevalent when the installation was established during the 1940's. Initial development of the installation included the construction of roads, buildings, magazine areas, and associated infrastructure. These changes to the existing environment, which had been previously used for farming, constituted a major change with respect to land use. As the installation area became utilized to accomplish the military mission and was taken out of faming, the area gradually returned to forest cover.

With development and installation activities, a new set of impacts to natural resources arose, most notably noise issues associated with vehicular traffic and ammunition disposal, as well as the disposal of waste materials. Development of the installation continues today, but at a lower rate than when the installation was first established. Furthermore, the more restrictive nature of current environmental regulations helps to minimize the impacts of military activities on the installation. Increased coordination between mission planners and natural resources managers ensures that natural resources at NSA Crane can successfully coexist with the installation's military mission and activities.

2.1.4.1 Military Activities

Military activities conducted at NSA Crane by NSWC Crane are composed of three primary focus areas: strategic missions, electronic warfare/information operations, and special missions. Specific activities related to these three focus areas include:

- Electronic warfare
- Microelectronic technology
- Electronic module test and repair
- Microwave components
- Acoustic sensors
- Defense security systems
- Small arms
- Conventional ammunition engineering
- Pyrotechnics
- Electrochemical power systems
- Radar engineering
- Night vision/electro-optics
- Chemical/biological detection systems
- Munitions storage
- Munitions demilitarization and disposal

Open space provided by the installation is important to accomplish many of these activities, particularly the munitions demilitarization and disposal operations. Vegetation is important in maintaining installation open space as well as essential to control erosion. NSA Crane will control erosion using vegetation to continue to comply with water quality requirements. The Navy recognizes the need to minimize damage to vegetation, lest the military environment be compromised and problems, such as soil erosion, make it unsuitable for future use.

2.1.4.2 Military Training

As described in Section 2.1.2, NSA Crane provides installation lands as training for outside DoD entities, as well as potential training in the future for the Indiana National Guard. Field training generally occurs along designated tactical training routes, as well as areas which do not conflict with natural resource management requirements. Any proposed training performed by the Indiana National Guard would be employed within the context of natural resource management restrictions (such as restrictions to protect sensitive natural resource areas like the great blue heron rookery). However, any proposed training would likely require an endangered species consultation with the USFWS to identify and mitigate potential conflicts.

2.1.4.3 Timber Management Program

NSA Crane maintains an active timber management program, which manages the installation's 51,578 acres of forest. Management of the installation's timber resources provides benefits to wildlife species and habitat while working under the overarching goals of the military mission. Management of timber resources is also conducted in consultation with the U.S. Fish and Wildlife due to the presence of the federally endangered Indiana bat and federally threatened northern long-eared bat on the installation. More detailed information regarding the timber management program can be found in Section 4.3.

2.1.4.4 Outdoor Recreation

NSA Crane has an active outdoor recreation component, providing a variety of leisure activities to NSA Crane associated personnel. Such activities include:

- Hunting
- Fishing
- Boating on Lake Greenwood
- Camping at the campground near Lake Greenwood
- Hiking on designated trails

Although available, outdoor recreation opportunities are limited primarily due to safety and/or security concerns, as well as the limited personnel resources available to direct such opportunities. More information regarding the installation's outdoor recreation program can be found in Section 4.9.

2.1.4.5 Grounds Maintenance and Pest Management

Maintenance activities associated with the grounds of the installation are performed by contract and administered by NAVFAC Midlant PWD Crane. Maintenance activities include but are not limited to mowing, landscaping, soil stabilization efforts, and pesticide application. Pest management activities are also performed via contract and conform to guidance issued under the Integrated Pest Management Plan (Williams, 1999). Pest management activities include herbicide, fungicide, and insecticide applications.

2.1.4.6 Invasive Species Control

Invasive species control on the installation is performed by the Natural Resources Office, and includes removing invasive plant species by manual or mechanical means, as well as the application of herbicides. Because there are limited resources that can be given to invasive species control, the program focuses on infestations that have a small spatial distribution. After these infestations are under control, efforts will

shift to those more prevalent throughout the installation. More information on invasive species and methods of control can be found in Sections 2.3.4.2 and 4.5.

2.1.4.7 PWD Operations and Maintenance

Operations and maintenance of NSA Crane infrastructure, including renovation of structures, maintenance of storm and wastewater facilities, and maintenance of utility infrastructure, are performed by the Facilities Management Division of NAVFAC Midlant PWD Crane.

2.1.5 Abbreviated History and Pre-Military Land Use

The following discussion was adapted from the *Historic and Archeological Resources Protection Plan Crane Division, Naval Surface Warfare Center Crane, Indiana* (Thomason and Associates, 1995) and the NSWC Crane Division booklet, *A Tradition of Excellence* (NSWC Crane Division, undated). More detailed historical information regarding the installation can be found in *A Good Neighbor: The First Fifty Years at Crane* (Reid and Rodgers, 1991).

Before Navy occupation, the site of NSA Crane had been used for small farms; however, the area is not well suited to farming due to hilly terrain and poor soil. During the Depression era, this area of the state became the most impoverished in Indiana. In the late 1930s, the U.S. Department of Agriculture purchased the land as part of the White River Utilization Project. The project's intention was to establish a state park and to restore forest productivity. Trees and shrubs were planted, and creeks were dammed to control erosion and create Lake Greenwood. The land was cleared of most original farmhouses and outbuildings, roads, bridges, culverts, recreational buildings, and a park ranger dwelling were built.

In 1940, the site of NSA Crane was chosen as an inland ammunition production facility and was initially funded by the first supplemental National Defense Appropriation Act passed by Congress. The area met several requirements for such a facility, such as the distance from the eastern seaboard to minimize the danger of enemy air attack, the remote and uncongested nature of the site, ideal terrain for magazine construction and camouflage, and the Lake Greenwood water supply. The area was traversed by two state highways, a railroad, and an electric power transmission line. Limestone rock for buildings was readily available, and the land could be easily obtained. Construction of thousands of munitions storehouses and hundreds of support buildings began in 1941. Construction of NSA Crane (originally named Naval Ammunition Depot, Burns City) progressed quickly with most buildings and infrastructure complete by late 1945.

The Naval Ammunition Depot, Burns City stored and issued various types of ammunition, including pyrotechnics and illuminating projectiles, and acted as a principal source of supply especially during the early days of World War II. In 1943, the depot was renamed the Naval Ammunition Depot, Crane (NAD Crane) in honor of Commodore William Montgomery Crane, the Navy's first Chief of the Bureau of Ordnance. During World War II civilian employment on the installation reached more than 10,000, and more than 1,300 Navy personnel were assigned to the installation. After World War II, NAD Crane became the primary storage center for the vast array of Navy weapons left over from the war. For over 50 years, the installation has maintained its function of assembling, storing, and shipping munitions. Thus, the installation has played a role in all national conflicts since, including the Korean War, the Vietnam War, and the Persian Gulf War.

In 1975, the installation's name was changed to the Naval Weapons Support Center, Crane, to reflect Crane's true function and establish the installation as a research, development, test, and evaluation center. In 1977 the Army was designated as the single-service manager of conventional ammunition. This

resulted in a tenant command, the Crane Army Ammunition Activity, which assumed responsibility for loading, assembly, and storage of ammunition at the installation. In 1992, the Naval Ordnance Station at Louisville, Kentucky merged with Crane forming the Crane Division of the Naval Surface Warfare Center. In 1996, the Louisville site was privatized and became a contractor-operated facility. In October 2003, management of the installation was turned over from NSWC Crane to NSA Crane.

2.1.6 Regional Land Use

NSA Crane is surrounded by rural farmland and forested areas with a few urban areas and scattered light manufacturing industries, which utilize various natural resources, especially forest resources, available in the region (Figure 2.5). Typical crops produced in the region include corn, soybeans, and small grains. Population estimates for the counties containing the installation are: Martin (10,531), Greene (33,467), and Lawrence (45,615). NSA Crane is the second largest employer in the state, and the largest employer of engineers and scientists in southern Indiana (Crane NSWC, 1996). Manufacturing industries employ the majority of workers in Martin and Lawrence counties, and retail industries employ the majority of workers in Greene County.

Typical Regional Land Use and Setting, NSA Crane, Indiana

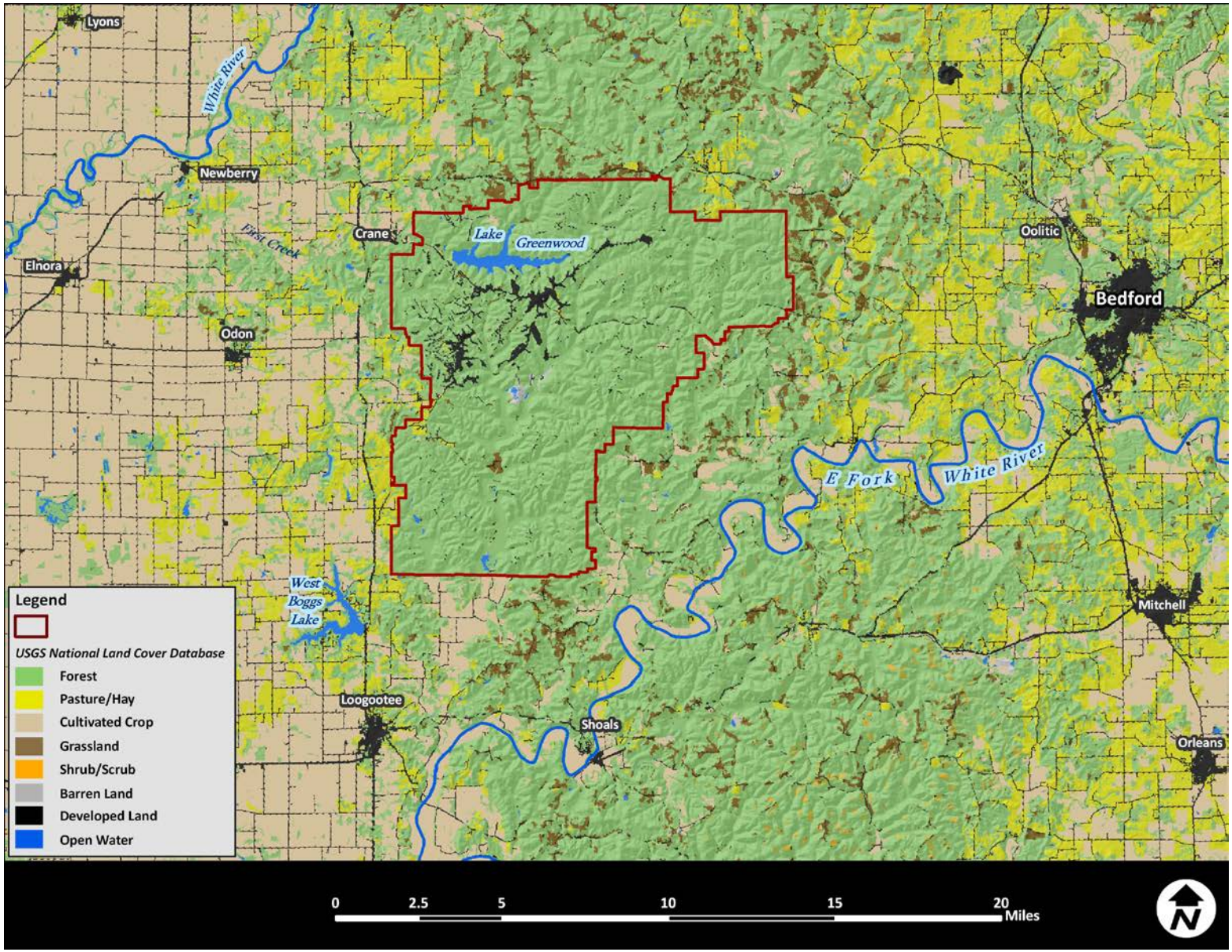

Figure 2.5: Regional Land Cover/Land Use

2.2 General Physical Environment

2.2.1 Physiography, Topography, and Climate

The geomorphology of southwest Indiana is controlled primarily by rock types exposed at the surface (Palmer, 1969). NSA Crane is located in an unglaciated area of the Crawford Upland, a rugged, dissected plateau. The Crawford Uplands show strong relief with steep slopes, narrow divides, and deep V-shaped valleys with few floodplains (Figure 2.6). Near the western boundary of the installation, the Crawford Upland grades into the Wabash Lowland, and east of NSA Crane the Mitchell Plain emerges as a low, dissected limestone plateau characterized by karst features.

The topography of the installation consists of steeply sloped, undulating terrain dissected by many small streams (Halliburton NUS, 1992). Elevations range from 860 feet above mean sea level on the eastern portion of the installation to 470 feet above mean sea level along Boggs Creek in the south-central portion (NORTHDIV, 1995) (Figure 2.7). Higher elevations and greater relief generally occur in the eastern portion of the installation. Surface drainage is to the south and southwest.

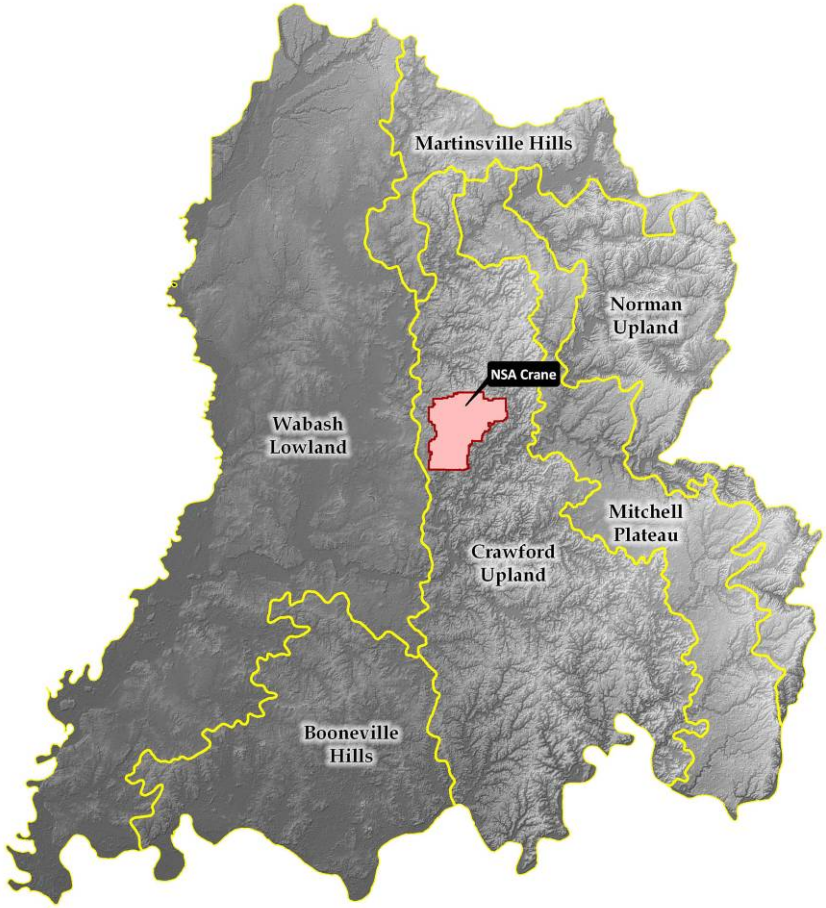

Figure 2.6: Physiographic Regions of Southwest Indiana

Southern Indiana is located in a temperate climatic zone. Significant seasonal variation of temperatures occurs. Summers at NSA Crane are warm and humid. The average summer temperature is 86 degrees Fahrenheit. Winters are mild except for occasional short periods of extreme cold. The average winter temperature is 32 degrees. The total annual precipitation for NSA Crane averages 44 inches. Average seasonal snowfall is 16 inches.

Prevailing winds at NSA Crane are from the south-southwest. The average maximum wind speed of 10 miles per hour occurs in spring (NRCS, 1988). Extremes in weather conditions, such as severe storms and prolonged periods of rain and snow, are relatively infrequent for the NSA Crane region.

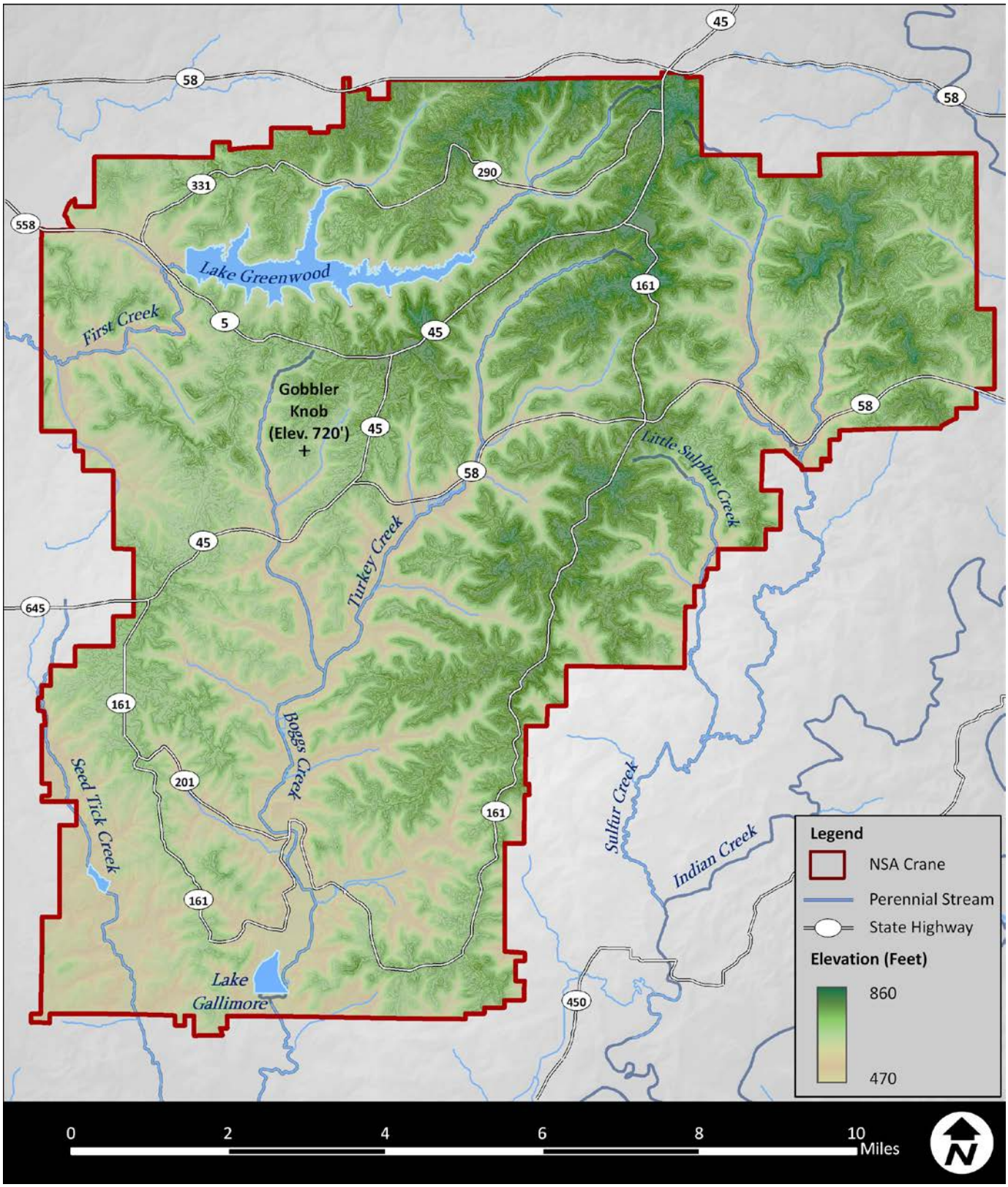

Figure 2.7: Topography

2.2.2 Geology

The underlying bedrock at NSA Crane is comprised of lower Pennsylvanian and upper Mississippian age sandstones, limestones, and shales (Halliburton NUS, 1992). The Indiana Department of Natural Resources prepared a report describing the Pennsylvanian and Mississippian sedimentology of the installation (U.S. Army Corps of Engineers, 1993). The Chester Formation of Mississippian age bedrock is exposed within deeply incised valleys and ravines of NSA Crane. The Pennsylvanian age Mansfield Formation, consisting of sandstone, siltstone, claystone, and shale, is found at the crests of hills and ridges in eastern NSA Crane and forms the surficial bedrock material of the western part of the installation.

Karst features, such as caves, shafts, and sinkholes, occur primarily in the eastern portions of NSA Crane where Mississippian age limestones are found near the surface (NORTHDIV, 1995). At least 14 caves are known on the installation, some with extensive formations. The remainder of the installation is underlain by Pennsylvanian age massive sandstones and evenly bedded limestones, shales, and coal. Deposits of coal are relatively abundant and are evident in northeastern and southeastern portions of the installation.

2.2.3 Soils

Soils on NSA Crane, as identified by the Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO), consist of five predominant series (Figure 2.8). Table 2.1 lists these soils and the percentage of land covered by the series on NSA Crane.

Soil Series	NSA Crane Percentage
Apalona Silt Loam	11%
Apalona-Udorthent Complex	10%
Wellston Silt Loam	10%
Wellston-Adyeville Complex	27%
Wellston-Tipsaw-Adyeville Complex	23%
Other Soil Series	19%

Table 2.1: Dominant Soil Types on NSA Crane

Apalona silt loams and Apalona-Udorthent Complex are found throughout NSA Crane, primarily on summits and shoulders of benches and hills, as well as along ridgetops. The soils formed in loess and the underlying residuum from shale interbedded with sandstone and siltstone. Slopes range from 0 to 12%. The soil is moderately well drained and moderately deep or shallow to a fragipan, which is a dense, natural subsurface layer of hard soil with relatively slow permeability to water due to its high density or compactness; permeability is moderate above the fragipan. Native vegetation is mixed, deciduous hardwood forest.

Wellston silt loams are dispersed throughout the installation, and typically occur on ridgetops and side slopes along drainage ways in the uplands. The soils formed in loess, siltstone, or sandstone (or a combination of these materials) to depths of up to 40 inches. Slopes range from 0 to 50 percent, but are commonly between 4 and 18 percent. The soil is deep and well drained, and permeability is moderate. Native vegetation consisted of oak, hickory, dogwood, tulip poplar, shortleaf pine, and cherry.

Wellston-Adyeville Complex soils are found primarily on the western portion of NSA Crane, and typically occur on ridgetops, back slopes of hills, and side slopes along drainage ways in the uplands.

The soils formed in loess, siltstone, sandstone, or shale (or a combination of these materials). Slopes range from 0 to 60 percent. The soil is moderately deep and well drained to somewhat excessively, and permeability is moderate to rapid. Native vegetation consisted of mixed deciduous hardwood forest.

Wellston-Tipsaw-Adyeville Complex soils are found primarily on the eastern portion of NSA Crane, and typically occur on ridgetops, scarps, back slopes of hills, and side slopes along drainage ways in the uplands. The soils formed in loess, siltstone, sandstone, or shale (or a combination of these materials). Slopes range from 0 to 70 percent. The soil is moderately deep and well drained to somewhat excessively drained, and permeability is moderate to rapid. Native vegetation consisted of mixed deciduous hardwood forest.

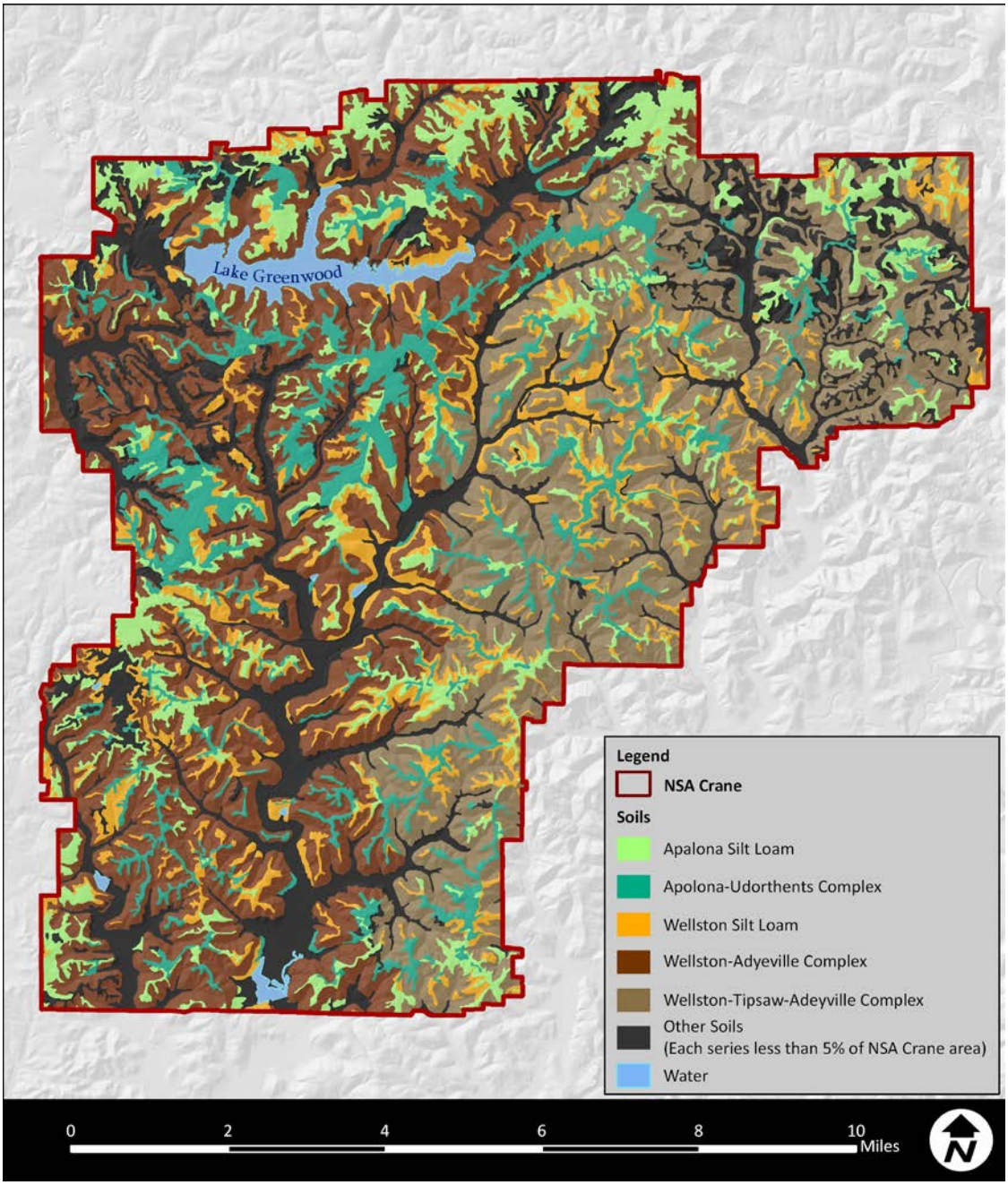

Figure 2.8: Detailed Soil Series

2.2.4 Surface Water and Watersheds

NSA Crane is divided into two eight-digit hydrologic unit code watersheds, as identified by the U.S. Geological Survey. The Lower White River watershed drains the northwestern portion of the installation, while the rest of the installation drains to the Lower East Fork White River. Six perennial streams, including First, Sulphur, Little Sulphur, Boggs, Turkey, and Seed Tick Creeks, dissect NSA Crane and divide the installation into corresponding subwatersheds (Figure 2.9). First Creek drains the northern portion of the installation, Boggs and Turkey Creeks drain central and southern portions of the installation, Sulfur and Little Sulphur Creeks drain the eastern portion, and Seed Tick Creek drains the southwestern corner of the installation. Surface water drainage predominantly exhibits a southerly trend with creeks at NSA Crane eventually draining into the White River and then to the Wabash River.

Lake Greenwood (820 acres) is located within the First Creek drainage and is the largest lake on NSA Crane. Lake Greenwood is used for potable water, flood control, and recreation. Lake Gallimore, located within the Boggs Creek drainage, and Seed Tick Lake, located within the Seed Tick Creek drainage, are 34 and 32 acres respectively. These lakes were built for flood control along with seven other flood control reservoirs along the Boggs Creek drainage. In addition, there are 33 smaller ponds which were constructed on NSA Crane for wildlife use (Schumann *et al.*, 1991).

Lake Greenwood, NSA Crane, Indiana

In general surface water quality on NSA Crane is relatively good due to the extensive amount of forested land. The greatest potential for pollution from fertilizers, pesticides, road chemicals, etc., comes during flood events when areas are exposed to more running water than normal. These chemicals are infrequently used in improved and semi-improved areas. There is a potential problem of algal blooms occurring in impoundments during summer, which would be magnified by fertilizer input. Algal blooms would likely be more noticeable in smaller ponds on the installation.

NSA Crane has thirty Solid Waste Management Units (*i.e*. Ammunition Burning-Ground, Sanitary Landfill and Lithium Battery Area, etc) (Schumann *et al*., 1991). Twelve of these areas are in or near wetlands, and nine potentially impact surface water quality due to their close proximity to intermittent and/or continually flowing streams.

2.2.5 Groundwater

Groundwater in Indiana occurs in both unconsolidated and bedrock aquifer systems (Indiana Department of Environmental Management, 1994). In general, groundwater of the unglaciated southwest portion of Indiana is contained in joint openings of limestone and sandstone aquifers. Groundwater in the region of NSA Crane is found in two aquifers, Mitchell Limestone and Mansfield Sandstone (Schumann *et al*., 1991). Groundwater enters the two main aquifers through outcrops and gravity flows to the southwest. Numerous seeps and springs issue from aquifers in valley cuts, locally complicating groundwater flow patterns. Groundwater percolates through karst regions of southern Indiana and can be carried to the surface as seeps and springs (Waterways Experiment Station, 1991). The two aquifers in the area supply good quality water for the region as a whole, but groundwater on NSA Crane is not abundant and is not used for public supply (NORTHDIV, 1995).

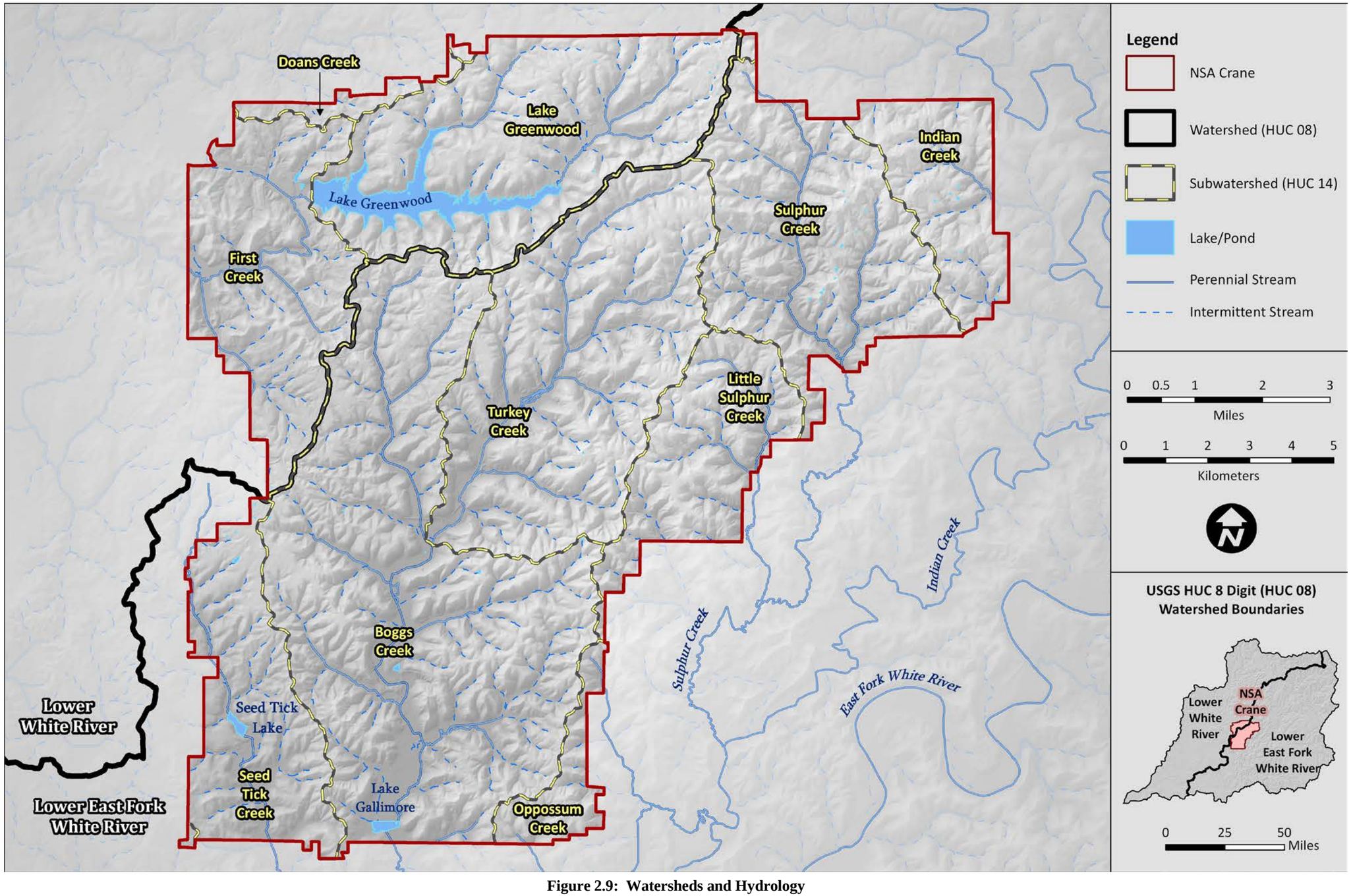

Figure 2.9: Watersheds and Hydrology

2.2.6 Floodplains

100 year floodplains on NSA Crane, as identified by the Federal Emergency Management Agency's (FEMA) flood insurance rate maps (FIRMs), are limited to narrow bands along First, Sulfur, Boggs, Turkey, and Seed Tick Creeks (Figure 2.10).

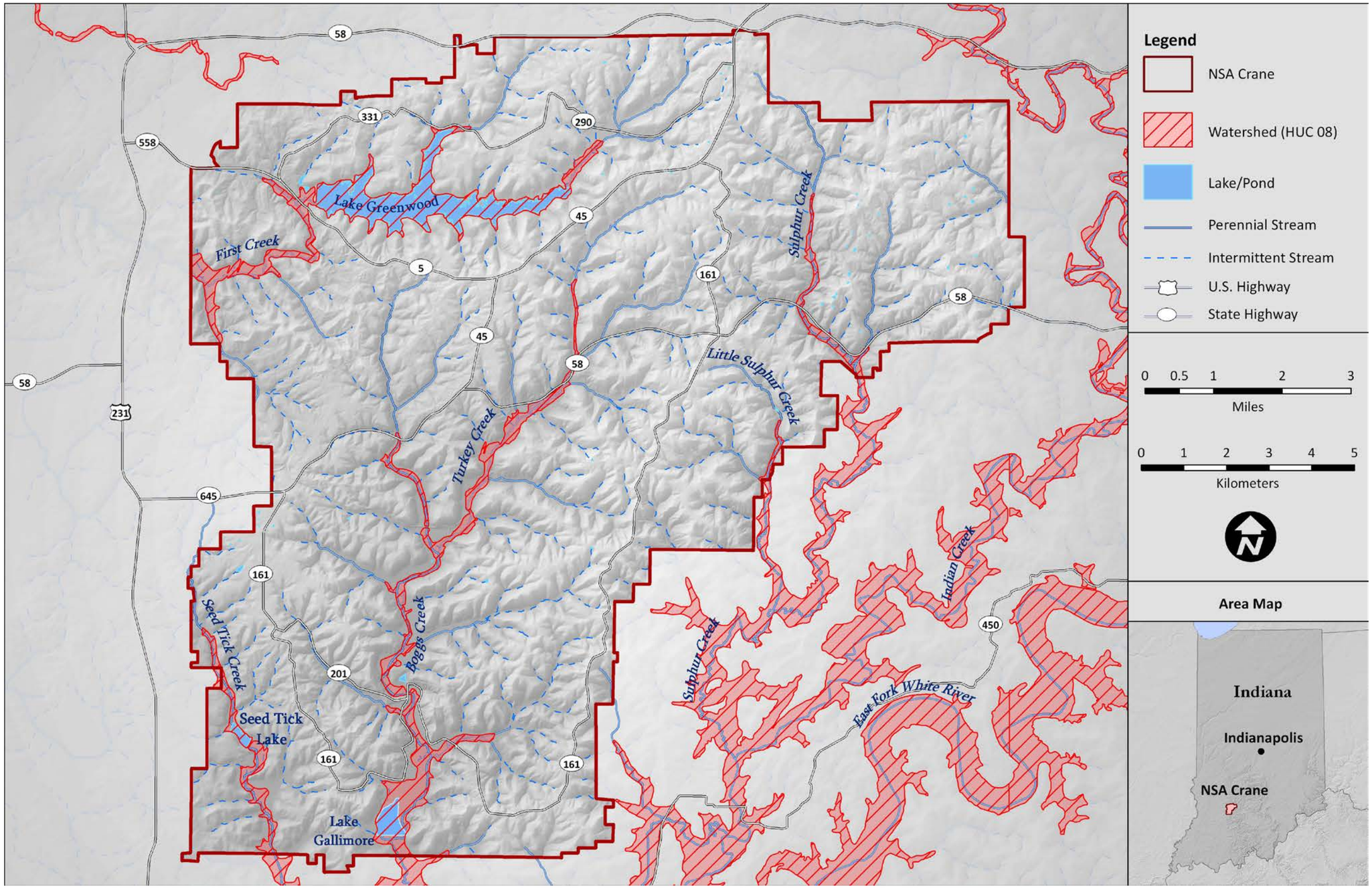

Figure 2.10: FEMA 100 Year Floodplains

2.3 General Biotic Environment

2.3.1 Threatened, Endangered, and Rare Species and Species of Concern

The U.S Fish and Wildlife Service lists four species of animals found in Martin, Greene, and Lawrence County as endangered. Additionally, one species has been identified as threatened. Table 2.2 lists these species. No federally listed plant species occur in the three county region surrounding NSA Crane.

Scientific Name	Common Name	Federal Status
Mammals		
Myotis sodalis	Indiana Bat	Endangered
Myotis septentrionalis	Northern Long-Eared Bat	Threatened
Mollusks		
Cyprogenia stegaria	Fanshell	Endangered
Pleurobema plenum	Rough Pigtoe	Endangered
Plethobasus cyphyus	Sheepnose	Endangered

Table 2.2: Federal Status Species of Martin, Greene, and Lawrence Counties, Indiana

The Indiana Department of Natural Resources has identified a total of 92 animal species and a total of 47 plant species in Martin, Greene, and Lawrence Counties on its list of state endangered, threatened, and rare species (INDNR, 2005a). Table 2.3 shows the number of animals and plants by listing class. The most current species lists for each county can be viewed at: http://www.in.gov/dnr/naturepreserve/4666.htm.

State Status	Number of Species
Animals	
Endangered	44
Threatened	3
Rare	5
Species of Concern	33
Watchlist	7
Plants	
Endangered	17
Threatened	11
Rare	10
Extirpated	2
Watchlist	7

Table 2.3: Status of State Listed Species of Martin, Greene, and Lawrence Counties, Indiana

2.3.1.1 Special Status Plants

No federally listed threatened, endangered, or rare plant species occur in the three county region surrounding NSA Crane. However, a number of state listed species occur in this area.

In 2006, a survey for threatened, endangered, and rare vascular plant species was conducted on NSA Crane by INDNR, Division of Nature Preserves (Homoya and Hedge, 2006). Listed species found during the survey are displayed in Table 2.4 (Figure 2.11).

