U. S. AIR FORCE

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

New Boston Air Force Station

(See INRMP signature pages for plan approval date)

Template Version June 2020

ABOUT THIS PLAN

This installation-specific Environmental Management Plan (EMP) is based on the United States Air Force's (USAF) standardized Integrated Natural Resources Management Plan (INRMP) template. This INRMP has been developed in cooperation with applicable stakeholders, which includes Sikes Act cooperating agencies and/or local equivalents, to document how natural resources will be managed. Where applicable, external resources, including Air Force Instructions (AFIs); Department of Defense Instructions (DoDIs); USAF Playbooks; federal, state, and local requirements; Biological Opinions; and permits are referenced.

Certain sections of this INRMP begin with standardized, USAF-wide "common text" language that address USAF and Department of Defense (DoD) policy and federal requirements. This common text language is restricted from editing to ensure that it remains standard throughout all plans. Immediately following the USAF-wide common text sections are installation sections. The installation sections contain installation-specific content to address local and/or installation-specific requirements. Installation sections are unrestricted and are maintained and updated by the approved plan owner.

NOTE: The terms "Natural Resources Manager," "NRM," and "NRM/POC" are used throughout this document to refer to the installation person responsible for the natural resources program, regardless of whether this person meets the qualifications within the definition of a natural resources management professional in DoDI 4715.03, Natural Resources Conservation Program.

TABLE OF CONTENTS

DOCUMENT CONTROL

Standardized INRMP Template

In accordance with (IAW) the Air Force Civil Engineer Center (AFCEC) Environmental Directorate (CZ) Business Rule (BR) 08, *EMP Review, Update, and Maintenance*, the standard content in this INRMP template is reviewed periodically, updated as appropriate, and approved by the Natural Resources Subject Matter Expert (SME).

This version of the template is current as of 06/26/2020 and supersedes the 2018 version.

NOTE: Installations are not required to update their INRMPs every time this template is updated. When it is time for installations to update their INRMPs, they should refer to the eDASH EMP Repository to ensure they have the most current version.

Installation INRMP

Record of Review – The INRMP is updated no less than annually, or as changes to natural resource management and conservation practices occur, including those driven by changes in applicable regulations. IAW the Sikes Act and AFMAN 32-7003, *Environmental Conservation*, the INRMP is required to be reviewed for operation and effect no less than every five years. An INRMP is considered compliant with the Sikes Act if it has been approved in writing by the appropriate representative from each cooperating agency within the past five years. Approval of a new or revised INRMP is documented by signature on a signature page signed by the Installation Commander (or designee), and a designated representative of the United States Fish and Wildlife Service (USFWS), state fish and wildlife agency, and National Oceanic and Atmospheric Administration (NOAA) Fisheries when applicable (AFMAN 32-7003).

Annual reviews and updates are accomplished by the installation Natural Resources Manager (NRM), and/or a Section Natural Resources Media Manager. The installation shall establish and maintain regular communications with the appropriate federal and state agencies. At a minimum, the installation NRM (with assistance as appropriate from the Section Natural Resources Media Manager) conducts an annual review of the INRMP in coordination with internal stakeholders and local representatives of USFWS, state fish and wildlife agency, and NOAA Fisheries, where applicable, and accomplishes pertinent updates. Installations will document the findings of the annual review in an Annual INRMP Review Summary. By signing the Annual INRMP Review Summary, the collaborating agency representative asserts concurrence with the findings. Any agreed updates are then made to the document, at a minimum updating the work plans.

INRMP APPROVAL/SIGNATURE PAGES

DANIEL P. HIGHLANDER, Lt Col, USAF

Commander, 23d Space Operations Squadron

SCOTT MASON, Executive Director

New Hampshire Fish and Game Department

WENDI WEBER, Regional Director, North Atlantic-Appalachian Region

US Fish and Wildife Service

EXECUTIVE SUMMARY

The New Boston Air Force Station (NBAFS) Integrated Natural Resources Management Plan (INRMP) provides guidance and assigns responsibility for management of natural resources located on NBAFS. NBAFS occupies 2,864 ac in Hillsborough County of south-central New Hampshire about 12 mi west of Manchester. Most of the station is comprised of unimproved (undeveloped) land that is managed for natural resource protection, outdoor recreation, and timber production.

The station supports a variety of native species (including threatened, endangered, and rare species) and natural habitats and ecosystems. The NBAFS INRMP supports the military mission of the station by ensuring the long-term sustainability of those species, habitats, and ecosystems, thus proactively avoiding conflicts associated with natural resource compliance issues. Natural resources are managed at NBAFS using an adaptive management process that integrates new findings and a developing understanding of human impacts on natural systems into future strategies and plans. Consequently, the INRMP is a living document that is modified in response to new information in a timely fashion. Implementation of the NBAFS INRMP is under the direction of the Natural Resources Planner at NBAFS. The INRMP is subject to annual reviews and updates, as appropriate, and full revision every five years as required by Air Force Manual (AFM) 32-7003, Environmental Conservation. The INRMP was developed in consultation with the U.S. Fish and Wildlife Service (USFWS) and the New Hampshire Fish and Game Department (NHFGD). The INRMP is intended to be in harmony with the current NHFDG Wildlife Action Plan as many of the Species of Greatest Conservation Need (SGCN) are present on NBAFS.

The 23d Space Operations Squadron (23 SOPS), a component of Space Delta 6 is located at NBAFS, and is the sole military presence at the station. The squadron is one of seven Satellite Control Network (SCN) Remote Tracking Stations that form a worldwide network of satellite command and control stations to provide U.S. Space Command with critical satellite command and control capability. The NBAFS site is also occasionally used for military training exercises by the Army National Guard, the Army Reserve, the U.S. Marine Corps, and the Military Air Force Police. Training activities can occur in any portion of the station grounds and at any time of the year.

Important components of the NBAFS INRMP include forest management, fish and wildlife management (including threatened, endangered, and other protected species), water resources protection, wetlands protection, wildland fire management, outdoor recreation, and integrated pest management. Forest management techniques are applied to sustain healthy ecosystems with sufficient diversity to support native plants and animals, including threatened, endangered, and rare species, while allowing timber production and sales. Wildland fire management at NBAFS, including prescribed burning, targets the maintenance of native species through creation and maintenance of appropriate habitats and control of competing invasive nonnative species.

The NBAFS INRMP describes the overall management goals and objectives at NBAFS. It identifies the projects planned over the next five years that would be implemented to support those objectives. Goals, objectives, and projects have been developed for six specific natural resource management topical areas. These topical areas include; threatened, endangered, and rare species populations; wetlands; rare natural communities; forest management; control of invasive nonnative plant species; outdoor recreation; and UXO remediation.

Goals, objectives, and projects associated with the management of threatened, endangered, and rare species on NBAFS focus on increasing an understanding of distributions, habitat use, and habitat needs; development of management strategies to sustain or improve habitat conditions; and ensuring that populations of these species continue to exist or expand on NBAFS.

Goals, objectives, and projects associated with the wetland management on NBAFS focus on sustaining high-quality wetland habitats by monitoring trends, identifying threats, and restoring degraded wetlands. Wetlands at NBAFS perform important ecological functions such as maintenance of water quality, flood control, and groundwater recharge, and also provide habitat for plant and animal species including listed and rare species. Degradation could be caused by invasive nonnative plants, natural succession, encroachment of human developments, and runoff from developed or disturbed areas. Monitoring wetland change and developing response actions before problems arise or worsen are important components of the NBAFS INRMP.

Goals, objectives, and projects associated with the management of rare natural communities on NBAFS focus on sustaining high-quality rare natural communities by monitoring trends, identifying threats, and restoring degraded communities. Degradation could be caused by invasive nonnative plants, natural succession, encroachment of human developments, and runoff from developed or disturbed areas. Monitoring community change and developing response actions before problems arise or worsen are important components of the NBAFS INRMP.

Because over 90% of NBAFS is forested, forest management is the dominant tool for natural resource management on NBAFS. Goals, objectives, and projects associated with forest management at NBAFS target the development of an overall forest management program that integrates the varied and sometimes disparate needs of a variety of forest-dependent species.

Currently, invasive nonnative plant species problems at NBAFS are limited to the impact of relatively few species that have been effectively managed through re-occuring treatment. The most problematic species is the autumn olive (*Elaeagnus umbellata*), but other invasive nonnative species occur at relatively low density. Invasive insect species at NBAFS are a significant issue, Hemlock Wooly Adelgid (HWA) (*Adelges tsugae*) and elongate hemlock scale (*Fiorinia externa*) are causing significant mortality and are difficult to control.