Scientific Name	Common Name	Federal Rank	State Rank	Occurrence at NSA Crane
Woodwardia areolata	Netted Chain Fern	None	Rare	Documented
Sagittaria australis	Southern Arrowhead	None	Rare	Documented
Carex lupuliformis	Knobbed Hop Sedge	None	Rare	Documented
Carex timida	Timid Sedge	None	Endangered	Documented
Leucothoe fontanesiana	Mountain Doghobble	None	None	Documented

Table 2.4: Threatened, Endangered, and Rare Vascular Plants, NSA Crane

Whether the occurrence of *Leucothoe fontanesiana* at NSA Crane is a natural occurrence is unclear. The species is a Southern Appalachian endemic, and if it's occurrence at NSA Crane is natural, it is a significant disjunct and would represent a new state record (Homoya and Hedge, 2006.)

Plants considered state rare, such as *Woodwardia areolata*, have only 11-20 known occurrences statewide. State endangered plants, such as *Carex timidia*, have only 1-5 known occurrences statewide (Homoya and Hedge, 2006).

Woodwardia areolata

Prior to the 2006 survey, the most recent survey for threatened and endangered plants occurred in 1987 by Jacquart and LeBlanc of the INDNR Division of Nature Preserves. This report identified seven state listed species, two of which (*Antennaria solitaria and Huperzia porophila)* were considered state rare. The other five were documented as watchlist species. Since the time of the 1987 survey, the two state rare plants have been relegated to watchlist status due to discovery of additional statewide occurrences (Homoya and Hedge, 2006). These species, as well as four other watchlist status species, were observed during the 2006 survey.

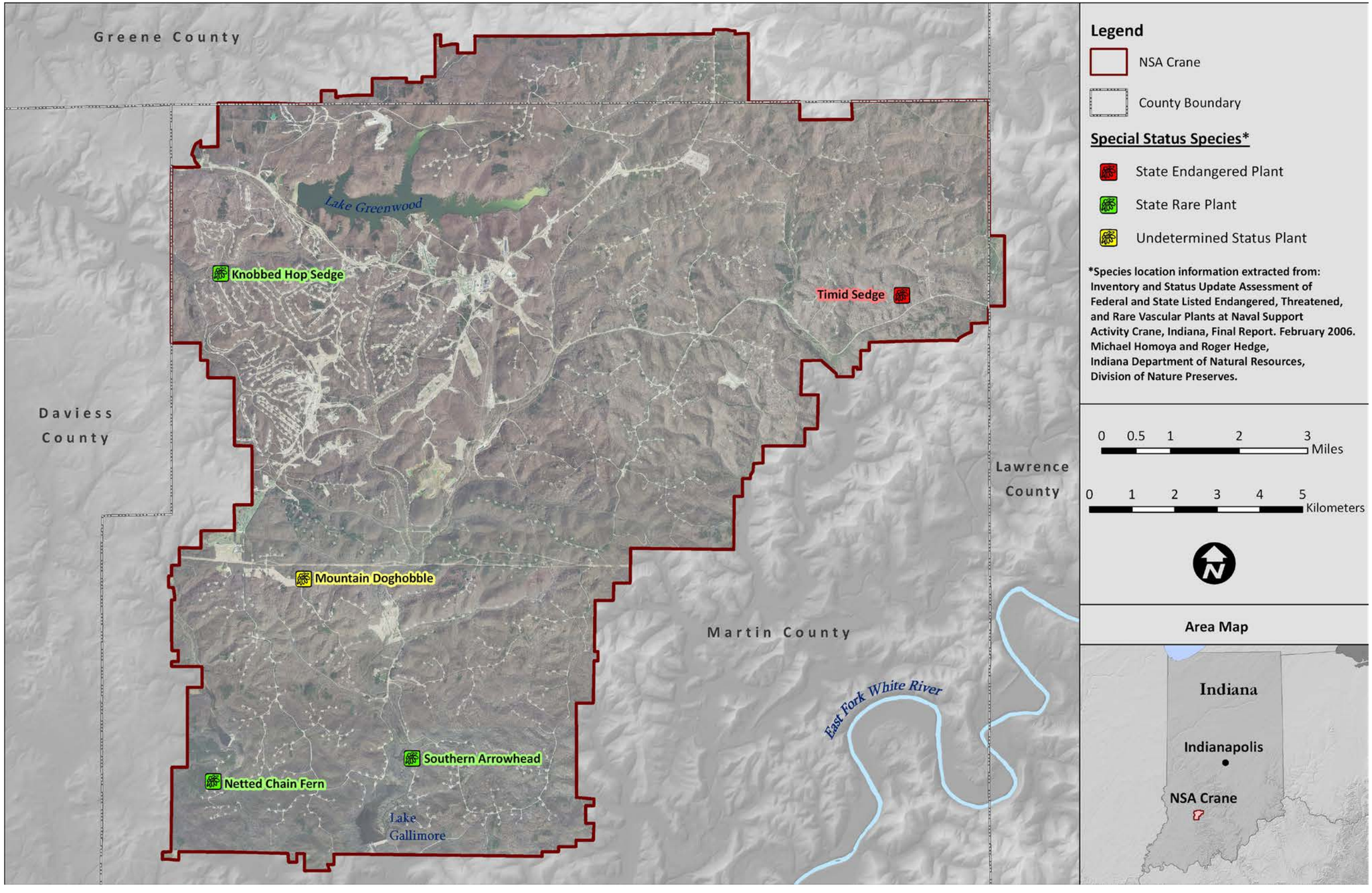

Figure 2.11: 2006 Survey Results of State Listed Endangered and Rare Vascular Plants

2.3.1.2 Special Status Fauna

NSA Crane contains no USFWS designated critical habitat. However, Ray's Cave in Greene County is approximately 9 miles north of NSA Crane and contains the largest known winter population of Indiana bats in the species' range (77,000 bats in 2007; Appendix D). Indiana bats are known to forage at least 10 miles from major hibernacula during the fall swarm (USFWS, 2007). Inventories of special status mammal, bird, amphibian, and reptile species were conducted in 1987, and results were presented in *An Inventory of the Rare Animal Species on the Naval Weapons Support Center Crane, Indiana* from a series of reports (Brack *et al*., 1987; Hengeveld, 1987; and Nelson *et al*., 1987). An update of the presence for threatened, endangered, and rare vertebrate species was conducted at NSA Crane in 2005 by INDNR Division of Nature Preserves (INDNR, 2005b). The results of this survey, as well as species previously documented on NSA Crane, are displayed in Table 2.5.

The Indiana bat was first listed as endangered by the USFWS in 1967. Census data indicates a decline of about 60 percent of the known population of Indiana bats since surveys began in the 1960s. Half of all hibernating Indiana bats winter in Indiana in caves or mines that meet their highly specific requirement for cold, but not freezing, temperatures. During summer, Indiana bats roost in trees and forage for insects primarily in riparian and upland forests.

Indiana bats were first discovered at NSA Crane in 1987 when a female juvenile Indiana bat was captured during the Jacquart and LeBlanc inventory of rare animal species. In 1996, a male Indiana bat was captured in the eastern portion of the installation. In 1998, six Indiana bats were captured during an intensive bat survey. In 2005, thirty mist net sites on NSA Crane were selected and operated between June 8 and August 15. Five adult male Indiana bats and one juvenile male were captured during this survey. The distribution of capture sites from 1987, 1996, 1998, and 2005 suggests that Indiana bats range throughout the installation (Figure 2.12). In addition to the Indiana bat, six other species of bats listed as state species of concern by INDNR were also captured during the 2005 survey (Table 2.6).

Myotis sodalis

NSA Crane has implemented recommendations from the USFWS with regard to Indiana bat habitat and silvicultural activities. Andrews (1999) describes management recommendations for Indiana bats, and Section 4.1.2 of this INRMP further discusses these recommendations. More detailed information concerning Indiana bats is available in the *Endangered Species Management Plan (ESMP) for the Crane Division, Naval Surface Warfare Center* (Andrews, 1999) and the *Agency Draft Indiana Bat (Myotis sodalis) Revised Recovery Plan* (USFWS, 2007).

Other special status small mammals documented during the 2005 survey at NSA Crane include smoky shrew (*Sorex fumeus*) and pygmy shrew (*Sorex hoyi*), both state listed as species of concern. Bobcat and river otter are additional state listed species of special concern that were not documented during the 2005 survey, but that have been observed at NSA Crane by installation personnel. In January and February of 2000, trapping conducted by INDNR resulted in the capture of 5 bobcats 10 times in 944 trap nights. River otters were observed on Lake Gallimore in 2002 and 2008, as well as on Boggs Creek in 2005.

Special status reptile species documented at NSA Crane include rough green snake (*Opheodrys aestivus*) and timber rattlesnake (*Crotalus horridus*). Rough green snake is a state listed species of concern, and was documented during the 2005 survey (INDNR, 2005b). Timber rattlesnake is a state listed endangered

species. The species was not documented during the 2005 survey, and the species has not had a documented, confirmed record on the installation for many years, although a specimen was recently collected on a road outside of NSA Crane (INDNR, 2005b).

No federally listed bird species are known to inhabit NSA Crane. However, several state listed bird species were documented during the 2005 surveys as well as during past surveys, including the state species of concern the bald eagle (*Haliaeetus leucocephalus*), the state endangered cerulean warbler (*Dendroica cerulea*), the state endangered loggerhead shrike (*Lanius ludovicianus*), the state endangered ruffed grouse *(Bonasa umbellas)* and the state endangered Henslow's sparrow (*Ammodramus henslowii*).

Bald eagles first nested on NSA Crane in 1989 at Lake Greenwood. In 1993, two eagles were born on NSA Crane at Lake Gallimore. In 1998, the pair at Lake Greenwood produced their first young and was again successful in 1999 and 2000. Between 1993 and 1999, the Lake Gallimore pair raised 10 young. Bald eagles were delisted from the federal listing of threatened and endangered species in 2008, but remain listed as a state species of concern by INDR.

The cerulean warbler is state listed as endangered. Cerulean warblers are experiencing an extremely high rate of decline in the United States (Castrale et al., 1998). Habitat loss in wintering range due to increasing forest fragmentation and parasitism by the brown-headed cowbird (*Molothrus ater*) are two reasons often suggested for cerulean warbler declines. Cerulean warblers are commonly found at NSA Crane during mid-April through mid-September.

The loggerhead shrike is state listed as endangered. Loggerhead shrikes rarely occur on the installation, as they favor habitat characterized by shrublands and open areas with scattered trees and shrubs not typically found within the installation.

Henslow's sparrow is also state listed as endangered. There is one record of a single summer sighting of this species on the installation. This species favors grasslands with tall stalks of standing dead vegetation, which are also uncommon at NSA Crane.

Haliaeetus leucocephalus

Ammodramus henslowii

Dendroica cerulea

Scientific Name	Common Name	Federal Rank	State Rank	Occurrence at NSA Crane	Documented in 2005 Survey
Mammals					
Myotis sodalis	Indiana Bat	Endangered	Endangered	Documented	Yes*
Myotis septentrionalis	Northern Long-Eared Bat	Threatened	Endangered	Documented	Yes*
Perimyotis subflavus	Tri-Colored Bat	None	Endangered	Documented	Yes
Lasiurus borealis	Eastern Red Bat	None	Special Concern	Documented	Yes*
Myotis lucifugus	Little Brown Bat	None	Endangered	Documented	Yes
Lasiurus cinereus	Hoary Bat	None	Special Concern	Documented	Yes
Lasionycteris noctivagans	Silver-Haired Bat	None	Special Concern	Documented	Yes
Sorex fumeus	Smoky Shrew	None	Special Concern	Documented	Yes
Sorex hoyi	Pygmy Shrew	None	Special Concern	Documented	Yes
Amphibians					
Acris crepitans	Northern Cricket Frog	None	Special Concern	Documented	Yes
Reptiles					
Opheodrys aestivus	Rough Green Snake	None	Special Concern	Documented	Yes
Terrapene carolina carolina	Eastern Box Turtle	None	Special Concern	Documented	Yes
Crotalus horridus	Timber Rattlesnake	None	Endangered	Rarely Observed	No
Birds					
Setophaga cerulea	Cerulean Warbler	None	Endangered	Seasonally Common	Yes
Nyctanassa violacea	Yellow-Crowned Night Heron	None	Endangered	Nesting Documented	No
Pandion haliaetus	Osprey	None	Special Concern	Rare Visitor	No
Ammodramus henslowii	Henslow's Sparrow	None	Endangered	Nesting Documented	No
Rallus elegans	King Rail	None	Endangered	Rare Visitor	No
Rallus limicola	Virginia Rail	None	Endangered	Rare Visitor	No
Lanius ludovicianus	Loggerhead Shrike	None	Endangered	Rare Visitor	No
Haliaeetus leucocephalus	Bald Eagle	None	Special Concern	Nesting Documented	Yes
Accipiter striatus	Sharp-Shined Hawk	None	Special Concern	Nesting Documented	No
Bonasa umbellus	Ruffed Grouse	None	Endangered	Nesting Documented	Yes
Setophaga citrina	Hooded Warbler	None	Special Concern	Nesting Documented	Yes
Caprimulgus vociferus	Eastern Whip-Poor-Will	None	Special Concern	Nesting Documented	Yes
Buteo platypterus	Broad-Winged Hawk	None	Special Concern	Seasonally Common	No
Helmitheros vermivorus	Worm-Eating Warbler	None	Special Concern	Nesting Documented	Yes
Mniotilta varia	Black-And-White Warbler	None	Special Concern	Seasonally Common	Yes
Colinus virginianus	Northern Bobwhite	None	Special Concern	Rarely Observed	No
Scalopax minor	American Woodcock	None	Special Concern	Nesting Documented	No
Chordeiles minor	Common Nighthawk	None	Special Concern	Rarely Observed	No
Botaurus lentiginosus	America Bittern	None	Endangered	Rare Visitor	No
Cicrus cyaneus	Northern Harrier	None	Endangered	Rare Visitor	No
Cistothorus platensis	Sedge Wren	None	Endangered	Rare Visitor	No
Vermivora chrysoptera	Golden-winged Warbler	None	Endangered	Rare Visitor	No
Ardea alba	Great Egret	None	Special Concern	Rare Visitor	No
Antigone canadensis	Sandhill Crane	None	Special Concern	Rare Visitor	No
Falco peregrinus	Peregrine Falcon	None	Special Concern	Rare Visitor	No
Tringa melanoleuca	Greater Yellowlegs	None	Special Concern	Rare Visitor	No

*****Also documented in 2015 surveys.

Table 2.5: Threatened, Endangered, and Rare Faunal Species, NSA Crane

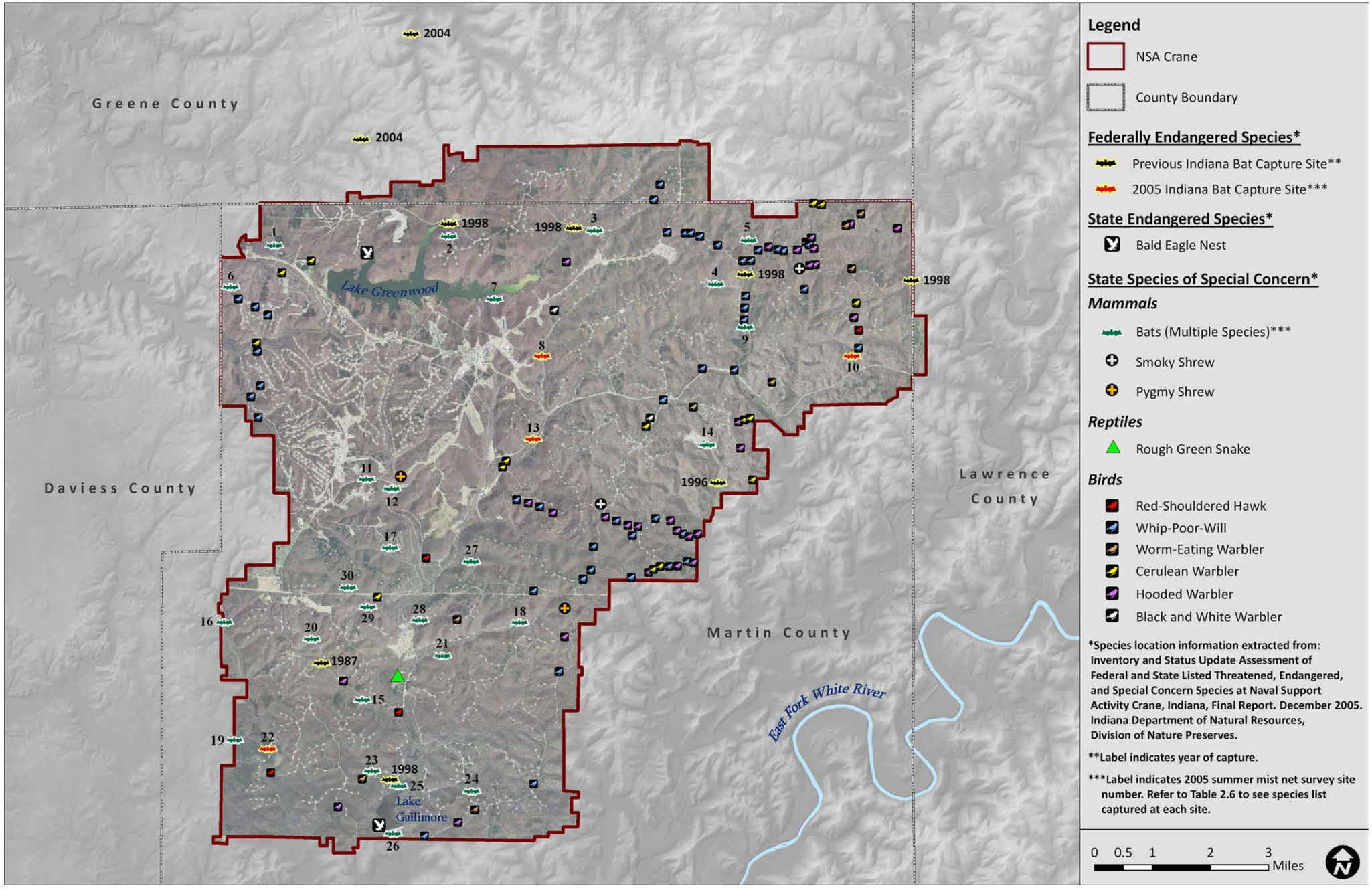

Figure 2.12: Documented Locations of Special Status Federal and State Faunal Species

Site Number	Indiana Bat(1)	Northern Bat(2)	Tri-Colored Bat(2)	Eastern Red Bat(2)	Little Brown Bat(2)	Hoary Bat(2)	Silver-Haired Bat(2)
1	0	1	0	0	0	0	0
2	0	2	5	18	15	1	0
3	0	2	2	8	0	0	0
4	0	1	2	1	2	0	0
5	0	6	0	0	0	0	0
6	0	2	0	1	1	0	0
7	0	2	2	0	16	0	0
8	3	6	10	9	1	0	0
9	0	4	7	5	3	0	0
10	1	11	0	1	0	0	0
11	0	1	3	1	1	0	0
12	0	1	4	5	1	0	0
13	1	0	4	9	2	4	1
14	0	3	5	35	5	0	0
15	0	4	0	1	0	0	0
16	0	0	9	5	1	0	0
17	0	1	0	1	0	0	0
18	0	8	1	0	0	0	0
19	0	6	0	2	1	0	0
20	0	17	0	1	0	0	0
21	0	7	0	0	3	0	0
22	1	0	9	1	0	0	0
23	0	9	0	5	0	0	0
24	0	2	0	5	0	0	0
25	0	6	1	0	2	0	0
26	0	1	62	6	6	0	0
27	0	13	0	1	0	0	0
28	0	2	0	0	0	0	0
29	0	5	1	3	0	0	0
30	0	6	1	1	0	0	0
Total	**6**	**129**	**128**	**125**	**60**	**5**	**1**
(1) Federally Endangered Species (2) Indiana Species of Special Concern							
Source: INDNR 2005b							

Table 2.6: 2005 Summer Special Status Bat Captures by Mist Net Survey Site

2.3.2 Ecosystems

NSA Crane is located in the Crawford Upland section of the Shawnee Hills Natural Region of Indiana. The Shawnee Hills appear to represent general presettlement conditions more than any other terrestrial region in the state, consisting primarily of upland forests. A distinctive feature of the Crawford Upland section is rugged hills with sandstone cliffs and rockhouses (Homoya and Hedge, 2006).

NSA Crane has a rich diversity of vegetative resources. Approximately 75 percent (48,000 acres) of the installation is classified as Upland Hardwood Forest and consists of rolling, mature, second-generation forests, composed primarily of oak-hickory and mixed hardwoods. Woodlands make up the dominant ecosystem on NSA Crane.

2.3.2.1 Natural Areas and Unique Communities

There have been two natural community surveys conducted at NSA Crane; the first in 1987, and the second in 2006.

Jacquart and LeBlanc (1987) identified three areas on NSA Crane as significant natural areas: First Creek Woods, Chestnut Oak Slopes, and Johnson Hollow Woods (Figure 2.13).

- ***First Creek Woods*** (97 acres) has steep, rocky slopes, sandstone cliffs occupying upland areas and wet and wet-mesic floodplain bordering First Creek. The diversity and composition of plants found at this site warrant the designation as a significant natural area.
- ***Chestnut Oak Slopes*** (170 acres) is significant due to the occurrence of chestnut oak (*Quercus prinus*), which is more common in the Shawnee Hills Natural Region south of the White River and NSA Crane. Chestnut oak is rarely found north of the White River.
- ***Johnson Hollow Woods*** (128 acres) is a mesic and dry-mesic upland forest with scattered sandstone outcroppings. Rock outcroppings at the site, some of the largest on the installation, serve as habitat for several, formerly listed rare and endangered plant species.

Homoya and Hedge (2006) identified and provided management recommendations for five small areas on NSA Crane as significant natural areas (Figure 2.13).

- ***Sinkhole Pond*** appears to be a natural karst depression and possessed several native wetland plants at the time of the survey 2006.
- ***Cliff, Cave and Pit Cave Communities*** distributed throughout the installation harbor a variety of fern and fern ally species.
- ***Prairie Area*** is a small area on the installation that contains species indicative of a remnant tallgrass prairie or barrens.
- ***Dry Oak Woodland/Barrens*** contains a mix of prairie and barrens species such as showy goldenrod, pencilflower, rosinweed, and others.
- ***Dry White Oak/Post Oak Woodland*** is a dry upland forest community consisting mostly of small white and post oak.

The Indiana Department of Natural Resources has identified special concern areas on NSA Crane (Figure 2.14). Two notable natural areas are Turkey Creek Woods and Mitchell Tree Woods.

- ***Turkey Creek Woods*** is about 100 acres of woodland that contains rare and infrequent species.

- ***Mitchell Tree Woods*** is about 25 acres of woodland that has some of the largest beech trees on the installation.

Other special management areas include the great blue heron (*Ardea herodias*) rookery, the bald eagle (*Haliaeetus leucocephalus*) nesting areas near Lake Gallimore and Lake Greenwood, the Lake Greenwood Riparian Management Area, and two areas set aside for growing white oak trees of the size and quality necessary for overhaul of the USS Constitution. White oak trees from these areas have not yet been harvested for use; however white oaks from other areas on the installation were used for the 1994 replanking of the USS Constitution. Special management areas are shown at Figure 2.13.

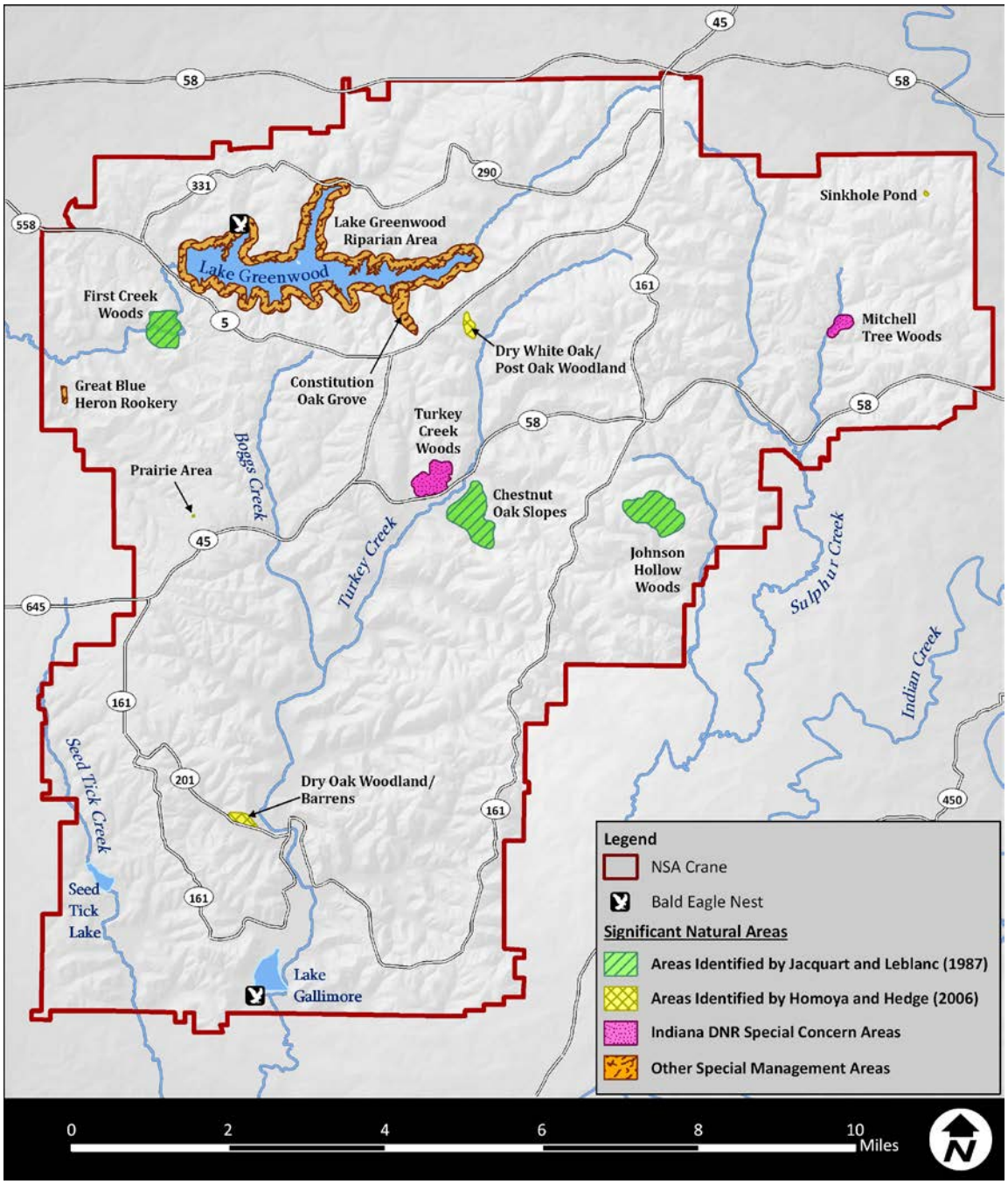

Figure 2.13: Natural Areas and Unique Communities

2.3.3 Wetlands

The U.S. Congress enacted the Clean Water Act in 1972 to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Section 404 of the Clean Water Act delegates jurisdictional authority over wetlands to the U.S. Army Corps of Engineers and the Environmental Protection Agency. Waters of the United States protected by the Clean Water Act include rivers, streams, estuaries, and most ponds, lakes, and wetlands. The U.S. Army Corps of Engineers and the Environmental Protection Agency jointly define wetlands as:

> *"Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas"*.

The USFWS defines wetlands to include a variety of areas that fall into one of five categories.

- Areas with hydrophytes and hydric soils, such as those commonly known as marshes, swamps, and bogs.
- Areas without hydrophytes but with hydric soils, such as flats where drastic fluctuation in water levels, wave action, turbidity, or high concentration of salts may prevent the growth of hydrophytes.
- Areas with hydrophytes but nonhydric soils, such as margins of impoundments or excavations where hydrophytes have become established but hydric soils have not yet developed.
- Areas without soils but with hydrophytes, such as the seaweed-covered portion of rocky shores.
- Wetlands without soils and without hydrophytes, such as gravel beaches or rocky shores without vegetation.

There are few natural wetlands on NSA Crane. Although the installation has not been systematically surveyed and delineated for the presence of wetlands, delineations are conducted when wetlands are suspected in project areas. This includes three small, project specific delineations that occurred in 2006,2008 and 2019. Results from the 2006 delineations included three small emergent wetlands (less than one acre) and a 2.86 acre forested wetland (Lee & Ryan, 2006a and 2006b). Results from the 2008 project specific delineation included three wetland communities, a .22 acre forested wetland, and two emergent wetlands totaling .04 acres (Williams Creek Consulting, 2008). Results from the 2019 project specific delineation included .8828 acres.of wetlands of which .3597 were impacted by the project and mitigated for. Additionally, a wetland delineation was conducted for the Lake Glendora Test Facility property in 2018. This delineation included 22.223 acres of wetlands.

Seed Tick Lake, NSA Crane, Indiana

Most permanent water bodies on the installation have been artificially created. Major wetland areas include five storage ponds ranging from 0.3 to 6.4 acres, Seed Tick Lake (32 acres), Lake Gallimore (34 acres), and 33 wildlife watering ponds. Lake Greenwood (820 acres) generally has steep sloped sides, and includes a substantial growth of water milfoil. Wetlands at NSA Crane total 3,262 acres (Crane NSWC, 1996). Palustrine wetlands account for 2,023 acres, and natural wetlands are found on floodplain areas of most of the larger streams on the installation. Most of these wetlands are classified as palustrine (swamp or marsh), forested, broad-leaved deciduous, and often temporarily flooded (NORTHDIV, 1995). U.S. Fish and Wildlife Service National Wetlands Inventory (NWI) mapping of NSA Crane has been completed (Figure 2.14).

Lake Gallimore, NSA Crane Indian

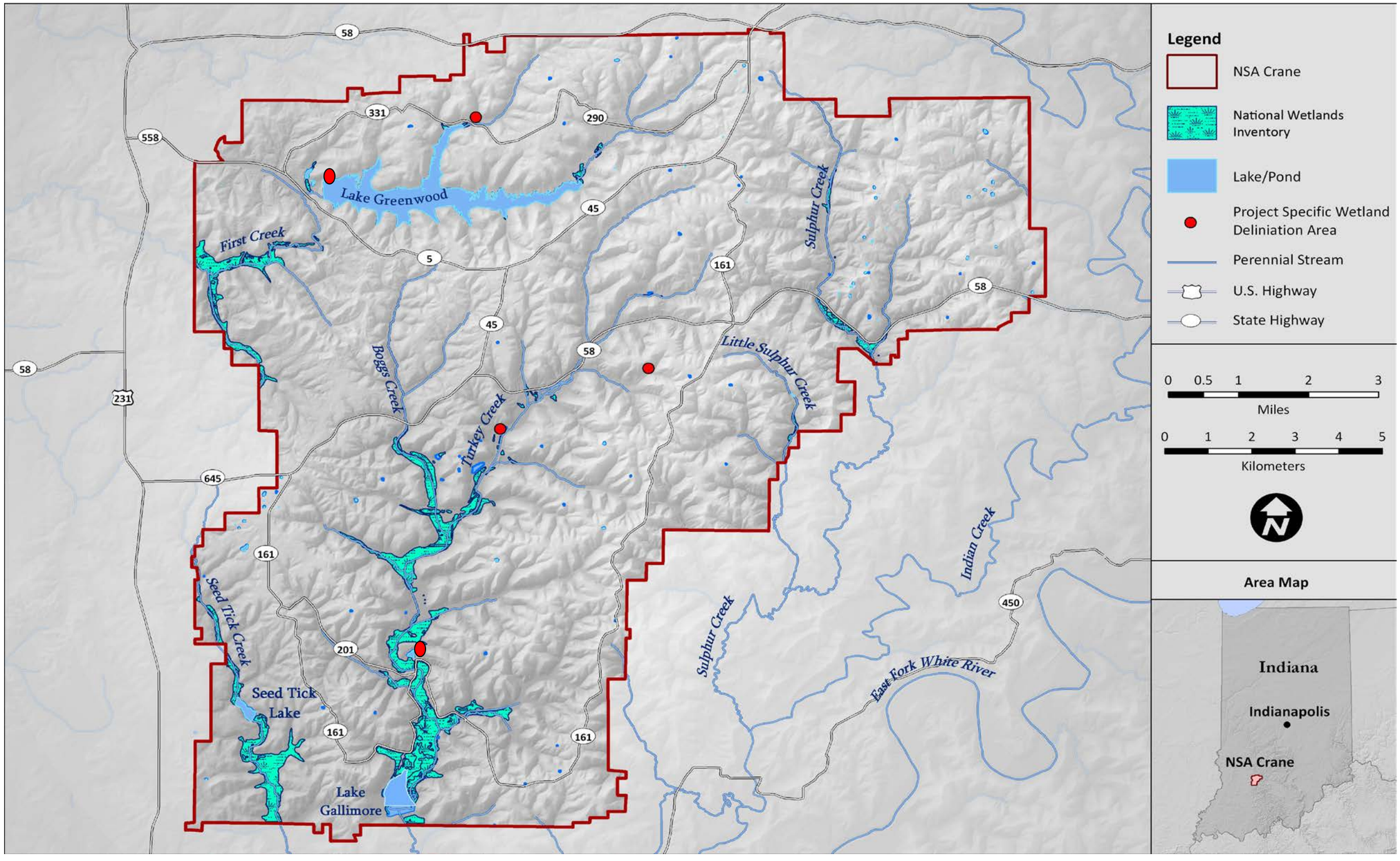

Figure 2.14: National Wetlands Inventory (NWI) and Project Specific Wetland Delineation Areas

2.3.4 Vegetation

2.3.4.1 Forests and Other Native Vegetation

NSA Crane forests are comprised of five principal types: upland oak-hickory (23,748 acres), upland mixed hardwoods (20,535 acres), bottomland hardwoods (4,017 acres), mixed pine-hardwood (2,830 acres), and pine (448 acres). Figure 2.15 shows the distribution of forest types across NSA Crane.

- ***Upland oak-hickory*** forests are generally found on rocky, steep slopes. Dominant tree species found in this forest type are white oak (*Quercus alba*), red oak (*Q. rubra*), black oak (*Q. velutina*), scarlet oak (*Q. coccinea*), hickory (*Carya* sp.), sugar maple (*Acer saccarum*), and tulip poplar (*Liriodendron tulipifera*).
- ***Upland mixed hardwoods*** intermix with oak-hickory forests where sites are more mesic on north and east aspects and on the lower slopes on some south and west aspects. Common tree species of the upland mixed hardwood type include predominantly tulip poplar with less frequent white oak, red oak, white ash (*Fraxinus americana*), beech (*Fagus grandifolia*), sugar maple, and black walnut (*Juglans nigra*).
- ***Bottomland hardwoods*** occur in small stands and typically include pin oak (*Q. palustris*), sycamore (*Plantanus occidentalis*), red maple (*A. rubrum*), elm (*Ulmus* sp.), river birch (*Betula nigra*), and ash (*Fraxinus* sp.).
- ***Mixed Pine-hardwood*** is comprised of pine plantations that have been invaded by hardwoods such as poplar and oak.
- ***Pine forests*** usually occur in eroded areas and consist of various pine species (*Pinus* sp.) originally planted in the 1930's by the Civilian Conservation Corps with an understory primarily of dogwood (*Cornus florida*), redbud (*Cercis* sp.), cherry (*Prunus* sp.), and black locust (*Robinia pseudoacacia*) (Crane NSWC, 1996).

Approximately 4,000 acres of NSA Crane are categorized as open or semi-open. These areas are vegetated by brushy or shrub-like species, such as sumac (*Rhus* sp.), honeysuckle (*Lonicera* spp.), sassafras (*Sassafras albidum*), black locust, viburnum (*Viburnum* sp.), coral berry (*Symphoricarpos orbiculatus*), and various grasses.

Approximately 1,700 acres of NSA Crane are categorized as bottomland or stream valley. Typical vegetation in these areas include cottonwood (*Populus* spp.), ash, sycamore, foxtail (*Setaria* spp.), reed canary grasses (*Phalaris* spp.), cattails (*Typha latifolia*), and other aquatic vegetation.

Commercial Forest Inventory (CFI) of forest resources on NSA Crane began in 1955 when a Soil Conservation Service forester began mapping the installation for the Land Use Survey (Graves, undated). Installation-wide forest inventories, based on a 10-year cycle, were completed in 1959, 1971, 1981, 1991, and 1999. The most recent inventory was completed in 2009. Inventories are conducted by installation foresters, but contracts are used for generation and analysis of data.

Much stand data has been developed into GIS databases. The electronic format is most commonly used, although various data formats are available to the Natural Resources Office.

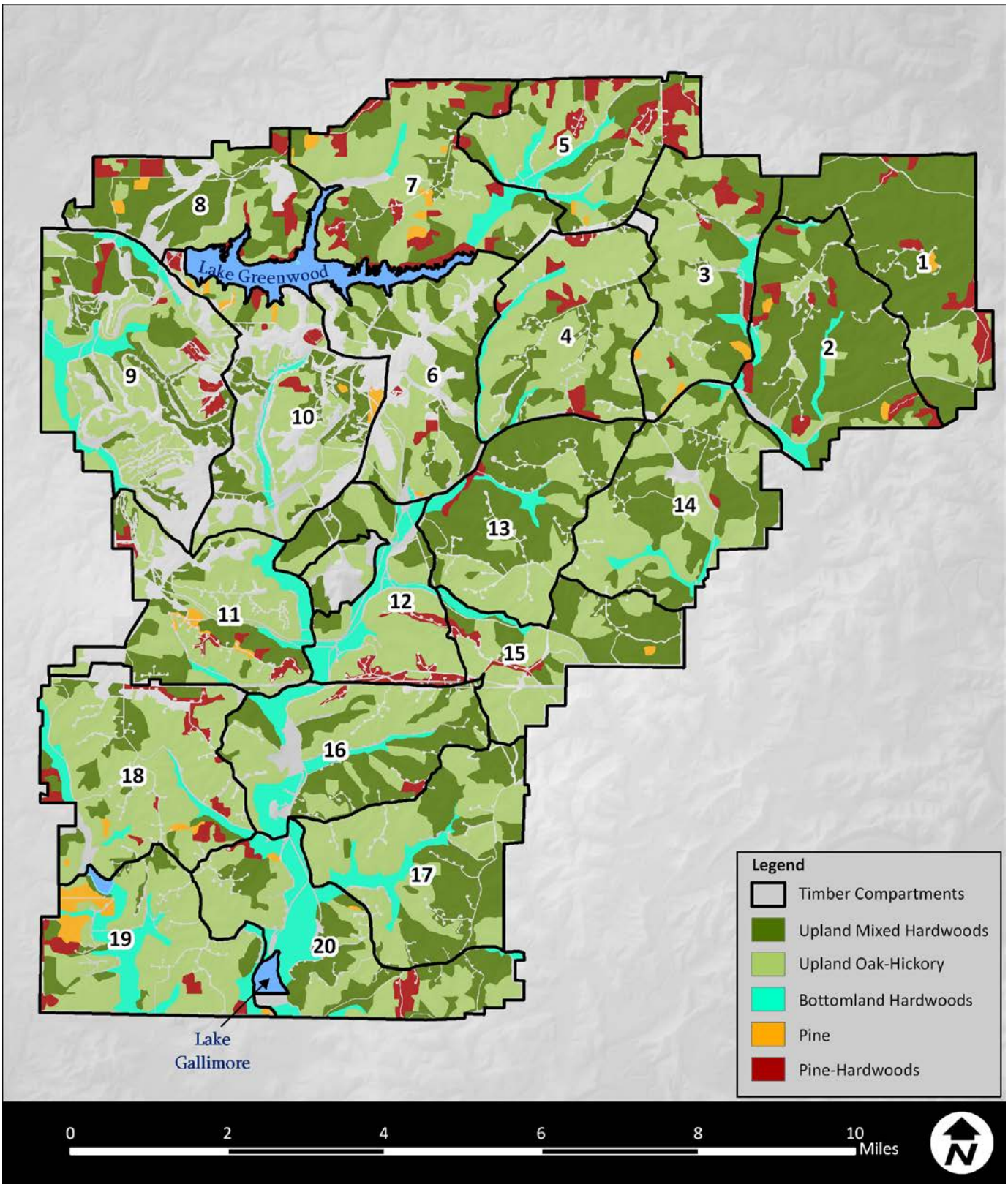

Figure 2.15: Forest Types

2.3.4.2 Invasive Plant Species

Federal laws and regulations prohibit introducing exotic species into any natural ecosystem, and require control or eradication of exotic species and noxious weeds from federal lands (7 U.S.C. 2814 et seq., 7 USC 7701, EO 11987, OPNAVINST 5090.1). Under Executive Order 13112, all alien or exotic species are to be controlled on federal land to the maximum practicable extent. Several invasive species found at NSA Crane can form expansive monocultures when left uncontrolled that in extreme cases will lead to complete loss of sensitive plant communities and reduction in regional biodiversity.