Outdoor recreation at NBAFS involves hunting, fishing, and wildlife observation. Goals, objectives, and projects associated with outdoor recreation at NBAFS are related to developing a more well-established non-consumptive nature-oriented recreational program (e.g., hiking, birding) that capitalizes on opportunities for outdoor education. In addition, management of hunting and fishing programs can result in high-quality hunting and fishing experiences for staff and visitors.

UXO remediation activities at NBAFS could result in significant adverse impacts to natural resources on the station. Goals, objectives, and projects associated with remediation activities address the restoration of disturbed habitats to pre-disturbance conditions.

1.0 OVERVIEW AND SCOPE

This INRMP was developed to provide for effective management and protection of natural resources. It summarizes the natural resources present on the installation and outlines strategies to adequately manage those resources. Natural resources are valuable assets of the USAF. They provide the natural infrastructure needed for testing weapons and technology, as well as for training military personnel for deployment. Sound management of natural resources increases the effectiveness of USAF adaptability in all environments. The USAF has stewardship responsibility for the physical lands on which installations are located to ensure all natural resources are properly conserved, protected, and used in sustainable ways. The primary objective of the USAF natural resources program is to sustain, restore, and modernize natural infrastructure to ensure operational capability and no net loss in the capability of USAF lands to support the military mission of the installation. The plan outlines and assigns responsibilities for the management of natural resources, discusses related concerns, and provides program management elements that will help to maintain or improve the natural resources within the context of the installation's mission. The INRMP is intended for use by all installation personnel. The Sikes Act is the legal driver for the INRMP.

1.1 Purpose and Scope

The INRMP is the principal tool for managing natural resources on NBAFS. Each military installation in the United States under the jurisdiction of the Secretary of Defense must prepare and implement an INRMP unless a determination is made that the absence of significant natural resources makes preparation of such a plan inappropriate. INRMPs are prepared to ensure and document compliance with the Sikes Act (16 United States Code [USC] 670 et seq.), which provides for cooperation by the Departments of the Interior and Defense with State agencies in planning, development, and maintenance of fish and wildlife resources on military reservations throughout the U.S. INRMPs are prepared to assist the installation commander with the conservation and rehabilitation of natural resources consistent with the Sikes Act and other Federal laws. NBAFS has been identified as a Category I installation by both the NHFGD and the USFWS (Najjar 1998). This classification indicates that NBAFS has habitat suitable for conserving and managing fish and wildlife. An INRMP is required for Category I installations.

The NBAFS INRMP establishes natural resource management goals and objectives for the entire station that are consistent with the station mission and ensures no net loss in the capability of NBAFS lands to support that mission. The NBAFS INRMP ensures that natural resource conservation and other mission activities are integrated and consistent with Federal mandates for land stewardship.

1.2 Management Philosophy

NBAFS is largely undeveloped and supports a variety of native species and natural habitats and ecosystems. The NBAFS INRMP supports the military mission of the station by ensuring the long-term sustainability of those species, habitats, and ecosystems, thus proactively avoiding conflicts associated with natural resource compliance issues.

The base comprehensive planning process, as described in AFI 32-1015, Integrated Installation Planning, establishes a systematic framework for decision-making related to the development of USAF installations. It incorporates USAF programs to identify and assess development alternatives and ensure compliance with applicable Federal, State, and local laws, regulations, and policies. The comprehensive planning process incorporates a wide range of data and information that allows commanders to logically and thoroughly analyze a variety of factors before making a decision that affects the installation or the surrounding community. The NBAFS INRMP supports this planning process by providing direction for those activities associated with natural resource management and conservation and by ensuring that mission activities and

station development are considered in the context of the NBAFS ecosystem. The INRMP ensures that there is adequate knowledge of station resources and identifies the appropriate management strategies to provide for the sustainability of those resources.

The NBAFS INRMP was developed in consultation with the USFWS and NHFGD to determine appropriate management and conservation practices for natural resources found on the station. The INRMP implements ecosystem management on the station by setting goals for attaining a desired ecological condition. Ecosystem management principles and guidelines presented in DoDI 4715.03, Natural Resources Conservation Program, were considered during development of this plan. These principals include:

Maintenance or restoration of native ecosystems where practical and consistent with the military mission.

Maintenance or restoration of ecological processes, such as fire and other disturbance regimes, where practical and consistent with the military mission.

Maintenance or restoration of hydrological processes in streams, floodplains, and wetlands when feasible.

Application of regional approaches to implement ecosystem management by collaboration with other DoD components as well as other Federal, State, and local agencies, and adjoining property owners.

Providing for outdoor recreation, agricultural production, harvesting of forest products, and other practical utilization of the land and its resources, provided that such use does not inflict long-term ecosystem damage or negatively impact the station mission.

Other considerations for management of natural resources on NBAFS include:

Maintenance or reestablishment of viable populations of all native species when practical and consistent with the military mission.

Implementation of programs to control or eradicate invasive nonnative species on NBAFS.

Management of rare species (Heritage Status Ranks of G1 through G3, N1 through N3, and S1 through S3) and rare natural communities, when practical and consistent with the military mission.

Natural resources are managed at NBAFS using an adaptive-management process that integrates new findings and a developing understanding of human impacts on natural systems into future strategies and plans. Consequently, the INRMP is a living document that is modified in response to new information in a timely fashion.

The INRMP serves as a key component of the Installation Development Plan, which provides background and rationale for the policies and programming decisions related to land use, resource conservation, facilities and infrastructure development, and operations and maintenance to ensure that they meet current requirements and provide for future growth. The INRMP supports the mission by identifying the natural resources present on the installation, developing management goals for these resources, and integrating these management objectives into the military requirements for mission operations/support and regulatory compliance to minimize natural resource constraints.

This INRMP outlines the steps needed to fulfill compliance requirements related to natural resources management and fosters environmental stewardship. It is organized into the following principal sections:

- An overview of the current status and potential future conditions of the natural resources
- Identification of potential impacts to or from natural resources
- The key natural resource management areas addressed

- Management recommendations that incorporate the installation's goals and objectives for natural resource management areas
- Specific work plans for effective implementation of the INRMP

Management issues and concerns, as well as goals and objectives, are developed from analysis of all the gathered information, and are reviewed by NBAFS personnel involved with or responsible for various aspects of natural resources management. The INRMP was developed using an interdisciplinary approach and is based on existing information of the physical and biotic environments, mission activities, and environmental management practices at NBAFS. Information was obtained from a variety of documents, interviews with installation personnel, on-site observations, and communications with both internal and external stakeholders. Coordination and correspondence with these agencies is documented and satisfies a portion of the requirements of 32 Code of Federal Regulations (CFR) 989, *Environmental Impact Analysis Process (EIAP)*. Goals and objectives require monitoring on a continuous basis and management strategies are updated whenever there are changes in mission requirements, adverse effects to or from natural resources, or changes in regulations governing management of natural resources.

1.3 Authority

A number of laws, regulations, and directives authorize the development and implementation of the NBAFS INRMP. These include:

- The Sikes Act (16 USC 670) as amended, which provides for conservation programs on government lands, including military installations, and requires development of the INRMP to guide related activities.
- DoD Instruction (DoDI) 4715.03, Natural Resources Conservation Program, which outlines the current natural resources policy and provides guidance to DoD installations on implementing an ecosystem-based approach to natural resources management.
- Air Force Policy Directive 32-70, Environmental Quality, which sets the framework for safeguarding the environment on U.S. Air Force (USAF) installations. It establishes that an environmental quality program will be developed and implemented at each installation that is composed of cleanup, compliance, conservation, and pollution prevention activities.
- 32 Code of Federal Regulations (CFR) Part 989, Environmental Impact Analysis Process, ensures compliance with the National Environmental Policy Act (NEPA) on USAF installations.
- AFI 32-1015, Integrated Installation Planning, which contains responsibilities and requirements for comprehensive planning.
- AFM 32-7003, Environmental Conservation, addresses the management of natural and cultural resources on USAF properties to comply with Federal, State, and local laws and regulations. It specifically calls for the preparation of an INRMP as required by the Sikes Act. The primary objective of USAF natural resources programs is to ensure continued access to land and air space required to accomplish the USAF mission by maintaining these resources in a healthy condition.

Other applicable Federal laws concerning the protection of natural resources on NBAFS include:

- Executive Order (EO) 11990, Protection of Wetlands, which directs Federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities.

- EO 11988, Floodplain Management, which directs Federal agencies to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities.
- Section 404 of the Clean Water Act (33 USC 1344), which prohibits the discharge of dredged or fill material into the waters of the U.S. without a permit. By regulation, wetlands are considered waters of the U.S.
- Section 401 of the Rivers and Harbors Act (33 USC 401), which regulates the construction of bridges, causeways, dams, and dikes.
- Endangered Species Act (16 USC 1531), which requires consultation with the USFWS for any action potentially affecting federally listed threatened or endangered species.
- Migratory Bird Treaty Act (16 USC 703-712), which prohibits the take, killing, or possession of migratory birds, their parts, nests, or eggs.
- EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, which directs Federal agencies to take actions, in consultation with the USFWS, to promote the conservation of migratory bird populations.
- Bald and Golden Eagle Protection Act (16 USC 668), which prohibits the take, possession, sale, barter, purchase, or transportation of bald or golden eagles, including any parts, nests, or eggs of these species.
- EO 13112, Invasive Species, which directs Federal agencies to take actions to prevent the spread of invasive, nonnative species. Such actions include prevention of introduction, response to invasion, monitoring of populations, and restoration of native species and habitat conditions.
- EO 13148, Greening Government through Leadership in Environmental Management, which directs Federal agencies to take a number of steps to improve environmental conditions on Federal properties including pollution prevention and environmentally responsible landscaping.
- EO 11644 and 11989, Use of Off-Road Vehicles on the Public Lands, which provides guidance for the use of off-road vehicles on public lands to minimize environmental impacts and conflicts with other land uses.

The Sikes Act, 16 United States Code (USC) § 670a, requires an INRMP be written and implemented for all DoD installations with significant natural resources. This plan has been developed cooperatively between the installation, the USFWS, and NH Fish and Game Department. The USAF natural resources program ensures continued access to land, air, and water resources to conduct realistic military training and testing, as well as to sustain the long-term ecological integrity of the resource base.

This INRMP is developed under, and proposes actions IAW, applicable DoD and USAF policies, directives, and instructions. AFMAN 32-7003 provides the necessary direction and instructions for preparing an INRMP. Issues are addressed in this plan using guidance provided under legislation, Executive Orders (EOs), Directives, and Instructions including DoDI 4715.03; Air Force Policy Directive (AFPD) 32-70, *Environmental Considerations in Air Force Programs and Activities*; and AFMAN 32-7003. DoDI 4715.03 provides direction for DoD installations to establish procedures for an integrated program for multiple-use management of natural resources. AFPD 32-70 discusses general environmental quality issues, including proper cleanup of polluted sites, compliance with applicable regulations, conservation of natural resources, and pollution prevention. AFMAN 32-7003 provides guidance on the preservation of cultural resources at USAF installations. The 'Annotated Summary of Key Legislation Related to Design and Implementation of the INRMP' Table, included as an appendix to this plan, summarizes key legislation and guidance used to create and implement this INRMP. Refer to the complete listing of AFIs, AFMANs, the Federal Register, and the USC to ensure that all applicable guidance documents, laws, and regulations are reviewed.

Installation-specific policies, including state and local laws and regulations are summarized in the table below.

Installation-Specific Policies (including State and/or Local Laws and Regulations)	
NBAFSII 32-7003 (draft)	Environmental Conservation

1.4 Integration with Other Plans

This INRMP is a component to the Schriever Installation Development Plan, District Six, New Boston Air Force Station. The NBAFS General Plan supports the military mission by providing comprehensive land use planning in all areas including infrastructure, soils, landform, cultural resources, natural resources and other environmental considerations. The INRMP also integrates with the installation pest management plan through overlap in resolving problem wildlife and invasive species control. Integration with the Integrated Cultural Resources Plan (ICRMP) includes ensuring that natural resources projects follow National Historic Preservation Act compliance procedures.

INRMP revisions and concurrence with the final plan must be coordinated through the installation chain of command. The NRM must ensure that the INRMP, ICRMP; Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) / Resource Conservation and Recovery Act (RCRA) cleanup plans; IPMP and any other plans that may affect natural resources, are mutually supportive and not in conflict.

2.0 INSTALLATION PROFILE

Office of Primary Responsibility (OPR)	23 SOPS/CEI has overall responsibility for implementing the natural resources management program and is the lead organization for monitoring compliance with applicable federal, state, and local regulations.
Natural Resources Manager/Point of Contact (POC)	Name: Stephen Najjar Phone: 603-471-2346 Email: stephen.najjar@spaceforce.mil
State and/or local regulatory POCs (Include agency name for Sikes Act cooperating agencies)	Wendi Weber, U.S. Fish and Wildlife Service Scott R. Mason, New Hampshire Department of Fish and Game
Total acreage managed by installation	2,864
Total acreage of wetlands	228
Total acreage of forested land	2700
Does installation have any Biological Opinions? (If yes, list title and date, and identify where they are maintained)	No
Natural Resources Program Applicability (Place a checkmark next to each program that must be implemented at the installation. Document applicability and current management practices in Section 7.0)	☒ Fish and Wildlife Management ☒ Outdoor Recreation and Access to Natural Resources ☒ Conservation Law Enforcement ☒ Management of Threatened, Endangered, and Host Nation-Protected Species ☒ Water Resource Protection ☒ Wetland Protection

	☒ Grounds Maintenance ☒ Forest Management ☒ Wildland Fire Management ☐ Agricultural Outleasing ☒ Integrated Pest Management Program ☐ Bird/Wildlife Aircraft Strike Hazard (BASH) ☐ Coastal Zone and Marine Resources Management ☒ Cultural Resources Protection ☒ Public Outreach ☒ Geographic Information Systems (GIS)

2.1 Installation Overview

2.1.1 Location and Area

NBAFS is located in south-central New Hampshire about 12 mi west of Manchester. The 2,864-ac site is located within the towns of New Boston, Amherst, and Mont Vernon, in Hillsborough County (see figure 1 titled *Map of New Boston Air Force Station, New Hampshire*).