Ten species of invasive plant were identified by Homoya and Hedge (2006) at NSA Crane during their survey for the presence of endangered, threatened, and rare vascular plant species. An additional eight species have been observed by NSA Crane personnel or are believed to be spreading in the general region of the state and should be expected to appear at NSA Crane (Homoya and Hedge, 2006). Table 2.7 lists the invasive species observed at NSA Crane. The following discussion provides a brief discussion of the species listed in Table 2.7, as well as the species' impact to the NSA Crane ecosystem.

Scientific Name	Common Name
Pyrus calleryana	Callery Pear
Rubus phoenicolasius	Wineberry
Microstegium viminineum	Stilt Grass
Ailanthus altissima	Tree of Heaven
Lespedeza cuneata	Sericea Lespedeza
Coronilla varia	Crown Vetch
Lonicera japonica	Japanese Honeysuckle
Arthaxon hispidus	Hairy Joint Grass
Perilla frutescens	Beefsteak Plant
Wisteria sinensis	Chinese Wisteria
Phragmites australis	Common Reed
Eleagnus umbellata	Autumn Olive
Lonicera maackii	Bush Honeysuckle
Pueraria montana	Kudzu
Polygonum cuspidatum	Japanese Knotweed
Alliaria petiolata	Garlic Mustard

Table 2.7: Invasive Plant Species at NSA Crane

Callery Pear

Callery pear (*Pyrus calleryana*) is a deciduous tree in the rose family (Rosaceae) growing 30 to 50 feet high and 20 to 30 feet wide. It spreads vegetatively and by seeds dispersed to new locations by birds that eat the fruit (USFS, 2005e). Callery pear is common in fields, edges, and forests within an area of several square miles from its apparent point of origin near an old nursery that operated in Burns City prior to the establishment of NSA Crane in the 1940's (Homoya and Hedge, 2006).

Callery pear is often found growing in the company of many other nonnative plants and competes with both the native and nonnative species. The tree has a tendency to split, fall apart, or uproot under wind, icing, and snow events (USFS, 2005e; USDA CSREES, 2008). The plant has the potential to become a problematic forest weed, and efforts should be made to limit its expansion (Homoya and Hedge, 2006).

Wineberry

Wineberry (*Rubus phoenicolasius*) is a perennial shrub in the rose family (*Rosaceae*) with long arching stems (canes) up to 9 feet in length. The edible raspberry like fruit ripens in midsummer. It reproduces by seeds, and through vegetative means including root buds and the sprouting of new plants from where the arching canes touch the soil. It prefers moist conditions and full sun to partial shade. It grows in forests, fields, streams and wetland edge habitats, open woods, savannas and prairie habitats. Many species of birds and mammals use the brambles for nesting and shelter (USFS, 2005d).

Wineberry is reported invasive in the eastern States and Colorado. It is a vigorous grower and can form dense thickets covering large areas, displacing many native plants in the process (USFS, 2005d). At NSA Crane, dense populations of wineberry are found in edge habitats near the NSA administration area.

Japanese Stilt Grass

Japanese stiltgrass (*Microstegium vimineum*) is an annual grass with a sprawling habit that may grow to 3 feet high. It spreads by rooting and producing a new plant at nodes along the stem. It also spreads by seed with each plant producing an estimated 100 to 1,000 seeds. It occurs on stream banks, river bluffs, floodplains, emergent and forested wetlands, moist woodlands, early succession fields, uplands, thickets, roadside ditches, gas and power line corridors and home lawns and gardens (USFS, 2004a).

Japanese stiltgrass is common in disturbed shaded areas like floodplains that are prone to natural scouring, and areas subject to mowing, tilling and other soil disturbing activities. Japanese stiltgrass occurs in areas of open soil that are generally not already occupied by other species, is adapted to low light conditions, and threatens native understory vegetation in open to shady locations. It has been reported to be invasive in natural areas in fourteen eastern states and Wisconsin. Japanese stiltgrass spreads to form extensive patches, displacing native species that are not able to compete with it. Where white-tailed deer are overabundant, the deer may facilitate its invasion by feeding on native plant species and avoiding stiltgrass (USFS, 2004a).

Tree-of-Heaven

Tree-of-heaven (*Ailanthus altissima*) is a rapidly growing, deciduous tree that can reach 80 feet or higher. Tree-of-heaven reproduces by seeds and vegetative sprouts. Established trees also produce numerous suckers from the roots and re-sprout vigorously from cut stumps and root fragments. It occurs in disturbed soils, fields, roadsides, fencerows, woodland edges, forest openings, and rocky areas. It thrives in poor soils and tolerates pollution. Tree-of-heaven is not found in wetlands or shaded areas (USFS, 2006d).

Tree-of-heaven is a prolific seed producer, grows rapidly, and can overrun native vegetation. It colonizes by root sprouts and spreads by prolific wind- and water-dispersed seeds. It is reported invasive in 30 states through the central portion of the country from California to Massachusetts. Once established, it can quickly take over a site and form an impenetrable thicket. The tree produces toxins that prevent the establishment of other plant species (USFS, 2006d).

Sericea Lespedeza

Sericea lespedeza (*Lespedeza cuneata*) is a perennial herbaceous plant in the pea family (*Fabaceae*) with an erect growth ranging from 3 to 5 feet in height. It was introduced from Asia in the 1940's for use as forage and hay production on poor soils, and for erosion control. It reproduces primarily by seed that can remain viable in the soil for twenty years or more. The root system has a woody taproot that branches laterally and grows 3 to 4 feet deep. It can grow in a variety of habitats including severely eroded sterile soils. It will invade open woodlands, grasslands, savannas, roadsides, fence rows, fields, prairies, drainage areas, wetland borders of ponds and swamps, meadows, and open disturbed ground. It is tolerant of light to moderate shade, but will not survive heavy shade. It will grow under red cedar trees and in areas with a canopy, but thin mid-story (USFS, 2006e; ISSG, 2005).

Sericea lespedeza is reported invasive in 14 central and Mid-Atlantic states where it is a threat to open areas such as meadows, prairies, open woodlands, wetland borders and fields where it can crowd out native plants and develop extensive seed banks in the soil (USFS, 2006e; MODC, undated). At NSA Crane, Sericea lespedeza has spread into fields and along roadsides and utility rights-of-way. It stimulates environments that formerly existed in the area, such as prairie and barrens and provides habitat for relict grassland species.

Crown Vetch

Crown vetch (*Coronilla varia*) is a perennial herb in the legume family with spreading stems that can reach two to six feet in length. Crown vetch has a multi-branched root system and can spread by its strong rhizomes. It was introduced to the U.S. from the Mediterranean region of Europe, northern Africa and southwest Asia in the 1950's and primarily used for erosion control. Its use for erosion control has greatly decreased in Indiana, given both its invasiveness and the availability of species that are much better at controlling erosion. Crown vetch prefers sunny, open areas, is tolerant of temperatures down to -33º C, periods of drought and periods of heavy precipitation (IPSAWG, 2006b).

Since the species was originally planted for erosion control, it is now located mostly along roadsides, rights-of-way, open fields, waste grounds and on gravel bars along streams. It is documented as naturalized in all but four U.S. states and is found in every county in Indiana. Crown vetch becomes a problem when it invades natural areas, such as native grassland prairies and dunes, where it works to exclude native vegetation by fully covering and shading those native plants. It can climb over small trees and shrubs, and eventually form large monocultures. It seeds prolifically, but can also rapidly spread by rhizome growth. Due to its nitrogen fixing capabilities, it has the capacity to adversely affect the nitrogen cycle of the native communities that may depend on infertile soils. It can also alter available fuel loads in fire-adapted ecosystems, changing fire intensity (IPSAWG, 2006b).

Japanese Honeysuckle

Japanese honeysuckle (*Lonicera japonica*) is a perennial woody vine that spreads by seeds, underground rhizomes, and aboveground runners. Native to East Asia, including Japan and Korea, it was introduced to the U.S. as an ornamental plant, for erosion control, and for wildlife forage and cover (IPSAWG, 2006c).

Japanese honeysuckle creates dense tangled thickets by a combination of stem branching, nodal rooting, and vegetative spread from rhizomes. It damages forest communities by out competing native vegetation for light, below-ground resources, and by changing forest structure. The vines overtop adjacent vegetation by twining about, and completely covering, small trees and shrubs. As it becomes established it forms a dense blanket that endangers most shrubs, herbs, and trees (IPSAWG, 2006c). It's evergreen to semi-evergreen nature gives it an added advantage over native species in many areas. Shrubs and young trees can be killed by girdling when vines twist tightly around stems and trunks, cutting off the flow of water through the plant. Dense growths of honeysuckle covering vegetation can gradually kill plants by blocking sunlight from reaching their leaves. Vigorous root competition helps it spread and displace neighboring native vegetation (USFS, 2005a). It now occurs throughout 26 states the eastern half of the United States. Japanese honeysuckle's range is limited to the north by severe winter temperatures and to the west by insufficient precipitation and prolonged droughts. It occurs in all 92 Indiana counties, but is much more aggressive in Southern Indiana. Japanese honeysuckle is widespread on the installation where, due to the extent of the infestation, it is most likely not feasible at this time to control it on a large scale (Homoya and Hedge, 2006).

Hairy Joint Grass

Hairy joint grass (*Arthraxon hispidus*) is a low-growing, creeping annual grass that grows to a height of 1.5 feet. It reproduces by seeds that can be dispersed by moving water. It favors sunny moist habitats. It is

often found in moist pastures and fields, shaded upland woods, floodplain forests, stream banks, along shorelines, and along roads and trails where soils remain moist. (USFS, 2005f; NatureServe, 2009)

Hairy joint grass can form dense stands, particularly along shorelines where it may threaten native vegetation. The species is reported invasive in the following states: CT, KY, MD, PA, TN, VA, and WV. Joint grass often occurs with another highly invasive annual grass species, Japanese stilt grass (*Microstegium vimineum*) (USFS, 2005f).

Beefsteak Plant

Beefsteak plants (*Perilla frutescens*) are small, freely branching annual herbs that superficially resemble basil and coleus and reach a height of 18 to 30 inches. Stems and leaves have a very strong characteristic odor. Beefsteak plants can grow in rich soils, alluvial soils or dry soils and are prominent along roadsides, railroad right-of-ways, streams, spring branches, pastures, fields, woodlands and gravel bars (USFS, 2005b).

This species is reported invasive in DC, IL, MD, MO, PA, TN, VA and WV. Often planted as showy ornamentals, beefsteak plants may readily escape cultivation, spreading to disturbed areas where they disrupt native ecosystems. The species has toxic characteristics and very few predators. It is ordinarily avoided by cattle and has been implicated in cattle poisoning. Plants are most toxic if cut and dried for hay late in the summer, during seed production. One reason for beefsteak plants' survival in pastures is that cattle avoid it. Sold as a salad plant for its dark purple foliage, this member of the mint family is extremely invasive by wind-borne seeds (USFS, 2005b).

Chinese Wisteria

Chinese wisteria (*Wisteria sinensis*) and Japanese wisteria are woody vines that can climb trees and reach up to 65 feet. Vegetative reproduction is the primary means of expansion. Vines climb surrounding vegetation and structures toward sunlight. Wisteria tolerates a variety of soil and moisture regimes but prefers loamy, deep, well drained soils. Infestations are commonly found along forest edges, roadsides, ditches, and rights-of-way (USFS, 2006c).

Exotic wisterias are long-lived, some vines surviving 50 years or more. Vines impair and overtake native shrubs and trees through strangling or shading. Climbing wisteria vines can kill sizable trees, opening the forest canopy and increasing sunlight to the forest floor, which in turn favors its aggressive growth. Chinese and Japanese wisterias are hardy and aggressive, capable of forming thickets so dense that little else grows. Large patches of Chinese wisteria occur at NSA Crane, mostly in the southwest of the installation. Its habitat is similar to that of kudzu, climbing into trees, overtopping them and killing them. NSA Crane natural resources management staff took measures in 2006 to control the spread of this invasive species (USFS, 2006c).

Common Reed

Common reed (*Phragmites australis*) is a tall perennial grass ranging in height from 3 to 20 feet that thrives in sunny wetland habitats. Strong leathery horizontal shoots, called rhizomes, growing on or beneath the ground surface give rise to roots and tough vertical stalks. The root system is comprised of rhizomes that can reach to 6 feet deep with roots emerging at the nodes. Common reed reproduces by spreading rhizomes that form large colonies. Common reed grows along drier borders and elevated areas of brackish and freshwater marshes and along riverbanks and lakeshores. The species is particularly prevalent in disturbed or polluted soils with alkaline and brackish waters, but will tolerate highly acidic conditions. It can grow in water up to 6 feet deep and also in somewhat dry sites. It can be found along roadsides, ditches, open wetlands, riverbanks, lake shores, dredged area, and disturbed or undisturbed plant communities (USFS, 2005c).

Common reed has become a destructive weed, quickly displacing desirable plants species such as wild rice, cattails, and native wetland orchids. Invasive stands of common reed eliminate diverse wetland plant communities, and provide little food or shelter for wildlife. Its high biomass blocks light to other plants and occupies all the growing space below ground so plant communities can turn into a *Phragmites* monoculture very quickly (USFS, 2005c). In Indiana, it is common in wetlands in the north and in the brackish water of oil/gas production areas in the southwest (IPSAWG, 2007).

Autumn olive

Autumn olive (*Elaeagnus umbellate)* is a medium to large deciduous shrub native to China, Korea and Japan and introduced to United States from Japan in 1830. In Indiana, as in the rest of the country, autumn olive was often used for the revegetation of disturbed habitats or sold commercially for roadsides, landscaping and gardens. Autumn olive is found in disturbed areas, along roadsides, in pastures, fields and sparse woodlands. It is often found in poor soils due to its nitrogen-fixing root nodules that allow it to tolerate poor conditions. It can also survive the effects of salt, drought and pHs as low as 4.0. However, it does not grow well in wet habitats or in dense forests. Autumn olive is now found over the eastern half of the United States and in all counties of Indiana (USFS, 2006a).

Autumn olive exhibits prolific fruiting and rapid growth, is widely dispersed by birds, and can thrive in poor soil. It has the ability to produce up to 80 pounds of fruit in a single season. Due to its nitrogen fixing capabilities, it has the capacity to adversely affect the nitrogen cycle of the native communities that may depend on infertile soils. It is vigorous and competitive against native species in open communities like prairies and savannas and resprouts after cutting or burning. It also creates heavy shade which suppresses plants that require direct sunlight (USFS, 2006a).

Bush Honeysuckle

Bush honeysuckle (*Lonicera maackii*) is one among a group of species of Asian bush honeysuckles that are 6-15 feet tall, upright shrub with arching branches that stand out in the understory of forests as the first shrubs to leaf out in the spring and the last to lose their leaves in the fall. Bush honeysuckles, which generally range from the central Great Plains to southern New England and south to Tennessee and North Carolina, originated in Eurasia and were introduced as ornamentals, for wildlife cover and for soil erosion control. In Indiana they are particularly invasive in central and northern parts of the state, but are starting to move into the southern portion (IPSAWG, 2006a).

Asian bush honeysuckles are relatively shade-intolerant and most often occur in forest edge, abandoned fields, roadsides and open wetlands. However, they will move into forest understories and dominate wherever there has been disturbance. They grow so densely they shade out everything on the forest floor, often leaving nothing but bare soil. This means a great reduction in the food and cover available for birds and other animals. Serious infestations can inhibit tree regeneration, essentially stopping forest succession. Higher rates of nest predation have been found in Amur honeysuckle than in native shrubs due to nests being more exposed to predators. Some bush honeysuckle species also release chemicals into the soil to inhibit other plant growth, effectively poisoning the soil (IPSAWG, 2006a). Exotic bush honeysuckles can rapidly invade and overtake a site, forming a dense shrub layer that crowds and shades out native plant species. They can alter habitats by decreasing light availability, by depleting soil moisture and nutrients, and possibly by releasing toxic chemicals that prevent other plant species from growing in the vicinity. Exotic bush honeysuckles may compete with native bush honeysuckles for pollinators, resulting in reduced seed set for native species. In addition, the fruits of exotic bush honeysuckles, while abundant and rich in carbohydrates, do not offer migrating birds the high-fat, nutrient rich food sources needed for long flights that are supplied by native plant species (USFS, 2006b).

Kudzu

Kudzu (*Pueraria montana*) is a climbing, semi-woody, perennial vine that grows 35 to 100 feet long by runners, rhizomes and vines that root at the nodes to create new plants. Kudzu also spreads through seeds contained in pods that mature in the fall. Kudzu grows well under a wide range of conditions and in most soil types. Preferred habitats are forest edges, abandoned fields, roadsides, and disturbed areas, where sunlight is abundant (USFS, 2004c).

Kudzu kills or degrades other plants by smothering them under a solid blanket of leaves, by girdling woody stems and tree trunks, and by breaking branches or uprooting entire trees and shrubs through the sheer force of its weight. Once established, Kudzu plants grow rapidly, extending as much as 60 feet per season at a rate of about one foot per day. This vigorous vine may extend 32-100 feet in length, with stems 1/2 - 4 inches in diameter. Kudzu roots are fleshy, with massive tap roots 7 inches or more in diameter, 6 feet or more in length, and weighing as much as 400 pounds. As many as thirty vines may grow from a single root crown (USFS, 2004c). Kudzu has been reported in Indiana as far north as Morgan County. IDNR has identified 70 sites, most in the Southern Region (Purdue University Extension, Weed Science, 2005).

Japanese knotweed

Japanese knotweed (*Polygonum cuspidatum*) is an herbaceous perennial. This stout, shrub-like plant forms large dense clumps that measure between 3-9 feet high. It reproduces by seed and by large rhizomes which may reach a length of 15-18 feet. Japanese knotweed is found in moist, open to partially shaded habitats. It has been reported from riverbanks and islands, wetlands, along roadways, hillsides, and disturbed areas in a variety of soil types and pH's. Japanese knotweed can also tolerate adverse conditions such as high temperatures, high salinity, drought and floods (USFS. 2004b; IPSAWG, 2006d).

Japanese knotweed has spread across the U.S., from the Northeastern states to California. It is found in most counties in Indiana, though most populations are small (<1/4 acre). Japanese knotweed emerges in early spring and grows quickly and aggressively. It forms dense, nearly pure stands which crowd out native plants. By eliminating grasses and other native plants along creeks, the banks are less stable and more likely to shear off during flooding. This greatly increases sediment in the creek. It spreads rapidly through rhizomes and seeds. Fragments are transported to new sites by water and by human interactions. Once established, Japanese knotweed is very difficult to eradicate (USFS, 2004b; IPSAWG, 2006d).

Garlic Mustard

Garlic Mustard *(Alliaria petiolata)* is an herbaceous biennial developing a rosette of leaves the first growing season and maturing into a tall, 4' high, erect plant the second year. Crushing the stems will release the scent of garlic, hence its name. Rosettes produce a single flowering stem, but on occasion can produce multiple stems. Flowers are white with 4-petals and clustered in racemes. Seeds are produced in erect, slender, four-sided pods, called siliques, beginning in May. Each silique contains between 12-19 seeds, and the number of siliques per plant can vary greatly from 1 to more than 200. Seeds are oblong to nearly cylindrical and about 0.12 inch long. The shiny black seeds mature in June and as the siliques turn from green to tan they will collapse and expel the seeds up to 6' away. Seeds remain viable for up to 6 years, however, seed bank viability drops off substantially after the 1st growing season following stratification. By late June, the above ground portions of the plants start dying off (NHDA, Undated).

Seed dispersal is linked to transport on muddy boots or pant cuffs. Seed dispersal may also be facilitated by roadside mowing, as well as on mud-encrusted automobile tires. Animals, especially white-tailed deer, may promote seed dispersal and spread of garlic mustard. Deer are thought to provide an important seed dispersal vector over short distances by transporting seeds in their fur (NHDA, Undated).

Garlic mustard can have a wide range of negative impacts to both the environment and to wildlife. When their populations gain ground and form dense monocultures they can outcompete native herbaceous species by robbing them of light, nutrients and soil moisture. Their rooting systems and decaying leaf litter release allelopathic chemicals into the soil. These chemicals inhibit the germination and growth of native herbaceous plants, and they also negatively affect the soil borne mycorrhizal fungi. The fungi is essential for nutrient uptake by our native hardwoods. In addition, Garlic mustard has a toxic affect to the development of butterfly eggs when laid on the foliage or stems (NHDA, Undated).

2.3.6 Fish and Wildlife

NSA Crane has rich and diverse fauna in a wide variety of habitats. Appendix B contains a list of fauna known or likely to occur on NSA Crane.

The biotic diversity on NSA Crane mirrors similar habitats outside installation boundaries. Information on species abundance and trends generally has not been collected. The following sections summarize the biological diversity on the installation.

2.3.6.1 Mammals

Thirty mammals were identified during the Jacquart and LeBlanc (1987) inventory of the installation. Mammals commonly occurring on NSA Crane include the white-tailed deer (*Odocoileus virginianus*), cottontail rabbit (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinensis*), fox squirrel (*S. niger*), woodchuck, (*Marmata monax*), gray fox (*Urocyon cinereoargenteus*), raccoon (*Procyon lotor*), opossum (*Didelphis marsupialis*), coyote (*Canis latrans*), beaver (*Castor canadensis*), and muskrat (*Ondatra zibethicus*).

Odocoileus virginianus

2.3.6.2 Birds

NSA Crane has been recognized by the Indiana Audubon Society as an Important Bird Area, due to its size and the amount of forested land encompassed on the installation. The NSA Crane *Checklist of Birds* lists 197 species on the installation. Schumann *et al.* (1991) indicated that 113 species had been identified during the Jacquart and LeBlanc (1987) inventory. Bird species that occur in abundance or are common throughout much of the year on the installation include the Canada goose (*Branta canadensis*), red-shouldered hawk (*Buteo lineatus*), red-tailed hawk (*Buteo jamaicensis*), wild turkey (*Meleagris gallopavo*), hairy woodpecker (*Picoides villosus*), northern flicker (*Colaptes auratus*), American crow (*Corvus brachyrhynchos*), tufted titmouse (*Parus bicolor*), Carolina wren (*Thryothorus ludovicianus*), and eastern bluebird (*Sialia sialis*).

Meleagris gallopavo

2.3.6.3 Reptiles and Amphibians

43 species of reptiles and amphibians were identified by Hedge (INDNR, 2005) in an assessment inventory. Some representative species occurring on NSA Crane include spotted salamander (*Ambystoma maculatum*), small-mouthed salamander (*A. texanum*), American toad (*Bufo americanus*), spring peeper (*Hyla crucifer*), stinkpot musk turtle (*Sternotherus odoratus*), eastern box turtle (*Terrapene carolina*), ground skink (*Scineella lateralis*), midland brown snake (*Storeria dekayi*), and eastern garter snake (*Thamnophis sirtalis*).

Ambystoma maculatum

2.3.6.4 Fish

Bandoli (2005) identified 42 species of fish in various watercourses on NSA Crane. Species of fish commonly found include the golden shiner (*Notemigonous soleucas*), yellow perch (*Perca flavescens*), bluegill (*Lepomis macrochirus*), redear (*L. microlophus*), warmouth (*Chaenobryttus gulosus*), channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*), white crappie (*Pomoxis annularis*), black crappie (*P. nigromaeulatus*), carp (*Cyprinus carpio*), brown bullhead (*Ictalurus nebulosus*), and yellow bullhead (*Ameiurus natalis*).

Micropterus salmoides

2.3.6.5 Invasive and Exotic Animals (Vertebrate Species)

Feral hogs or "wild boars" come from several sources and include released or escaped domestic swine and the truly wild European boar. When free-roaming in North America, all are included in the term "feral swine," as are hybrids of the two types. Although morphologically distinct, both the feral swine and European wild swine are recognized as *Sus scrofa* (Midwest AFWS, 2006). Feral hogs are found in Lawrence County but have not yet been observed on NSA Crane.

The physical damage caused by feral swine has been well documented and includes damage to vehicles, vineyards, tree plantings, archaeological sites, agricultural crops, turf, soils, rare plant communities, and wildlife habitat. In addition they compete with livestock and native wildlife for food resources; prey on domestic animals and wildlife; and carry diseases that affect pets, livestock, wildlife and people. The total damage caused by feral swine in the United States is estimated to be approximately $800 million annually. This estimate is approximate, and probably conservative, because environmental damage costs attributable to feral swine are not easily quantified nor are the costs of potential disease outbreaks. The Midwest Association of Fish and Wildlife Agencies, Wildlife and Fish Health Committee, is greatly concerned about the expanding populations and range of feral swine in member states and elsewhere (Midwest AFWS, 2006).

Feral hogs pose threats to companion animal, livestock, native wildlife, and human health. Also, feral swine could also play a role in the spread and amplification of several foreign animal diseases, which

could severely limit opportunities for hunting, fishing, and other outdoor recreation; reduce agency income; require substantial public funds for eradication and thereby severely reduce resources available for traditional wildlife management. Damage caused by feral hogs has been reported in some southern Indiana counties. Crops commonly damaged by feral hogs include wheat, corn, watermelon, and cantaloupe. One of the most common types of damage to these crops occurs when the hogs root in the fields. Hogs not only consume, but also trample the crops. Feral hogs also will destroy the nests and consume the eggs of ground nesting birds such as quail and wild turkey and destroy habitats used by many species of native flora and fauna either through direct consumption, tusking, rooting, and other disturbance activities (Midwest AFWS, 2006).

In Indiana, feral hogs are considered free-ranging, exotic animals and may be taken at any time of the year by any legal means. The possession and relocation of live feral hogs is illegal in Indiana (see Indiana Administrative Code 312 IAC 9-3-18.5) (Purdue Extension , 2009a).

2.3.6.6 Invasive and Exotic Animals (Invertebrate Species)

Emerald Ash Borer

Emerald ash borer (*Agrilus planipennis* Fairmaire) is an exotic beetle that was discovered in southeastern Michigan near Detroit in the summer of 2002. Emerald ash borer probably arrived in the United States on solid wood packing material carried in cargo ships or airplanes originating in its native Asia. Emerald ash borer is also established in Windsor, Ontario, was found in Ohio in 2003, northern Indiana in 2004, northern Illinois and Maryland in 2006, western Pennsylvania and West Virginia in 2007, and Wisconsin, Missouri and Virginia in summer 2008.

The adult emerald ash borer beetles nibble on ash foliage but cause little damage. The larvae (the immature stage) feed on the inner bark of ash trees, disrupting the tree's ability to transport water and nutrients (MSU, 2008). Since its discovery, the species has:

- Killed tens of millions of ash trees in southeastern Michigan alone, with tens of millions more lost in Ohio, Illinois, Indiana, Pennsylvania, West Virginia, Missouri, Wisconsin, Virginia, Ontario, and Quebec.
- Caused regulatory agencies and the USDA to enforce quarantines in 10 states including Indiana and in two Canadian provinces and to enforce fines to prevent potentially infested ash trees, logs or hardwood firewood from moving out of areas where EAB occurs.
- Cost municipalities, property owners, nursery operators and forest products industries tens of millions of dollars.

Emerald ash borer is found throughout Indiana and on NSA Crane.

Gypsy Moth

Gypsy moth (*Lymantra dispar*) is an exceptional pest species of forest and urban landscapes. The species was first introduced to Massachusetts from Europe in 1869, and now is established in the northeastern United States, as well as portions of eastern Michigan, Ohio, and Wisconsin. In Indiana, the species is established in northern portions of the state (INDNR, 2008).

Gypsy moth caterpillars migrate to tops of trees after being hatched, where they feed on foliage and drift in silk strands to colonize other trees. The caterpillars can feed on the foliage of approximately 500 different plants, but prefer oak species (INDNR, 2008). Approximately 3.25 million acres of Indiana's 4.4

million acres of forest land are moderately or highly susceptible to gypsy moth damage. Indiana's forests are approximately 40% oak, while another 40% of the forests are tree species moderately or highly preferred by gypsy moths as hosts. Thus, gypsy moth control is a priority for the state, which began a control program to detect and eradicate artificial introductions in 1973 (INDNR, 2008). The first wave of defoliation will cause the most substantial changes to Indiana forests. Changes would include:

- Reduction in numbers of preferred trees, such as oaks, in the forest.
- Increased surface water runoff in areas where large numbers of trees have been killed.
- Forest regeneration in open areas.

After the gypsy moths' initial pass through Indiana, subsequent outbreaks will probably not be as severe or cause as much tree damage. In states where forests have been infested for over 100 years, forests have eventually recovered from gypsy moth damage and are still standing. Forests will continue to be prominent features of Indiana landscapes long after the gypsy moth has become established.

2.3.6.7 Nuisance Animals

Canada Goose

The Canada goose (*Branta canadensis*) is one of the largest members of the Anatidae (waterfowl) family. Canada geese have a large degree of variation in size, travel habits, and location. The subspecies most recognized in Indiana is the Maxima or "giant" Canada goose (*Branta canadensis maxima*). However, seven subspecies of greater Canada geese exist in North America ranging in weight from approximately 3 to 24 pounds. Several different subspecies of Canada geese migrate through Indiana each spring and fall. However, the vast majority of the birds that stay in Indiana are the giant Canada geese (INDNR, 2009a).

Canada geese are grazers and feed extensively on fresh, short, green grass. With a nearby permanent body of water such as a lake adjacent to their feeding area, geese to set up residence, multiply and concentrate. Geese, including their young, have a strong tendency to return to the same area year after year. Once geese start nesting in a particular place, more geese are likely to assemble in successive years. Congregating geese can cause a number of problems. Damage to landscaping can be significant and expensive to repair or replace, while large amounts of excrement can render swimming areas, parks, golf courses, lawns, docks, and patios unfit for human use. Since they are active grazers, they are particularly attracted to lawns and ponds located near apartment complexes, houses, office areas, and golf courses.

Geese are particularly aggressive during breeding and nesting season. Their behavior can cause problems around populated areas and businesses when geese attack and nip at residents, workers and customers. Most of the problems in developed areas occur from March through June during the nesting season (INDNR, 2009b). At NSA Crane, Canada Geese become a nuisance periodically in the administration area and at the beach on Lake Greenwood. Hunting for geese was permitted for many years on Lake Greenwood but ended in 2020 due to low participation and risk assessment. Hunting for geese is permitted at other NSA Crane lakes and ponds.

Breeding pairs begin nesting in late February and March. Egg-laying begins soon after nest construction is complete. Female giant Canada geese lay one egg every day and a half, and the average clutch size is five. Incubation of eggs begins after the last egg is laid and lasts 28 days. Geese can cause a great deal of localized damage if many young are hatched in one area. After hatching, goslings are incapable of flight for about 70 days, so the young birds and their parents will graze near the hatching area for that time. Adults also molt their flight feathers near the end of June, rendering them flightless for 15 to 20 days. Molting also leaves feathers and down scattered around the area (INDNR, 2009b).

Beaver

The beaver (*Castor canadensis* is the largest rodent in North America with adults ranging from 35 to 46 inches long (including a flattened 12-18 inch tail) and weighing from 45 to 60 pounds. The occupants of a beaver pond or group of ponds are a family consisting of two adults and their offspring of two breeding seasons. The kits remain with the parents until they are two years old and then are driven off to find their own territories. This dispersal of juveniles can contribute greatly to the total number of property damage complaints. As a food source, beavers prefer aspens and willows but will eat the leaves, twigs and bark of most species of woody plants found along the water's edge. During the growing season beavers will also consume large quantities of non-woody plants such as grasses and cattails. During the fall, they will stockpile their woody food supply in the water near their house for use during the winter months. The presence of these fresh cut feed piles is an important indicator of an active beaver lodge. During the ice covered winter months beavers are generally inactive with regard to tree cutting and dam building.

Although all beaver are capable of building lodges, most beaver in Indiana build a modified bank burrow. One of two tunnels leads from below water level up into the bank to a nest chamber above water level. The nest chamber is about two feet high and 4 to 6 feet in diameter. Frequently, a pile of interlaced sticks and branches mixed with mud is placed on top of the bank directly above the nest chamber. During the 1950s, the principal beaver range was the Kankakee and Tippecanoe River drainage systems. More than 8,000 miles of flowing water and thousands of acres of lakes and ponds are available in Indiana for beaver to inhabit. Beaver have few enemies and predation is limited primarily to man. Because they live in small, isolated colonies and are intolerant of newcomers, disease is not spread and has very little effect in depressing population growth. It is estimated that without control, the beaver population would increase by about one-third each year (INDNR, 2009d).

Beaver create ponds and wetlands used by waterfowl, shorebirds, muskrats, otters, fish, amphibians, aquatic plants and other living species. Beaver ponds generally slow the water flow from drainage areas and alter silt deposition, thus creating new habitat. During drought conditions, beaver ponds create water holes for livestock and wildlife, particularly waterfowl. However, their engineering feats cause problems when they (1) flood homes, roads, croplands and timberlands, (2) dam canals, drainages and pipes, which inhibits water control, or (3) girdle and fell or flood valuable trees, thus causing them to die after prolonged flooding. Problem beaver situations may include an impoundment threatening downstream property, upstream flooding of land, trees or crops killed or damaged by flooding, flooding of homes, flooding of highways or railroads, contamination of water supplies, impairment of drainage systems, damage to wildlife habitat or landowner distress.

Nuisance beavers are trapped when needed to protect pond dams, culverts and bridges. Numbers of beavers trapped by nuisance trappers are reported to the natural resources manager.

3.0 Environmental Management Strategy and Mission Sustainability

The goal of NSA Crane's Natural Resources Management Program is to manage resources in a sustainable fashion, so that the installation's present day needs are met while allowing the resources to be available for future generations. By acting in a sustainable fashion, NSA Crane considers not only the environmental aspects and impacts of the installation's activities with respect to natural resources, but the social and economic impacts associated with the installation's mission. Incorporating natural resource management objectives into overall installation long-term planning aids in compliance, ensures efficient installation operations, and enhances the military mission. NSA Crane is committed to sustainability to

ensure that the military mission has sufficient resources with which to operate, while at the same time acting as proper stewards of the natural resources which compose NSA Crane.

3.1 Cooperative Management

This INRMP replaces the 1991 *Fish and Wildlife Management Section of the Natural Resources Management Plan,* which was the cooperative plan between the U.S. Fish and Wildlife Service, Indiana Department of Natural Resources, and NSA Crane. The Sikes Act, as amended, requires that Navy installations manage fish and wildlife populations with appropriate federal and state fish and wildlife agencies. Acceptance and concurrence of the previous INRMP (*Integrated Natural Resources Management Plan, 2002-2006, Crane Division Naval Surface Warfare Center)* by appropriate federal and state fish and wildlife agencies, in essence, serves as a cooperative agreement between these agencies and NSA Crane. This INRMP has the signatory approval of the U.S. Fish and Wildlife Service and the Indiana Department of Natural Resources. This signature approval includes agreement that the INRMP complies with the Endangered Species Act. Review of the INRMP is informal consultation with regard to the Endangered Species Act.

NSA Crane maintains a partnership with the U.S. Fish and Wildlife Service and the Indiana Department of Natural Resources on many issues relating to natural resources management on the installation. NSA Crane will invite USFWS and INDNR to participate cooperatively in the preparation of this INRMP. Through this cooperative process, these agencies will remain informed with respect to NSA Crane's military mission, will provide valuable input regarding natural resource management issues, and expedite the approval of the final INRMP.

3.2 Adaptive Management

NSA Crane is committed to utilizing an adaptive management strategy throughout the lifecycle of this INRMP. Management strategies directed in this INRMP are intended to be dynamic, interdisciplinary, and flexible as warranted by the military mission or changes in the composition of natural resources at NSA Crane.

To provide direction, recognize target management actions, and construct the framework for measuring success of this INRMP, the following goals have been established:

- Provide for the conservation, enhancement, and rehabilitation of land and water resources of NSA Crane while supporting the military mission.
- Maintain or increase the diversity and populations of plants and animals under the stewardship of the Department of the Navy through habitat maintenance, enhancement, or rehabilitation activities on NSA Crane that do not detract from the military readiness of the installation.
- Enhance the quality of life of Navy personnel by providing high-quality, accessible, outdoor recreational opportunities that do not degrade the natural resources.
- Foster and promote natural resource stewardship among Navy personnel, their dependents, and the public by providing opportunities to participate in natural resource conservation, education, and rehabilitation activities on NSA Crane.

From these goals, a variety of management objectives and projects specific to the needs of NSA Crane have been developed. The management objectives are components of the four goals and represent measurable targets to be used to quantify the success of this INRMP. Ecosystems are dynamic systems, and may exhibit responses to management actions different than those expected. A process of adaptive management will be used to compare the responses exhibited by the natural resources to the management

projects against the desired response towards reaching the objective for that management project. Modification of the management objectives and projects may be needed to reach the desired goal. For example, a change in management actions may become necessary because of an unforeseeable and large-scale disturbance (e.g., fires, large storm events, or droughts) to the natural resources. An adaptive management approach allows for changes in short and long-term objectives from possible large-scale changes in the conditions of the natural resources to reach the goals of this INRMP.

This INRMP acknowledges that improving understanding within and among the complex biophysical and social-economic-political systems on NSA Crane requires an increased emphasis on new knowledge. As a result, it will utilize an adaptive management strategy to gain new understanding. This strategy employs a four-phase adaptive management cycle. In the first phase, plans are framed, based on existing knowledge, organizational goals, current technology, and existing inventories. In phase two, on the ground actions are initiated. Phase three involves monitoring results of those actions and, in phase four, results are evaluated. The cycle could then reinitiate, driven by emerging knowledge and experience. Results could validate existing practices and policies or reveal the need for alterations in the plan.

3.3 Ecosystem Management

The goal of ecosystem management on military lands is to ensure that military lands support the present and future military mission while, as much as possible, preserving, improving, and enhancing an ecosystem's characteristics and communities of which it is comprised. Over the long-term, that approach will maintain and improve the sustainability and biological function of ecosystems; while supporting sustainable economies, human use, and the environment required for realistic military training operations (DoD Instruction 4715.3).