Picture 1 New Boston Air Force Station

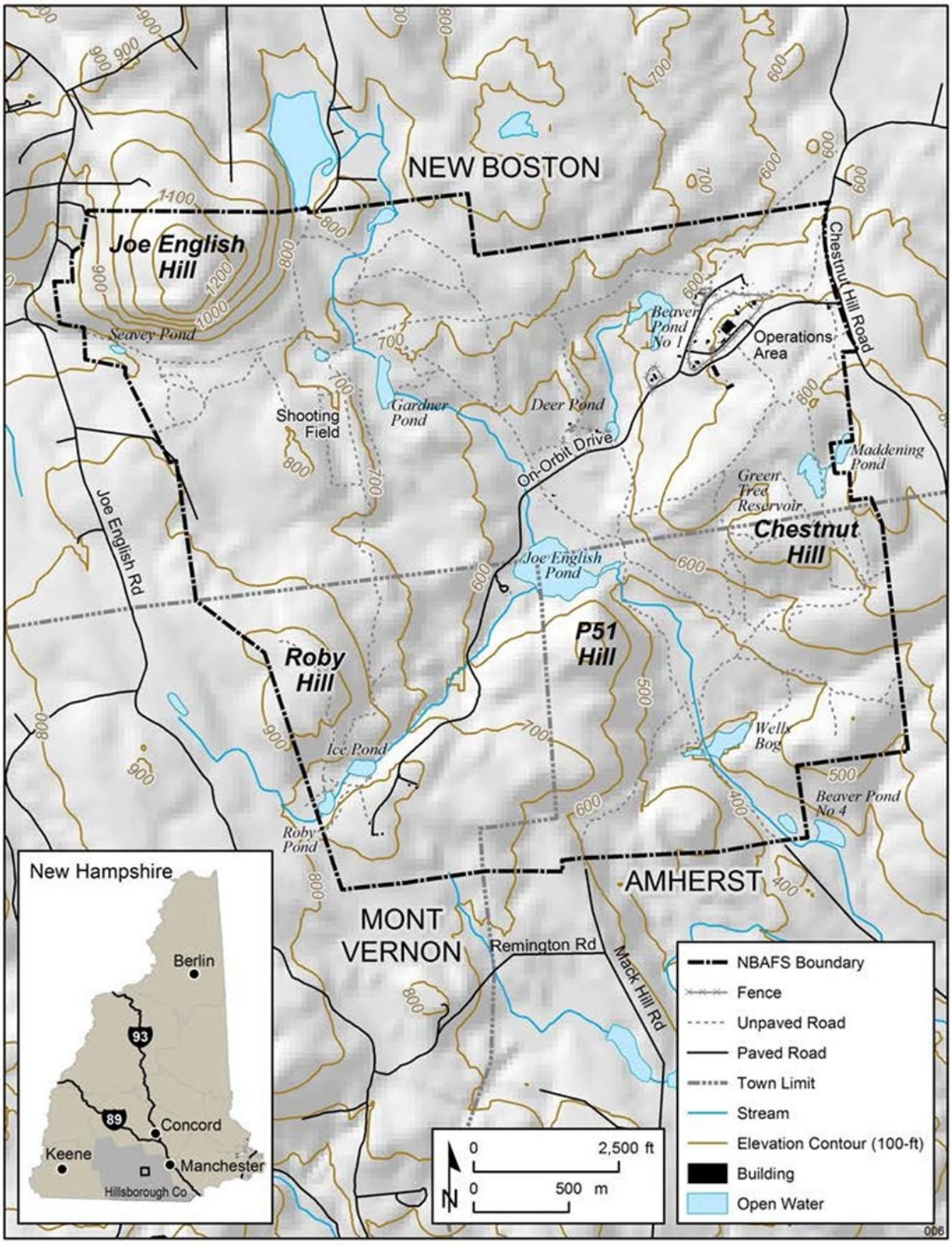


Figure 1 Map of New Boston Air Force Station

Installation/GSU Location and Area Descriptions

Installation/ Geographically Separated Unit (GSU)	Main Use/ Mission	Acreage	Addressed in INRMP?	Describe Natural Resource Implications
NBAFS/23 SOPS	Satellite Communication	2864	Section 2.1	Mission has limited implications to NR

2.1.2 Installation History

Small and large-scale farming was the predominant land use in the NBAFS area between the time of European settlement until acquisition of the site by the Federal government. Much of the land at the time of acquisition was reverting back to forest. In the autumn of 1941, the Federal government bought the land comprising NBAFS and used it until 1956 as an active bombing range in support of Grenier Field in Manchester, New Hampshire (O'Rourke and Elliott 2003). From 1941 until 1956, NBAFS (then known as the New Boston Bombing and Gunnery Range) was used as an air-to-ground bombing and strafing range. The USAF acquired rights to the site in 1957 for use as a satellite-tracking station.

On October 1, 1959, the 6594th Instrumentation Squadron was activated at NBAFS (O'Rourke and Elliott 2003). Satellite support operations began on April 1, 1960, using van-mounted equipment while permanent buildings were being constructed. By the summer of 1964, the station's dual satellite tracking, telemetry, and commanding capabilities were operating in permanent facilities. In the early 1960s, the Operations Area was cleared of unexploded ordnance (UXO) before the permanent facilities for the satellite-tracking mission were constructed. In March 1972, it was announced that Grenier Field would close in September; support facilities including base supply, transportation, fire protection, and civil engineering were moved to the station.

The 6594th Instrumentation Squadron was redesignated as Detachment 2, Air Force Satellite Control Facility (AFSCF), Air Force Systems Command, on October 1, 1979 (O'Rourke and Elliott 2003). Eight years later in 1987, Detachment 2, AFSCF was redesignated as Detachment 2, 2nd Satellite Tracking Group and ownership was transferred from Air Force Systems Command to AFSPC. On November 1, 1991, Detachment 2, 2nd Satellite Tracking Group was redesignated as 23 SOPS.

Currently, the satellite-tracking mission is conducted from the Operations Area (figure 1: Map of New Boston Air Force Station, New Hampshire); the remainder of NBAFS is managed for military training, recreation, natural resources conservation, and cultural resources protection.

2.1.3 Military Missions

The 23 SOPS, a component of US Space Force, Space Operations Command, Space Delta 6 is located at NBAFS, and is the sole military presence at the station. The squadron is one of seven SCN Remote Tracking Stations that form a worldwide network of satellite command and control stations to provide U.S. Space Command with critical satellite command and control capability (USAF 2004). The 23 SOPS provides launch, operation, and on-orbit support for more than 192 military satellites, communication satellites, and North Atlantic Treaty Organization and other allied nation satellites.

NBAFS is occasionally used for military training exercises (Argonne National Laboratory [ANL] 1990, 1999a,). The types of military training exercises include; tactical maneuvers, combat patrolling, emergency response, and land navigation by various military units of the U.S. Department of Defense. Military training exercises have occurred at NBAFS since 1974 (ANL 2007).

The New Hampshire Army National Guard (NHARNG) is currently (January 2021) working to establish a 900 acre land navigation training area in the northwest portion of the installation. The NHARNG is also conducting an engineering study (during 2021) to determine the feasibility of establishing a 300 meter rifle range.

Listing of Tenants and Natural Resources Responsibility

Tenant Organization	Natural Resources Responsibility
Source B and Source B Antenna, NOPS	No NR responsibility for tenant, antenna only
Building 101 antenna, Pentagon Project	No NR responsibility for tenant, antenna only

2.1.4 Natural Resources Needed to Support the Military Mission

The satellite communication mission at NBAFS does not typically require significant Natural Resources assistance. Primary assistance includes assisting with site selection for new mission equipment and management of vegetation. In the event NHARNG increases training activities on NBAFS additional support may be needed.

2.1.5 Surrounding Communities

NBAFS is located in central Hillsborough County. The estimated population size for the county in 2019 was 417,025, which equates to a population density of 467.5 persons/mi2 (U.S. Census Bureau [USCB] 2020). The closest cities to NBAFS are Manchester, New Hampshire (population 112,673), located 10 mi east of NBAFS, and Nashua, New Hampshire (population 89,355; USCB 2020), located 15 mi south of the installation. Concord, New Hampshire (population 43,672; USCB 2020), the State capitol, is located approximately 20 mi north of NBAFS. Smaller communities in the vicinity include Mont Vernon (population 2,583) New Boston (population 5,899), Goffstown (population 18,053), Bedford (population 22,628), and Amherst (population 11,393) (source USCB 2020).

The land surrounding NBAFS is a mosaic of forest, farmland, and residential developments. The communities near NBAFS have experienced population growth and are located within one of the most rapidly expanding residential areas of New England. Population growth in the County between 2010 and 2019 was estimated as 4.1% (USCB 2020). Residential development is expected to continue in the area surrounding NBAFS.

2.1.6 Local and Regional Natural Areas

There are no major natural areas or parks located within 10 mi of NBAFS. The Joe English Reservation, Town of Amherst conservation land, abuts NBAFS along the southwest portion of the installation. The reservation is approximately 500 ac in size and has a forest composition similar to that found at NBAFS. Pulpit Rock Conservation Area (about 200 ac), which is Town of Bedford conservation land, is located to the northeast of the station. There are other smaller conservation areas maintained by local towns in the vicinity, but none of them are adjacent to NBAFS.

2.2 Physical Environment

2.2.1 Climate

The region around NBAFS is characterized by a humid continental climate. Northwesterly winds predominate, bringing cold, dry air during the winter and pleasantly cool, dry air in the summer (Wood

1996). Stronger southerly winds occur during July and August, and easterly winds usually accompany summer and winter storms. For the 1964 to 1994 period, the annual average temperature at the Concord, New Hampshire weather station was 45.1°F, with highest and lowest monthly average temperatures in July and January, respectively (Table 1: General Weather Statistics for the NBAFS Region). Temperature extremes ranged from -37°F to 102°F (Wood 1996). The National Weather Service station in Concord, New Hampshire, about 20 mi (32 km) north of NBAFS, was selected as representative of the NBAFS site, and thus, the climatological and meteorological data presented here are for Concord. The Nashua station, about 15 mi (24 km) south of the site and at an elevation of 140 ft (43 m), is closer to the NBAFS site. However, the Concord station, with an elevation of 342 ft (104 m) is considered more representative of the NBAFS site, since the elevations at NBAFS range from 350 ft (107 m) to 1,208 ft (368 m).

Precipitation is distributed relatively evenly throughout the year, with no particular wet or dry season (Table 1: General Weather Statistics for the NBAFS Region). The mean annual precipitation is about 36.4 in., with a maximum monthly mean in November and a minimum monthly mean in January. Precipitation of 0.01 in. or more occurs 125.5 days per year, or approximately one day in three. From 1964 to 1994, annual snowfall in the area averaged 63.2 in., with little or no measurable snow in May through October (Wood 1996). Average monthly snowfall of greater than 10 in. was reported from December through March.

Coastal storms can be a serious weather hazard in southeastern New Hampshire, but decrease in importance northward (Ruffner 1985). Such storms generate very strong winds and heavy rain or snow. Storms of tropical origin affect or threaten New Hampshire about once every two to three years. Thunderstorms occur 15 to 30 times per year. Ice storms occur in the winter, but are usually of short duration. However, a few widespread and prolonged ice storms have occurred. Data for the 3,530-mi^2 area that includes NBAFS indicate that fewer than two tornadoes occur per year. The localized area affected by a tornado averages only 0.11 mi^2 (0.29 km^2; Ramsdell and Andrews 1986).

Table 1 General Weather Statistics for the NBAFS Region 1964-1994

	Mean Temperatures		Mean Daily Maximum Temperatures		Mean Daily Minimum Temperatures		Precipitation-Water Equivalent		Mean Wind Speed	
Month	**°F**	**°C**	**°F**	**°C**	**°F**	**°C**	**in.**	**cm**	**mi/hr**	**km/hr**
January	18.6	-7.4	29.8	-1.2	7.4	-13.7	2.5	6.4	7.2	11.6
February	21.8	-5.7	33.0	0.6	10.4	-12.0	2.5	6.4	7.8	12.6
March	32.4	0.2	42.8	6.0	22.1	-5.5	2.7	6.9	8.2	13.2
April	43.9	6.7	56.3	13.5	31.5	-0.3	2.9	7.4	7.8	12.6
May	55.2	12.9	68.9	20.5	41.4	5.2	3.1	8.0	7.0	11.3
June	64.2	17.9	77.3	25.2	51.2	10.7	3.2	8.0	6.4	10.3
July	69.5	20.8	82.4	28.0	56.5	13.6	3.2	8.2	5.7	9.18
August	67.3	19.6	79.8	26.6	54.7	12.6	3.3	8.4	5.4	8.69
September	58.8	14.9	71.6	22.0	46.0	7.8	2.8	7.1	5.5	8.86
October	47.8	8.8	60.7	15.9	34.9	1.6	3.2	8.2	6.0	9.66
November	37.1	2.8	47.1	8.4	27.0	-2.8	3.7	9.3	6.7	10.8
December	24.3	-4.3	34.2	1.2	14.4	-9.8	3.2	8.0	7.1	11.4

Source: Wood (1996)

Table 2 contains the most recent analysis of climate normals for Concord NH available from the National Weather Service. All monthly averages showed an increase in Mean Avg Temperature as compared to the 1964-1994 analysis.

Table 2 Monthly Climate Normals 1981-2010 for Concord NH

Month	Total Precipitation Normal (inches)	Mean Max Temperature Normal (°F)	Mean Min Temperature Normal (°F)	Mean Avg Temperature Normal (°F)
January	2.7	30.8	10.4	20.6
February	2.62	34.9	13.8	24.3
March	3.27	43.8	22.5	33.1
April	3.41	57.4	32.7	45.1
May	3.66	68.9	42.6	55.8
June	3.69	77.4	52.5	64.9
July	3.74	82.3	57.7	70
August	3.18	80.9	56.1	68.5
September	3.38	72.6	47.4	60
October	4.04	60.5	35.8	48.2
November	3.72	48.4	28.2	38.3
December	3.2	36.3	17.2	26.8
Annual	40.61	57.9	34.7	46.3

Source: National Weather Service (weather.gov)

2.2.2 Landforms

NBAFS is located within an area of hilly and mountainous terrain. The main physiographic features on NBAFS are Chestnut Hill in the northeastern section, Roby Hill in the southwestern section, and Joe English Hill in the northwestern section. Within the center of the station is Joe English Pond (figure 1: Map of New Boston Air Force Station, New Hampshire). Elevations on NBAFS range from 340 ft mean sea level (MSL) where Joe English Brook exits the southeastern corner of the station to about 1,275 ft MSL at the summit of Joe English Hill (see figure 1). The steepest areas of terrain include the near-vertical slopes on the southern cliffs of Joe English Hill and the northeast aspect of P-51 Hill, located south of Joe English Pond. The sides of stream ravines in the south-central and southwestern portions of the station are also relatively steep. The most extensive, nearly level areas are glacial till uplands that occur in the area east of Roby and Ice Ponds. Small, nearly level outwash plains or stream valley areas occur south of Joe English Hill, near Joe English Pond, and surrounding Wells Bog (ENSR 1993).

Picture 2 Joe English Hill in Background

2.2.3 Geology and Soils

The bedrock geology underlying NBAFS consists of Pre-Quaternary metamorphic and igneous rocks. Generally, the bedrock is buried beneath glacial drift. Till is the dominant surficial deposit and is composed of an unsorted to poorly sorted mixture of clay, silt, sand, gravel, cobble, and boulders. However, swamp deposits and recent alluvium are also present. Glacial striations and drumlins (elongated or oval hills of glacial origin) are present throughout the area and provide evidence of general north-to-south glacial movement. Chestnut Hill (a drumlin) and Joe English Hill (a moutonee) are two such glacial features.

Soil units, phases, and complexes of the area are described in the Soil Survey of Hillsborough County, New Hampshire, Eastern Part (Bond and Handler 1981). Twenty-three soil map units occur within the limits of NBAFS. Over 90% of the soils on NBAFS were formed in glacial till; the remainder formed in outwash plains, kame terraces, or stream valleys. Much of the Operations Area occurs on fill that was placed during the original development of the area. Soils formed in glacial till tend to be fine-textured and dense and contain many stones. Soils covering about one-half of NBAFS are classified as stony or very stony. The erosion hazard of the soils on NBAFS is slight if stabilized by vegetative cover; however, they have moderate to extreme erosion potential in bare areas because of their fine texture and the steep slopes present in portions of NBAFS. Activities that disturb or remove vegetation are likely to increase the erosion hazard,

particularly on slopes (ENSR 1993). Some areas of NBAFS contain exposed bedrock. A more detailed description of the soils of NBAFS, including soil maps, can be found in Bond and Handler (1981).

2.2.4 Hydrology

NBAFS contains a number of open waters and intermittent and perennial stream segments (see figure 2). The approximate area of the station's larger water bodies (including associated wetlands) are Seavy Pond, 0.5 ac; Joe English Pond, 50 ac; Gardner Pond, 6.0 ac; Green Tree Reservoir, 7.5 ac, Ice Pond, 2.8 ac; Deer Pond, .5ac and Roby Pond, 0.8 ac (Najjar 1998). The ponds range between 1 and 28 ft in depth. The only known water quality problem in these impoundments is an annual buildup of coliform bacteria during dry periods in the summer (Najjar 1998).

Joe English Pond, in the center of NBAFS, is the largest water body on the station (see figure 2). Water surface elevation is maintained at approximately 500 ft MSL, the pond water level is currently maintained by beaver. Joe English Pond was dammed until 2010 when the dam was removed. Maximum depth of the pond is about 25 ft. Culverts maintain hydrologic connection between the areas north and south of the causeway. Joe English Pond is designated by the State as a Class B water and is considered suitable for swimming and other recreation, fish habitat, and, after adequate treatment, use as a water supply (PES 1995).

Streams on NBAFS include those that flow into Joe English Pond from the upland to wetland areas of Murphy Swamp, Gardner Pond, Beaver Pond No. 1, Deer Pond, and Ice Pond. Drainage from Joe English Pond flows southeast in Joe English Brook, which exits the station boundary about 1 mi. downstream of the pond. Joe English Brook is the largest onsite stream. It ranges from 10 to 20 ft wide and between 2 to 5 ft deep (PES 1995). Joe English Brook is designated as a Class B water by the State (PES 1995).

There are three watersheds on NBAFS (see figure 2, Watersheds of NBAFS). Most of NBAFS is located within the Joe English Brook watershed which flows towards the southeast. About half of the Operations Area is within the Bog Brook watershed which flows towards the northwest. Drainage from the northwestern portions of the station flows off site towards the west and north in the Meadow Brook watershed.

The major aquifer system at NBAFS is in the bedrock. Fractured meta-sedimentary rocks that have adequate effective porosity, permeability, and thickness to provide a high degree of groundwater transmissivity in the aquifer system are typical. Groundwater levels at NBAFS range from 73 ft below land surface to flowing artesian conditions near Joe English Pond. The NBAFS potable water supply is provided by groundwater from five wells (two at the Operations Area, one at the Community Center [Building 161], one at the Joe English Pond Campground, and one at the trailer park). The two wells supporting the Operations Area pump to a 110,000-gal storage tank (Building 135), then through a radon-stripping aeration device and chlorination treatment system to a 60,000-gal storage tank in Building 107.