Ecosystem management is based on a holistic, systems-oriented approach, and not predicated on single species management or maximizing the prevalence of a small group of organisms. However, rare species management should absolutely complement the conservation of a healthy, biologically diverse system. Combining both management objectives will ensure that ecosystems maintain their integrity, their constituent species and dynamics, and continue to support those species that are most vulnerable to ecosystem change – federal and state listed special status species.

Management of NSA Crane natural resources will support sustainable military use through the application of an integrated approach to ecosystem management. An ecosystem, by definition, is a dynamic and natural complex of living organisms interacting with each other and with their associated non-living environment.

A process of adaptive management will be used to compare the responses exhibited by the natural resources to the management projects against the desired response towards reaching the objective for that management project. An adaptive management approach to ecosystems allows for changes in short and long-term objectives due to large-scale changes in the conditions of natural resources.

Ecosystem management is an interdisciplinary planning and management process that focuses on identifying, restoring and maintaining natural communities in support of the military mission and other sustainable activities. The principles of ecosystem management, (DoD Conservation Instruction 4715.3), are as follows:

- *Maintain and improve the sustainability and native biological diversity of NSA CRANE ecosystems.*
- *Administer with consideration of ecological units and timeframes.*

- *Support sustainable human activities.*
- *Develop priorities and reconcile conflicts.*
- *Develop a vision of ecosystem health.*
- *Develop coordinated approaches to work towards ecosystem health.*
- *Rely on the best science and data.*
- *Use benchmarks to monitor and evaluate outcomes.*
- *Use adaptive management.*
- *Implement through installation plans and programs.*

3.4 Achieving No Net Loss to the Military Mission

The Sikes Act, as amended, states that an INRMP shall provide for "no net loss in the capability of military installation lands to support the military mission of the installation." The Sikes Act also states that the purpose of an INRMP is to "ensure consistency with the use of military installations to support the preparedness of the Armed Forces", while providing for the following:

- *The conservation and rehabilitation of natural resources on military installation.*
- *The sustainable multipurpose use of the resources including hunting, fishing, trapping, and non-consumptive use.*
- *Public access to military installations within safety and military security requirements.*

NSA Crane natural resources personnel consult with USFWS when new training activities are proposed on the installation, and develop mitigation strategies when necessary to help protect threatened and endangered species or habitats. Surveys are also periodically conducted to determine what the probable impacts to threatened and endangered species might be from such activities. One such survey investigated the impacts of bat usage along a designated tactical training route. Results of the survey provided no evidence that bat usage of the area declined when training activity had recently occurred (BHE Environmental, 2002).

3.5 Supporting Sustainability of the Military Mission and the Natural Environment

This INRMP supports the military mission by protecting and enhancing lands upon which the mission is dependent. The INRMP also describes recreational opportunities associated with natural resources that are available to the NSA Crane, local, and regional communities.

The INRMP describes impacts of the military mission upon natural resources and means to mitigate these impacts. However, this INRMP does not evaluate the NSA Crane military mission, nor does it replace any requirement for environmental documentation of the military mission at NSA Crane.

3.6 Natural Resource Consultation Requirements

It is Navy policy that installations must comply with laws for the protection and management of natural resources. To ensure compliance, installation projects and actions that may affect regulated resources require consultation with, and/or acquisition of required permitting documentation from appropriate regulatory agencies. The natural resources manager at NSA Crane is routinely in communication with agencies such as the USFWS and the INDNR.

To facilitate effective and efficient management of NSA Crane resources while ensuring regulatory compliance for ongoing programs and actions, programmatic consultations may be established in

coordination with appropriate regulatory agencies. While formal consultations are required under many circumstances, natural resource managers often engage in informal consultations with regulatory agencies as well. Such informal consultations are integral to the continued assurance of compliance under varying circumstances, to the facilitation of management planning and project support, and to the building of positive working relationships with regulating agencies.

The majority of consultations at NSA Crane are informal consultations with the USFWS under the Endangered Species Act. Due to the presence of the federally endangered Indiana bat and federally threatened northern long-eared bat, all tree clearing projects involving tree species listed in Section 4.1.1 must be approved by USFWS. This is because those clearings may constitute a taking of habitat under the Endangered Species Act. In nearly every case, these takings are very small in relation to the amount of Indiana bat habitat present at NSA Crane.

3.7 Planning for National Environmental Policy Act (NEPA) Compliance

The primary planning tool for the evaluation of projects and actions potentially affecting the environment and for the coordination of these projects and actions with NSA CRANE environmental management programs is the National Environmental Policy Act (NEPA). NEPA is the basic national charter for the protection of the environment and requires federal agencies to assess and document, in detail, the potential environmental impacts of their actions that could significantly affect the quality of the environment. NEPA is intended to help decision makers make informed decisions and take actions that protect, restore, and enhance the environment. In brief, the NEPA process requires that the installation consider the environment in decisions concerning potential individual and cumulative impacts; make diligent efforts to inform and involve the public at appropriate stages in the decision making process; develop and evaluate less environmentally damaging alternatives to potential projects; and support informed decisions with quality documents. NEPA requires a detailed statement of significant environmental impacts of major federal actions. For example, an action may be considered significant if it has a long-term impacts or potential risk because of its effect on a species protected under the Endangered Species Act. The process identifies reasonable alternatives to proposed actions that might have less or no environmental effect. Individual and cumulative impacts must be considered. The following three-tiered approach is used to document impacts:

- Categorical Exclusions (CATEX) are used for actions that do not individually or cumulatively have a significant effect on the human environment and therefore do not require preparation of an Environmental Assessment (EA) or Environmental Impact statement (EIS).

- An EA is the analysis to be completed when the government is uncertain as to whether an action will significantly affect the environment or whether the action is controversial; the result of an EA is either a Finding of No Significant Impact (FONSI) or a requirement to complete an EIS.

- An EIS is a full-disclosure document that presents a full and complete discussion of significant impacts, informing the public and decision makers of reasonable alternatives to the proposed action.

3.7.1 Coordination and Planning for Construction and Facility Maintenance

Activities related to construction and facility maintenance at NSA Crane require consultation with NAVFAC Midlant Business Line and PWD Environmental Division, which determines the type and level of regulatory agency coordination and permitting that is required. General requirements include the following:

- PWD Environmental Division review is required for all facilities-related activities.
- NSA Crane will design, use, and promote construction and facility maintenance practices to minimize adverse impacts to natural resources and habitats.
- PWD Environmental Division will review major construction and facility maintenance projects during the planning stage to ensure compliance with applicable regulations.
- Pest control measures that are required as a part of construction activities will be coordinated with PWD Environmental Division.

Project impacts are analyzed using the NEPA process discussed above in Section 3.7. Implementation of best management practices during all construction related activities are encouraged. These practices include the following:

- Minimizing the area disturbed and the duration barren ground is left exposed to limit potential erosion.
- Utilizing general sediment and erosion control measures, and limiting runoff.
- Utilizing landscaping practices that minimize pesticide use, erosion, and flooding.

3.7.2 Mitigation Elements

Mitigation is required by NEPA and OPNAVINST 5090 when a proposed action adversely affects the environment. Mitigation is a technique to either consider less damaging alternatives to a proposed action or provide means to off-set damage to the environment resulting from implementation of the proposed action. General mitigation tactics include the following:

- ***Avoidance:*** Avoid adverse impacts on natural resources by not performing activities that would result in such impacts. Confine construction to areas where no significant impact would occur to natural areas.
- ***Limitation of action:*** Reduce the extent of an impact by limiting the degree or magnitude of the action. Minimize impacts of construction projects by arranging timing, location, and magnitude of actions so that they have the least impact on natural resources.
- ***Restoration of the environment:*** Restore the environment to its previous condition (or better). This could involve reseeding and/or replanting an area with native plants after it has been damaged by construction projects.
- ***Preservation and maintenance operations:*** Design the action to reduce adverse environmental effects. This could involve actions such as monitoring and controlling pollution, contamination, disturbance, or erosion caused by construction projects that would impact natural resources.
- ***Replacement:*** Replace the resource or environment that will be impacted by construction projects. Replacement can occur in-kind or otherwise, on-site or at another location. This could involve creation of the same type or better quality habitat for a particular impacted species or creation of habitat for another type of species.

Mitigation proposed for a specific impact at NSA Crane will be addressed on a case-by-case basis. Mitigation requirements shall be planned for, funded, and implemented as part of the proposed action by the proponent of the project.

3.8 Beneficial Partnerships and Collaborative Resource Planning

In addition to required partnerships with the USFWS and INDNR, NSA Crane has also established beneficial partnerships with universities and other natural resource agencies. Purdue University has conducted research on the installation for over forty years. This includes deer data collection, Christmas bird counts, and several graduate research projects. NSA Crane has also partnered with Indiana and Ball State Universities on past projects.

NSA Crane has also partnered with other agencies, including the Martin County Soil and Water Conservation District and the Natural Resources Conservation Service (NRCS). These partnerships include maintenance of flood control reservoirs and soil conservation initiatives. Recently, the NRCS has assisted NSA Crane with equipment needed to establish native grasses and forbs in open areas on the installation.

3.9 Public Access and Outreach

3.9.1 Public Access and Outdoor Recreation

Public access is a tradition on NSA Crane. In the past, there were several opportunities for the general public to participate in installation activities. In maintaining a policy of public access to the greatest extent possible, NSA Crane relies on a responsible public to adhere to restrictions placed on range access.

Department of Defense Directive 4715.3, *Environmental Conservation Program*, May 3, 1996, states, "*The principal purpose of DoD lands and waters is to support mission-related activities. Those lands and waters shall be made available to the public for educational or recreational use of natural and cultural resources when such access is compatible with military mission activities, ecosystem sustainability, and other considerations such as security, safety, and fiscal soundness. Opportunities for such access shall be equitably and impartially allocated.*"

Section 12-3.10-4.1.d of OPNAVINST 5090.1, Outdoor Recreation, states that "*The INRMP must address the appropriate level of public access for natural-resources-based recreational opportunities consistent with installation security, installation mission, and sustainable NRC objectives. The ICO has the discretion to allow hunting and fishing in explosive storage and operations areas under carefully controlled conditions that do not endanger life, property, or hazardous materials. Limits to public access for recreational puproses and any controlling conditions must be specifically addressed in the installation INRMP.*"

NSA Crane policies toward public access are within both the spirit and letter of Navy and Department of Defense policies. However, due to safety and security concerns associated with the military mission, NSA Crane restricts general access to the installation. Persons authorized use of natural resources on NSA Crane include military and civilian personnel assigned to the installation and tenant activities, as well as their dependents; retired installation employees; and personnel assigned for duty on the installation on special orders. All other U.S. citizens are authorized to participate in the firearm deer hunts as drawn by the INDNR. Prior to September 2001 public access to Lake Greenwood was permitted. Due to the September 11 terrorist attacks, public access was suspended on Lake Greenwood and it remains in this state today.

Access to certain areas, even for those authorized access to use installation natural resources, may be denied due to conflicting use. The amount of time NSA Crane is annually open to hunting is limited, and hunts are tightly controlled. Exceptions to access policies are authorized for special events and annual deer hunts. To allow deer hunts to occur, NSA Crane increases security controls, curtails some mission-related functions, and takes additional steps to ensure the security of the military mission.

Deer hunting on NSA Crane has been greatly restricted since September 2001. Due to the September 11 terrorist attacks deer hunting was suspended until 2002. In 2002 deer hunting was reinstated at NSA Crane but due to the safety and security of the mission it remains mostly limited to military and civilian DoD employees. Since 1985, with the exception of a couple of years, public access for deer hunting has continued with the disabled hunter firearm deer hunt. Eligible disabled hunters are drawn and must then pass a security investigation before being given access to hunt on that hunt. Currently, NSA Crane conducts 3-4 regular firearm deer hunts and one public disabled hunter firearm deer hunt.

A 1999 change to DODINST 6055.9, Explosives Safety Standards, restricts personnel exposure within explosives areas. The change stated, in part, that personnel should be afforded protection from explosives safety arcs associated with explosives containing facilities based on public traffic route criteria tables. Hunting and fishing is allowed as a wildlife population management tool in accordance with NAVSEA OP 5, Volume 1.

NSA Crane has large, relatively undeveloped, open spaces. This open space and outdoor recreation opportunities associated with it are perhaps the installation's best natural attributes in terms of community quality of life. With ever-increasing time to pursue recreational interests, the NSA Crane community and general public will undoubtedly place more demand on installation natural resources.

The history of outdoor recreation on NSA Crane is directly related to the history of hunting and fishing on the installation. NSA Crane's outdoor recreation program developed as recreation interests broadened and now provides recreational opportunities other than hunting and fishing.

Camping has always been a popular pursuit at the Lake Greenwood campground, which is operated and maintained by the Morale, Welfare, and Recreation Department (MWR). MWR has built facilities, including a marina on Lake Greenwood, and acquired an extensive assortment of recreational equipment available to rent by military personnel and civilians.

Lake Greenwood Marina

Other types of recreational opportunities exist at NSA Crane. Various types of indoor recreation are available in the administrative areas as are other dispersed outdoor activities not included in the formal definition of "outdoor recreation." Some of these types of recreation are discussed below; however, management recommendations are not provided.

- Provide opportunities to the NSA Crane community and the public to participate in high quality, safe outdoor recreation.
- Manage outdoor recreation consistent with needs of the NSA Crane military mission.
- Integrate recreation activities with natural resources stewardship and compliance.
- Encourage the development of facilities that improve use and enjoyment of fishing, hunting, and other natural resources-based recreation.
- Update natural resources rules and regulations as needed.
- Investigate hunting and fishing license fee increases, and consider initiating a fee system for other recreational activities.
- Use the GIS to provide improved maps for hunters and anglers.
- Investigate the initiation of an annual kids fishing derby.

The military mission and its security and safety requirements have priority over outdoor recreation involving range access. If hunting and fishing (or other outdoor recreational activities) are to continue on NSA Crane, this military mission priority must not be compromised. If recreational or management activities conflict with military activities, the military mission maintains priority over other pursuits.

The installation has been producing and storing the ammunition that America's sailors and troops need to win on ocean and land battlefields around the world for over half a century while providing quality recreational opportunities for installation personnel, their families, civilian employees, and the general public. NSA Crane has shown that these two goals can be achieved simultaneously.

3.9.2 Public Outreach

Public outreach and conservation awareness is instrumental in creating conditions needed to manage natural resources. The NSA Crane approach to awareness stresses education. It provides installation personnel and the public with insights into the installation's natural environment and conservation challenges. The more people know about the installation's unique and valuable natural resources, the more responsibly they act toward them.

Education also promotes awareness of critical environmental projects and the rationale behind them. Activities such as fish stocking, erosion control, wildfire suppression, etc. can be accomplished with little conservation awareness effort since installation personnel, recreationists, and the general public, support these easily understood efforts. However, issues such as protection of sensitive areas for little understood plant and wildlife species, restrictions on operations, permit fees and their uses, etc. require effective conservation communication to get positive support and, perhaps more importantly, to avoid adverse reactions from various users. A conservation awareness program must be directed to both installation and external interests if it is to be effective. Objectives include the following:

- Provide decision makers with information to make judgments which affect the NSA Crane natural resources program.
- Provide information to the military community and general public on recreational opportunities on NSA Crane, especially those related to hunting, fishing, and other natural resources-based activities.
- Continue to use printed and electronic media as an important part of natural resources management on NSA Crane.
- Continue to provide high quality hunting and fishing awareness to recreational users.
- Provide watchable wildlife opportunities at NSA Crane.
- Whenever possible, continue to work with youth groups as a good investment in the future.

3.9.2.1 Printed Media

The Natural Resources staff periodically writes articles for the *Plan of the Week*, *eBulletin*, and *Currents*, and staff writers also cover natural resources programs. Many articles emphasize regularly recurring items, such as hunting season dates and regulations and hunting harvest summary, but special issues are also covered (*e.g*., bobcat trapping on the installation).

Annual deer hunts are probably the most publicized aspect of the NSA Crane natural resources management program. Besides local publicity, the INDNR publicizes the hunts state-wide through its annual hunting and trapping guide. In addition, NSA Crane natural resources have occasionally been the

subject of articles in the INDNR outdoor magazine, *Outdoor Indiana,* and other regional outdoor publications. A news release is published annually when timber revenues are shared with the counties.

Other newspapers occasionally publicize special events occurring on the installation. NSA Crane will continue to use the printed media as an important part of natural resources management.

The NSA Crane natural resources program is seldom the subject of television or radio coverage. However, segments concerning forestry and deer hunting were filmed on the installation during 2007. The use of television and radio during the next ten years largely will be driven by media events on the installation.

3.9.2.2 Electronic Media

Electronic media is used for conservation awareness at NSA Crane. A VIP brief and a public brief are available for visiting dignitaries and other visitors wishing an overview of the natural resources program. The Natural Resources Office maintains slides for use in awareness programs and has some exceptional wildlife video to share with tour groups.

The installation has an internal website with NSA Crane military information and directives including those governing natural resources usage.

3.9.2.3 Hunting and Fishing Awareness

Many already discussed uses of media and special events are related to hunting and fishing on NSA Crane, particularly the use of newspapers and INDNR publications to disseminate information on hunting and fishing opportunities. Each gun deer hunter on NSA Crane is required to attend a pre-hunt safety briefing. These briefings offer not only safety information, but also natural resources awareness information to assist hunters in knowledge of their assigned hunting area and hunting techniques.

The Natural Resources Office strives to use personal communications with hunters and anglers throughout the year, especially during official seasons. Other activities used to enhance hunting and fishing opportunities on the installation include those listed below.

- Educating anglers on fish stocking histories.
- Dissemination of information, such as wildlife checklists and regulations, and answering questions concerning fish and wildlife resources and conservation.
- Publishing and distributing maps and instructions on hunting and fishing areas, regulations, and procedures.
- Endorsing and supporting public education and social activities, such as fishing tournaments.
- Updating and improving ways to inform users of outdoor opportunities available on NSA Crane.

3.9.2.4 Watchable Wildlife

The Watchable Wildlife program is important to NSA Crane. There are many naturally occurring opportunities to observe wildlife in and near the installation. An officially designated site, equipped with a platform and large binoculars, was established to allow visitors to view bald eagles. However, the eagles relocated and the installation removed the site. NSA Crane will continue to examine ways to support Watchable Wildlife opportunities during the next ten years.

3.9.2.5 Youth Groups

Youth groups are involved in various wildlife programs on NSA Crane. Scouts use installation projects to earn their conservation badges. NSA Crane has sponsored limited youth turkey hunts in cooperation with the Indiana Wild Turkey Federation and for terminally ill children. The annual Crane Division Science Fair involves over 400 students who compete for cash prizes contributed by installation employee groups and organizations. NSA Crane will continue to work with youth groups whenever possible as a good investment in the future.

3.10 Encroachment Partnering

In 2005, the Indiana state legislature passed House Bill No. 1022, termed the Military Base Protection Act, which established the Military Planning Council and was designed to protect military installations from encroachment issues. The bill requires a unit of local government to notify the commander of an installation within the unit before the unit takes action regarding planning or zoning. Furthermore, the bill prohibits a unit of local government from taking action concerning planning or zoning that would have an adverse impact on the installation's operations, within three miles of the installation.

3.11 GIS Management, Data Integration, Access, and Reporting

The collection of natural resources data is of limited value without the capability to store, retrieve, and analyze these data. NSA Crane is committed to providing efficient, cost-effective systems for data storage and analysis.

Microcomputers are essential to the routine operation of efficient natural resources management organizations. The volume of data is too substantial to handle without computers, and routine administrative tasks are accomplished considerably more efficiently with computers. One example is the new computerized workflow program being used by NAVFAC.
The Natural Resources Office has microcomputer capability available to its employees. Each of the Natural Resources Office staff has access to a computer and peripherals. Software currently used by the Natural Resources Office is Microsoft Office Professional®. Upgrades of hardware and software will occur as needed during the lifecycle of this INRMP.

A Geographic Information System (GIS) allows users to manipulate spatial data (*e.g.*, maps, aerial photos, satellite images) in a similar fashion as a data management program allows the analyses and presentation of mathematical data. GIS deals with data in vector (points, lines, and polygons) and raster (cell or grid based) formats. Data can be displayed and used to create maps. The natural resources GIS system is often used to support other functions at NSA Crane such as environmental permitting and planning.

NSA Crane developed a GIS for natural resources use in 1992. The system is operated by personnel in the Natural Resources Office. Data are now entered into the ESRI ArcView® GIS system. Database development will continue during the lifecycle of this INRMP. Any GIS data collected by contractors will be in compliance with current DoD standards.

The oldest known aerial photos of NSA Crane are from 1935. These have been scanned, rectified, and preserved on the GIS. NSA Crane Natural Resources staff now use publicly available satellite imagery for GIS applications.

3.12 Training of Natural Resource Personnel

NSA Crane has a goal to continuously improve the success of natural resources management activities through professional development and information exchange. This will be accomplished by:

- Maintaining staff knowledge of management strategies at the current state of the art through training; and
- Sharing information with natural resources experts to ensure maximum benefits of adaptive management and research efforts.

NSA Crane plans to send one person to the annual workshops or professional conferences listed below if schedules and budgets allow:

- National Military Fish and Wildlife Association annual workshop.
- North American Natural Resources Conference.
- Society of American Foresters/DoD natural resources annual meeting.
- Partners in Flight national, regional, and state meetings (generally in conjunction with other listed meetings).
- Midwest Fish and Wildlife Conference.
- State natural resources professional organization meetings.
- Navy-sponsored training.

Other conferences/workshops will be evaluated for their usefulness, and decisions will be made based on appropriateness to ongoing projects and funding availability. Projects which are especially useful include ecosystem restoration workshops, GPS training and advanced GIS training. If funding is available, consideration will be given to sending some Fire Department personnel to a forest fire fighting workshop.

4.0 Program Elements

The implementation of this INRMP is intended to be a dynamic, multidisciplinary process. To provide direction, recognize target management actions, and construct the framework for measuring success of this INRMP, the following goals have been established:

- Provide for the conservation, enhancement, and rehabilitation of land and water resources of the installation while supporting the military mission.
- Maintain or increase the diversity and populations of plants and animals under the stewardship of the Department of the Navy through habitat maintenance, enhancement, or rehabilitation activities on NSA Crane that do not detract from the military readiness of the installation.
- Enhance the quality of life of Navy personnel by providing high -quality, accessible, outdoor recreational opportunities that do not degrade the natural resources.
- Foster and promote natural resource stewardship among Navy personnel, their dependents, and the public by providing opportunities to participate in natural resource conservation, education, and rehabilitation activities on NSA Crane.

From these goals, a variety of management objectives and projects specific to the needs of NSA Crane have been developed. The management objectives are components of the four goals and represent measurable targets to be used to quantify the success of this INRMP. It should be noted that individual goals, objectives and supporting projects could be applied to one or more program elements. A more

detailed discussion of the goals, objectives and supporting projects in relation to various program elements follow.

4.1 Threatened and Endangered Species, Critical Habitat, and Species of Concern

Baseline information regarding threatened and endangered species, critical habitat, and species of concern was presented in Section 2.3.1. NSA Crane contains no USFWS designated critical habitat (see Appendix D). The federally endangered Indiana bat (*Myotis sodalis*) and the federally threatened northern long-eared bat *(Myotis septentrionalis)* have been documented at NSA Crane. An additional twenty-seven faunal species and four plant species listed by the Indiana Department of Natural Resources as threatened, endangered, rare, or species of concern have been documented or observed at NSA Crane.

The Navy has five primary requirements under the Endangered Species Act. NSA Crane is committed to these primary requirements.

- To conserve and promote recovery of listed species.
- Not to "jeopardize" federally listed species.
- To "consult" and "confer" with USFWS on any action that may affect a federally listed species.
- To conduct a biological assessment for any project that will result in a taking of a federally listed species or its habitat.
- Not to "take" federally listed fish and wildlife species or to remove or destroy federally listed plant species.

The *Endangered Species Management Plan* (Andrews, 1999) does not recommend additional Indiana bat inventories or monitoring for NSA Crane. However, surveys for bats were conducted in 2005 and 2015 (INDNR, 2005b), and funding has been requested for additional surveys in 2024 (see Appendix A). Natural resources personnel will continue to monitor eagle activity and document use and behavior during nesting.

Andrews (1999) indicated the need for a survey of mollusks on NSA Crane. Although the amount of habitat is limited in both diversity and amount (Andrews, 1999), mollusks do occur on the installation. Mollusks are gravely imperiled in the Midwest with over half of the 78 known species classified as federally endangered, threatened, or species of concern (U.S. Fish and Wildlife Service, 1999). A mussel survey was conducted on NSA Crane in 2002, which identified no threatened or endangered species as occurring on the installation (see Appendix B5).

4.1.1 Endangered Species Management Program

General information regarding the management recommendations of special status species is taken from the *Endangered Species Management Plan for the Crane Division, Naval Surface Warfare Center* (Andrews, 1999), the *Inventory and Status Update Assessment of Federal and state Listed Threatened, Endangered, and Special Concern Vertebrate Species at Naval Support Activity Crane* (INDNR, 2005b), and the *Inventory and Status Update Assessment of Federal and state Listed Endangered, Threatened and Rare Vascular Plants at Naval Support Activity Crane* (Homoya and Hedge, 2006). Special status species found at NSA Crane were discussed in Section 2.3.1.

Andrews (1999) includes the general endangered species management recommendations listed below.

- Retain the forest cover.
- Balance timber sales with other resource needs.

- Continue to collect wildlife inventory data.
- Document conditions at Glendora Test Facility.

Homoya and Hedge (2006) includes the general management recommendations for special status vascular plants listed below.

- Active management for the special status vascular plant species at NSA Crane is generally not required, and the sites where they occur may be maintained in their current conditions.

The Indiana Department of Natural Resources (2005b) and the NSA Crane Endangered Species Management Plan (Andrews, 1999) includes the general management recommendations for special status vertebrate species listed below.

Federally Listed Indiana Bat and Northern Long-Eared Bat, as well as Other State Listed Bat Species

- Utilize even-aged and uneven-aged timber management practices, providing for a variety of forested habitat types.
- Restrict timber harvesting activities during the summer roosting period (April 1 through September 30).
- Develop a variety of forest conditions with respect to size, height, age, condition, etc., in order to create a renewable resource of suitable roosting habitat.
- In certain large areas of contiguous forest, maintain canopy cover between 30 and 80 percent.
- When trees are retained during timber harvest activities, tree species that have a high potential to serve as roosts are preferred.
- Live trees with smooth bark may potentially be removed at any time, as they provide no immediate roosting opportunities.
- Fallen trees may be salvaged or harvested at any time regardless of condition.
- Retention of standing dead trees or snags should occur wherever possible.
- Dead or dying trees that must be removed due to the potential risk to human safety should be removed outside of the roosting season if possible (September 30 through April 1).
- In uplands, consider regeneration methods that favor oaks and hickories over beech and maple.
- Use timber stand improvements (TSI), particularly along forest edges that will open the understory.
- Control non-native species that compete with and lessen the quality of native woodlands.
- Conserve riparian forest habitat adjacent to stream corridors.
- Preserve, create, restore, and/or enhance wetlands, streams, and ponds, particularly in upland areas.
- Any installed bat boxes should be placed on a south-facing exposure to facilitate solar warming; preference should be given to placing bat boxes along forest edges or corridors.

State Listed Small Mammals

- Old field populations of small mammals may potentially benefit from less mowing.
- Increase sampling in surveys in order to more accurately determine species abundance.

State Listed Birds

- Maintain existing areas of mature forest, decreasing the amount of habitat fragmentation.
- Maintain forest areas with a mosaic of open understory as well as areas of dense shrub layers.
- Monitor and control the deer population to ensure protection of ground cover for ground nesting birds.
- Observe a ¼ mile buffer on timber harvest activities around the bald eagle nest sites.

- Protect dominant trees along lake shorelines, as they may be potential bald eagle nest sites.
- Reduce the frequency of mowing to encourage species such as Henslow's sparrow.
- When possible, conduct roadside mowing activities outside of the Henslow's sparrow breeding season.
- Maintain broom-sedge fields that could potentially benefit Henslow's sparrow and other species that inhabit such areas.
- Maintain emergent wetlands near Lake Gallimore and other sites to potentially benefit king rail.
- Maintain healthy fish populations to benefit osprey use of the installation.
- Maintain bottomland hardwoods that may be used by yellow-crowned night heron.
- More research is needed to assess the impacts of current resource management activities at NSA Crane on listed bird species.

State Listed Amphibian and Reptiles

- Maintain existing forest habitat matrix.
- Minimize use of pesticides.
- If timber rattlesnakes are documented on the installation, information on their locations should be protected, beyond using such information for conservation and research initiatives.
- Ensure that installation visitors and the general public are aware of the special status of timber rattlesnakes and that they should not be disturbed if encountered.
- If possible, avoid development on high south facing ridges across the installation, as these areas potentially provide the most suitable habitat for timber rattlesnake on the installation.
- Continue surveys for listed species.

State Listed Fish

Although no listed species of fish occur on NSA Crane, care should be taken to minimize erosion in any future construction projects, particularly in the vicinity of Sulphur Creek, as surveys of this stream suggest it is quite pristine with good water quality.

4.1.2 Indiana and Northern Long-Eared Bat Forest Management

NSA Crane construction and maintenance projects and mission-associated testing and research operations can impact Indiana and northern long-eared bat habitat. At the request of the USFWS, NSA Crane submits projects that may remove woody vegetation for review. NSA Crane will continue informal consultation with the USFWS for proposed construction projects or other activities that could impact Indiana and northern long-eared bats.

Project sites will be surveyed for Indiana and northern long-eared bats prior to significant ground disturbance if required by the USFWS. NSA Crane will continue to minimize or avoid any adverse effects on Indiana and northern long-eared bats and their habitat. NSA Crane natural resources personnel will continue to brief other installation personnel on their responsibilities to protect and enhance recovery of Indiana and northern long-eared bats.

The forest management guidelines for the State of Indiana listed below, as directed by the U.S. Fish and Wildlife Service Bloomington Ecological Service Field Office (USFWS, 2019), will be implemented on NSA Crane to help assure the continued existence of Indiana and northern long-eared bats.

- At least 60 percent canopy cover (on a stand-by-stand basis, depending on the size of stands) will be maintained after timber harvest activities.
- Shagbark hickory (*Carya ovata*) or shellbark hickory (*C. laciniosa*) trees will not be harvested or manipulated during timber stand improvement (TSI) activities, unless the density of these species

combined exceeds 16 trees per acre. If present, at least 16 live shagbarks and shellbark hickory (combined) greater than 11 inches diameter breast height (dbh) will be maintained per acre.

- Standing snags (trees with less than 10 percent live canopy) will not be removed except where they pose a serious human safety hazard. Snags that have no remaining bark and no visible cracks, splits, or hollows may be felled, as well as any snags leaning more than 45º from vertical.
- The following tree species have been identified as having relatively high value as potential Indiana bat maternity roosts, based on literature and unpublished roosting data:
    - shagbark hickory (*Carya ovata*)
    - shellbark hickory (*Carya laciniosa*)
    - mockernut hickory *(Carya tomentosa)*
    - bitternut hickory (*Carya cordiformis*)
    - silver maple (*Acer saccharinum*)
    - sugar maple (*Acer saccharum)*
    - red maple *(Acer rubrum)*
    - boxelder *(Acer negundo)*
    - green ash (*Fraxinus pennsylvanica*)
    - white ash (*Fraxinus americana*)
    - eastern cottonwood (*Populus deltoides*)
    - northern red oak (*Quercus rubra*)
    - post oak (*Quercus stallata*)
    - white oak (*Quercus alba*)
    - slippery elm (*Ulmus rubra*)
    - American elm (*Ulmus americana*)
    - black locust (*Robina pseudoacacia*)
    - yellow poplar *(Liriodendron tulipifera)*
    - black walnut *(Juglans nigra)*

- On average, at least 3 live trees per acre greater than 20 inches dbh (of the high value species listed above) will always be maintained in the stand (a tree with less than 10 percent live canopy should be considered a snag). These "leave trees" must be the largest trees of the listed species remaining in the stand. An additional 6 live trees per acre greater than 11 inches dbh of the listed species must also be maintained. The "per acre" requirement can be expressed as the average per acre on a stand-wide basis, depending on the definition of a stand.
- If there are no trees greater than 20 inches dbh to leave, then 16 live trees per acre must be left, and these must include the largest specimens of the listed species remaining in the stand.
- No harvest or TSI activities are permitted within 100 feet of a perennial stream or within 50 feet of an intermittent stream.
- No harvest of trees greater than 5 inches dbh is permitted from April 1 through September 30.

Additionally, guidelines for the use of prescribed fire are as follows:

- Prescribed burns shall not be conducted from April 15 through September 15 in burn areas containing potential bat roost trees/snags greater than 5 inches dbh.
- Temporary fire breaks shall be created and/or maintained around any known Indiana bat primary maternal roost trees that fall within a proposed burn area prior to the burn.

Any future timber sales in the forested areas that occur within a 10-mile radius of Ray's Cave (i.e., some areas north of Lake Greenwood) should be further delayed until the bats have completed their fall swarm and entered hibernation. These sales should be harvested from November 15 through March 15.

Implementation of these guidelines along with overall, uneven-aged management practices of the installation forestry program will enhance Indiana and northern long-eared bat habitat.

Goals, Objectives, and Supporting Projects

Goals and Objectives

- Adhere to forest management guidelines for the state of Indiana as directed by USFWS, outlined above, for Indiana bat.
- Federal laws do not require NSA Crane to manage state listed species. However, current management practices are thought to benefit some state listed species. As additional research is conducted, NSA Crane natural resources personnel should review this data to determine if changes in management practices would be warranted. Additionally, if important populations of state-listed species are discovered, actions to protect or enhance their habitats should be considered.

Supporting Projects

- Threatened, endangered, species at risk and state species of special concern inventory and status update.

4.2 Fish and Wildlife

The overall fish and wildlife management goal is to maintain populations in accordance with species priorities, population ecology, population health considerations, and habitat capacities. Much of the historical information in this section is taken from annual Natural Resources Conservation Program Reports and from Graves (Undated). These reports and other documents contain detailed information on past activities of the fish and wildlife management program and are on file at the Natural Resources Office.

Fish and wildlife population management for selected species are discussed below in sections specific to each species or group. In general, the population management option selected for many game species is hunting and fishing.

The manipulation of fish and wildlife populations is an important aspect of fish and wildlife management. Human use of sustainable resources is a critical aspect of ecosystem management. This use includes hunting and fishing on NSA Crane. Navy Instruction OPNAVINST 5090.1 (*Environmental and Natural Resources Program Manual*) requires the management of game and sport fish to ensure sustainability of harvests and protection of species involved.

4.2.1 White-Tailed Deer

Management of white-tailed deer on NSA Crane focuses on maintaining the population slightly to significantly below the carrying capacity of the range to allow for an upward trend in habitat condition.

The Indiana Department of Conservation released 12 white-tailed deer on NSA Crane in 1941. From that meager stocking the installation deer population expanded to the point of requiring control with an estimated population of 6,000 to 10,000 by 1960. The first deer hunt was held in 1960, and resulted in a harvest of 176 deer during a two-day hunt.

In 1985 NSA Crane initiated a special deer hunt for handicapped individuals. The hunt is for holders of an Indiana Handicapped Hunting Permit, and is held in cooperation with the Indiana Deer Hunters

Association and the INDNR. This one-day hunt is held prior to the opening of annual deer gun hunting, and participants enjoy a high level of success (about 40 percent) due to assistance with locating deer and tracking wounded deer by dedicated volunteer helpers. The handicapped deer hunt has grown from seven hunters to over 100 hunters annually participating. Participants generally harvest 35-50 deer during this hunt.

NSA Crane employees are allowed to archery hunt during the state season except for days when other special hunts take place. Archers generally harvest around 100 deer during the archery deer season. NSA Crane generally holds 3-4 one-day firearm deer hunts annually. There has been varied combinations of public and military/employees assigned to NSA Crane who are eligible to hunt on these hunts. In consideration of the safety and security of the NSA military mission, these hunts are now largely limited to military and civilian employees assigned to NSA Crane. In 2012 NSA Crane began honoring a fallen Indiana veteran at the first regular firearm hunt. There is generally a short ceremony prior to the hunt in which the fallen Indiana veteran is honored, family and friends are invited to the ceremony. Hunting dates are usually on Sundays with a total of approximately 500 firearm hunting efforts throughout all firearm hunts combined. The average harvest for the firearm season is approximately 130 deer producing a success rate of 25 percent.

All deer hunting on NSA Crane is designed to control overall deer population levels. Thus, annual harvest of white-tailed deer by hunting is the primary control measure used for the installation deer population. The number of deer harvested annually on NSA Crane has fluctuated from a high of about 1,658 in 1968 to the 176 taken the first year deer were hunted on the installation. The NSA Crane deer herd has stabilized and an average of approximately 240 deer are now harvested annually. Deer harvest statistics can be obtained at the Natural Resources Office.

Specific population estimates for white-tailed deer are not done for NSA Crane. The status of the NSA Crane deer herd is estimated in cooperation with the INDNR by monitoring trends.. Deer hunting is highly controlled. Trend information is analyzed for annual hunter success rates, number of antlered deer harvested per 1,000 gun hunter efforts, antlered deer harvested per square mile of habitat and deer-vehicle accidents. Browse conditions of the vegetation is also used in consideration of the management of deer at NSA Crane. NSA Crane has began conducting trail camera surveys and archery hunters are encouraged to participate in the IDNR Archers Survey to collect valuable data on deer as well as other wildlife. White-tailed deer data will continue to be collected and used to determine population and allowable harvest levels.

Goals, Objectives, and Supporting Projects

Goals

- Maintain a deer herd which is compatible with the military mission and INDNR management objectives.

Objectives

- Maintain a deer herd which produces a firearm success rate of less than 30%.
- Continue looking at ways to increase harvest of does while providing equitable hunting opportunities.
- Collaborate with Purdue University on deer research.

Supporting Projects

- Continue employee archery hunting.
- Continue firearm hunting for both employees and the general public when possible.
- Maintain natural resources security system.

4.2.2 Furbearers

Furbearers and predators on NSA Crane include muskrat, mink, raccoon, opossum, skunk, beaver, weasel, red fox, gray fox, and coyote. No management specific to furbearers/predators is performed on the installation beyond occasional trapping. NSA Crane does get some data on furbearers with the annual Archers Survey.Under normal conditions, predators are an asset to a well managed wildlife program. Raccoon, opossum, fox, and coyote are considered small game on NSA Crane and in Indiana, and sport hunting and calling are allowed; thus, limited population control occurs.

Trapping of furbearers and predators was permitted on NSA Crane in the past. However, hunting and trapping pressures for furbearers are primarily dependent upon pelt prices or the expectation of those prices. While the most common species pursued are raccoon and muskrat, demand for long hair fur (raccoon, fox, and coyote) or short hair fur (muskrat, beaver, and mink) generally directs fur harvest activity. The raccoon is the primary species trapped, but due mainly to low fur demand and depressed pelt prices in recent years the trapping of raccoons and other species has declined. Furbearers are taken incidentally by hunters pursuing other game. While increases in harvest can be sustained by current populations, expanded interest in furbearer hunting and trapping is unlikely unless pelt prices rebound substantially.

Trapping on NSA Crane is now limited to removal of problem animals by contract trappers. If necessary for wildlife management or if animals become too numerous or problematic, NSA Crane will consider reinitiating trapping by installation employees and perhaps the general public.

NSA Crane has collected data on the number and species of furbearers trapped on the installation in the past. This data indicated general trends in furbearer populations. However, trapping has been a very minimal activity on the installation during the past several years. Nationwide, fur prices are low, trapping has become an unpopular use of the resource in many areas, and interest in trapping has declined. Trapping that occurs on the installation is used primarily to control problem species in specific areas, such as beavers damming watersheds or tunneling into impoundment dams. Trapping harvest data can be obtained at the Natural Resources Office. If trapping should again become a significant pursuit, the installation will consider collecting trapping harvest data.

Goals, Objectives, and Supporting Projects

Goals

- Maintain furbearer populations in balance with their habitats and the military mission.

Objectives

- Control furbearer populations when they impact the military mission.

Supporting Projects

- Hire a pest control contractor to remove nuisance beaver and other furbearers as required.
- Track number of furbearers trapped by contractors.

4.2.3 Turkey

Wild turkeys were first stocked on NSA Crane in 1956. The population increased to between 100 and 200 individuals by 1962. By the late 1960s the population declined drastically. In 1974 and 1975 the INDNR released three and six birds respectively. The INDNR also made several subsequent releases from 1983 to 1986 on lands immediately adjacent to the installation in Martin and Greene counties.

Population levels in the past have been high enough to allow turkeys from the installation to be trapped and used to restock other areas of the state. The installation also greatly assisted reintroduction of other species, such as wild turkey, by providing ruffed grouse to trade with other states for other species.

The turkey population on NSA Crane is high due to ideal habitat on the installation. The goal for the installation turkey population is to allow it to reach habitat carrying capacity. Roadside gobble counts were initiated in 2002 and continue to provide trend data. NSA Crane also conducts brood surveys and reports this information to the IDNR.

The installation uses harvest to manage its turkey population. Turkey hunting was first allowed on the installation in the early 1990s. Limited annual spring turkey hunting is permitted only for active or retired military and DoD Civilian mployees due to safety and security reasons.
Specific population estimates for wild turkey are not performed on NSA Crane. Physical data (weights, spur length, beard length, etc.) were collected as part of a research project during the limited spring hunting season but are not collected on a regular basis. Turkey harvest data (number of birds and hunters) is collected each year. Spring turkey hunts have produced an average of 34 turkeys harvested and 338 hunting efforts per year. Turkey harvest data can be obtained at the Natural Resources Office. NSA Crane will continue to collect data related to turkey harvest.

NSA Crane Instruction 11015.2, The *Natural Resources Rules and Regulations,* and state hunting regulations are the primary regulations for turkey hunting on the installation.

Goals, Objectives, and Supporting Projects

Goals

- Maintain a turkey flock which is compatible with the military mission and INDNR management objectives.

Objectives

- Maintain a turkey flock which produces five or fewer vehicle collisions per year.

Supporting Projects

- Continue employee turkey hunting.
- Continue annual turkey gobbling counts and brood surveys

4.2.4 Small Game and Game Birds

In addition to turkey, small game and game bird species on NSA Crane include cottontail rabbit, fox and gray squirrel, bobwhite quail, ruffed grouse, and crow. Ruffed grouse were first stocked on the installation in the 1960s. These stockings were unsuccessful. The INDNR released nine more ruffed grouse in 1973 and twenty more were released in 1974. This reintroduction of ruffed grouse on the installation was very successful. Habitat conditions during this time were very conducive to ruffed grouse. Birds from NSA Crane were later trapped and transplanted to other areas of the state. From 1981 through

1990, 1,269 ruffed grouse were trapped and relocated off of the installation to help re-establish other areas of the state. Today, few ruffed grouse remain on NSA Crane due primarily to habitat changes associated with later successional forest habitats. State wide ruffed grouse populations are also in decline and currently are a state endangered species.

Other small game species that have been stocked on the installation, with varying degrees of success, include pheasant, chukar partridge, and bobwhite quail. Bobwhite quail, like ruffed grouse, faired better before NSA Crane forests matured. The population of bobwhite quail on the installation is thought to be low. A self sustaining population of pheasant and chukar partridge was never achieved. Other small game (squirrels and rabbits) populations appear to be consistent with their available habitat.

The objective for small game population management is to maintain the current level of effort. This includes no small game specific habitat improvement projects beyond what is accomplished through general vegetation management practices. Small game hunting is allowed on NSA Crane. However, eligibility to hunt small game is limited to NSA Crane-associated personnel and their dependents and is only open on Saturdays, Sundays, and holidays. Small game hunting on the installation is of a much smaller magnitude than deer hunting. There are many desirable and easily accessible areas off the installation's property to pursue small game hunting activities. There are annually approximately 115 user efforts for small game hunting.

NSA Crane Instruction 11015.2, The *Natural Resources Rules and Regulations* and state hunting regulations are the primary regulations for small game hunting.

Goals, Objectives, and Supporting Projects

Goals

- Maintain small game populations in balance with their habitats and the military mission.

Objectives

- Increase populations of small game species dependent on early successional forest habitat.

Supporting Projects

- Continue annual ruffed grouse drumming counts.

4.2.5 Non-game Birds

Several bird inventories have been performed on NSA Crane. Since 1970 Purdue University personnel have conducted a Christmas Bird Count on the installation. The Checklist of Birds of NSA Crane (Weeks, 1994a) is a compilation of these counts and numerous other observations by Purdue University including Hoekstra and Kirkpatrick (1972) and Weeks (1976, 1977a and 1977b, 1978a and 1978b, 1979, 1984, and 1994b). Other bird-related research performed by Purdue University on NSA Crane includes Weakland (1995) and Weeks (1995).

The results of the Survey of Bird Species at the Naval Weapons Support Center, Crane (Hengeveld, 1987) recorded 101 bird species. This survey confirmed the presence of a great blue heron rookery on the installation. Another source of information on birds at NSA Crane is the Atlas of Breeding Birds of Indiana (Castrale et al., 1998). Bird surveys conducted by Hedge (INDNR, 2006) found a total of 96 bird species.

In 1989 the monitoring avian productivity and survivorship (MAPS) study was established on the installation. MAPS provides long-term demographic data on landbirds at multiple spatial scales. Data are gathered from birds captured at permanent mist net stations. Typically, nets are operated for six hours for one day per 10-day period during 8-12 consecutive 10-day periods from May 1 to August 28. Captured birds are marked with an aluminum leg band. Since 1994 six stations have been operated annually on NSA Crane (Pyle et al., 1998). The MAPS program on NSA Crane will continue during the next ten years, dependent on available funding.

Goals, Objectives, and Supporting Projects

Goals

- Maintain non-game bird populations in balance with their habitats and the military mission.

Objectives

- Monitor non-game bird populations.

Supporting Projects

- Continue MAPS program conducted by IBP provided funding is available.
- Partner with universities to conduct research.

4.2.6 Migratory Game Birds

Migratory game birds on the installation include waterfowl, mourning dove, and woodcock. NSA Crane has been involved with re-establishing waterfowl species, such as Canada geese, and mallard ducks. In addition, wood ducks successfully breed on the installation. Lake Greenwood and other water bodies of the installation provide important resting and feeding areas for migrating waterfowl. During migration an estimated 1,000 geese can be observed at Lake Greenwood. Population data for waterfowl using NSA Crane is unavailable. Mourning dove use of the installation is thought to be minimal. American woodcock can be seasonally abundant during their migrations and during breeding season

NSA Crane allows waterfowl hunting on Lake Gallimore and Seedtick Lake. Migratory waterfowl hunting is authorized normally seven days a week during the open season. Eligible hunters must be NSA Crane-associated personnel. Federal, state, and NSA Crane regulations are in effect for migratory waterfowl hunting. The development of wildlife water facilities and nesting structures encourage waterfowl use of the installation.

An inventory of neotropical migratory birds was accomplished at NSA Crane in 1993. The primary objective of the inventory was to document the population of neotropical migratory birds that breed in deciduous forests (Young, 1994). The field study consisted of three components: bird surveys, nest monitoring, and vegetation sampling. Neotropical migratory birds will continue to be monitored as part of the MAPS program on NSA Crane while the project continues. In 2020 spring American woodcock singing ground surveys were conducted in partnership with the IDNR.

Goals, Objectives, and Supporting Projects

Goal

- Maintain suitable habitat to support migratory game birds during their annual migrations.

Objective

- Control Canada goose populations when necessary.

Supporting Projects

- Conduct American Woodcock Surveys and habitat analysis

4.2.7 Fish

Fish management at NSA Crane is directed at maintaining a harvestable surplus of game fish. Each lake is an entity in itself and may experience population fluctuations over the short and long-term, stemming from fish harvest, enforced regulations, stocking, fish kills, pond productivity, aquatic weed infestation, etc. Primary species emphasized in the NSA Crane fisheries program are largemouth bass, bluegill and other sunfish, and channel catfish.

Lake Greenwood is open to any individual with access to the installation. Other waters of NSA Crane are open only to NSA Crane-associated personnel and their dependents. Fishing regulations are identical to state limits. In 2017 the 13-15 inch minimum size limit was lifted on Lake Greenwood. The *Natural Resources Rules and Regulations* outlines responsibilities, eligibility, procedures, etc. for fishing at NSA Crane.

Stocking is used to establish fish populations in new or renovated lakes and ponds and to maintain populations in intensively managed lakes. Fish stocking on NSA Crane began in the 1940s by the installation Fish and Conservation Club with assistance from the INDNR and USFWS. Various species have been stocked, particularly in Lake Greenwood, with varying degrees of success, including walleye, northern pike, white bass, and channel catfish. White bass have developed self-sustaining populations at Lake Greenwood.

Fish stocked on NSA Crane have most often been obtained through the USFWS. However, fish, primarily catfish, have been obtained from the INDNR and private hatcheries. Some introductory stocking of bluegill and redear in other ponds on the installation may be initiated to develop a self-sustaining, warm water fishery. However, before proceeding with introductions where no fish are present, the installation will need to survey potential sites for species that may be adversely affected by fish (*i.e*. amphibians). NSA Crane will also work to educate installation fishermen about possible negative effects of unwanted introductions made by the public. NSA Crane will rely on scientific management techniques to determine which water bodies to stock, what species to stock, stocking levels, etc.

Fish population manipulation is based on data collected and analyzed from fish population surveys. Fisheries management on NSA Crane is lake-specific which requires collection of population data from different bodies of water.

In 1987, an endangered fish survey was conducted on various NSA Crane watercourses. This study, *Endangered Fish Survey of the Crane Naval Weapons Support Center, Martin County, Indiana* (Seegert, 1987), collected 46 fish species. All fish expected to occur were observed, and no federal or state-listed species were found. The most unusual species found was the southern redbelly dace (*Phoxinus erythrogaster*), which was confined to the Big Sulfur Creek area in the northeastern portion of the installation. Additional sampling for southern redbelly dace was conducted at this site by the University of Southern Indiana in 2019.This baseline survey is adequate for NSA Crane.

Lake Greenwood has received the most intensive management, including surveying, of any installation fisheries. Prior to about 1960, management was limited to fish stocking by the Base Conservation Club and creel census conducted by Navy personnel. The INDNR surveyed Lake Greenwood using electrofishing techniques, and the USFWS used traps and gill nets from 1960 through 1965. The INDNR

surveyed again in 1968, 1972, and 1973. In 1979 the INDNR conducted a comprehensive survey using gill nets, trap nets, and electrofishing. The most recent survey conducted by the INDNR was done in 1997 using gill nets.

Due to changes in public access policies for fishing at Lake Greenwood, management responsibilities were turned over to the USFWS. In 1980 the USFWS performed a fishery survey of installation waters. By 1983 the INDNR resumed responsibility of fisheries management. The INDNR conducted a creel census in 1984, and in 1990 the USFWS surveyed Lake Greenwood using gill nets, trap nets, and daytime direct current electrofishing. Results of the 1990 survey were used to develop the *1990 Fisheries Management Report for Lake Greenwood* (Surprenant, 1990b) and the installation Fisheries Management Plan, which presents the management and survey history of NSA Crane fisheries. The USFWS currently has primary management responsibility for Lake Greenwood, although the INDNR is consulted on all management recommendations.

Lake Greenwood is regularly surveyed by the USFWS, Fisheries Resource Office with surveys typically conducted every 2-3 years. The focus of these surveys is to improve the recreational fishing opportunities at Lake Greenwood. Fish population and composition data are collected using electrofishing techniques, and overall fisheries resources health and abundance are determined from the surveys. The list below shows the year specific water bodies were surveyed since 2000.

- Lake Greenwood – 1999 through 2015, 2018
- Lake Oberlin – 2000, 2015
- Seedtick Lake – 2002, 2010
- Captain's Pond – 2001
- C-3 Pond – 2003, 2012
- PT-12 Pond – 2004
- JT-4 Pond - 2008
- 3105 Pond – 2006
- Golf Course Clubhouse Pond – 2018
- South Golf Course Pond- 2018

Goals, Objectives, and Supporting Projects

Goals

- Maintain high quality recreational fisheries that contribute to the military mission by providing recreation and increasing employee morale.

Objectives

- Continue to manage fish populations on the installation primarily for panfish and bass.
- Continue supplemental stocking to maintain populations for selected non-reproducing species at Lake Greenwood and other waters as appropriate.

Supporting Projects

- Conduct fisheries surveys on Lake Greenwood.
- Conduct periodic fisheries surveys on other waters.
- Continue supplemental stocking of walleye, channel catfish, and other species.
- Maintain natural resources security system.
- Establish handicap accessible launch facilities on Lake Greenwood.

4.2.8 Reptiles and Amphibians

A Field Survey of Amphibians and Reptiles at Crane Naval Weapons Support Center, Martin County, Indiana with Emphasis on Rare and Unusual Species (Nelson *et al*., 1987) documented 43 species of amphibians and reptiles including 11 salamander and 12 snake species. In 1996 NSA Crane surveyed for the presence of timber rattlesnakes. No rattlesnakes were located, but the habitat was assessed as suitable for timber rattlesnakes (Hotle, 1996). An additional survey was conducted by Hedge in 2005 (INDNR, 2006), documenting 43 species of amphibians and reptiles.

Goals, Objectives, and Supporting Projects

Goals

- Maintain reptile and amphibian populations in balance with their habitat and the military mission.

4.2.9 Invasive and Exotic Animals

The following describes management and control procedures specific to invasive and exotic animal species observed at NSA Crane, or known to be present in the general region. NSA Crane has a Pest Management Plan (Williams, 1999) to help deal with invasive, exotic, and nuisance animals.Integrated pest management is utilized at NSA Crane and typically involves a combination of tools and techniques, such as mechanical control, biological control, regulatory control, and chemical control. Control measures are typically implemented on the basis of surveillance. Surveys are used to determine the type of pest, extent of problem, and management technique most appropriate for safe, effective, and economic control. NSA Crane generally employs selective control measures directed at the target species for animal damage control on the installation.

All chemicals used on NSA Crane are EPA-approved. Requisitions for pesticides must receive technical review and approval/disapproval by the NAVFAC Atlantic Pest Management Consultant, as required by DoD and OPNAV directives. All pesticides must be applied in accordance with their EPA-approved labels. All contract pest control services are inspected by DoD-certified or Quality Assurance Evaluator-qualified personnel. Monthly reports of surveillance and control operations are forwarded to NAVFAC Atlantic.

The number and variety of birds, mammals, and other wildlife that inhabit the installation require that any outside applicants not impact non-target organisms and are not introduced into aquatic environments. NSA Crane assures that measures to minimize drift and prevent runoff are implemented.

NSA Crane will consult with the USFWS on all chemicals used in the control of invasive and exotic species that may affect Indiana bats and/or their habitat.

4.2.9.1 Vertebrate Species

Feral hogs are the primary invasive/exotic vertebrate species which may potentially be found on the installation. Although no observation of the species has been recorded on the installation to date, it has been observed in Lawrence County, Indiana. If the species is observed on the installation in the future, NSA Crane will decide at such time on the most appropriate control measure. Feral hogs can be effectively controlled by snaring, live trapping, shooting and hunting. There are currently no toxicants or repellents registered for the control of feral hogs. In Indiana, feral hogs are considered free-ranging, exotic animals and may be taken at any time of the year by any legal means. The possession and

relocation of live feral hogs is illegal in Indiana (see Indiana Administrative Code 312 IAC 9-3-18.5) (Purdue Extension, 2009a).

4.2.9.2 Invertebrate Species

Invasive and exotic invertebrate species which may potentially affect NSA Crane include gypsy moth and emerald ash borer. Gypsy moth detection trapping has occurred on the installation since 1983. In 1985, two male gypsy moths were trapped, but no record of infestations has occurred since. Should future infestations occur on the installation, NSA Crane will decide on the most appropriate control measure, which may include suppression, trapping, regulatory work, or insecticide application. NSA Crane will consult with the USFWS on all chemicals used in the control of invasive and exotic species that may affect Indiana bats and/or their habitat and/or drinking water supply or prey.

Goals, Objectives, and Supporting Projects

Objectives

- Control invasive and exotic animal populations when they impact the military mission or represent a direct threat to the overall health of the NSA Crane ecosystem.

4.2.10 Nuisance Animals

The following describes management and control procedures specific to nuisance animal species observed at NSA Crane, or known to be present in the general region.

Canada Goose

There is no one technique or strategy that can be used every time or everywhere to control nuisance goose problems. Resolving a problem requires a management approach combining the use of several techniques. Ideally, it is best to use preventative techniques before a nuisance problem gets started in an area. Once geese are established, it can become very difficult to deter them from a given area, particularly after nesting has begun. Long-term management, not just a short-term solution, is required. Among the management techniques that may be used are hunting, habitat modification, harassment, nest or egg destruction, and trapping and relocation or lethal removal (INDNR, 2009c).

Hunting waterfowl should be encouraged during the legal waterfowl hunting seasons using legal methods. Hunting is the most effective and preferred method of removing surplus ducks and geese. Hunting also removes some of the adult breeding birds that are adding to the population.

Habitat modification techniques involve eliminating or modifying the landscape to restrict access to the areas that attract geese for food and water. ***Vegetative buffer strips*** are a form of physical barrier used to deter geese from using shorelines directly adjacent to a water body. Geese like a gently rolling slope with short vegetation at the water's edge. It provides a clear line of vision to avoid would-be predators and provides them easy access to the water. Creating a buffer strip of tall thick vegetation will deter geese from using this shoreline. Native warm season grasses are stiff stemmed grasses that remain tall and erect, even throughout the winter. This characteristic makes them an excellent choice for establishing tall buffer strips for this purpose. In order for these buffer strips to be effective, they must retain their mature height throughout the entire year. Therefore, any mowing of the buffer strips will reduce their effectiveness and may render them useless as a goose deterrent. Some mixtures of cool season grasses and legumes can also function as an effective "goose deterring" buffer strip. An alternative to using grasses and herbaceous plants as buffer strips would be the establishment of trees or shrubs. It is not recommended to establish trees or shrubs on the dams or levees of waterways. A buffer strip used in conjunction with a fence

barrier, described below, is particularly effective in deterring waterfowl from using a water body. Buffer strips should be at least 10' wide to be effective (INDNR, 2009c).

Rock barriers consisting of boulders at least two feet in diameter can be placed along the shoreline. Geese normally like to walk out of the water on bare, flat or gently sloping banks. The effectiveness of a rock barrier can be enhanced when used in combination with vegetative barriers. Rip-rap and smaller rock around a pond will not deter geese. ***Fence barriers*** will physically prevent geese from walking out of the water into feeding areas. They can consist of woven wire, wooden or plastic snow fencing, chicken wire, silt fencing, netting, mylar tape, or several strands of heavy fishing line or wire strung 4 inches, 8 inches, 12 inches, 18 inches and 24 inches above the ground. The fence must be long enough so the geese will not walk around the ends of it (INDNR, 2009c).

Harassment techniques are used to frighten and discourage geese from using a property. Different harassment methods can entail the banging of pots and pans, clapping hands, following with a leaf blower, chasing with dogs, high pressure water spray devices such as garden hoses, pyrotechnics or anything that makes a loud noise. Geese should be scared away as soon as they fly in. Once they get comfortable and feel safe in a certain area, they are much more difficult to run off. Harassment techniques must be used repetitively each time geese appear on a property to be successful (INDNR, 2009c).

Chemical repellents can be applied directly to the grass at the problem area and do not harm the geese. Disadvantages of chemical repellents are high cost and having to reapply them frequently. They are most effective on small areas. Some repellents may be restricted use and must be applied by a certified applicator. NSA Crane will consult with the USFWS on all chemicals used in the control of invasive and exotic species that may affect Indiana bats and/or their habitat and/or drinking water supply or prey.

Nest and egg destruction are very effective ways to keep local populations of Canada geese in check, if there is a high number of nesting birds at the site. Nest destruction and removal can be carried out, at any time, as long as no eggs are present. Repeatedly removing nesting materials usually will force breeding geese to relocate, build a new nest or nest later in the season. Nest construction may last for several weeks and the first egg may be laid less than 24 hours after the nest is constructed. When attempting egg destruction, caution is required as Canada geese are very aggressive during the nesting period and may attack anyone coming close to their nest. A person may either shake the egg for at least 60 seconds, puncture the large end of the egg with a sharp object, or coat the egg with corn oil to prevent it from hatching. Only eggs that are over 14 days old and float in the water float test should be removed from the nest because if the eggs are removed or broken too early the goose will just lay more eggs. The eggs can be treated by using food grade corn oil only and placed back in the nest. This will trick the goose into sitting on the eggs for an extended time, but they will not hatch. The oil blocks the pores on the eggshell and the egg becomes unviable. Nest removal with eggs present is an effective way to reduce goose reproduction and reduce the local goose population if the birds are nesting in the area. If the goose can be seen on the nest, remove the nest after she has been sitting on her eggs for 14 days. If the nest is taken earlier, she is likely to re-nest and lay new eggs, so it is important to wait for 14 days after the last egg is laid. It is probably better to leave the eggs a few days longer than two weeks, rather than take them too early. If the goose cannot be seen on her nest, the following guidelines should be used. Nests with cold eggs should be left alone, because the goose is still laying eggs. Return two weeks later to remove any nests that are cold on the first attempt. The entire nest and all eggs should be removed and placed in garbage bags. These can be sent to a landfill (INDNR, 2009c).

Trapping and relocation are conducted only during the bird's flightless period (molt), which occurs from about mid-June through early July in Indiana. The same time frame for trap and relocation applies to trapping and lethal removal. Adult birds are transported off site and euthanized according to American Veterinary Medical Association standards. Because this method removes adult breeders from the

population, other geese may move into the now available habitat so this measure should be used with other abatement techniques including harassment, habitat modification, and egg and nest destruction to prevent nuisance geese from becoming a problem in the future and having to repeat trap and removal on a yearly basis (INDNR, 2009c).

Beaver

Destruction of dams and lodges may be utilized to control nuisance beavers; however, this control measure may be ineffective. Even a small colony can quickly rebuild a completely destroyed dam in less than 24 hours. Sometimes, beaver inhabiting a fairly new dam will move, but only to the next strategic dam location up or down the stream or ditch. Depending on conditions, stream flow and length of residence by the beaver, they will often build several dams. It is not uncommon to find three or four dams along one-half mile of drainage ditch or stream. Occasionally, new beaver colonies can be moved by burning, dynamiting or otherwise destroying the lodge and the dam. However, another colony may move into the area if desirable habitat is available. Therefore, solely removing dams to reduce beaver populations is not recommended (UAR Extension, 2004).

Habitat alternation can be quite effective for resettling problem beaver. On many drainage ditches or canals where beaver become a problem, they can be moved simply by cleaning up the food and construction material. Trees can be removed, thereby eliminating the basic food and construction material for beaver. Another alternative is installing a Clemson Beaver Pond Leveler (See "Flood Water Management with a Beaver Pond Leveler," FSA9068). This device works on the principle that the detection of water currents stimulates beaver to quickly plug the source of water drainage. The leveler consists of a perforated PVC pipe that is encased in heavy-gauge hog wire. This is placed upstream of a dam or blocked culvert in the deepest part of the stream or water flow. It is connected to nonperforated sections of PVC pipe which are run through the dam or culvert to a water control structure downstream. Because beaver do not detect flowing water as it drains, they do not block the pipe. The leveler works best in relatively flat terrain with short-term flooding. The leveler will not work where water volumes exceed the capacity of the pipe, such as periods of unusually high rainfall, or where steep terrain may cause excessive flooding (UAR Extension, 2004).

Fencing may be an option for small areas such as culverts or drains, but can also promote more damage by providing beaver with materials for dam construction. Encircle important trees with metal barriers, hardware cloth or woven wire. Fences should be at least 3 feet high and constructed of 1/2-inch mesh hardware cloth or 2- by 4-inch welded wire. Install the fence so that it is 8 to 10 inches from the plant and completely surrounds it. Bury the fence 3 or 4 inches in the ground, and drive metal rods into the ground inside the fence. An alternative for protecting small areas is installing an electric fence. One or two strands of 1/2-inch wide electric polytape will suffice, with the lower strand no more than 4 inches above the ground. The polytape should run on nonconductive or insulated posts which are spaced 20 to 30 feet apart on flat ground or as close as 6 to 10 feet on rougher terrain to maintain the 4-inch height. In areas up to 10 acres, a 12-volt battery will be adequate, but areas over 10 acres may require a solar charger. Keep weeds from grounding the electric fence by clipping frequently or applying herbicide two or three times a year (UAR Extension, 2004).

There have been many attempts to find a practical, effective and selective ***toxic agent or repellent***. However, at the time of this publication, there are no registered toxicants, fumigants or repellents that are effective, practical and species-selective for beaver control (UAR Extension, 2004).

Trapping is the most effective and practical method of control where beavers cause damage, including leg-hold traps, body-gripper traps and snares depending on which is recommended by INDNR. Of the various beaver traps, the body-gripper, or Conibear trap, is one of the most effective and widely used. These traps must be at least one-half submerged in water, but can be set in deep or shallow water with

equal effectiveness. Conibear traps can be set in the dam, burrow or lodge entrance, in runs, in front of drain pipes or beneath slides. Using snares can be a safer and more cost-effective method for capturing beaver, since snares cost much less than body-gripper traps and are more convenient to use in many situations. Snares can be placed in runways, much like traps, but unlike body-grippers, do not have to be placed in the water. Other types of traps, such as suitcase-type live traps and foot-hold traps, also can be used. Suitcase-type traps are rarely used, since they are rather expensive (in the hundreds of dollars) and not very efficient. Large foot-hold traps (No. 3 or larger) used as a drown set may catch beaver in slides, runs or between dam crossovers or feeding areas (UAR Extension, 2004). In the past, approximately four beavers annually have been removed from NSA Crane by pest control contractors (Andrews, 2009).

Goals, Objectives, and Supporting Projects

Objectives

- Control nuisance animal populations when they impact the military mission or represent a direct threat to the overall health of the NSA Crane ecosystem.

Supporting Projects

- Hire a pest control contractor to remove nuisance species as required.
- Track number of species trapped by contractors.

4.2.11 Native Invertebrates

Native invertebrates, particularly pollinators, are important both ecologically and economically. They are increasingly threatened by a variety of factors ranging from climate change to pesticides to habitat alteration. Terrestrial invertebrate surveys were completed at NSA Crane in 2012 and 2013 (Appendix H) and reviewed by the INDNR, Division of Entomology & Plant Pathology in 2014.

The rusty patched bumble bee (*Bombus affinis*) was listed as endangered by the USFWS effective February 10, 2017. Although this bee has not been documented at NSA Crane or Glendora Test Facility, both installations are close to the boundary of the known historical range of the species. Additional survey work focusing on grassland pollinator species would be helpful in determining if this species or other at-risk species are present on NSA Crane or Glendora Test Area.

Goals, Objectives, and Supporting Projects

Objectives

- Continue improving inventory information for both NSA Crane and Glendora Test Area to document presence or absence of at-risk invertebrate pollinator species.

Supporting Projects

- Collaborate with NAVFAC Mid-Atlantic on future invertebrate surveys at Mid-Atlantic installations.

4.3 Forests

Lands of NSA Crane were originally used for small farms, and most forest resources were removed. The lands were not well suited to farming, and in the late 1930s, 32,000 acres (the northern portion of present

day NSA Crane) was purchased as part of a land utilization project. Large scale reforestation was initiated on these lands, and some timber stand improvement occurred.

The Navy acquired land utilization project lands and an additional 30,463 acres to establish the installation in 1941. Prior to the Navy assuming ownership of these lands, private owners harvested most of the desirable timber. Sporadic harvesting also occurred to partially supply installation requirements for lumber, crating, dunnage, etc. Systematic forest management began in 1959 when the Department of Navy Forest Management Program was established and funded. However, mapping of installation forest resources began in 1955 by a Soil Conservation Service forester (Graves, undated). The first forest management plan for the installation was prepared by 1959. This plan indicated that only 9,000 acres of installation woodlands had merchantable timber. Timber sold under the 1959 plan was mostly from salvage-sanitation sales, which attempted to remove low value and cull trees that remained after years of mismanagement through high-grading, grazing, and other improper land management practices.

Several forest management plans have been written and implemented since the original 1959 plan. There are currently 51,578 acres included in the forest management plan on NSA Crane.

Under uneven-aged management, the majority of acreage has become sawtimber size. However, each stand will contain some groups of saplings and poletimber resulting from group selection cuts.
The amount of open land on NSA Crane has decreased over the years. Areas that were deforested prior to NSA Crane management, but were productive enough to support stands of hardwoods, were stocked with saplings by 1959 and are now well stocked with poletimber and sawtimber sized trees. Land now classified as open is less productive and is stocked with sumac (*Rhus* sp.), dogwood (*Cornus* sp.), sassafras (*Sassafras albidum*), persimmon (*Diospyros virginiana*), broomsedge grass, etc.

Management of NSA Crane forests, using primarily an uneven-aged management scheme, has enhanced biodiversity and emphasized ecosystem management on the installation instead of concentrating on commercial production. The NSA Crane forestry program has emphasized support of the military mission, enhancement of ecosystem integrity in many areas, production of commercial forest products, protection of forest watersheds, management of wildlife habitat, and provision of outdoor recreation opportunities.

4.3.1 Forest Management Strategy

Forest resources of NSA Crane are a heterogeneous ecological complex comprised of a rich mixture of tree species and forest types combined with varying age classes and a variety of sites, topography, soil, exposure, and drainage patterns. These characteristics, along with directives to manage for biodiversity, old growth, endangered species, etc., make forest management on the installation challenging.
Because oak/hickory hardwoods are the primary forest types of the installation, silvicultural treatments emphasize them. Uneven-aged management is the primary harvest system employed on the installation; however, other systems are used depending on stand characteristics and circumstances. In most cases stand condition, type of land use, or special habitat requirements determine which system to apply to a particular stand.

Uneven-aged management using group selection cutting provides several advantages for forest production. Younger, high quality trees can be retained throughout the stand to allow for additional growth to achieve larger diameters and higher quality, producing high value logs. Oak and other desirable species regenerate in group selection openings that often approximate environmental conditions found in even-aged systems. Biodiversity is promoted by the variation of age groups in uneven-aged stands, and aesthetically this management method is more acceptable.

Forest stands on the installation are often patchy or group-like as a result of site variation and past management practices. The average stand size is about 40 acres. Each stand may contain several variations in size class, species, or site. Thus, certain cutting or timber stand improvement operations can be performed on a sub-stand basis. Group selection cutting lends itself to this type of management.

Thinning is often used in younger stands to provide more growing space to more vigorous, valuable tree species. Usually no more than one-third of the acreage in a stand is in regeneration openings. Heavier cuts approaching clearcuts may be used for salvage operations, insect and disease management, or to provide an early successional element to installation forests. The USFWS will be consulted on such timber harvests on a case-by-case basis.

4.3.2 Scope of Forest Management

There are approximately 51,578 acres of forest at NSA Crane. A 10-year programmed cut schedule based on stand prescriptions is the primary control for harvest. Since most installation forests are managed under an uneven-aged system, area regulation principles are used as guidelines and overall allowable cut allowances. Most stands will be cut during a 30-year period under the uneven-aged system. This level of harvest complements prescription recommendations for stands.

4.3.3 Commercial Forest Products

Although changing technologies and increasing trends toward biodiversity and ecosystem management have changed the emphasis for managing and monitoring forests, the forest management program at NSA Crane still produces commercial timber. Most commercial timber on the installation is from the oak-hickory and mixed hardwood forest types. Several other species produce commercial forest products but in smaller volumes.

4.3.4 Emphasized Species

The two timber types comprising the majority of forested areas on the installation are oak-hickory hardwoods (approximately 46 percent) and mixed hardwoods (approximately 40 percent). Oak-hickory hardwood species are emphasized at NSA Crane. The following are dominant in installation forests based on total net volume by tree species (in descending order by volume): white oak, yellow poplar, black oak (*Q. velutina*), hickory, sugar maple, red oak, red maple, white ash, scarlet oak (*Q. coccinea*), beech, sycamore, black walnut, black gum (*Nyssa sylvatica*), and white pine (*Pinus strobus*).

4.3.5 Forest Regulation

Timber harvests are expected to yield about 30,800,000 board feet (approximately 14,000 acres at an average of 2,200 board feet/acre) of hardwood sawtimber during this INRMP. This will be accomplished through annual harvests of 3,080,000 board feet. The planned harvest considers the annual growth. Annual growth per acre/year is 234.43 board feet per acre. Over the ten-year period of this plan, that accounts for approximately 120,000,000 board feet of growth. Much more acreage is reaching sawtimber size than is being harvested.

Provisions in the Endangered Species Management Plan (Andrews, 1999) are not anticipated to significantly affect the amount of timber harvested annually. However, timber harvesting is prohibited in the riparian buffer strips that are required for the management of the Indiana bat. These riparian buffer

strips contain approximately 3,100 acres, and this acreage is removed from any timber harvesting activities.

4.3.6 Timber Stand Improvement

Timber stand improvement (TSI) is accomplished using several different methods on NSA Crane. TSI on NSA Crane is performed using primarily mechanical methods and/or chemical methods if necessary.

One type of TSI is conducted on stands that were harvested the preceding year. This is intended to complete regeneration openings, release crop trees in uncut or lightly cut sections of the stand, and control grapevine. This type of TSI may not be performed where site productivity is very low or where other stand conditions may limit the benefits of TSI.
Grapevines are serious competitors with tree seedlings in regeneration openings on NSA Crane. Untreated, grapevines can take acreage in openings out of production and lengthen rotations of stands. Satisfactory control requires that grapevines be cut at ground level 3-5 years prior to harvesting timber from the stand. Control of grapevine is given high priority for stands scheduled for harvest on the installation. Stands with heavy populations of grapevine are identified and maintained in the GIS.

Weeding and cleaning TSI often benefits stands that have been cut 10-20 years ago. This type of TSI thins and releases desirable saplings and young poletimber that have regenerated following harvesting operations. Weeding and cleaning is often essential to ensure that oak regeneration can survive and compete against more rapidly growing species. It is done at an opportune time to eliminate undesirable species. On NSA Crane weeding and cleaning TSI is a high priority in stands with oak regeneration. Crop tree release TSI is conducted in stands that will not be cut for at least 30 years but are on better sites or contain oak that could be released. This type of stand improvement comprises a small portion of annual TSI work.

Release and pruning of young black walnut trees has been a priority on the installation in the past. Individual black walnut trees can greatly improve in value with this type of treatment. However, changes in markets and environmental conditions have lessened the importance of black walnut tree improvement operations on the installation.

4.3.7 Harvests

The basis for timber harvests at NSA Crane is timber stand field inspections and the annual allowable cut. The annual allowable cut is the volume of timber that may be harvested by sustained yield based on the present inventory volume, desired inventory volume, and growth rate. Using this system the annual allowable cut would be 4,878,365 board feet. However, this level of harvest is not realized under the current forestry management program. Constraints on harvesting by other natural resources management considerations, such as set asides, rare or endangered species management, invasive species and limited markets for pulpwood and poletimber-sized material limit the harvest to less than could be attained.

Harvests are conducted under a programmed cut schedule. The harvesting schedule is planned for 2019 - 2031. Table 4.1 presents the schedule (FY 2019-2031) for programmed cuts on the installation. During the life of this plan, annual harvests will be approximately 3,080,000 million board feet. The programmed cut schedule is prepared after all forest stands are examined in the field and evaluated according to silvicultural conditions, growth determinations, stand vigor, soil suitability, market potential, and other factors when classifying and preparing management prescriptions for each stand. Individual stands programmed for harvesting during the harvesting schedule are included in Appendix C. Individual stand

prescriptions for all forest stands are contained in the forestry GIS system maintained in the natural resources office.

Firewood cutting is allowed for NSA Crane-associated personnel. A permit is required for firewood cutting, and only down or fallen trees may be cut. Annually approximately 50 permits are sold to interested personnel.. Permitees are allowed a pickup truck load of firewood per permit purchased.

White oak for replanking of the USS Constitution has been harvested from the installation. In 1991 NSA Crane has supplied 78 trees for replanking of the ship. In 2015 NSA Crane supplied 26 trees for replanking of the ship. The most recent replanking and the last time white oak were harvested for this reason was in 2014.

Year	Compartment	Acres
2019	5,7	1,551
2020	1,16	1,539
2021	4,20	1,558
2022	13,18	1,761
2023	8,17	1,594
2024	10,14	518
2025	3,9	1,228
2026	15,19	892
2027	6,11	523
2028	2,12	984
2029	5,7	967
2030	1,16	1366
2031	4,20	1582

Table 4.1: Planned Compartment Harvesting Order

4.3.8 Reforestation and Prescribed Burning

Most regeneration in harvested stands on NSA Crane is natural. Regeneration of oak-hickory and mixed hardwood forests require an abundance of advanced regeneration (seedlings and saplings, which develop in canopy shade). Drier sites tend to accumulate higher amounts of advanced regeneration while better sites may lack in advanced regeneration. Most oak-hickory stands on NSA Crane are on less productive sites, and mixed hardwood stands also contain oak and hickory but have a greater percentage of other species, such as yellow poplar, ash, maple, and cherry. Thus, advanced regeneration is usually present in sufficient amounts to regenerate these stands.

Merchantable timber is removed in areas to be regenerated (group selection cuts). Many remaining trees will have been suppressed, and regeneration in openings often approximates environmental conditions found in even-aged systems. This produces prolific stump sprouting and removes overstory competition. Seedlings and sprouts from stumps combine to reforest the stand.

Prescribed burning has been proven to be a useful tool in the regeneration of oak species under the correct conditions. NSA Crane has developed a Standard Operating Procedure for implementing prescribed fire in forested areas for vegetation management, which is adhered to when conducting prescribed burns. Controlled burning is expected to become a common forest management tool utilized on NSA Crane. The intent is to apply the prescribed fire in conjunction with timber harvests. The burning will occur between September 15 and April 15 to avoid the possibility of Indiana bat disturbance. The burns will be low intensity in nature and will not likely affect standing snags within the areas. If fire does threaten to overtake a snag it will be extinguished. Burning will be accomplished with a combination of state and federal agency partners, NSA Crane Fire Department staff and NSA Crane Natural Resources staff. A minimum bare soil firebreak of 5 feet will surround each prescribed fire area. Currently, NSA Crane has a 5 year prescribed burning permit from the Indiana Department of Environmental Management which allows the installation to burn up to 400 acres per year for the next 5 years. Due to a number of constraints NSA Crane will likely only burn 40-100 acres per year.

Areas targeted for prescribed fire will be the same as those targeted for timber harvest. Some pre- harvest burning may occur in the timber stands to encourage advance oak regeneration.