A wetland delineation performed in 1995 and 1996 identified 228 wetland areas totaling 198 ac (see figure 3, Wetlands of NBAFS) located within the boundaries of NBAFS (PES 1996). Wetland complexes were identified in the central portion of NBAFS associated with Joe English Pond; in the southeast associated with Joe English Brook and Wells Bog; along West Meadow Road south of Joe English Hill; along the Ice Pond drainage; and in the east central portion of the station associated with Green Tree Reservoir. Most of the wetlands identified were classified as palustrine forested wetlands (60.4 ac) using the Cowardin et al. (1979) system of classification (PES 1996). Other wetland types on NBAFS include palustrine mixed (35.9 ac), palustrine open water (35.2 ac), palustrine scrub shrub (13.1 ac), and palustrine emergent wetlands

(10.7 ac) (PES 1996). A more complete description of wetlands on NBAFS is presented in the section 2.3.5 titled Wetlands and Floodplains.

No Federal Emergency Management Agency data are available for floodplains within NBAFS (PES 1995). However, for a 100-yr flood event, it has been predicted that Joe English Pond would rise about 7 ft above its bank (PES 1995). The width of the Joe English Brook 100-year floodplain ranges between 100 to 400 ft from its start at Joe English Pond downstream to the vicinity of Greeley Road, located over 1.5 mi southwest of the NBAFS boundary. The 500-year floodplain does not vary appreciably in width from that of the 100-year floodplain boundary (PES 1995).