Pre-harvest burning will be conducted 4-5 years prior to the harvest on a stand by stand basis as determined by an NSA Crane forester. Due to limited burning opportunities and conditions, generally these areas will only include 2 stands out of the total harvest acreage planned. Areas targeted for pre-harvest burning may also be burned 4-6 years post harvest to further the development of future oak-hickory stands. To date, NSA Crane has only been able to conduct on average 3 burns per year and all but one of those burns have been conducted in post harvest areas. There has been one pre-harvest burn completed to date and it is anticipated that 2 can be completed in a typical year.

Most areas capable of supporting hardwood growth on NSA Crane have been reforested, and remaining open areas are poor sites that will not support hardwoods. Most of these areas are less than 20 acres, and the larger areas have been planted or seeded with various species of pine, primarily white pine, under earlier forest management plans on the installation.

4.3.9 Forest Health

Overall forest health can be improved with timber management practices designed to manage stand density, improve tree composition, reduce hazard fuels, and reduce vulnerability to insect epidemics. Circumstances such as unmanaged forests where trees grow too close to each other, developing small crowns, roots systems, and low vigor, can lead to high tree mortality under such stressful conditions (USFS, 2003).

Numerous species of insects and diseases could inflict damage to NSA Crane forests. Insect species, such as tent caterpillars, gypsy moths, Linden loopers, fall cankerworms, locust leafminers, Ips bark beetles, and pine sawflies, have been documented in the installation forests.

Forest tent caterpillars caused large scale defoliation of about 2,000 acres of forest at NSA Crane during 1975-1977. Gypsy moth detection trapping has occurred on the installation since 1983. Two male moths

were trapped in 1985, but no indication of moths has occurred since. Linden loopers and fall cankerworms have caused no heavy defoliation in recent years. Locust leafminers cause browning of many locust stands but do little long-term damage. Ips bark beetles heavily infested shortleaf pine trees that were damaged by the severe winter of 1977. Outbreaks of pine sawflies occur periodically, but little long term damage is done.

Dutch elm disease occurs on the installation, and most trees affected are infected and die before reaching a large diameter. Oak wilt disease was discovered and treated on NSA Crane in 1961.

Emerald ash borer, an exotic species of beetle originating from Asia, has been discovered throughout Indiana, including NSA Crane.

Gypsy moth is a exceptional pest species of forest and urban landscapes. The species was first introduced to Massachusetts from Europe in 1869, and now is established in the northeastern United States, as well as portions of eastern Michigan, Ohio, and Wisconsin. In Indiana, the species is established in northern portions of the state (INDNR, 2008).
Gypsy moth caterpillars migrate to tops of trees after being hatched, where they feed on foliage and drift in silk strands to colonize other trees. The caterpillars can feed on the foliage of approximately 500 different plants, but prefer oak species (INDNR, 2008).

Approximately 3.25 million acres of Indiana's 4.4 million acres of forest land are moderately or highly susceptible to gypsy moth damage. Indiana's forests are approximately 40% oak, while another 40% of the forests are tree species moderately or highly preferred by gypsy moths as hosts. Thus, gypsy moth control is a priority for the state, which began a control program to detect and eradicate artificial introductions in 1973 (INDNR, 2008).

4.3.10 Records and Reporting

The Natural Resources Office maintains a general forestry file system and library, including information on silvicultural, harvest, and timber stand improvement practices; contracts; markets and sales; products; etc. The Natural Resources Office GIS is used extensively for mapping and decision-making associated with the forestry program.

The NSA Crane Contracting Office sends notices to local forestry businesses and advertises planned harvests in the Commerce Business Daily.

Goals, Objectives, and Supporting Projects

Goals

- Manage NSA Crane forests to encourage a healthy and diverse ecosystem while maintaining the capabilities of the military mission.

Objectives

- Manage NSA Crane forests in accordance with Navy guidance.
- Produce commercial forest products.
- Provide valuable wildlife habitat.
- Protect forest watersheds.
- Enhance ecosystem integrity.

Supporting Projects

- Timber harvesting.
- Timber Stand Improvement.
- Prescribed burning.

4.4 Non-Forest Vegetation

Goals, objectives, and supporting projects relating to non-forest vegetation, are listed below, and primarily involve the establishment of native grassland plants and warm season grasses where appropriate. There are no plans to replace existing forest vegetation with non-forest vegetation. Native grasses will be burned every 3 to 5 years following the same guidelines used for prescribed burns in forest vegetation. These burns will be conducted prior to April 15 to avoid disturbance of nesting birds.

Goals, Objectives, and Supporting Projects

Goals

- Establish native grassland plants in existing grasslands.

Objectives

- Plant warm season grasses in disturbed areas that are being revegetated.
- Convert existing cool season grasses to warm season grasses where appropriate.

Supporting Projects

- Establish wildlife plantings as resources are available.

4.5 Invasive Plant Species

Invasive and/or noxious weeds pose threats to native habitats, endangered species, and plant community composition and diversity. More specifically, they threaten wetland ecosystems, complicate land restoration projects, add to the cost of pest management, and in general, threaten ecosystem functionality. NSA Crane is dedicated to prevention of introduction of invasive species as well as their control as per Executive Order 13112, *Invasive Species*, defined as “an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health”.

At this time, NSA Crane has a limited amount of resources that can be allocated to controlling the spread of invasive species. Control methods employed to manage invasive species at NSA Crane include herbicide application techniques, manual, and mechanical removal of small areas of infestation. Currently, priority for control and eradication efforts is focused on species that have not spread over a large spatial distribution, such as kudzu, Japanese knotweed, and bush honeysuckle. In this manner, invasive species that have not spread over a large area can be eradicated before they become a larger problem across the installation. Callery pear is widespread on the western half of the installation with roughly half of this area being severely infested. Treatments in these areas continue as funding allows. Any areas planned for timber harvest where callery pear is widespread will be treated if problematic prior to the harvest.

Goals, Objectives, and Supporting Projects

Goals

- Continue control of invasive species.

Objectives

- Establish future partnerships with private agencies outside of the installation to encourage control of source populations.

Supporting Projects

- Invasive species control program.

4.6 Wetlands

Wetlands protection is required by Executive Order 11990, *Protection of Wetlands*. Protection and maintenance of habitat are the primary thrust of wetlands management on NSA Crane, as the quality of wetland watersheds affects the quality of downstream wetland plant and animal communities.

Environmental clearance review is the primary means of detecting threats to wetlands on NSA Crane. The Natural Resources Office reviews actions which may affect wetlands. Reviews come from several sources: engineer work orders, service orders, military mission plans, NEPA documentation, major construction plans, etc. If necessary, projects with potential impacts are referred to the U.S. Army Corps of Engineers (Louisville District) to determine if jurisdictional wetlands are implicated, establish mitigation procedures, and/or obtain permits. Wetland-affecting projects require NEPA documentation.

Activities in wetlands that require federal permits include but are not limited to: placement of fill material, ditching activities when the excavated material is sidecast, mechanized land clearing, land leveling, most road construction, and dam construction. The Corps of Engineers permit process requires coordination with the USFWS and the State Historic Preservation Office (SHPO) to allow for the assessment of potential impacts to protected species and cultural resources.

The USFWS National Wetlands Inventory provides adequate wetlands information for installation needs. Additional wetlands surveys, except those specific to project sites that may affect wetlands, are not planned during the next ten years.

Goals, Objectives, and Supporting Projects

Goals

- No net loss in accordance with Executive Order 11990.

Objectives

- Establish a mitigation area to offset possible development in wetlands at NSA Crane.

Supporting Projects

- Large scale wetland delineation in most developable areas on NSA Crane

4.7 Wildland Fire

The NSA Crane Fire Department is responsible for fire suppression on the installation. Primary emphasis of fire management on the installation is prevention. It is important to minimize the number of wildfires. To fully accomplish this, installation personnel and those who visit NSA Crane are made conscious of the need for fire prevention. The installation educates employees and the public in fire safety through a very visible fire prevention program. For example, no smoking signs are visibly posted; smoking on the installation is not allowed except in designated areas; and natural resource user regulations, such as the

annual deer hunting notice, contain restrictions for smoking and having lighters or matches on an individual's person while on the installation.

NSA Crane annually experiences very few wildfires. The fires that do start are often small and are extinguished expediently.

Fire suppression is provided by a full-time Fire Department, manned 24 hours per day, 7 days a week and equipped with structural, brush, and grass fire fighting apparatus. Fire fighters are fully trained in wildfire suppression and follow a Standard Operating Guide for wildland fire fighting. Various hand tools are carried on trucks to allow suppression in areas inaccessible to vehicles, although specialized jeeps are available for off-road fire fighting activities. NSA Crane maintains mutual support agreements with many of the surrounding communities for fire suppression. The Natural Resources Office maintains and posts current fire danger ratings.

The installation's 411 miles of roads and 163 miles of railways act as firebreaks. Most roads and railways have mowed shoulders which widen the fire-retarding quality of these breaks in the forest cover. The road system provides quick access for fire management and facilitates effective response to wildfires. The NSA Crane suppression of wildfires protects numerous acres of forest habitat and provides a safe environment for employees and resource users, particularly considering the vast amount of ammunition storage on the installation.

Goals, Objectives, and Supporting Projects

Goals and Objectives

- Continue prevention and education efforts associated with wildland fire risk.

4.8 Land Management

4.8.1 Land Uses

The two primary land uses of NSA Crane's 62,467 acres are production facilities and associated storage magazines and buffer areas around magazines; however, much of this area is considered wildlife and/or natural habitat. Housing, warehouse, operations, maintenance, high technology operations (ordnance and electronic functions), administrative functions, medical, and open space comprise the use for about 3,000 acres concentrated near the center of NSA Crane.

Land uses at NSA Crane are classified into three maintenance categories: improved grounds, semi-improved grounds, and unimproved grounds. These areas account for 251 acres, 11,499 acres, and 48,346 acres respectively. An additional 2,338 acres are classified as "other" areas.

Improved grounds include acreage on which intensive or periodic recurring maintenance activities must be planned and performed annually as fixed requirements. These include lawns and landscaped areas, the golf course, athletic facilities, cemeteries, and other intensive use areas. Semi-improved grounds include small arms ranges, antenna facilities, picnic areas, mowed road shoulders, golf course roughs, and ammunition storage areas. Maintenance operations in these areas include mowing, irrigating, fertilizing, cultivating, aerifying, seeding, sodding, spraying, pruning, trimming, weed control, soil sterilization, erosion control, drainage maintenance, vegetative insect and disease control, and planting for landscaping wind/sound abatement. On NSA Crane, improved and semi-improved grounds comprise a small percentage (18 percent) of the total land area.

Unimproved grounds include all areas not considered improved or semi-improved, including forests, lakes, ponds, and other areas requiring limited to no maintenance. Unimproved grounds comprise the largest land use on NSA Crane (77 percent).

4.8.1.1 Natural Resource Areas

NSA Crane is divided into 39 natural resource use areas (including two Military-Security Areas) to allow areas to be opened and closed as necessary to separate types of activities, primarily for safety reasons. Natural resource use areas are shown in Figure 4.1.

4.8.1.2 Timber Management Compartments

NSA Crane is divided into 20 timber management compartments (Figure 4.2). Each compartment is further divided into stands with as many as 86 stands comprising a compartment.

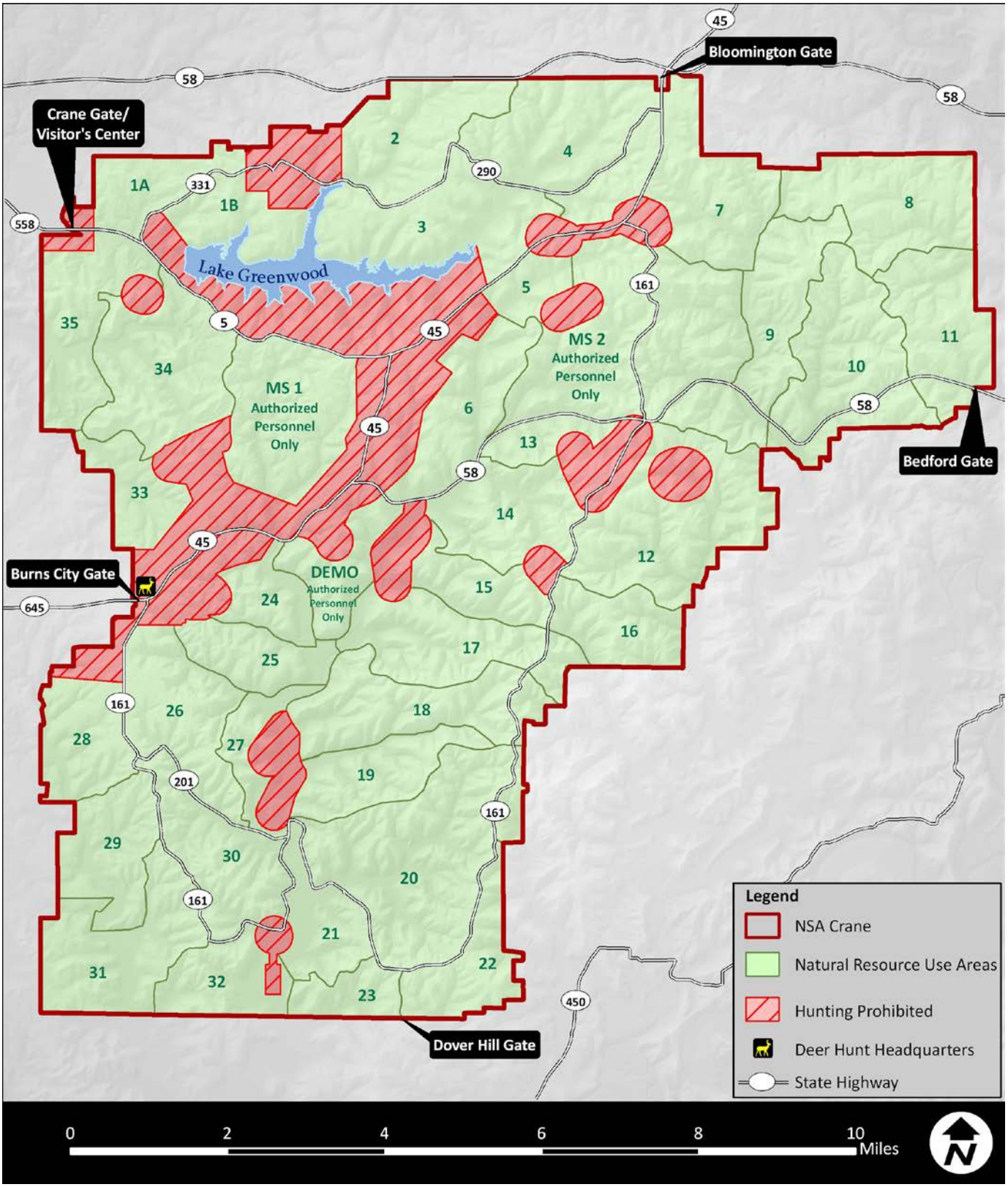

Figure 4.1: Natural Resource Areas

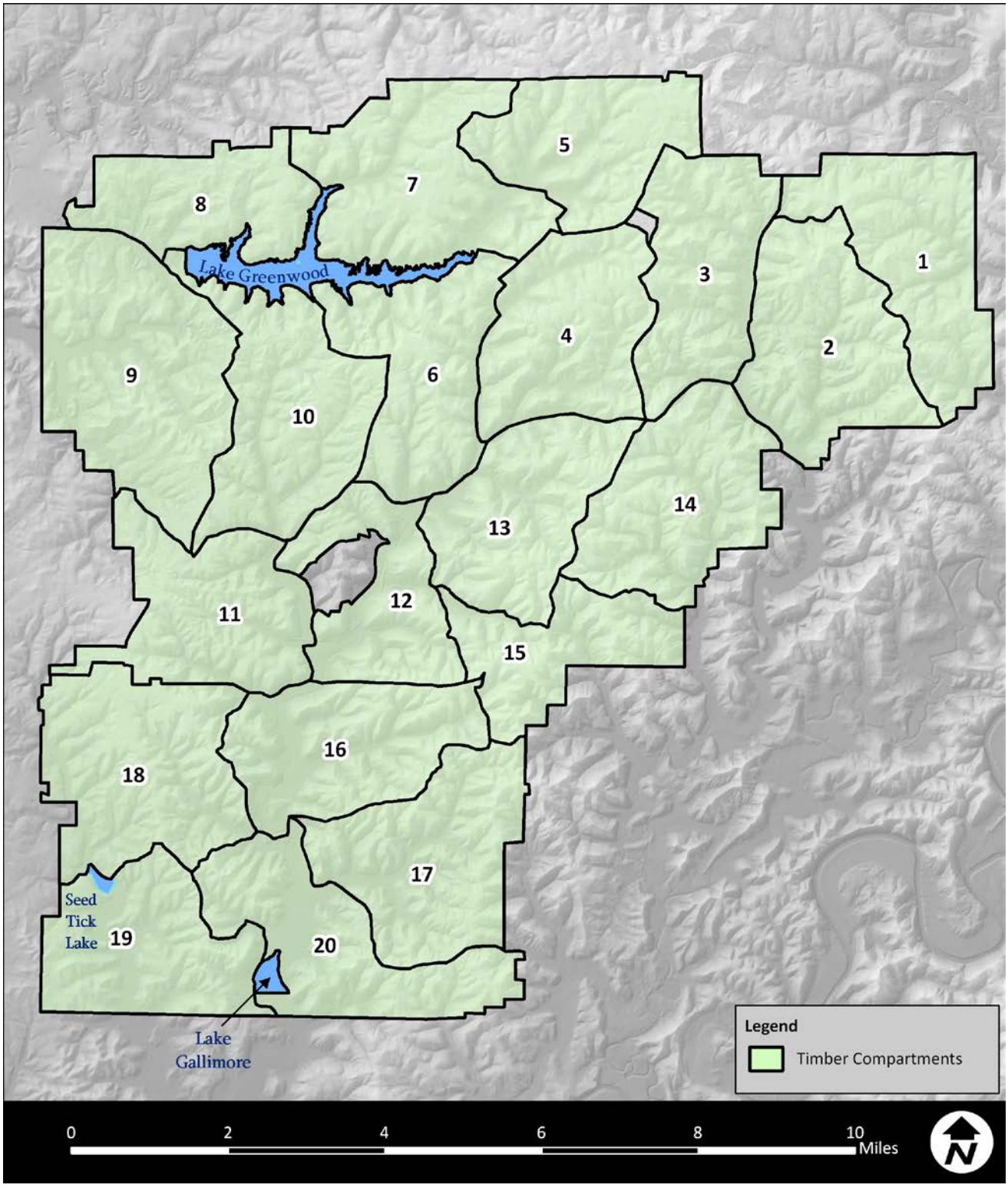

Figure 4.2: Timber Compartments

4.8.1.3 Fisheries Management Units

Lakes and ponds are managed primarily for largemouth bass, catfish, and various sunfish. NSA Crane fisheries are divided into four units for management purposes: Lake Greenwood, Boggs Creek Small Watershed Project, Lake Oberlin, and Wildlife Watering Ponds (Surprenant, 1990a). Fisheries resources within the four management units include those listed below.

- Lake Greenwood, the most intensively managed fishery on NSA Crane.
- Boggs Creek Small Watershed Project which includes Seedtick Lake, Lake Gallimore, and seven ponds ranging in size from 0.3 to 6.4 acres.
- Lake Oberlin.
- Wildlife Watering Ponds, which includes 33 small watering ponds.

4.8.1.4 Special Management Areas

Special management areas were mentioned in Section 2.3.2.1, *Natural Areas and Unique Communities*. Several of these areas were noted in Homoya and Hedge (2206), who provided management recommendations for natural areas that provide habitats for rare species. Several of these sites have regionally uncommon natural community types, and although many of the sites did not harbor special status species, they are nonetheless unusual regional habitats that maintain the potential to harbor such species. General management recommendations for many of these sites included buffering the areas from management activities such as timber harvesting in order to avoid disturbing the sites.

Cave access on NSA Crane is prohibited without written approval from the Officer-in-Charge (OIC). This rule was originally made for safety reasons, but is now even more important due to the possibility of White-Nose Syndrome (WNS) being transferred from one cave to another. WNS is a disease of bats which is currently causing significant mortalities in the eastern United States. Therefore, any requests for cave access should be routed through the Natural Resources Office before going to the OIC for approval.

Goals, Objectives, and Supporting Projects

Goals

- Maintain unique characteristics of special management areas.

Objectives

- Do not disturb blue heron rookery.
- No disturbance within ¼ mile of existing eagle nests.

Supporting Projects

- Record GPS location of existing eagle nests.
- Delineate boundaries of heron rookery to assess temporal changes.
- Conduct additional natural community inventory

4.9 Outdoor Recreation

NSA Crane has large, relatively undeveloped, open spaces. This open space and outdoor recreation opportunities associated with it are perhaps the installation's best natural attributes in terms of community quality of life.

The history of outdoor recreation on NSA Crane is directly related to the history of hunting and fishing on the installation. NSA Crane's outdoor recreation program developed as recreation interests broadened and now provides recreational opportunities other than hunting and fishing.

Camping has always been a popular pursuit at the Lake Greenwood campground, which is operated and maintained by the MWR. MWR has built facilities, including a marina on Lake Greenwood, and acquired an extensive assortment of recreational equipment available to rent by military personnel and civilians.

Other types of recreational opportunities exist at NSA Crane. Various types of indoor recreation are available in the administrative areas as are other dispersed outdoor activities not included in the formal definition of "outdoor recreation."

4.9.1 Hunting and Fishing Activities

Hunting is strictly regulated on NSA Crane, particularly deer hunting. Interest in hunting and fishing has steadily increased on NSA Crane.

NSA Crane generally holds 3-4 one-day firearm deer hunts annually. There has been varied combinations of public and military/employees assigned to NSA Crane who are eligible to hunt on these hunts. In consideration of the safety and security of the NSA military mission, these hunts are now largely limited to military and civilian employees assigned to NSA Crane. Public hunting consists of the special hunt for holders of the INDNR Disabled Hunter Permits and participants generally harvest 35-50 deer during this hunt. Success rates for firearm hunters is generally 20-25 percent throughout the season.. NSA Crane turkey hunting seasons usually provide six hunting days annually for gun hunting for installation-associated hunters. Spring turkey hunts have produced an average of 34 turkeys harvested and 338 hunting efforts per year.

NSA Crane fishing seasons and bag limits are identical to those used outside of the installation. Lake Greenwood lifted the 13 to 15 inch slot size limit for largemouth bass in 2016. Other fishing restrictions on Lake Greenwood can be found in the NSA Crane *Natural Resources Rules and Regulations*. Size limits on Lake Greenwood are adjusted periodically to achieve management goals.

NSA Crane hunting seasons and bag limits are similar to those used outside of the installation. NSA Crane white-tailed deer hunts are controlled, and some permits must be obtained through an INDNR drawing. Application deadlines are usually in August for fall hunts. The regulations listed below are applicable to these hunts.

- Deer hunters must possess a valid Indiana Deer Hunting License.
- Hunters who hold three Indiana Archery Deer Hunting Licenses are permitted to harvest three deer during the archery season.
- Hunters who purchase an Indiana Military/Refuge Deer Hunting License can use it to take a deer of either-sex at NSA Crane and save their regular Indiana Deer Hunting License to hunt elsewhere in Indiana.
- Hunters choosing not to purchase the Indiana Military/Refuge Deer Hunting License can still harvest a deer of either-sex at NSA Crane with their regular Indiana Deer Hunting License but are then ineligible to hunt elsewhere in Indiana with their regular license.
- NSA Crane employees are required to purchase a NSA Crane gun deer hunting permit (good for all gun hunts), and NSA Crane employee archery hunters are required to purchase a NSA Crane archery permit.
- Legal deer for all hunts on the installation vary by season.

Hunts available on NSA Crane are listed below.

- Three to four 1-day gun deer hunts in November and early December.
- A 1-day gun deer hunt for holders of Indiana Special Handicapped or Persons with Disabilities Hunting Permits, usually in early November prior to the start of the state gun hunting season.

In addition, NSA Crane employees and dependents often are allowed additional archery deer hunting opportunities, within state seasons and at the discretion of the Officer-in-Charge.

Deer hunters are assigned one of 39 hunting areas and are restricted to that area. Each hunter is given a safety and security briefing. Access to NSA Crane lands for activities other than deer hunting is not allowed during annual firearm deer hunts except for activities on Lake Greenwood or at recreational facilities on the south shore of Lake Greenwood. These safety precautions, with the added security and safety precaution of searching each vehicle for drugs and alcohol when they enter the gates, ensure very safe hunting conditions. NSA Crane provides each successful deer hunting applicant with an annual deer hunting notice delineating policies, rules, and regulations.

NSA Crane supports limited annual spring turkey hunting. Spring turkey hunts have produced an average of 34 turkeys harvested per year. Gun hunting for turkey is during weekends, usually six total days. Archery turkey hunters are allowed to hunt the entire season. Eligible hunters include NSA Crane employees, retired employees, and military. Civilian and retired employees may not sponsor guests for turkey hunting. Only bearded turkeys are legal, and firearms restrictions are in effect. Hunters must have both an Indiana turkey license and a Game Bird Habitat Stamp. Hunters 17 years of age or younger can purchase a youth license which covers both requirements. A NSA Crane Small Game Permit is also required. Successful hunters must take their turkey to an official Indiana turkey check station. NSA Crane also allows fall turkey hunting since 2006.

Small game is hunted on NSA Crane; however eligibility to hunt small game is limited to NSA Crane-associated personnel and some dependents and is only open on Saturdays, Sundays, and holidays. A NSA Crane Small Game Permit is required of hunters pursuing small game animals. Other regulations pertaining to small game hunting on the installation can be found in the NSA Crane *Natural Resources Rules and Regulations.*

Migratory waterfowl hunting is allowed at Lake Gallimore and Seedtick Dam, seven days a week during open season. Waterfowl hunters must obtain a NSA Crane Small Game Permit, Indiana Hunting License, Indiana Migratory Waterfowl Stamp, and for hunters 16 years or older, a Federal Duck Stamp.

4.9.1.1 Hunter and Angler Administration Process

Military installations usually have complex hunter and angler control systems. These are needed to accommodate recreational activities without interference with the military mission and to ensure safe, high quality recreational experiences. Records of permit sales and hunting trips are maintained by the Natural Resources Office.

4.9.1.2 Hunting and Fishing Regulations

The Indiana Department of Natural Resources issues regulations for hunters and anglers in Indiana, including those who use NSA Crane. OPNAVINST 5090.1, Chapter 12, *Natural Resources Conservation* and NSA Crane *Natural Resources Rules and Regulations* are the primary means of establishing controls

on hunting, fishing, and trapping (when used) on NSA Crane. In addition, NSA Crane has specific regulations and rules issued annually for deer and turkey hunting. Individuals who desire to hunt must obtain NSA Crane hunting permits after obtaining Indiana licenses and appropriate tags. Deer gun hunters are also required to attend pre-hunt briefings and safety sessions. Anglers are required to have the appropriate installation and Indiana licenses. Rules and regulations will be updated as needed throughout the life of this INRMP.

4.9.1.3 NSA Crane Permits

Individuals must obtain appropriate installation permits to participate in hunting and fishing on NSA Crane. Daily permits are sold at the marina. All permits are sold at the MWR office during normal duty hours.

Permit costs at NSA Crane have remained at the current level for several years. Budget constraints for programs supported by these funds, higher operating costs, inflation in general, etc. have made it necessary for the installation to consider increasing fees for outdoor recreation.

4.9.1.4 State Licenses

Persons are responsible for obtaining Indiana hunting and fishing licenses before obtaining installation permits.

4.9.1.5 Log-In and Out Procedures

Individuals who use NSA Crane for natural resources purposes are required to log in and out using the Natural Resources Log-in/out System (NRLS). Procedures for using the NRLS can be found in the NSA Crane Instruction 11015.2, *Natural Resources Rules and Regulations.*

4.9.1.6 Hunting and Fishing Maps

NSA Crane maps are essential for hunter and angler use of range areas. Maps are provided to hunters when permits are purchased, particularly for managed deer hunts. Other recreationists can obtain maps from the Natural Resources Office. Maps feature off-limits areas, major roads, and other features for orientation.

4.9.1.7 Safety Considerations

NSA Crane Instruction 11015.2, *Natural Resources Rules and Regulations,* contain many references to hunting, fishing, and water safety practices and requirements. Hunters born after 1986 must satisfactorily complete a state-certified hunter education course to obtain state licenses and thus, installation hunting permits. In addition, persons hunting during the general public deer hunts on NSA Crane are required to attend a safety briefing prior to their hunt.

4.9.1.8 Fishing Events

The Crane Bass Club and MWR have sponsored fishing tournaments on Lake Greenwood in the past. There was limited (10-15 boats) interest in such tournaments. NSA Crane will investigate providing opportunities for children to fish and building interest in the sport within youth. One option is to organize and promote an annual kids fishing derby. A small pond could be designated and stocked heavily before

each derby to allow for each child to have a better than average chance of catching a fish and having an enjoyable experience.

4.9.2 Other Outdoor Recreation Activities

NSA Crane has natural resources-related recreation other than hunting and fishing, including picnicking, camping, boating, and wildlife watching. Outdoor recreation, other than hunting and fishing, is generally a responsibility of the MWR.

4.9.2.1 Camping

Camping is permitted only in the Lake Greenwood camping areas; these camping areas and marina facilities are authorized only for DoD personnel. NSA Crane campgrounds feature forty-eight full hookup sites (water, electric, and sewage), seven primitive sites, and two screen houses. Primitive campsites and family screen houses are available along the shore of Lake Greenwood.

4.9.2.2 Picnicking, Nature Walks, and Non-Commercial Harvest of Vegetation

NSA Crane has developed several picnic areas that are open to DoD personnel. Picnic facilities are located around the Lake Greenwood Recreation Area and camping area. Harvesting of ginseng and yellowroot is currently prohibited, and will only be allowed if it does not endanger the resource in the future. Other restrictions are listed below.

- Persons pursuing these activities are authorized use of the installation only from sunrise to sunset.
- No non-regenerating or nonrenewable natural or historical material may be removed.
- Pursuing these activities are subject to explosive safety restrictions.

4.9.2.3 Boating and Water Skiing

Boating is a popular recreational pursuit at NSA Crane, particularly on Lake Greenwood. Boating is allowed on other installation waters; however, access is limited to installation-associated personnel. Most boat use is associated with fishing, and the installation has several rules and regulations delineated in NSA Crane Instruction 11015.2, *Natural Resources Rules and Regulation*. Regulations include items such as Indiana boating laws, speed limits for boat operation, and a provision to ensure minimal pollution of the potable water supply of Lake Greenwood.

Water skiing is allowed on Lake Greenwood but only in the designated and marked area (about the west ¼ of the lake). NSA Crane has numerous safety rules associated with water skiing and can be found in NSA Crane Instruction 11015.2, *Natural Resources Rules and Regulations*. Other boating rules and Indiana boating laws also apply to ski boats on Lake Greenwood. Expanded use of NSA Crane's surface waters for other water sports is not anticipated.

4.9.2.4 Hiking, Mountain Biking, and Birding

The primary trail for hiking and mountain biking on NSA Crane is the 8-mile Howard Trail that is on the south side of Lake Greenwood. This trail provides ideal locations for bird watching. The NSA Crane bird checklist helps people better enjoy this activity.

4.10 Law Enforcement

Many aspects of natural resources management require effective environmental law enforcement (*e.g.*, endangered species protection, protection of sensitive areas, hunting and fishing recreation). Protection of cultural resources is also required by the Integrated Cultural Resources Management Plan (NSA Crane, 2013).

4.10.1 History, Authority, Operations

In accordance with the SAIA and NSA Crane directives, the Natural Resources Office and Force Protection Department are responsible for natural resources enforcement. NSA Crane supports a DoD civilian police force that is responsible for performing general police duties, physical security, and fish and wildlife enforcement. The police staff included as many as 120 officers at one time; the current staffing is 78. The issue of whether Environmental or Force Protection should fund conservation law enforcement is still being decided by CNIC.

Specific game wardens with dedicated natural resources duties are not appointed by the Police Chief. Natural resources enforcement is generally accomplished coincidental with other duties or in response to specific situations. Periodically, Navy Reserves assist the Law Enforcement Branch with enforcement operations. No training specific to natural resources enforcement is given to officers performing game warden duties on NSA Crane.

4.10.2 Jurisdiction

NSA Crane is exclusive federal jurisdiction. United States District Court Violation Notice, DD Form 1805 may be issued in instances of hunting, fishing and/or boating violations and adjudicated in Federal Magistrate Court. After an investigation and written incident report is filed with Command, administrative action may result in penalties including temporary/permanent forfeiture of recreational privileges and possible disbarment from the installation.

4.10.3 Enforcement Emphasis

Installation deer hunts require more enforcement emphasis than any other aspect of natural resources law enforcement on NSA Crane. Personnel requirements are so high during these hunts that dedicated overtime is available to police officers. Perimeter surveillance associated with access violations (trespass) is the other primary area of enforcement emphasis on NSA Crane. This emphasis is also seasonal and usually coincides with state hunting seasons.

4.10.4 Training

NSA Crane police officers receive annual refresher training from in-house trainers following their initial basic police training. Part of this training is a review of the annual fish and wildlife laws and regulations.

The National Military Fish and Wildlife Association (NMFWA) offers annual training for experienced wardens. This one-week training uses highly qualified instructors, many of whom have national reputations. The course is open to DoD civilian, contractors, and military wardens and is held on various military installations. This is the most commonly used course by military installations for refresher training. A project to provide this training to appropriate personnel at NSA Crane has been entered into the budget system.

The Sikes Act mandates that DoD installations employ adequate numbers of professionally trained natural resources personnel, including law enforcement personnel to implement the INRMP. The Act authorizes DoD to enforce all federal environmental laws, including National Historic Preservation Act, Archeological Resources Protection Act, Migratory Bird Treaty Act, Clean Water Act, and Endangered Species Act. DoD Directive 4715.3 (May 3, 1996) states, "*Professional natural and cultural resources staff shall oversee the enforcement of applicable laws as an integral part of an installation's conservation program".*

Goals, Objectives, and Supporting Projects

Goals

- Maintain conservation law enforcement program using local police and natural resources personnel in accordance with NSA Crane directives.

Objectives

- Follow up on reported violations with enough evidence.
- Apply penalties to users with substantiated violations.

Supporting Projects

- Maintain natural resources security system.

4.11 Agricultural Outleasing

About 60 percent of the soils at NSA Crane could support agriculture, but nearly 75 percent of the installation is more suitable for woodland production (Crane NSWC, 1996). NSA Crane has no agricultural outleases. There are no plans to institute such leases since they are not compatible with the military mission or ecosystem management strategies.

4.12 Geographic Information Systems (GIS)

Goals and objectives for the GIS component of the natural resources program are to remain functionally viable and provide GIS technology to store forestry program data in a manner in which is usable and provides assistance to the managers and employees of the program. This would include, but is not limited to, printing maps for field use and other purposes, storing historic field operations data both spatially and in database form, and providing a work flow system where future projects such as timber harvests are input for planning purposes.

5.0 Implementation

This INRMP was prepared with a goal of 100 percent implementation. Described below are the organizational tools, personnel, and funding needed to implement programs described in Chapter 4, "Program Elements".

Objectives

- Provide personnel and training to implement this INRMP.
- Obtain funding to implement this INRMP.
- Provide command support to implement this INRMP.
- Upgrade computer hardware and software as needed and continue to develop GIS databases.

5.1 Organization

NSA Crane ultimately has the responsibility of implementing this INRMP, operating under a number of legal and regulatory concerns, policies, and budgetary constraints. The need to address threatened and endangered species issues and successfully manage the natural resources while supporting the military mission are the basis for prioritizing management recommendations.

The Natural Resources Office, NAVFAC Midlant PWD Crane can implement most of this INRMP and fulfill goals and policies established in this INRMP. Other responsible NSA Crane organizations are also capable of implementing their portions of this INRMP with no organizational changes, although they may elect to make changes for improved operations efficiency.

5.2 Personnel

5.2.1 Staffing

The following staffing is necessary to fully implement this INRMP at NSA Crane:

Natural Resources Manager	1
Forester	3
Fish and Wildlife Biologist	1 (Proposed)
Office Manager	1 (Proposed)

Above personnel do not include personnel within MWR and other personnel within NAVFAC Midlant PWD Crane who have significant roles in implementation of this INRMP. Support will also be needed in the area of conservation law enforcement once funding has been established by CNIC.

5.2.2 External Personnel Assistance

The rapid development of natural resources management combined with military personnel cutbacks have resulted in the highest need ever for outside assistance with natural resources programs on NSA Crane. The installation has used its partnerships in a variety of ways, but particularly for wildlife research and management, erosion control, and others. The growth of environmental compliance requirements has increased many of these needs and added considerably to the need for partners in other areas, including on-the-ground personnel support.

5.2.2.1 Volunteers

Volunteers are a time-honored source of personnel assistance at NSA Crane. Many volunteers at NSA Crane are from scout groups with individuals often earning badges for work performed on the installation. The Student Conservation Association was instrumental in completion of the 8-mile Howard Trail on the south side of Lake Greenwood. Volunteers will continue to be fostered during the lifecycle of this INRMP.

5.2.2.2 Other Agency Assistance

NSA Crane recognizes the importance of cooperating with federal and state agencies, most notably the U.S. Fish and Wildlife Service and the Indiana Department of Natural Resources. NSA Crane will utilize federal and state agencies, particularly this INRMP's signatory partners, the USFWS and the INDNR, to assist with implementation of various aspects of this INRMP.

5.2.2.3 University Assistance

Universities are an excellent source of research assistance. The NSA Crane relationship with Purdue University dates back to 1963 when a formal agreement was signed to promote cooperative wildlife research. Purdue University, Indiana University and other universities will be considered as a source of assistance in implementation of this INRMP.

5.2.2.4 Other Support

Contractors give NSA Crane access to a wide variety of specialties and fields. A variety of projects could use the support of contractors in the next ten years. Contractor and other sources of support will be evaluated on a case-by-case basis during the next ten years.

5.3 Detailed Prescriptions that Drive the Projects

The natural resource management program elements described in Chapter 4 are divided into mandatory and stewardship categories to reflect implementation priorities. Every effort will be made to obtain funding through appropriate mechanisms to implement mandatory projects in the timeliest manner feasible. Stewardship projects will be funded through appropriate sources as funding and/or personnel resources become available.

NSA Crane has developed twelve natural resource program elements for the INRMP, described in detail in Chapter 4 and designed with guidance found in *Integrated Natural Management Plan Guidance for Navy Installations July, 2006.* Goals, objectives and supporting projects listed in this INRMP for natural resource management program elements may change over time to meet overall mission and natural resource management needs. Additionally, areas of overlapping goals and objectives between two or more natural resource management program elements may offer opportunities for potential project integration.

Priority of each supporting project listed under the appropriate natural resource management program element in Chapter 4 as mandatory (required by law) or stewardship (authorized but not required), legal driver(s) for each project, funding sources and priorities, and estimated costs of specific projects are found in Appendix A.

5.4 Environmental Planning and Mission Sustainability

Long range environmental planning is a vital component to successful natural resource management, integration, compliance, and mission support at NSA Crane. Long range planning helps to ensure that activities occurring at NSA Crane are consistent with the natural resource management goals and objectives presented in this INRMP, and that those goals and objectives are consistent with the military mission of NSA Crane. Master planners at NSA Crane will use this INRMP and consider natural resource implications when planning and designing new facilities, ensuring regulatory compliance of projects as they relate to environmental planning.

5.5 Achieving No Net Loss

The Sikes Act Improvement Act states that an INRMP shall provide for "no net loss in the capability of military installation lands to support the military mission of the installation". The Sikes Act also states that the purpose of an INRMP is to "ensure consistency with the use of military installations to support the preparedness of the Armed Forces, while providing for the conservation and rehabilitation of natural resources on military installations; the sustainable multipurpose use of the resources including hunting, fishing, trapping, and non-consumptive uses; and public access to military installations within safety and military security requirements". Currently, there are very few natural resource related projects or areas that would detract from any future training areas. The one area that is off limits to training, the great blue heron rookery, has been designated as a Navy Ecological Reserve. However, it is located in a wet floodplain that is generally unsuited for training or development.

5.6 Use of Cooperative Agreements

A cooperative agreement is a legal instrument used by a federal agency to enter into a relationship whose principal purpose is assistance (that is, the transfer of something of value to the recipient to carry out a public purpose of support or stimulation authorized by U.S. law). The use of a cooperative agreement necessitates detailed involvement between the agency and the recipient during the activity. Sikes Act cooperative agreements may be used to accomplish work identified in the INRMP and may be entered into with States, local governments, non-governmental organizations, and private individuals. These cooperative agreements authorized under the Sikes Act must comply with the procedural requirements of the DoD Grant and Cooperative Agreement Regulations.

Currently, NSA Crane has no authorized cooperative agreements, but there ability to aid in the implementation of this INRMP will be investigated and used where applicable during the lifecycle of this plan.

5.7 National Environmental Policy Act (NEPA) Compliance

As discussed in Section 3.7, NEPA is the primary planning tool for the evaluation of actions potentially affecting the environment on federal lands, including NSA Crane. The most common NEPA document prepared for projects which may potentially impact natural resources is a Categorical Exclusion (CATEX). This simple documentation generally works well for routine projects, such as borrow sites, small digging projects, and similar projects where natural sites are not damaged. Environmental Assessments (EAs) are required when conditions for a CATEX are not met. This can happen when a large construction project is planned, when a building is demolished, when the action involves a wide geographic area, or when wetlands or other sensitive communities may be involved. Examples include major erosion control projects, new military missions, or major construction. EAs require the

Commander's approval, as well as publishing a Finding of No Significant Impact (FONSI). EAs also provide a mechanism for public input regarding the action through scoping processes as well as a comment period, usually 30 days after the publication of the EA. If the FONSI which accompanies the EA is not appropriate, there are four actions which may be taken:

- Modify the action to remove significant impacts.
- Provide mechanisms to mitigate significant adverse impacts.
- Drop the action.
- Publish a Notice of Intent to prepare an Environmental Impact Statement (EIS).

Previously, an EA was prepared in 2001 for the NSA Crane INRMP covering 2002-2006. Because of the size of the installation and several environmental factors, such as the timber management plan and the presence of the federally listed Indiana bat on the installation, it was decided that a new EA would be most appropriate to accompany the revised INRMP for 2010-2019. This is the case even though activities on the installation have not markedly changed since the 2001 EA was prepared. The EA is being prepared concurrently with the INRMP revision, and will be presented in a separate document.

5.8 Program Hierarchy and Funding

Navy programming is based on DoD funding classification levels. As described in DoD Instruction 4715.3, projects are placed into one of two groups: "Must Fund" (Class 0 and Class 1) projects and "Stewardship" (Class 2 and Class 3) projects. Must fund projects are those projects and activities that are required to meet recurring natural resource conservation requirements or current legal compliance needs. Stewardship projects are those that enhance an installation's natural resources, promote proactive conservation measures, and support investments that demonstrate Navy environmental leadership and proactive environmental leadership. Specific definitions of the DoD programming hierarchy are listed below.

- ***Class 0:*** Recurring Natural and Cultural Resources Conservation Management Requirement – INRMP actions necessary to rehabilitate or prevent resource degradation that may affect military readiness.
- ***Class1:*** Current Compliance – INRMP actions to manage species and habitats of concern to prevent listing of species that could affect military readiness.
- ***Class 2:*** Maintenance Requirements – INRMP actions that are not currently out of compliance, but will be out of compliance if projects or activities are not implemented in time to meet an established deadline.
- ***Class 3:*** Enhancement Actions Beyond Compliance – INRMP actions that enhance conservation resources or the integrity of the installation mission, or are needed to address overall environmental goals and objectives, but are not specifically required under a regulation or Executive Order and are not of an immediate nature.

Navy funding classification and program hierarchy are divided into further classifications as listed below.

Environmental Readiness Level 4

- Supports all actions specifically required by law, regulation, or Executive Order just in time.
- Supports all DoD Class 0 requirements as they relate to a specific statute.
- Supports recurring administrative, personnel, and other costs associated with managing environmental programs that are necessary to meet DoD Class 0 requirements.
- Supports DoD policy requirement to comply with overseas Final Governing Standards and Overseas Environmental Baseline Guidance Document

- Supports minimum feasible Navy executive agent responsibilities, participation in Office of the Secretary of Defense sponsored inter-agency efforts, and Office of the Secretary of Defense mandated regional coordination efforts.

Environmental Readiness Level 3

- Supports all capabilities provided by Environmental Readiness Level 4.
- Supports existing level of Navy executive agent responsibilities, participation in Office of the Secretary of Defense sponsored inter-agency efforts, and Office of the Secretary of Defense mandated regional coordination efforts.
- Supports proactive involvement in the legislative and regulatory process to identify and mitigate requirements that will impose excessive costs or restrictions on operations and training.
- Supports proactive initiatives critical to the protection of Navy operational readiness.

Environmental Readiness Level 2

- Supports all capabilities provided by Environmental Readiness Level 3.
- Supports enhanced proactive initiatives critical to the protection of Navy operational readiness.
- Supports all Navy and DoD policy requirements.
- Supports investments in pollution reduction, compliance enhancement, energy conservation, and cost reduction.

Environmental Readiness Level 1

- Supports all capabilities provided by Environmental Readiness Level 2.
- Supports proactive actions required to ensure compliance with anticipated laws or regulations in a timely manner and/or to prevent adverse impact to the military mission.
- Supports investments that demonstrate Navy environmental leadership and proactive environmental stewardship.

In the Navy funding classification system listed above, "Must Fund" projects fall under Environmental Readiness Levels 4 and 3, and may include projects such as developing/revising INRMPs, baseline surveys, wetland surveys for planning/monitoring/permit applications, and erosion control measures. "Stewardship" projects fall under Environmental Readiness Levels 2 and 1, and may include actions such as community outreach activities, biological surveys for non-listed species, demonstration plantings of native plant materials, and public awareness projects.

Formal adoption of an INRMP by a Regional Commander or Officer-in-Charge constitutes a commitment to seek funding and execute, subject to the availability of funding, all "Must Fund" projects and activities in accordance with specific timeframes identified in the INRMP. Priority of each supporting project listed under the appropriate natural resource management program element in Chapter 4 as mandatory (required by law) or stewardship (authorized but not required), legal driver(s) for each project, funding sources and priorities, and estimated costs of specific projects are found in Appendix A.

Unlike most functions within the Department of Defense, natural resources management relies on a variety of funding mechanisms, some of which are self-generating and all of which have different application rules. Below are general discussions about different sources of funding that will be utilized to implement this INRMP.

O&MN Environmental Funds

The majority of natural resource projects are funded with Operations and Maintenance, Navy (O&MN) environmental funds. These appropriated funds are the primary source of resources to support "Must Fund" projects (Environmental Readiness Level 4) associated with this IRNMP. Environmental funds are

most commonly used for projects to return to compliance with federal or state laws, especially if non-compliance is accompanied by Notices of Violation or other enforcement agency actions.

Forestry Funds
Forestry funds are generated from sale of forest products. Individual installations can be reimbursed for forestry program obligations that are directly related to the commercial production of forest products. These obligations are for the following functional expenses: (1) forest improvements, (2) reforestation, (3) forest protection, (4) forest access roads, (5) sales, (6) management, and (7) forestry equipment. Program obligations do not include amounts incurred for operations that, while related to the land and forest, are for other purposes.

Forty percent of the net revenue produced by an installation is distributed to the state in which the installation is located. Any remaining revenue is transferred to the DoD Forest Reserve Account. Funding from the reserve account may be requested for the following uses: (1) improvements in forest lands; (2) unanticipated contingencies for the forestry program for which other sources of funds are not available in a timely manner; and (3) natural resources management that implements approved plans and agreements.

The Forestry program will generate an average of about $1 to $1.5 million annually during 2010-2019. Of this income, about $400,000 will be annually required to operate the Forestry program and purchase equipment.

Legacy Funds
The Legacy Resource Management Program is a special Congressionally mandated initiative to fund military conservation projects. Such projects may include habitat preservation initiatives, regional ecosystem management initiatives, and monitoring and predicting migratory patterns of animals. Projects proposed for legacy funds are reviewed by the Navy chain of command before being submitted to the DoD Legacy Resources Management for final selection.

User Fees
User fees collected from hunting, fishing, or trapping fees will be collected, deposited, and used in accordance with Sikes Act and DoD financial management regulations. The Sikes Act specifies that user fees will be used only on the installation where said fees are collected, and that the funds will be used for fish and wildlife conservation and management initiatives.

Working Capital Funds
Working Capital Funds are funds received from a customer used to finance specific work required by the customer. These are revolving funds which do not rely on Congressional appropriations to finance operations. With respect to this INRMP, Working Capital Funds would be funds that are provided by NSA Crane tenant customers such as NSWC and CAAA.

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Appendices

Appendix B: Faunal Species of NSA Crane

B1: Mammals

Common Name	Scientific Name	Special Status
Indiana bat	*Myotis sodalis*	Federal/State Endangered
northern long-eared bat	*Myotis septentrionalis*	Federal Threatened
bobcat	*Lynx rufus*	
eastern red-eared bat	*Lasiurus borealis*	State Species of Concern
hoary bat	*Lasiurus cinereus*	State Species of Concern
little brown bat	*Myotis lucifugus*	State Species of Concern
pygmy shrew	*Sorex hoyi*	State Species of Concern
river otter	*Lontra canadensis*	State Species of Concern
silver-haired bat	*Lasionycteris noctivagans*	State Species of Concern
smoky shrew	*Sorex fumeus*	State Species of Concern
tri-colored bat	*Pipistrellus subflavus*	State Species of Concern
beaver	*Castor canadensis*	
big brown bat	*Eptesicus fuscus*	
bog lemming	*Synaptomys cooperi*	
cottontail rabbit	*Sylvilagus floridanus*	
coyote	*Canis latrans*	
deer mouse	*Peromyscus maniculatus*	
eastern chipmunk	*Tamias striatus*	
eastern mole	*Scalopus aquaticus*	
fox squirrel	*Sciurus niger*	
gray fox	*Urocyon cinereoargenteus*	
gray squirrel	*Sciurus carolinensis*	
least shrew	*Cryptotis parva*	
long-tailed weasel	*Mustela frenata*	
meadow mouse	*Microtus pennsylvanicus*	
mink	*Mustela vison*	
muskrat	*Ondatra zibethicus*	
opossum	*Didelphis marsupialis*	
pine vole	*Pitymys pinetorum*	
prairie vole	*Microtus orchrogaster*	
raccoon	*Procyon lotor*	
red bat	*Lasiurus borealis*	
red fox	*Vulpes vulpes*	
short-tail shrew	*Blarina brevicauda*	
southeastern shrew	*Sorex longirostris*	
southern flying squirrel	*Glaucomys volans*	
striped skunk	*Mephitis mephitis*	
white-footed mouse	*Peromyscus leucopus*	
white-tailed deer	*Odocoileus virginianus*	
woodchuck	*Marmata monax*	

B2: Amphibians

Common Name	Scientific Name	Special Status
northern cricket frog	*Acris crepitans*	State Species of Concern
American toad	*Bufo americanus*	
bullfrog	*Rana catesbeiana*	
cave salamander	*Eurycea lucifuga*	
eastern newt	*Notophthalmus viridescens*	
Fowler's toad	*Bufo fowleri*	
gray treefrog	*Hyla chrysoscelis*	
green frog	*Rana clamitans melanota*	
Jefferson's salamander	*Ambystoma jeffersonianum*	
longtail salamander	*Eurycea longicauda longicauda*	
marbled salamander	*Ambystoma opacum*	
northern slimy salamander	*Plethodon glutinosus*	
red-backed salamander	*Plethodon cinereus*	
smallmouth salamander	*Ambystoma texanum*	
southern leopard frog	*Rana utricularia*	
spotted salamander	*Ambystoma maculatum*	
spring peeper	*Pseudacris crucifer crucifer*	
two-lined salamander	*Eurycea cirrigera*	
western chorus frog	*Pseudacris triseriata triseriata*	
wood frog	*Rana sylvatica*	
zig-zag salamander	*Plethodon dorsalis dorsalis*	

B3: Reptiles

Common Name	Scientific Name	Special Status
timber rattlesnake	*Crotalus horridus*	State Endangered
rough green snake	*Opheodrys aestivus*	State Species of Concern
eastern box turtle	*Terrapene carolina carolina*	State Species of Concern
banded water snake	*Nerodia sipedon*	
black kingsnake	*Lampropeltis getula nigra*	
black rat snake	*Elaphe obsoleta obsoleta*	
common map turtle	*Graptemys geographic*	
common musk turtle	*Sternotherus odoratus*	
common snapping turtle	*Chelydra serpentina serpentina*	
eastern garter snake	*Thamnophis sirtalis sirtalis*	
eastern hognose snake	*Heterodon platirhinos*	
five-lined skink	*Eumeces fasciatus*	
midland brown snake	*Stoeria dekayi wrightorum*	
midland painted turtle	*Chrysemys picta marginata*	
midwest worm snake	*Carphophis amoenua helenae*	
North American racer	*Coluber constrictor*	
northern copperhead	*Agkistrodon contortrix mokasen*	
northern fence lizard	*Sceloporus udulatus hyacinthinus*	
northern redbellied snake	*Stoeria occipitomaculata*	
northern ringneck snake	*Diadophis puncatus edwardsi*	
prairie kingsnake	*Lampropeltis calligaster calligaster*	
red-eared slider	*Trachemys scripta elegans*	
western earth snake	*Virginia valeriae elegans*	

B4: Fish

Common Name	Scientific Name	Special Status
bigmouth buffalo	*Ictiobus cyprineilus*	
black bullhead	*Ictalurus melas*	
black crappie	*Pomoxis nigromaculatus*	
blacknose dace	*Rhinchthys atratulus*	
blackside darter	*Percina maculata*	
blackstripe topminnow	*Fundulus notatus*	
bluegill	*Lepomis macrochiris*	
bluntnose minnow	*Pimephales notatus*	
bowfin	*Amia calva*	
brook silverside	*Ladidesthes sicculus*	
brown bullhead	*Ictalurus nebulosus*	
carp	*Cyprinus carpio*	
central stoneroller	*Campostoma anomalum*	
channel catfish	*Ictalurus punctatus*	
creek chub	*Semotilis atromaculatus*	
creek chubsucker	*Erimyzon oblongus*	
dusky darter	*Percina sciera*	
fantail darter	*Etheostoma flabellare*	
flathead catfish	*Pylodictus olivaris*	
gizzard shad	*Dorosoma cepedianum*	
golden redhorse	*Moxostoma erythrurum*	
golden shiner	*Notemigonus chrysoleucas*	
grass pickerel	*Esox americanus*	
green sunfish	*Lepomis cyanellus*	
johnny darter	*Etheostoma nigrum*	
largemouth bass	*Micropterus salmoides*	
longear sunfish	*Lepomis mega lotus*	
longnose gar	*Lepisosteus oculatus*	
mottled sculpin	*Cottus bairdi*	
northern hog sucker	*Hypentelium nigricans*	
northern pike	*Esox lucius*	
orangethroat darter	*Etheostoma spectabile*	
paddlefish	*Polyodon spathula*	
redear sunfish	*Lepomis microlophus*	
redfin shiner	*Notropis umbratilus*	
ribbon shiner	*Notropis fumeus*	
silverjaw minnow	*Ericymba buccata*	
slough darter	*Etheostoma gracile*	
southern redbelly dace	*Phoxinus erythrogaster*	
spotfin shiner	*Notropis spilopterus*	
spotted sucker	*Minytrema melanops*	
steelcolor shiner	*Notropis whipplei*	
striped shiner	*Notropis chrysocephalus*	
walleye	*Stizostedion vitreum*	
warmouth	*Lepomis gulosus*	
white bass	*Morone chrysops*	
white crappie	*Pomoxis annularis*	
white sucker	*Catostomus commersoni*	
yellow bullhead	*Ictalurus natalis*	
yellow perch	*Perca flavescens*	

B5: Mussels

Common Name	Scientific Name	Special Status
Threeridge	*Amblema plicata*	
Fatmucket	*Lampsilis siliquoidea*	
Yellow sandshell	*Lampsilis teres*	
Washboard	*Megalonaias nervosa*	
Pink heelsplitter	*Potamilus alatus*	
Giant floater	*Pyganodon grandis*	
Mapleleaf	*Quadrula quadrula*	
Pistolgrip	*Tritogonia verrucosa*	
Paper pondshell	*Utterbackia imbesillis*	
Asian clam	*Corbicula fluminea*	

B6: Birds

Common Name	Scientific Name	Special Status
cerulean warbler*	*Dendroica cerulea*	State Endangered
Henslow's sparrow**	*Ammodramus henslowii*	State Endangered
king rail**	*Rallus elegans*	State Endangered
loggerhead shrike**	*Lanius ludovicianus*	State Endangered
osprey**	*Pandion haliaetus*	State Endangered
Virginia rail**	*Rallus limicola*	State Endangered
yellow-crowned night heron**	*Nycticorax violaceus*	State Endangered
bald eagle*	*Haliaeetus leucocephalus*	State Species of Concern
black-and-white warbler*	*Miniotilta varia*	State Species of Concern
broad-winged hawk**	*Buteo platypterus*	State Species of Concern
hooded warbler*	*Wilsonia citrina*	State Species of Concern
northern bobwhite	*Colinus virginianus*	State Species of Concern
ruffed grouse	*Bonasa umbellus*	State Endangered
sharp-shinned hawk**	*Accipiter striatus*	State Species of Concern
whip-poor-will*	*Caprimulgus vociferous*	State Species of Concern
worm-eating warbler*	*Helmitheros vermivorus*	State Species of Concern
acadian flycatcher	*Empidonax virescens*	
American bittern	*Botaurus lentiginosus*	State Species of Concern
American black duck	*Anas rubripes*	
American coot	*Fulica americana*	
American crow	*Corvus branchyrhynchos*	
American goldfinch	*Carduelis tristis*	
American kestrel	*Falco sparverius*	
American redstart	*Setophaga ruticilla*	
American robin	*Turdus migratorius*	
American tree sparrow	*Spizella arborea*	
American wigeon	*Anas americana*	
American woodcock	*Scolopax minor*	State Species of Concern
barn swallow	*Hirundo rustica*	
barred owl	*Strix varia*	
belted kingfisher	*Ceryle alcyon*	
black-billed cuckoo	*Coccyzus erythropthalmus*	
blackburnian warbler	*Dendroica fusca*	
black-throated green warbler	*Dendroica virens*	
blue jay	*Cyanocitta cristata*	
blue-gray gnatcatcher	*Polioptila caerulea*	
blue-winged teal	*Anas discors*	
blue-winged warbler	*Vermivora pinus*	
Bonaparte's gull	*Larus philadelphia*	
Brewer's blackbird	*Euphagus cyanocephalus*	
brown creeper	*Certhia americana*	
brown thrasher	*Toxostoma rufum*	
brown-headed cowbird	*Molothrus ater*	
bufflehead	*Bucephala albeola*	
Canada goose	*Branta canadensis*	
canvasback	*Aythya valisineria*	
Cape May warbler	*Dendroica tigrina*	
Carolina chickadee	*Parus carolinensis*	
Carolina wren	*Thryothorus ludovicianus*	
**Documented during 2005 survey.*		
***Not documented during 2005 survey, but documented at other times or is likely to occur on NSA Crane.*		

Common Name	Scientific Name	Special Status
cedar waxwing	*Bombycilla cedrorum*	
chestnut-sided warbler	*Dendroica pensylvanica*	
chimney swift	*Chaetura pelagica*	
chipping sparrow	*Spizella passerina*	
chuck-will's-widow	*Caprimulgus carolinensis*	
cliff swallow	*Hirundo pyrrhonota*	
common goldeneye	*Bucephala clangula*	
common grackle	*Quiscalus quiscula*	
common loon	*Gavia immer*	
common merganser	*Mergus merganser*	
common nighthawk	*Chordeiles minor*	
common snipe	*Gallinago gallinago*	
common yellowthroat	*Geothlypis trichas*	
Cooper's hawk	*Accipiter cooperii*	
dark-eyed junco	*Junco hyemalis*	
downy woodpecker	*Picoides pubescens*	
eastern bluebird	*Sialia sialis*	
eastern kingbird	*Tyrannus tyrannus*	
eastern meadowlark	*Sturnella magna*	
eastern phoebe	*Sayornis phoebe*	
eastern screech-owl	*Otus asio*	
eastern wood-pewee	*Contopus virens*	
European starling	*Sturnus vulgaris*	
evening grosbeak	*Coccothraustes vespertinus*	
field sparrow	*Spizella pusilla*	
fox sparrow	*Passerella iliaca*	
gadwall	*Anas strepera*	
golden eagle	*Aquila chrysaetos*	
golden-crowned kinglet	*Regulus satrapa*	
golden-winged warbler	*Vermivora chrysoptera*	
gray catbird	*Dumetalla carolinensis*	
gray-cheeked thrush	*Catharus minimus*	
great blue heron	*Ardea herodias*	
great crested flycatcher	*Myiarchus crinitus*	
great egret	*Casmerodius albus*	
great horned owl	*Bubo virginianus*	
greater scaup	*Aythya marila*	
greater yellowlegs	*Tringa melanoleuca*	
green heron	*Butorides striatus*	
green-winged teal	*Anas crecca*	
hairy woodpecker	*Picoides villosus*	
hermit thrush	*Catharus guttatus*	
herring gull	*Larus argentatus*	
hooded merganser	*Lophodytes cucullatus*	
horned grebe	*Podiceps auritus*	
horned lark	*Eremophila alpestris*	
house finch	*Carpodacus mexicanus*	
house sparrow	*Passer domesticus*	

Common Name	Scientific Name	Special Status
house wren	*Troglodytes aedon*	
indigo bunting	*Passerina cyanea*	
Kentucky warbler	*Oporornis formosus*	
killdeer	*Charadrius vociferus*	
king eider	*Somateria spectabilis*	
Le Conte's sparrow	*Ammodramus leconteii*	
least flycatcher	*Empidonax minimus*	
lesser scaup	*Aythya affinis*	
Lincoln's sparrow	*Melospiza lincolnii*	
little blue heron	*Egretta caerulea*	
long-eared owl	*Asio otus*	
Louisiana waterthrush	*Seiurus motacilla*	
magnolia warbler	*Dendroica magnolia*	
mallard	*Anas platyrhynchos*	
merlin	*Falco columbarius*	
mourning dove	*Zenaida macroura*	
Nashville warbler	*Vermivora ruficapilla*	
northern bobwhite	*Colinus virginianus*	
northern cardinal	*Cardinalis cardinalis*	
northern flicker	*Colaptes auratus*	
northern harrier	*Circus cyaneus*	
northern mockingbird	*Mimus polyglottos*	
northern oriole	*Icterus galbula*	
northern parula	*Parula americana*	
northern pintail	*Anas acuta*	
northern rough-winged swallow	*Stelgidopteryx serrupennis*	
northern saw-whet owl	*Aegloius acadicus*	
northern shoveler	*Anas clypeata*	
northern waterthrush	*Seiurus noveboracensis*	
orange-crowned warbler	*Vermivora celata*	
orchard oriole	*Icterus spurious*	
ovenbird	*Seiurus aurocapillus*	
palm warbler	*Dendroica palmarum*	
peregrine falcon	*Falco peregrinus*	
Philidelphia vireo	*Vireo philadelphicus*	
pied-billed grebe	*Podilymbus podiceps*	
pileated woodpecker	*Dryocopus pileatus*	
pine siskin	*Carduelis pinus*	
pine warbler	*Dendroica pinus*	
prairie warbler	*Dendroica discolor*	
prothonotary warbler	*Protonotaria citrea*	
purple finch	*Carpodacus purpureus*	
purple martin	*Progne subis*	
red crossbill	*Loxia curvirostra*	
red-bellied woodpecker	*Melanerpes carolinus*	
red-breasted merganser	*Mergus serrator*	
red-breasted nuthatch	*Sitta canadensis*	
red-eyed vireo	*Vireo olivaceus*	
redhead	*Aythya americana*	

Common Name	Scientific Name	Special Status
red-headed woodpecker	*Melanerpes erythrocephalus*	
red-tailed hawk	*Buteo jamaicensis*	
red-throated loon	*Gavia stellata*	
red-winged blackbird	*Agelaius phoeniceus*	
ring-billed gull	*Larus delawarensis*	
ring-necked duck	*Aythya collaris*	
rock dove	*Columba livia*	
rose-breasted grosbeak	*Pheucticus ludovicianus*	
rough-legged hawk	*Buteo lagopus*	
ruby-crowned kinglet	*Regulus calendula*	
ruby-throated hummingbird	*Archilochus colubris*	
ruddy duck	*Oxyura jamaicensis*	
ruffed grouse	*Bonasa umbellus*	
rufous-sided towhee	*Pipilo erythrophthalmus*	
rusty blackbird	*Euphagus carolinus*	
sandhill crane	*Grus canadensis*	
savannah sparrow	*Passerculus sandwichensis*	
scarlet tanager	*Piranga olivacea*	
sedge wren	*Cistothorus platensis*	
snow goose	*Chen caerulescens*	
solitary sandpiper	*Tringa solitaria*	
solitary vireo	*Vireo solitarius*	
song sparrow	*Melospiza melodia*	
sora	*Porzana carolina*	
summer tanager	*Piranga rubra*	
Swainson's thrush	*Catharus ustulatus*	
swamp sparrow	*Melospiza georgiana*	
Tennessee warbler	*Vermivora peregrina*	
tree swallow	*Tachycineta bicolor*	
tufted titmouse	*Parus bicolor*	
turkey vulture	*Cathartes aura*	
veery	*Catharus fuscescens*	
vesper sparrow	*Pooecetes gramineus*	
warbling vireo	*Vireo gilvus*	
white-breasted nuthatch	*Sitta carolinensis*	
white-crowned sparrow	*Zonotrichia leucophrys*	
white-eyed vireo	*Vireo griseus*	
white-throated sparrow	*Zonotrichia albicollis*	
wild turkey	*Meleagris gallopavo*	
willow flycatcher	*Empidonax traillii*	
Wilson's warbler	*Wilsonia pusilla*	
winter wren	*Troglodytes troglodytes*	
wood duck	*Aix sponsa*	
wood thrush	*Hylocichla mustelina*	
yellow warbler	*Dendroica petechia*	
yellow-bellied sapsucker	*Sphyrapicus varius*	
yellow-billed cuckoo	*Coccyzus americanus*	
yellow-breasted chat	*Icteria virens*	
yellow-rumped warbler	*Dendroica coronata*	
yellow-throated vireo	*Vireo flavifrons*	
yellow-throated warbler	*Dendroica dominica*	

Appendix C: Programmed Stand Harvest Schedule

Compartment 1	
Stand ID	Acreage
103	115
106	19
109	42
113	12
122	116
135	27
139	14
140	34
148	21
150	14
151	19
152	11
156	19
158	41
161	9
164	63
165	40
169	81
172	20
173	85
174	9
175	68
176	6
102	15
105	57
107	65
108	34
110	68
112	23
114	31
116	15
117	10
119	25
121	110
126	134
128	40
129	14
134	84
136	53
138	59
145	39
147	5
149	29
155	50
157	28
160	27
170	11
total stands=47	
total acres=1911	

Compartment 2	
Stand ID	Acreage
201	24
202	77
203	38
211	60
230	114
248	40
249	17
250	26
257	68
261	125
263	45
276	11
Total stands= 12	
Total acres=645	

Compartment 3	
Stand ID	Acreage
301	17
310	37
317	51
323	27
324	11
330	61
344	34
345	104
358	30
363	15
368	134
379	10
Total stands=12	
Total Acre=531	

Compartment 4	
Stand ID	Acreage
404	16
405	57
406	27
408	44
410	79
411	8
412	155
418	66
420	38
422	28
423	58
424	72
426	84
429	66
434	83
443	44
461	35
407	40
409	9
414	48
416	26
417	23
433	42
436	106
439	16
441	42
446	113
447	28
448	32
450	29
453	19
456	114
457	41
460	59
Total stands =34	
Total acres=1747	

Compartment 5	
Stand ID	Acreage
504	50
508	64
511	39
515	91
518	62
520	294
527	28
544	48
569	83
502	34
517	49
523	45
530	31
536	24
537	30
545	29
552	36
566	15
567	19
568	86
Total stands=20	
Total acres= 1157	

Compartment 6	
Stand ID	Acreage
614	46
618	63
621	54
622	86
623	64
636	69
645	45
646	73
647	23
Total stands=9	
Total Acres=523	

Compartment 7	
Stand ID	Acreage
715	50
717	10
718	29
720	77
756	9
762	33
706	22
711	119
714	159
730	27
731	54
732	25
735	88
739	178
741	43
742	7
744	20
745	34
746	94
749	94
750	27
752	83
764	9
774	70
Total stands=24	
Total acres= 1361	

Compartment 8	
Stand ID	Acreage
809	33
810	11
811	34
812	21
813	51
814	24
820	49
822	39
829	248
832	36
834	164
843	19
Total stands= 12	
Total acres= 729	

Compartment 9	
Stand ID	Acreage
905	20
906	31
907	17
911	78
918	102
920	65
922	24
923	24
927	32
930	29
934	91
946	85
952	37
959	62
Total stands=14	
Total acres= 697	

Compartment 10
None Scheduled
Treat Callery Pear

Compartment 11
None Scheduled
Treat Callery Pear

Compartment 12	
Stand ID	Acreage
1202	46
1205	142
1207	120
1208	15
1215	16
Total stands=5	
Total acres=339	

Compartment 13	
Stand ID	Acreage
1305	73
1306	69
1307	86
1308	15
1311	118
1315	41
1319	39
1322	43
1323	62
1327	37
1329	49
1330	68
1331	44
1332	41
1337	23
1338	92
1343	40
1344	59
1349	30
1350	165
1351	81
Total stands=20	
Total acres=1275	

Compartment 14	
Stand ID	Acreage
1404	64
1406	16
1415	30
1416	121
1424	56
1425	70
1430	68
1436	10
1439	16
1440	67
Total stands=10	
Total acres=518	

Compartmant 15	
Stand ID	Acreage
1514	50
1537	103
1538	16
1541	19
Total stands=4	
Total acres=188	

Compartment 16	
Stand ID	Acreage
1609	20
1623	94
1638	65
1640	10
1641	119
1645	24
1646	28
1649	78
1652	43
1610	30
1611	61
1614	30
1620	64
1626	42
1627	57
1630	46
1644	78
1648	20
1658	66
1659	19
Total stands=20	
Total acres=994	

Compartment 17	
Stand ID	Acreage
1702	150
1703	38
1716	67
1721	66
1723	21
1724	45
1726	16
1727	10
1730	39
1739	73
1740	27
1741	65
1742	8
1743	9
1744	78
1751	153
Total stands=16	
Total acres=865	

Compartment 18	
Stand ID	Acreage
1821	129
1823	36
1824	29
1831	36
1832	172
1851	84
Total stands=6	
Total acres=486	

Compartment 19	
Stand ID	Acreage
1914	13
1915	11
1916	7
1936	77
1937	9
1947	25
1948	56
1951	68
1960	51
1962	48
1966	49
1968	63
1974	89
1975	17
1976	69
1979	52
Total stands=16	
Total acres=704	

Compartment 20	
Stand ID	Acreage
2002	57
2003	25
2032	22
2036	82
2043	39
2046	48
2048	30
2052	64
2053	29
2055	14
2056	73
2057	50
2063	70
2065	19
2010	153
2011	59
2012	92
2017	14
2023	24
2028	36
2033	32
2034	32
2037	58
2040	114
2041	31
2044	18
2051	15
2058	75
2064	18
Total stands=29	
Total acres=1393	

Total All Compartments = 16,063 Acres

Appendix D: Critical Habitat Issues

Critical habitat is defined in the Endangered Species Act as a specific geographic area that contains features essential for the conservation of a threatened or endangered species, and that may require special management and/or protection. Critical habitat may include areas not currently occupied by a species at the time of listing status designation, but that will be needed for species recovery.

When a species is listed as federally threatened or endangered, the Secretary of the Interior is required to designate habitat that is considered to be of critical importance. NSA Crane currently contains no officially designated critical habitat. The federally endangered Indiana bat and federally threatened northern long-eared bat have been documented on the installation. The closest designated critical habitat for Indiana bat near NSA Crane is located at Ray's Cave in Greene County, Indiana, approximately 9 miles north of the installation. No critical habitat has been designated for the northern long-eared bat.

In 2004, the Endangered Species Act was revised by the National Defense Authorization Act to recognize the role Integrated Natural Resource Management Plans have in the conservation of threatened and endangered species. Specifically, the use of INRMPs on DoD lands may preclude the need to designate critical habitat on military lands. Section 4(a)(3) of the Endangered Species Act, as revised, states:

> *"The Secretary [of the Interior] shall not designate as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an integrated natural resources management plan prepared under Section 101 of the Sikes Act (16 U.S.C. 670a), if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation."*

Appendix E: Migratory Bird Management

The Migratory Bird Treaty Act of 1918 is the primary legislation in the United States to conserve migratory birds. The act prohibits the taking, killing, or possession of migratory birds unless authorized by regulation, and requires the Secretary of Defense to minimize, mitigate, and monitor the taking of birds during military activities. The act also requires the Secretary of the Interior, in consultation with the Secretary of Defense, to identify regulation that exempts the Armed Forces for the incidental taking of migratory birds during the taking of military activities.

Additionally, the Sikes Act Improvement Act, as amended, states:

> *"The Secretary of Defense in cooperation with the Secretary of the Interior and the appropriate state agency is authorized to carry out a program for the conservation, restoration and management of migratory game birds on military installations, including the issuance of special hunting permits and the collection of fees therefore, in accordance with an integrated natural resources management plan mutually agreed upon by the Secretary of Defense, the Secretary of the Interior and the appropriate state agency: Provided, That possession of a special permit for hunting migratory game birds issued pursuant to this subchapter shall not relieve the permittee of the requirements of the Migratory Bird Hunting Stamp Act as amended [16 U.S.C. 718 et seq.] nor of the requirements pertaining to state law set forth in Public Law 85-337."*

NSA Crane allows hunting for some species of migratory game birds (such as waterfowl, woodcock, and mourning dove). Waterfowl hunters must obtain a NSA Crane Small Game Permit, Indiana Hunting License, Indiana Migratory Waterfowl Stamp, and for hunters 16 years of age and older, a Federal Duck Stamp.

Department of Defense lands such as NSA Crane represent a system of important habitats stopover points for neotropical migratory birds. As such, the Department of Defense promoted a policy to develop and support a partnership role with Partner in Flight organizations. One important component of partnerships to conserve and monitor neotropical birds on NSA Crane is the MAPS (Monitoring Avian Productivity and Survivorship) program. The MAPS program was initiated by the Institute for Bird Populations in 1989 to provide long-term demographic data on birds at multiple spatial scales, and is in part funded by Department of Defense legacy funds. The MAPS program at NSA Crane is a component of the overall natural resources management of the installation, and will continue in the future dependent on available funding sources.

Appendix F: Comments Issued on Draft INRMP and Errata Tables

Prior to the issuance of the final INRMP, a draft version of the document was provided internally to various NSA Crane Command units, and externally to the U.S. Fish and Wildlife Service Bloomington Ecological Service Field Office and the Indiana Department of Natural Resources, Division of Fish and Wildlife. These organizations were asked to review the draft INRMP and to provide comments. Comments were received from the Crane Explosives Safety Department, the Indiana Department of Natural Resources, and the U.S. Fish and Wildlife Service. The following tables document comments received by the organizations and NSA Crane's responses. Page and section numbers in the "Comment Location" column reference the comment's location in the final INRMP.