Picture 3 Joe English Pond

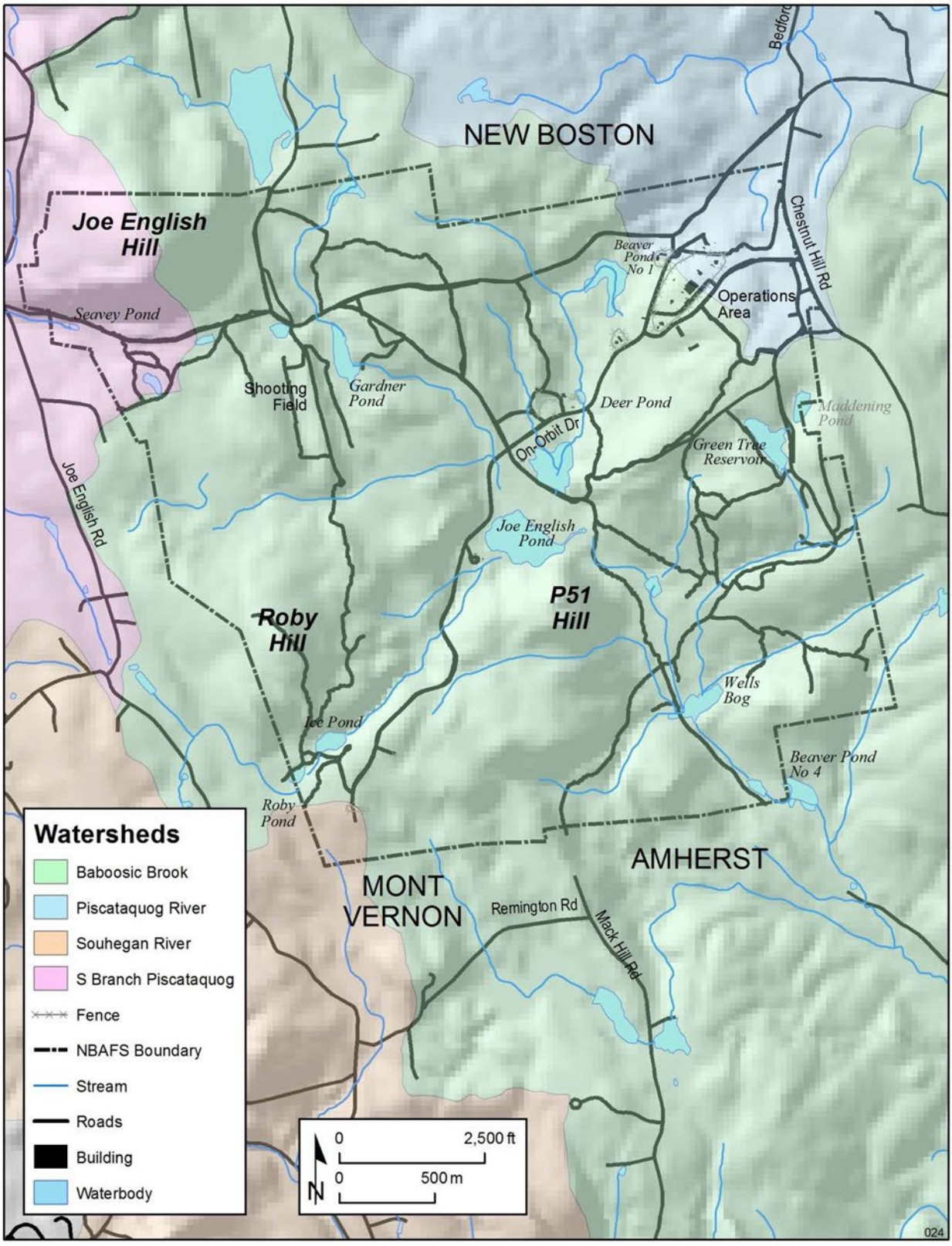


Figure 2 Watersheds of NBAFS

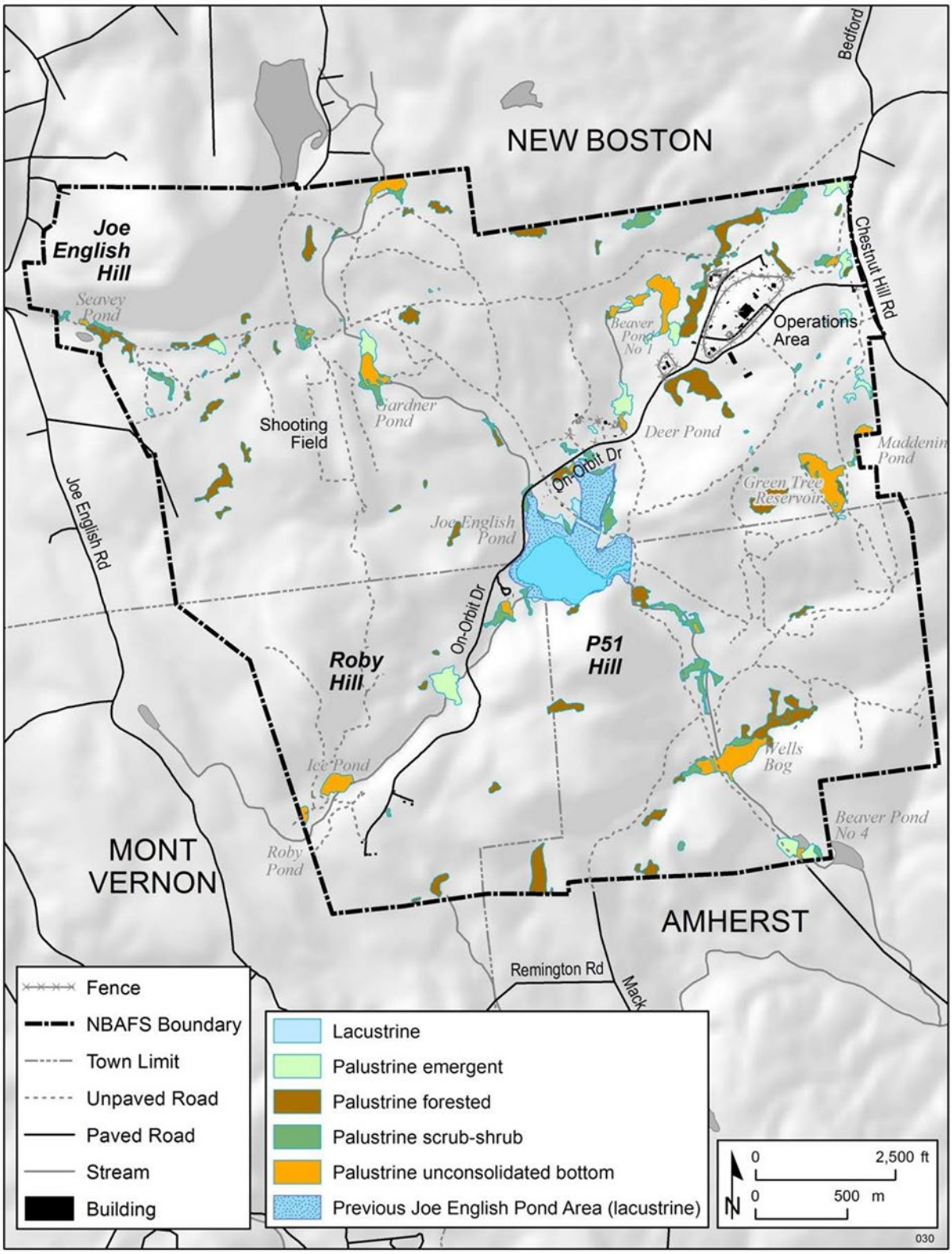


Figure 3 Wetlands of NBAFS

2.3 Ecosystems and the Biotic Environment

2.3.1 Ecosystem Classification

According to Bailey's delineation of ecoregions of North America (Bailey 1995, 1996, and 1998), NBAFS and the surrounding region is within the Humid Temperate Domain–Hot Continental Division–Eastern Broadleaf Forest Province. Nine sections have been delineated in this province; the NBAFS region is located within the Lower New England Section (McNab and Avers 1994) and the Gulf of Maine Coastal Plain Subsection (Sperduto and Nichols 2004).

Elevations in the Lower New England Section gradually descend in a series of broad, hilly plateaus to the coastal zone. Vegetation types include northern hardwood, Appalachian oak, and northeastern oak-pine forest. Important vegetation types in different regions within the section include northern hardwood-hemlock-white pine, central hardwoods, coastal pitch pine, maritime oak, and maritime red cedar. Natural vegetation in the section is predominantly deciduous forest dominated by tall broad-leaved trees that provide a dense canopy in summer (Bailey 1995, 1998). A subcanopy of small trees and shrubs tends to be weakly developed, and a luxuriant ground cover of herbaceous species is present only in spring prior to emergence of the canopy. Soils of the division are typically rich in humus and moderately leached. Forest land dominates 70% of the area, mostly in small holdings. About 15% of the area is used for agricultural and about 10% is urbanized (McNab and Avers 1994). Regionally, the distribution of modern forest types corresponds well with that of presettlement forests.

The original ecosystem of the Lower New England Section was greatly altered by European settlement. Large predators (e.g., gray wolf, *Canis lupus*) were intentionally exterminated, while other large vertebrates were exterminated (e.g., moose, *Alces alces*), reduced, or restricted (e.g., white-tailed deer, *Odocoileus virginianus*; wild turkey, *Meleagris gallopavo*) by hunting and habitat loss (McNab and Avers 1994). Many of these species became re-established with the regrowth of forests on abandoned agricultural lands. The large predators have not returned, and their niche has been partially filled by midsize predators (e.g., bobcat, *Lynx rufus*; coyote, *Canis latrans*). The loss of predators, habitat changes, and patterns of human settlement have resulted in imbalances between herbivores and plant resources. Early successional habitats are lacking in the section (McNab and Avers 1994).

Precipitation, which ranges from 35 to 50 in, is evenly distributed throughout the year in the Lower New England Section (McNab and Avers 1994). The amount of snow varies from 36 to 100 in. and increases with elevation. The mean annual temperature ranges from 45 to 50°F, and the growing season lasts for 120 to 180 days.

The Lower New England Section has abundant water resources, which include perennial streams, natural and artificial lakes and ponds, fresh and saltwater wetlands, and estuaries (McNab and Avers 1994). Stream gradients are generally low. Maximum monthly streamflows typically occur in March and April, but high peak flows may occur any time of year, and are typically associated with hurricanes or rain-on-snow events. Minimum monthly stream flows occur in August, September, and October. Most lakes and impoundments are small.

Ecological disturbance in the Lower New England Section results from fire, hurricanes, land use, tree diseases, and insect pests. Central and coastal New England have intermediate to high occurrences of fire and hurricane winds (once every thirty to fifty years) relative to more inland New England sites. At a landscape scale, modern forest characteristics and distribution are strongly affected by land use, particularly agriculture. Insect and disease disturbances result from gypsy moth (*Lymantria dispar*), beech bark disease (*Nectria* spp.), chestnut blight (*Chryphonectria parasitica*), Dutch elm disease (*Ceratocystis ulmi*),

hemlock woolly adelgid (*Adelges tsugae*), pitch pine looper (*Lambdina athasaria pellucidarium*), hemlock looper (*Lambdina fiscellaria*), oak leaf tier (*Croesia semipurpurana*), red pine scale (*Matsucoccus matsumurae*), and red pine adelgid (*Pineus borneri*).

The Gulf of Maine Coastal Plain Subsection, in which NBAFS is located, has soils that are moderately deep tills deposited by glaciers, and are underlain by both igneous and metamorphic bedrock (Sperduto and Nichols 2004). Glacial drumlins are common in this subsection producing its characteristic rolling topography. The Merrimack River valley, filled with glacial outwash and glacial lake deposits, is a prominent feature of this Subsection.

2.3.2 Vegetation

Historic and current vegetative cover at New Boston Air Force Station are described in this section.

2.3.2.1 Historic Vegetation Cover

A long history of human occupation and settlement in New Hampshire has resulted in significant changes in ecological conditions (Whitney 1994). The Native American practice of burning forested areas in late summer and autumn affected forest structure and species distributions (Najjar 1998). European settlement began in the early 1600s with the clearing of the predominantly forested landscape for farms and villages. Tree species of the original forest included species typical of today's forest such as eastern white pine (Pinus strobus), beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), eastern hemlock (*Tsuga canadensis*), paper birch (*Betula papyrifera*), yellow birch (*Betula alleghaniensis*), white ash (*Fraxinus americana*), alder (*Alnus* spp.), and red oak (*Quercus rubra*). Clearing continued until the mid-1800s when over 50% of the land in southern New Hampshire was farm land. After the late 1800s, farm abandonment was commonplace and many cleared areas began to revert back to forest. Farm abandonment continues to this day, but replacement with residential development has become increasingly common rather than the natural succession of previous decades. Logging on a large scale, especially of white pine, began in the middle 1800s and peaked in the early 1900s; managed timber harvest continues throughout New Hampshire.

Tree diseases and pests have resulted in important changes in forest composition. Perhaps the most important of these is the chestnut blight which has virtually eliminated this formerly dominant species. The disease, introduced from Asia in about 1904, killed most of the mature American chestnut (*Castanea dentata*) in New England within 20 years (Najjar 1998). Succession following the elimination of the chestnut has resulted in simple replacement of that species by its former associates. Sprouts from the old roots of American chestnut can be found today throughout the station, but these die before reaching maturity.

2.3.2.2 Current Vegetation Cover

Over 90% of NBAFS is forested. Nine land cover types have been delineated on NBAFS (figure 4. Habitat Types of NBAFS) and are described below (based on LaGory et al. 1997). Plant species observed on NBAFS are listed in the Appendix: B., Lists of Plant and Animal Species Observed on NBAFS. Much of the area surrounding NBAFS is rural, with interspersed farms, forests, and residential areas. Land cover on the station is consistent with the surrounding area, and much of the habitat present on the station is represented elsewhere in the county and region. However, residential development of surrounding lands has increased within the past decade, resulting in an increase in the ecological importance of the undeveloped land on the station.

Picture 4 Forest Habitat

Coniferous Forest

Coniferous forest habitats on NBAFS include areas with a tree canopy comprised of 60% or more coniferous trees, especially eastern white pine or eastern hemlock. Areas dominated by hemlock (*Tsuga canandensis*) typically have little if any vegetation in the understory, but areas dominated by white pine (*Pinus strobus*) often have relatively diverse understories comprised of young deciduous trees, including red oak (*Quercus rubra*), red maple (*Acer rubrum*), and black birch (*Betula lenta*); shrubs such as mountain laurel (*Kalmia latifolia*) and lowbush blueberry (*Vaccinium angustifolium*); and herbaceous species such as Solomon's seal (*Polygonatum pubescens*), bracken fern (*Pteridium aquilinum*),clubmoss (*Lycopodium* spp.), and pipsissewa (*Chimaphila umbellata*). Coniferous forest is well represented on NBAFS, especially in the southern portions of the station (figure 4, Habitat Types of NBAFS), and occupies a total of about 710 ac.