F1: Comments Provided by Crane Explosives Safety Department

Comment Location	Comment	NSA Crane Response	Change Made
Page 4: Section 1.5.1.4, 4th Bullet	Recommend delete “and industrial” ; and delete “and chemical engineering”. Explosives Safety does not provide those services for NSA Crane.	Concur.	Yes
Page 8: Section 1.7	Suggest change CAAA, last sentence, to delete NSWC Crane as the reference.	This is a correct reference to NSWC’s internet site: http://www.crane.navy.mil/whoweare/	No
Page 10: Section 1.7.2.2, 1st Paragraph	Recommend delete rest of paragraph after 4th sentence (I’m not aware that the Navy is currently reviewing it’s policy; perhaps this is old language).	Concur.	Yes
Page 15: Section 2.1.1, 2nd Paragraph	Recommend delete rest of paragraph after 2nd sentence. We’re not currently doing sonar, transducer, etc., work at Glendora.	Concur.	Yes
Page 19: Section 2.1.2	Suggest might want to add the Lanes/TAMs training areas on-base.	Referred to as tactical training routes under Golden Cargo Exercises and shown on figure 2.4. I believe that Lanes/TAMs are specific exercises that are conducted on the tactical training routes.	No
Page 21: Section 2.1.4.1	The activities/focus areas listed are relevant to NSWC Crane only; paragraph states NSA Crane.	Concur, added “by NSWC Crane” after NSA Crane in 1st sentence	Yes
Page 67: 4th Paragraph	Section contains old language, suggest change as follows: “A 1999 change to DODINST 6055.9, Explosives Safety Standards, restricts personnel exposure within explosives areas. The change stated, in part, that personnel should be afforded protection from explosives safety arcs associated with explosives containing facilities based on public traffic route criteria tables. Hunting and fishing is allowed as a wildlife population management tool in accordance with NAVSEA OP 5, Volume 1.”	Concur.	Yes
Page 69: Section 3.9.2.3	Suggest deleting Section "Special Events".	Concur, sections renumbered accordingly.	Yes

F2: Comments Provided by the Indiana Department of Natural Resources, Division of Fish and Wildlife

Comment Location	Comment	NSA Crane Response	Change Made
Section 2.3.6.5 to 2.3.6.7; Section 4.2.9 and 4.2.10	We do not feel it is appropriate to include native "nuisance" species with invasive exotics on p. 57. For beavers and coyotes, specific examples of how they are "nuisance" species on NSA Crane are not provided. We would submit that in a large natural area like Crane, beavers and coyotes are unlikely to be a true nuisance, as they may be in other, more heavily managed situations (managed wetlands or livestock production areas).	Sections on beavers and Canada goose have been moved to new sections 2.3.6.7 and 4.2.10, "Nuisance Animals". Reference to coyotes as nuisance animals have been removed; however, reference to beavers as nuisance animals have been retained due to potential impacts to infrastructure (such as roads) that may result due	Yes
Page 38: Section 2.3.1.2	Page 38, 2nd paragraph from the bottom: Plan mentions two special status small mammals documented during 2005 survey: smoky shrew and pygmy shrew. We believe you are referring to our state classification of "special concern" here. If so, there are two other state special concern species on NSA Crane: bobcat and river otter. Neither were documented during the 2005 survey but they occur there. An otter was sighted by a duck hunter in 2002 and a NSA Crane employee in 2008 in Lake Gallimore and another was sighted in Boggs Creek above the lake in 2005.	Bobcat and river otter have been added as state-listed special concern species to Table 2.5 and Appendix B1. Information about observations of these species on NSA Crane have been added to section 2.3.1.2.	Yes
Page 59: Section 2.3.6.7	The last line of the second paragraph under "Canada Goose" is probably not true, and at any rate is not contained in the citation listed. The assertion "Geese can rapidly denude lawns, turning them into barren, dirt areas" is not supported anywhere in INDNR 2009b. Division staff have seen many areas that are covered with goose feces, but have never seen any grassy areas "denuded" by these birds. We understand the difficulty due to security concerns, but public goose hunting, particularly during the September season, may help to reduce the local breeding population. More intensive hunting	Previous link to INDNR 2009b reference was incorrect. Sentence regarding denuding lawns has been removed, although the correct reference link (http://www.in.gov/dnr/fishwild/2996.htm) does make reference to this act.	Yes
Page 78: Section 4.2.2	…in the document (Section 4.2.2, "Furbearers"), it is asserted that no predator control program is planned, "nor is the need for such a program anticipated." If this is the case, why are coyotes listed under "nuisance" species?	Sentence referred to has been removed. While there technically is no formal predator control program, individual animals that are presenting problems and that are characterized as nuisance animals may potentially be removed by a contract	Yes
Page 87: *"Trapping and Relocation"* Paragraph	On page 87 under "Trapping and relocation", the Division is unaware that any meat from killed Canada geese has been donated due to food safety protocols.	Concur, sentence referred to has been removed.	Yes
Global	Regarding Canada geese, the goose management community no longer uses the term "resident" to describe temperate-breeding Canada geese, because there is a large body of work that shows convincingly that these birds migrate more that was once believed. Birds banded as breeders in Indiana have been harvested in 31 states and provinces.	Concur, change made throughout the document.	Yes
Global	The common name for *Perimyotis subflavus* has been changed from eastern pipistrelle to tri-colored bat.	Concur, change made throughout the document.	Yes

F3: Comments Provided by the U.S. Fish and Wildlife Service, Bloomington Ecological Services Field Office

Comment Location	Comment	NSA Crane Response	Change Made
Page 3: 4th Bullet	Omit phrase: "…and assisting in determining whether such habitats should be designated as critical habitats…" It is the sole responsibility of the USFWS to determine whether or not to designate critical habitat as defined in the ESA.	Concur, phrase removed.	Yes
Page 5: Section 1.5.3.1, 1st Paragraph	Add "an Ecological Services Field Office".	Concur.	Yes
Page 5: Section 1.5.3.1, 2nd Paragraph	Add information regarding the USFWS's role in fisheries management through the Service's Carterville Fishery Resources Office. Likewise, the Service also has oversight responsibilities for game and non-game migratory birds under the Migratory Bird Treaty Act.	Concur, information added.	Yes
Page 19: Section 2.1.2, 2nd Paragraph	This would require a separate Section 7 consultation with the USFWS.	Concur, added sentence noting potential need for consultation with USFWS on page 22, section 2.1.4.2.	Yes
Page 22: Section 2.1.4.2, 3rd Sentence	As currently worded (i.e., "any proposed training"), this statement is a bit too broad and premature. Conflicts with Indiana bats or other natural resources could still arise. Until an analysis has been conducted to identify potential conflicts, you really don't know with certainty what can be employed.	Concur, changed the word "can" to "would".	Yes
Page 38: Section 2.3.1.2, 1st Paragraph	However, Ray's Cave in Greene County is approximately 9 miles north of NSA Crane and contains the largest known winter population of Indiana Bats in the species' range (77,000 bats in 2007; Appendix D). Indiana Bats are known to forage at least 10 miles from major hibernacula during the fall swarm (USFWS 2007 - IBat Draft Rec. Plan).	Concur, inserted comment after first sentence.	Yes
Page 38: Section 2.3.1.2, 1st Paragraph	Any proposed timber harvests in the forested area that occur within a 10-mile radius of Ray's Cave (i.e., some areas north of Lake Greenwood) should be further delayed until the bats have completed their fall swarm and have entered hibernation. To avoid the potential for take, we recommend that NSA Crane only allow timber harvests within 10 miles of Ray's Cave to occur from 15 November through 15 March.	Concur, inserted language regarding protocols for harvesting timber in forested portions of Lake Greenwood within 10 mile buffer of Ray's Cave to Section 4.1.2 (paragraph starting with "Any future timber sales..." on page 76).	Yes
Page 43: Section 2.3.2.1, 2nd Bulleted List, *Cliff, Cave, and Pit Cave Communities;* Page 104, Section 4.8.1.4	…the draft INRMP does not address how NSA Crane manages human access at its known caves. Given the magnitude of the new threat, White-Nose Syndrome (WNS), poses to bat species, and the potential for human-assisted transmission, we feel it is appropriate for WNS and cave management to be more clearly and explicitly addressed in the INRMP. WNS could be viewed and managed as yet another invasive species in the INRMP. To gain a better understanding of how other agencies and conservation groups in Indiana are responding to this emerging bat disease, we suggest you visit the following websites...	Concur, language regarding cave access procedures added to Section 4.8.1.4 (2nd Paragraph).	Yes
Page 56	Change maculatu to maculatum	Concur.	Yes

Comment Location	Comment	NSA Crane Response	Change Made
Page 57	Change salmoide to salmoides	Concur.	Yes
Page 58: Section 2.3.6.6, 4th Paragraph	Lawrence and Orange Counties have recently been added to the list (May 2009).	Concur.	Yes
Page 63: Section 3.4, 2nd Sentence	Change Skies to Sikes.	Concur.	Yes
Page 64: Section 3.6, 3rd Paragraph, 3rd Sentence	Insert "may" ("This is because those clearings *may* …").	Concur.	Yes
Page 72: Section 4.1, 2nd Sentence	Insert "(See Appendix D)".	Concur.	Yes
Page 72: Section 4.1, 1st Bullet	Insert "...and promote recovery of...".	Concur.	Yes
Page 72: Section 4.1, 2nd Bullet	Insert "…federally...".	Concur.	Yes
Page 72: Section 4.1, 3rd Bullet	Insert "…with USFWS on any action that may affect a federally listed species".	Concur.	Yes
Page 72: Section 4.1, 4th Bullet	Insert "…for any project that will result in a taking of a federally listed species or its habitat".	Concur.	Yes
Page 72: Section 4.1, 3rd Paragraph	Crane's ESMP is 10 years old and ideally should be updated along with this current INRMP revision. In contrast to what the ESMP states, the Service does recommend that some minimum level of monitoring continue at NSA Crane on an on-going basis (e.g., near Lake Gallimore) and/or where significant habitat modifications have occurred on base. Most DoD installations with Indiana bats have committed to monitoring maternity colonies via periodic mist net surveys, radio-tracking, and emergence counts at identified roost trees. Without some commitment to monitoring, the stated goal of adaptive management is not possible.	The new INRMP is intended to replace both the previous INRMP and ESMP. All federal legal requirements regarding endangered species will be addressed in the new INRMP. Added the following sentence after the first sentence: "However, surveys for Indiana bats were conducted in 2005 (INDNR, 2005b), and funding has been requested for additional surveys in 2014 (see Appendix A)".	Yes
Page 73: 1st Full Paragraph, Last Sentence	Are these the mussel species listed in Appendix B5?	Yes. Added "(see Appendix B5)" after sentence.	Yes
Page 74: 1st Bullet	Remove phrase "….particularly in upland areas".	Concur.	Yes
Page 75	Should there be a new heading here.	Added new section heading 4.1.2, "Indiana Bat Forest Management".	Yes
Section 4.2.7	Was the USFWS Carterville Fisheries Resource Office given an opportunity to review the Draft INRMP?	Yes, and they declined.	No
Page 84: Section 4.2.9	A large number of pesticides are mentioned in this section as potential means of controlling invasive/exotic species. Does Crane have an Integrated Pesticide Management Plan?	NSA Crane has a pest management plan (Williams, 1999), and is currently in process of being revised.	No
Page 84: Section 4.2.9	You should add a statement in this section to the affect that NSA Crane will consult with the USFWS on all chemicals that may affect Indiana bats and/or their habitat and/or drinking water supply or prey.	Concur, language regarding consultation with USFWS for chemical pesticide use added.	Yes

Comment Location	Comment	NSA Crane Response	Change Made
Page 84: Section 4.2.9	Control measures/options listed are generic. What are Crane's specific plans to address these species? What (if any) of these measures has Crane already employed? Which of these measures does Crane plan to use? All of them, a subset of these, some combination?	NSA Crane's Pest Management Plan (Williams, 2009) is currently under review and revision. Which control measure that may be employed would depend on the particular circumstances and which measure may be most appropriate. Section 4.2.9 (and subsections) has been revised to reflect more general language and remove reference to specific chemicals.	Yes
Page 87: 1st Sentence under *"Beaver"*	Awkward wording.	Concur, wording changed.	Yes
Page 89: Section 4.3.1, 2nd Paragraph, Last Sentence	What is the size range of these group selection cuts? Can this marking guide be added as an appendix?	Sentence removed; NSA Crane follows forest management guidelines for Indiana bat as described in Section 4.1.2.	Yes
Page 89: Section 4.3.1, 5th Paragraph, Last Sentence	Add phrase: "The USFWS will be consulted on such timber harvests on a case-by-case basis".	Concur, phrase added.	Yes
Page 92: Section 4.3.8 Heading	Change from "Reforestation" to "Reforestation and Prescribed Burning".	Concur, change made.	Yes
Page 92: Section 4.3.8, 3rd Paragraph	Please elaborate. Will the burns be conducted both before and after timber harvest? On average, how many burns do you anticipate a timber sale area will receive pre and post harvest? What is the timing of these burns in relation to the timber harvest? How will these fires affect the abundance and longevity of snags being left in the stand for bat roosting habitat? Will any measure be taken to prevent large/high quality snags from burning?	Replaced the third and fourth paragraphs of section 4.3.8 from the draft INRMP with new language in current 3rd, 4th, and 5th paragraphs.	Yes
Page 93: Section 4.3.9, 5th Paragraph	Add Lawrence and Orange Counties.	Concur, additional counties added.	Yes
Page 94: Section 4.4	Will prescribed fire be used to maintain these grasslands? If so, please describe.	Added additional language to end of first paragraph: "There are no plans to replace existing forest vegetation with non-forest vegetation. Native grasses will be burned every 3 to 5 years following the same guidelines used for prescribed burns in forest vegetation. These burns will be conducted prior to avoid disturbance of nesting birds".	Yes

Comment Location	Comment	NSA Crane Response	Change Made
Page 95: Section 4.5	Highlighted specific chemicals used for control.	All reference to specific chemicals removed, as well as individual species sections. Which control measure that may be employed would depend on the particular circumstances and which measure may be most appropriate. Section has been revised to reflect more general language and remove reference to specific control measures.	Yes
Page 105: Section 4.9.2.4	Is this the old NR building or the current one?	Removed information regarding Salem Nature Trail.	Yes
Page 113: Section 6.0 (Andrews, 1999 Reference)	This (Endangered Species Management Plan) needs to be updated to incorporate new Indiana bat surveys and records since 1999 and new USFWS guidance.	The new INRMP is intended to replace both the previous INRMP and ESMP. All federal legal requirements regarding endangered species will be addressed in the new INRMP. Required portions are incorporated within the new INRMP.	No
Page A3: Appendix B1	Change eastern pipestrelle to tri-colored bat; change pipestrellus subflavus to perimyotis subflavus.	Concur, changes made.	Yes
Page A19: Appendix D, 2nd Paragraph, Last Sentence	Change to "…approximately 9 miles north of the installation."	Concur, change made.	Yes
Global	Scientific name for Northern Bat is Myotis septentrionalis.	Concur.	Yes
Global	New common name for Eastern Pipestrelle is Tri-Colored Bat.	Concur.	Yes

Appendix G: NSA CRANE Natural Resources Metrics

(Updated Annually as part of Annual INRMP Review)

Appendix H: Insect Species of NSA Crane

Order Blattodea: cockroaches, termites

Common Name	Scientific Name	Special Status
German cockroach	*Blatella germanica*	indigenous, common in US
Oriental cockroach	*Blatta orientalis*	exotic (from Asia), common in US
Western wood cockroach	*Parcoblatta americana*	exotic (from W US), rare in IN
American cockroach	*Periplaneta americana*	indigenous, common in US
Brown-banded cockroach	*Supella longipalpa*	exotic (from Africa), common in US

Order Coleoptera: beetles

Common Name	Scientific Name	Special Status
Striped Cucumber beetle	*Acalymma vittatum*	indigenous, common in US
Eyed Click beetle	*Alaus oculatus*	indigenous, common in E US
Ground beetle	*Amara* spp.	indigenous, common in US
Oak Timberworm beetle	*Arrhenodes minutus*	indigenous, common in US
Click beetle	*Authous brightwelli*	indigenous, common in E US
Texas beetle	*Brachypsectra fulva*	exotic (from W US), rare in IN
Metallic Wood-Boring beetle	*Buprestis* spp.	exotic (from SE US), rare in IN
Net-Winged beetle	*Calopteron terminale*	indigenous, common in US
Flathead Pine Heartwood Borer beetle	*Chalcophora virginiensis*	indigenous, common in NE US
Soldier beetle	*Chauliognathus pennsylvanicus*	indigenous, common in US
Green Ground beetle	*Chlaenius sericeus*	exotic (from tropics), common in US
Dogbane beetle	*Chrysochus auratus*	indigenous, common in E US
Seven-Spotted Lady beetle	*Coccinella septempunctata*	indigenous, common in US
California Lady beetle	*Coccinellini californica*	exotic (from CA), rare in IN
Nine-Spotted Lady beetle	*Cocinella septempunctata*	indigenous, common in US
Spotted Lady beetle	*Coleomegilla maculate*	indigenous, common in E US

Green June beetle	*Cotinis nitida*	indigenous, common in US
Red lady beetle	*Cycloneda munda*	indigenous, common in E US
Spotted Cucumber beetle	*Diabrotica undecimpunctata*	indigenous, common in US
June bug	*Diplotaxis moerens*	indigenous, common in US
Antelope beetle	*Dorcus parellulus*	indigenous, common in NE US
Eastern Hercules beetle	*Dynastes tityus*	exotic (from SE US), rare in IN
Water Scavenger beetle	*Enochrus* spp.	indigenous, common in US
Striped Blister beetle	*Epicauta vittata*	indigenous, common in US
Mexican Bean beetle	*Epilachna varivestis*	exotic (from SE US), common in US
Variable Lady beetle	*Exochomus marginipennis*	indigenous, common in US
Long-Horned Beetle	*Graphisurus fasciatus*	indigenous, common in E US
Asian multicolored lady beetle	*Harmonia axyridis*	exotic (from Asia), common in US
Ground beetle	*Harpalus pennsylvanicus*	indigenous, common in US
Ladybird beetle	*Hippodamia convergens*	indigenous, common in E US
Pales Weevil	*Hylobius pales*	indigenous, common in US
Pinching beetle	*Leucanus capreolus*	indigenous, common in NE US
Colorado Potato beetle	*Liptinotarsa decemlineata*	indigenous, common in US
Rose Chafer beetle	*Macrodactylus subspinosus*	indigenous, common in E US
Asiatic Ground beetle	*Maladera castanea*	exotic (from Asia), common in NE US
Micromalthid Beetle	*Micromalthus debilis*	indigenous, common in NE US
Northeastern Sawyer beetle	*Monochamus notatus*	indigenous, common in NE US
Southern Pine Sawyer beetle	*Monochamus titillator*	indigenous, common in US
Horned Passalus beetle	*Odontotaenius disjunctus*	indigenous, common in US
Hermit Flower beetle	*Osmoderma eremicola*	indigenous, common in US
Bark-Gnawing beetle	*Ostoma* spp.	indigenous, common in US
Grapevine beetle	*Pelidnota punctata*	indigenous, common in E US
Common Black Ground beetle	*Perostichus* spp.	indigenous, common in US
Big Dipper firefly	*Photinis pyralis*	indigenous, common in US
Firefly beetle	*Photuris pennsylvanicus*	indigenous, common in US
May beetle	*Phyllophaga* spp.	indigenous, common in US
June beetle	*Phyllophaga submucida*	indigenous, common in US

Spined Soldier beetle	*Podius* spp.	indigenous, common in US
Japanese beetle	*Popilla japonica*	exotic (from Japan), common in NE US
Pinching bug	*Pseudolucanus capreolus*	indigenous, common in E US
Ground beetle	*Pterostichus* spp.	indigenous, common in US
Firefly beetle	*Pyropyga* spp.	indigenous, common in US
Cocklebur weevil	*Rhodobaenus quidquedecimpunctatus*	indigenous, common in NE US
Ground beetle	*Scarites* spp.	indigenous, common in US
Silky Chafer beetle	*Serica perigonia*	exotic (from CA), rare in IN
Bark-gnawing beetle	*Temnochila mauritanicus*	indigenous, common in US
Yellow Mealworn beetle	*Tenebrio molitor*	indigenous, common in E US
Red Milkweed beetle	*Tetraopes tetrophthalmus*	indigenous, common in US

Order Diptera: true flies, crane flies, mosquitoes, midges, gnats

Common Name	Scientific Name	Special Status
Bee fly	*Anthrax analis*	indigenous, common in US
Tachinid Fly	*Archytas apicifer*	indigenous, common in US
Elongate Aphid fly	*Baccha elongata*	indigenous, common in N US
Crane fly	*Brachypremna dispellens*	indigenous, common in E US
Deer fly	*Chrysops callidus*	indigenous, common in US
Deer fly	*Chrysops* spp.	indigenous, common in US
Deer fly	*Chrysops vittatus*	indigenous, common in US
Long-legged fly	*Condylostylus* spp.	indigenous, common in US
Texan long-legged fly	*Condylostylus* spp.	indigenous, common in US
Wood-boring Crane fly	*Ctenophora apicata*	indigenous, common in NE US
Robber fly	*Diagmites neoternatus*	indigenous, common in E US
Robber fly	*Diogmites* spp.	indigenous, common in US
Dixid midge	*Dixella* spp.	indigenous, common in US
Long-Legged fly	*Dolichopus* spp.	indigenous, common in US
Bearded Robber fly	*Efferia pogonias*	indigenous, common in SE US
Robber fly	*Efferia* spp.	indigenous, common in US, especially in W

Dance fly	*Empis* spp.	indigenous, common in US
Horn fly	*Haematobia irritans*	indigenous, common in US
Crane fly	*Holorusia hespera*	indigenous, common in US
Greenbottle fly	*Lucilia sericata*	indigenous, common in US
House fly	*Musca domestica*	indigenous, common in US
Mydas fly	*Mydas clavatus*	indigenous, common in E US
Eastern Tree-hole mosquito	*Oclerotatus triseriatus*	indigenous, common in E US
Skipper fly	*Prochyliza xanthostoma*	indigenous, common in US
Snipe fly	*Ragis* spp.	indigenous, common in US
Flesh fly	*Sarcophaga* spp.	indigenous, common in US
Minute Black Scavenger fly	*Scatopse notate*	indigenous, common in US
Window fly	*Scenopinus fenestralis*	exotic, rare in IN
American Horse Fly	*Tabanus americanus*	indigenous, common in US
Marsh fly	*Tetanocera* spp.	indigenous, common in N US
Skipper fly	*Thyreophora cynophila*	exotic (from Spain), rare in IN
Crane fly	*Tipula platytipula*	indigenous, common in US
Crane fly	*Tipula* spp.	indigenous, common in US
True Fruit fly	*Ulidiidae* spp.	indigenous, common in US

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Order Ephemeroptera: mayflies

Common Name	Scientific Name	Special Status
Brown Drake mayfly	*Ephemera simulans*	indigenous, common in US
Burrowing mayfly	*Hexagenia* spp.	indigenous, common in S Great Lakes

Order Hemiptera: bugs, cicadas, leafhoppers, planthoppers, spittle bugs, aphids, jumping plant lice, scale

Common Name	Scientific Name	Special Status
Leafhopper bug	*Acanalonia* spp.	indigenous, common in US
Leaf-footed bug	*Acanthocephala* spp.	indigenous, common in US
Leaf-footed bug	*Acanthocephala terminalis*	indigenous, common in US

Broad-Headed bug	*Alydus eurinus*	indigenous, common in US
Leaf-Footed bug	*Anasa tristis*	indigenous, common in US
Squash bug nymph	*Anasa tristis*	indigenous, common in US
Flatid Planthopper bug	*Anormenis chloris*	indigenous, common in US
Flatbug	*Aradus* spp.	indigenous, common in US
Wheel bug	*Arilus cristatus*	indigenous, common in US
Brown Stink bug	*Brochmena* spp.	indigenous, common in US
Brochymenas	*Brochymena spp.*	indigenous, common in US
Leafhopper bug	*Comellus comma*	indigenous, common in NE US
Leafhopper bug	*Draeculacephala* spp.	indigenous, common in US
Toad bug	*Gelastocoris oculatus*	indigenous, common in US
Water Strider	*Gerris remigis*	indigenous, common in US
Leaf Hopper	*graphocephala coccinea*	indigenous, common in US
leaf-footed nymph	*Leptoglosus ssp.*	indigenous, common in US
Hyaline Grass Bug	*Liorhyssus hyalinus*	indigenous, common in E US
Hyaline Grass bug	*Liorhyssus hyalinus*	indigenous, common in US
Small Milkweed bug	*Lygaeus kalmii*	indigenous, common in US
Tarnished plant bug (nymph)	*Lygus lineolaris*	indigenous, common in US
Annual cicada	*Magicicada* spp.	indigenous, common in E US
Long-Necked Seed bug	*Myodocha serripes*	indigenous, common in E US
Hieroglyphic cicada	*Neocicada hieroglyphica*	exotic (from SE US), rare in IN
Green Stink bug	*Nezara viridula*	exotic (from SE US), rare in IN
Southern Green Stink bug	*Nezara viridula*	exotic (from SE US), rare in IN
Peanut Burrower bug	*Pangaeus bilineatus*	indigenous, common in US
Meadow Spittlebug	*Philaenus spumarius*	indigenous, common in US
Spined Soldier bug	*Podisus maculiventris*	indigenous, common in US
Two-Lined Spittlebug	*Prosapia bicincta*	indigenous, common in E US
Tree Hopper bug	*Publilia concava*	indigenous, common in US
Buffalo Treehopper	*Stictocephala bisonia*	indigenous, common in US
Dog-Day cicada	*Tibicen canicularis*	indigenous, common in NE US
True Fruit fly	*Ulidiidae* spp.	indigenous, common in US

Flower fly	*Xanthogramma flavipes*	indigenous, common in E US

Order Hymenoptera: ants, bees, wasps, sawflies, wood wasps

Common Name	Scientific Name	Special Status
Sweat bee	*Agapostemon* spp.	indigenous, common in US
Thread-Waisted wasp	*Ammophilia* spp.	indigenous, common in US
Burrowing bee	*Andrena* spp.	indigenous, common in US
Spider wasp	*Anoplius marginalis*	indigenous, common in E US
Honey bee	*Apis mellifera*	indigenous, common in US
Augochlora Green Metallic Bee	*Augochlora* spp.	indigenous, common in US
Sweat bee	*Augochlora* spp.	indigenous, common in US
Two-spotted Bumble bee	*Bombus bimaculatus*	indigenous, common in E US
Common Eastern Bumble bee	*Bombus impatiens*	indigenous, common in E US
American Bumble bee	*Bombus pennsylvanicus*	indigenous, common in US
Yellow-faced Bumble bee	*Bombus vosnesenskii*	exotic (from W US), rare in IN
Texas Carpenter ant	*Camponotus festinates*	exotic (from SW US), rare in IN
Black carpenter ant	*Camponotus pennsylvanicus*	indigenous, common in US
Field ant	*Camponutus* spp.	indigenous, common in US
Small carpenter bee	*Ceratina* spp.	indigenous, common in US
Blue Mud Dauber wasp	*Chalybion californicum*	indigenous, common in US
Steel Blue Cricket Hunter wasp	*Chlorion aerarium*	indigenous, common in US
Cuckoo wasp	*Chrysura pacifica*	indigenous, common in US
Ichneumons Wasp	*Cryptus spp.*	indigenous, common in US
Red Velvet ant	*Dasymutilla occidentalis*	indigenous, common in E US
Eastern Velvet ant	*Dasymutilla quadriguttata*	indigenous, common in US
Bald-faced hornet	*Dolichovespula maculate*	indigenous, common in US
Hunting wasp	*Eremnophila aureonotata*	indigenous, common in US
Potter wasp	*Eumenes fraternus*	indigenous, common in E US
Mound ant	*Formica subsericea*	indigenous, common in E US
Sweat bee	*Halictid* spp.	indigenous, common in US

Yellow Faced bee	*Hylaeus* spp.	indigenous, common in US
Argentine ant	*Linepithema humile*	indigenous, common globaly
Little Black Ant	*Monomorium minimum*	indigenous, common in US except Pacific NW
Ichneuman wasp	*Ophion* spp.	indigenous, common in US
Mason bee	*Osmia* spp.	indigenous, common in US
Wood Roach wasp	*Podium luctuosum*	indigenous, common in E US
Paper wasp	*Polistes annularis*	indigenous, common in US
Polistes Paper wasp	*Polistes* spp.	indigenous, common in US
Hunting wasp	*Prionyx* spp.	indigenous, common in US
Aulacid wasp	*Pristaulacus flavicrurus*	indigenous, common in E US
Red tailed Ichneumon wasp	*Scambus hispae*	exotic (from W US), rare in IN
Black and Yellow Mud Dauber wasp	*Sceliphron caementarium*	indigenous, common in US
Mud-Dauber wasp	*Sceliphron caementarium*	indigenous, common in US
Braconid wasp	*Spathius elegans*	indigenous, common in E US
Great Black wasp	*Sphex pennsylvanicus*	indigenous, common in US
Parasitic ant	*Trigonalid* spp.	exotic, rare in IN
Bald Faced hornet	*Vespula maculate*	indigenous, common in midwest US
Eastern Yellowjacket bee	*Vespula maculifrons*	indigenous, common in E US
Yellow Jacket wasp	*Vespula maculifrons*	indigenous, common in E US
Southern Yellow Jacket wasp	*Vespula squamosa*	indigenous, common in E US
Yellow Jacket wasp	*Vespula squamosa*	indigenous, common in E US
Eastern Carpenter bee	*Xylocopa virginica*	indigenous, common in US
Large Carpenter bee	*Xylocopa virginica*	indigenous, common in E US
Mason wasp	*Zethus spinipes*	indigenous, common in E US

Order Isoptera: termites

Common Name	Scientific Name	Special Status
Eastern Subterrean Termite	*Reticulitermes flavipes*	indigenous, common in US

Order Lepidoptera: moths, butterflies

Common Name	Scientific Name	Special Status
Hoary Edge butterfly	*Achalarus lyciades*	indigenous, common in E US
Fragile Dagger moth	*Acronicta fragilis*	indigenous, common in E US
Luna Moth	*Actias luna*	indigenous, common in E US
Fall Cankerworm moth	*Alsophila pometeria*	indigenous, common in US
Roadside Skipper butterfly	*Ambyscirtes vialis*	indigenous, common in US
Common Gray moth	*Anavitrinella pampinaria*	indigenous, common in US
Least Skipperling butterfly	*Ancyloxypha numitor*	indigenous, common in US
Orange-tipped Oakworm moth	*A* nn*isota senatoria*	indigenous, common in E US
Nais Tiger moth	*Apantesis nais*	indigenous, common in NE US
Io moth	*Autimeris io*	indigenous, common in US
Pipevine Swallowtail butterfly	*Battus philenor*	indigenous, common in US
Meadow Fritillary butterfly	*Boloriab bellona*	indigenous, common in NE US
The Vestal moth	*Cabera variolaria*	indigenous, common in E US
Red-banded Hairstreak butterfly	*Calycopis cecrops*	exotic (from SE US), rare in IN
Spring Azure butterfly	*Celastrina* spp.	indigenous, common in US
Gorgone Checkerspot butterfly	*Chlosyne gorgone*	indigenous, common in W US
Kentucky Lichen moth	*Cisthene kentuckiens*	indigenous, common in NE US
Clemens' Clepsis moth	*Clepsis clemensiana*	indigenous, common in NE US
Orange Sulphur Butterfly	*Colias eurytheme*	indigenous, common in US
Clouded Sulphur butterfly	*Colias philodice*	indigenous, common in US
Morning Glory Plume moth	*Emmelina monodactyla*	indigenous, common in US
Silver-Spotted Skipper butterfly	*Epargyreus clarus*	exotic (from S. America), rare in IN
Tulip Tree Beauty	*Epimecis hortaria*	indigenous, common in US
Lesser Grapevine Looper moth	*Eulithis diversineata*	indigenous, common in US
Zebra Swallowtail butterfly	*Eurytides marcellus*	indigenous, common in US
Curve-Toothed Geometer moth	*Eutrapela clemataria*	indigenous, common in US
Fleece Winged Dart moth	*Euxoa velleripennis*	indigenous, common in NE US
Eastern Tailed-Blue butterfly	*Everes comyntas*	indigenous, common in NE US
Virgin Tiger moth	*Grammia virgo*	indigenous, common in E US

Clymene Moth	*Haploa elymane*	exotic (from S midwest & SE US), rare in IN
Grape Leaf Skeletonizer	*Harrisina americana*	indigenous, common E of US
Grapevine Skelontizer butterfly	*Harrisina americana*	indigenous, common in E US
Snowberry Clearwing moth	*Hemaris diffinis*	indigenous, common in E US
Carolina Satyr butterfly	*Hermeuptychia sosybius*	exotic (from SE US), rare in IN
Cecropia moth	*Hyalophora cecropia*	indigenous, common in US
Buckeye butterfly	*Junonia coenia*	indigenous, common in NE US
Red-spotted Purple butterfly	*Limenitis arthemis astyanax*	exotic (from W US), rare in IN
Drab Brown Wave	*Lobocleta ossularia*	indigenous, common E of US
Bluish Spring moth	*Lomographa semiclarata*	indidenous, common in N.E. North America
Alfalfa webworm moth	*Loxostege cerealis*	indigenous, common in US
Black & Yellow Lichen moth	*Lycomorpha pholus*	indigenous, common in US
Little Wood Satyr butterfly	*Megisto cymela*	indigenous, common in E US
White-Speck Wainscot moth	*Mythimna unipuncta*	indigenous, common in E US
Lucerne moth	*Nomophila nearctica*	indigenous, common in US
Dainty Sulphur butterfly	*Nothalis iole*	indigenous, common in US
Woodland Skipper butterfly	*Ochlodes sylvanoides*	exotic (from W US), rare in IN
Splendid Palpita moth	*Palpita magniferalis*	indigenous, common in E US
Short-tailed Swallowtail butterfly	*Papilio brevicauda*	exotic (from E Canada), rare in IN
Canadian Tiger Swallowtail	*Papilio glaucus*	exotic (Canada & N Great Lakes), rare in IN
Eastern Black Swallowtail	*Papilio glaucus*	indigenous, common in E US
Eastern Tiger Swallowtail butterfly	*Papilio glaucus*	indigenous, common in E US
Black Swallowtail	*Papilio polyxenes*	indigenous, common in US
Spicebush Swallowtail butterfly	*Papilio troilus*	indigenous, common in E US
Morrison's Pero moth	*Pero morrisonaria*	indigenous, common in NE US
The Half-Wing moth	*Phigalia titea*	indigenous, common in US
Pearl Crescent butterfly	*Phyciodes tharos*	indigenous, common in US
Cabbage White butterfly	*Pieris rapae*	indigenous, common in US
Sandhill Skipper butterfly	*Polites sabuleti*	exotic (from W US), rare in IN
Question Mark butterfly	*Polygonia interrogationis*	indigenous, common in E US
Ironwood Root moth	*Polygrammodes flavidalis*	indigenous, common in E US

Checkered White moth	*Pontia protodice*	indigenous, common in US
Western Tiger Swallowtail butterfly	*Pterourus rutulus*	exotic (from W US), rare in IN
Mustard Sallow moth	*Pyrefera hesperidago*	indigenous, common in NE US
Sylvan Hairstreak butterfly	*Satyrium sylvinus*	exotic (from W US), rare in IN
Hornet Clearwing moth	*Sesia apiformis*	indigenous, common in E US
Split-Lined Granite moth	*Sperenza bitactata*	exotic (from SE US), rare in IN
Great Spangled Fritillary	*Speyeria cybele*	indigenous, common in E US
Great Spangled Fritillary butterfly	*Speyeria cybele*	exotic (from W US), rare in IN
Gray Common Hairstreak	*Strymon melinus*	indigenous, common in US
European Skipper butterfly	*Thymelicus lineola*	indigenous, common in NE US
Red Admiral butterfly	*Vanessa atalanta*	indigenous, common in E US
Painted Lady butterfly	*Vanessa cardui*	indigenous, common in US
American Painted Lady butterfly	*Vanessa virginiensis*	indigenous, common in NE US
Orange Virbia moth	*Virbia aurantiaca*	indigenous, common in NE US
Tersa Sphinx moth	*Xylophanes tersa*	exotic (from S US), rare in IN
Horrid Zale moth	*Zale horrida*	indigenous, common in US
Wavy-lined Fan-foot moth	*Zanclognatha jacchusalis*	indigenous, common in NE US

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Order Mantodea: mantids

Common Name	Scientific Name	Special Status
European mantis	*Mantis religiosa*	exotic (from Mediterranean), common in NE US
Scudderv mantis	*Oligonicella scudderi*	indigenous, common in E US
Carolina mantis	*Stagmomantis carolina*	indigenous, common in US

Order Megaloptera: Dobsonflies, Fishflies, and Alderflies

Common Name	Scientific Name	Special Status
Eastern Dobsonfly	*Corydalus cornutus*	indigenous, common in E US

Order Neuroptera: lacewings, antlions, owlflies

Common Name	Scientific Name	Special Status
Eastern Green lacewing	*Chrysopha ornata*	indigenous, common in US
Spotted Winged antlion	*Dendroleon obsoletus*	indigenous, common in E US

Order Odonata: dragonflies, damselflies

Common Name	Scientific Name	Special Status
Eastern Blue Darner dragonfly	*Aeshna verticalis*	indigenous, common in NE US
Common Green Darner dragonfly	*Anax junius*	indigenous, common in N US
Green Darner dragonfly	*Anax junius*	indigenous, common in N US
Blue-fronter Dancer damselfly	*Argia apicalis*	indigenous, common in central & E US
Sooty Dancer damselfly	*Argia lugens*	exotic (from SW US), rare in IN
Violet Dancer damselfly	*Argia violacea*	indigenous, common in US
Ebony Jewelwing damselfly	*Calopteryx maculata*	indigenous, common in US
Halloween Pennant dragonfly	*Celithemis eponina*	indigenous, common in US
Common Skimmer dragonfly	*Celithemis* spp.	indigenous, common in US
Pennant dragonfly	*Celithemis* spp.	indigenous, common in E US
Regal Darner dragonfly	*Coryphaeschna ingens*	exotic (from SE US), rare in IN
Stream Cruiser dragonfly	*Didymops transversa*	indigenous, common in NE US
Black-shouldered Spinyleg dragofly	*Dromogomphus spinosus*	indigenous, common in E US
Familiar bluet damselfly	*Enallagama civile*	indigenous, common in US
Rainbow Bluet damselfly	*Enallagma antennatum*	indigenous, common in E US
Doubleday's Bluet damselfly	*Enallagma doubledayii*	indigenous, common in E US
Orange Bluet damselfly	*Engallagma signatum*	indigenous, common in E US
Green Clearwing dragonfly	*Erythemis simplicicoll*	indigenous, common in US
Lancet Clubtail dragonfly	*Gomphus exilis*	indigenous, common in US
Dragon Hunter dragonfly	*Hagenius brevistylus*	indigenous, common in E US
Rambur's Forktail damselfly	*Ischnura ramburii*	indigenous, common in US

Eastern Forktail damselfly	*Ischnura verticalis*	indigenous, common in NE US
Common Spreadwing damselfly	*Lestes disjunctus*	indigenous, common in US
Widow dragonfly	*Libellula luctuosa*	indigenous, common in US
Twelve-Spotted Skimmer dragonfly	*Libellula pulchella*	indigenous, common in US
Blue Dasher Skimmer dragonfly	*Pachydiplax longipennis*	indigenous, common in US
Eastern Amberwing dragonfly	*Perithemis tenera*	indigenous, common in US
Black Saddlebag dragonfly	*Tramea lacerate*	indigenous, common in US

Order Orthoptera: grasshoppers, locusts, katydids, crickets

Common Name	Scientific Name	Special Status
Robust Ground cricket	*Allonemobius* spp.	indigenous, common in US
Oblong-Winged katydid	*Amblycorypha oblongifolia*	indigenous, common in E US
Round-headed katydid	*Amblycorypha* spp.	indigenous, common in E US
Sulphur-winged grasshopper	*Arphia sulphurea*	indigenous, common in US
Spotted Camel cricket	*Ceuthophilus maculatus*	indigenous, common in US
Camel cricket	*Ceuthophilus* spp.	indigenous, common in US
Slant-faced grasshopper	*Chloealtis* spp.	indigenous, common in US
Straight-lanced Meadow katydid	*Conocephalis strictus*	exotic (from W US), rare in IN
Meadow grasshopper	*Conocephalus brevipennis*	indigenous, common in E US
Wrinkled grasshopper	*Cratypedes neglectus*	indigenous, common in US
Slant-faced grasshopper	*Dichromorpha viridis*	indigenous, common in E US
Carolina locust	*Dissosteira carolina*	indigenous, common in US
Band-Winged grasshopper	*Dissosteria pictipennis*	indigenous, common in US
Long-winged locust	*Dissosteria pictipennis*	exotic (from W US), rare in IN
Obscure Slant-faced grasshopper	*Eritettix obscurus*	exotic (from S US), rare in IN
Carolina Ground cricket	*Eunemobius carolinus*	indigenous, common in US
Field cricket	*Gryllus pennyslvanicus*	indigenous, common in US
Two-striped grasshopper	*Melanoplus bivittatus*	indigenous, common in US
Two-striped grasshopper	*Mermiria bivittata*	exotic (from Southern Great Plains), rare in IN
Roesel’s katydid	*Metrioptera roeselii*	exotic (from Europe & NE US), rare in IN

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Broad-winged katydid	*Microcentrum rhombifolium*	indigenous, common in US
Bush cricket	*Phyllopalpus pulchellus*	indigenous, common in E US
True katydid	*Pterophylla camellifolia*	indigenous, common in US
Camelback Cricket	*Rhaphidophoridae* spp	indigenous, common in US
American grasshopper	*Schistocerca americana*	indigenous, common in E US
Spur-Throated grasshopper	*Schistocerca americana*	indigenous, common in US
Bush katydid	*Scudderia curvicauda*	indigenous, common in US
Fork-tailed Bush katydid	*Scudderia furcata*	indigenous, common in US
Toothpick grasshopper	*Stenacris vitreipennis*	exotic (from SE US), rare in IN
Handsome locust	*Syrbula admirabilis*	indigenous, common in E & SW US
Pallid-winged grasshopper	*Trimerotropis pallidipennis*	exotic (from W US), rare in IN

Order Phasmatodea: walking sticks & tememas

Common Name	Scientific Name	Special Status
Giant Walking Stick	*Megaphasma dentricus*	indigenous, common in mid-west US

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