Deciduous Forest

Deciduous forest habitats on NBAFS include areas with a tree canopy comprised of 60% or more deciduous trees, especially red oak (*Quercus rubra*), black oak (*Quercus velutina*), American beech (*Fagus grandifolia*), white ash (*Fraxinus Americana*), sugar maple (*Acer saccharum*), red maple, and gray birch (*Betula populifolia*). The understory of deciduous forest is typically dominated by saplings of these and other deciduous trees, as well as occasional white pine and hemlock; shrubs such as witch hazel (*Hamamelis virginiana*), mountain laurel (*Kalmia latifolia*), and highbush blueberry (*Vaccinium corymbosum*); and herbaceous species such as wild sarsaparilla (*Aralia nudicaulis*), Canada mayflower (*Maianthemum canadense*), starflower (*Trientalis borealis*), clubmoss, wintergreen (*Gaultheria procumbens),* whorled wood aster (*Aster acuminatus*), Indian cucumber root (*Medeola virginiana*), and hay-scented fern (*Dennstaedtia punctilobula*). Deciduous forest occupies about 540 ac on NBAFS, and the largest stands are located in the northeastern portion of the station (figure 4, Habitat Types of NBAFS).

Mixed Forest

Mixed forest habitats include areas with a tree canopy comprised of a nearly even mix of coniferous and deciduous trees (each less than 60%). Mixed forests vary widely in species composition and typically feature a mix of the species found in coniferous and deciduous forests. The mixed forest is the most extensive habitat type on NBAFS and occupies about 1,300 ac (figure 4).

Oldfield

Oldfield habitats include early successional areas dominated by grasses and forbs. Most of the oldfield habitat on NBAFS is located in three areas—the Shooting Field, the area south of Green Tree Reservoir, and the area east of Joe English Hill (figure 4). Species found in oldfield habitats on NBAFS include broomgrass (*Andropogon scoparius*), timothy (*Phleum pratense*), meadow fescue (*Festuca pratensis*), New York aster (*Aster novi-belgi*), Queen Anne's lace (*Daucus carota*), goldenrod (*Solidago* spp.), and fireweed (*Erechtites hieracifolia*). Some shrubs and small trees are also scattered throughout oldfield habitats and include autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), red maple, paper birch, and white pine. Oldfield habitat occupies a total of 49 ac on NBAFS.

Parkland

Parkland habitats at NBAFS include the Joe English Pond Campground and areas near Deer Pond and Seavy Pond (figure 4). Parkland habitats occupy about 47 ac on NBAFS, and are characterized by maintained turf grass and ornamental trees and shrubs (see further description of maintained areas under Developed Land below.

Wetlands

A total of 228 wetlands were identified by PES (1996) that occupied a total of 198 ac on NBAFS. Wetlands are areas containing vegetation adapted to saturated soil conditions. They are shown in the Figure 3, Wetlands of New Boston Air Force Station, New Hampshire and the Figure 4, Habitat Types of NBAFS and described in detail in the section 2.3.5, Wetlands and Floodplains.

Open Water

Open-water habitat is an area of permanent water that supports little if any emergent vegetation. Open-water habitat is limited to Joe English Pond (figure 4) and occupies 43 ac. This area was classified as a lacustrine wetland in PES (1996).

Disturbed Land

Disturbed lands on NBAFS are those areas with little vegetation or built structures such as clearcuts, gravel pits, or recently graded areas. Disturbed land occupies 37 ac (figure 4).

Developed Land

Developed lands on NBAFS are those areas that support buildings, parking lots, roads, or other built structures, and include areas of mowed lawn and landscape plantings. Developed land on NBAFS is largely limited to the Operations Area in the northeast portion of the site (figure 4) and occupies 44 ac. See the section titled Grounds Maintenance for a description of grounds maintenance practices at NBAFS.

Several seed mixes are used in developed areas of NBAFS (Najjar 1998). A contractor mix is used for lawn areas, and is a mix of turf grasses including annual rye (*Lolium multiflorum*), perennial rye (*Lolium perenne*), Kentucky 31 fescue (*Festuca arundinacea*), creeping red fescue (Festuca rubra), and Kentucky

bluegrass (*Poa pratensis*). A slope mix is used on steeper slopes to prevent erosion; slope mix consists of grasses and hardy low-growing forbs including hard fescue (*Festuca longifolia*), birdsfoot trefoil (Lotus corniculatus), crown vetch (*Coronilla varia*), and white clover (*Trifolium repens*). A conservation mix is used in areas that are mowed less frequently or left unmowed. Species in the conservation mix used at NBAFS include creeping red fescue, annual rye, perennial rye, Kentucky bluegrass, white clover, and red clover (*Trifolium pratense*).

A variety of ornamental tree and shrub species have been planted in developed areas (Najjar 1998). These include Norway maple (*Acerplatanoides*), clump birch (*Betula platyphylla*), crabapple (*Malus* spp.), pagoda dogwood (*Cornus alternifolia*), red-twig dogwood (*Cornus sericea*), forsythia (*Forsythia suspensa*), American cranberry bush (*Viburnum opulus*), Korean lilac (Syringa meyeri), junipers (*Juniperus* spp.), yews (Taxus spp.), mugo pine (*Pinus mugo*), burning bush (*Euonymus alatus*), rhododendron (*Rhododendron* spp.), azalea (*Azalea* spp.), and Colorado blue spruce (*Picea pungens*). Native species (e.g., white pine and sugar maple) have also been used in landscape plantings in the Operations Area and in the Joe English Pond Campground.

Rare Natural Communities

Nine locations (seven wetlands and two woodlands) support five rare natural community types on NBAFS (Lagory 2009). The areal extent of these rare natural community types totaled about 36.5 ac and included: Black gum-red maple basin swamp: five locations, totaling 11.4 ac, a complex of two community types (highbush blueberry-mountain holly wooded fen and large cranberry short sedge moss lawn) found in two locations, totaling 3.6 ac, Red oak-black birch wooded talus community, one location, totaling 8.6 ac; and Appalachian oak-pine rocky ridge community, one location, totaling 12.9 ac.

Black Gum–Red Maple Basin Swamp

Black gum-red maple basin swamps are ranked S1S2 in the state and are considered a diagnostic community of temperate peat swamp systems (Sperduto 2005b). Although only one black gum-red maple basin swamp was described in LaGory et al. (1997), several other wetlands had been identified as potential black gum red maple basin swamps by NBAFS Natural Resources staff since 1995. A total of five black gum-red maple basin swamps were surveyed in 2009. All of the sites surveyed showed characteristics consistent with the black gum-red maple basin swamp description provided in Sperduto and Nichols (2004), including size, geographic situation, hydrological features, and vegetative structure and composition. None of the sites showed any indication of disturbance, either natural or human caused.

Picture 5 Black Gum-Red Maple Swamp (LaGory 2011)

Highbush Blueberry-Mountain Holly Wooded Fen and Large Cranberry-Short Sedge Moss Lawn (Murphy Swamp)

The NBAFS feature known locally as Murphy Swamp, and depicted in the figure 5, Location of Rare Natural Communities on NBAFS as Murphy Swamp, is a 1.5-ac wetland system surrounded by upland mixed forest south of West Meadow Road and north of the road to Gate 15. This wetland was surveyed in 1995, and was composed of three concentric vegetation zones that differed in species composition, structure, and water depth. The outermost zone that bordered upland forest consisted of a dense tall shrub thicket dominated by highbush blueberry, but also contained mountain holly, common winterberry, chokeberry (Photinia sp.), and occasional white pine, red maple, and black gum. This tall-shrub zone (up to 60 ft wide) transitioned into a zone of tall herbaceous species and low shrubs dominated by tall sedges (identified in 1995 as *Carex rostrata*), large cranberry, scattered highbush blueberry (typically on hammocks), common buttonbush (*Cephalanthus occidentalis*), pod-grass (*Scheuchzeria palustris*), and sphagnum (*Sphagnum magellanicum)*. The central portion of the wetland where the water was deepest had markedly shorter vegetation that included needle spikerush (identified in 1995 as *Eleocharis acicularis*), pod-grass, beaksedge (identified in 1995 as *Rhynchospora* sp.), three-way sedge (*Dulichium arundinaceum*), common arrowhead (*Sagittaria latifolia*), large cranberry (*Vaccinium macrocarpon*), sphagnum, and abundant sundews (*Drosera* sp.).

This wetland was identified as a coastal/southern acidic fen in LaGory et al. (1997). Comparing the 1994 (Sperduto 1994) and 2004 (Sperduto and Nichols 2004) classification systems, and using descriptions presented in LaGory et al. (1997), Sperduto (2005a) determined that this wetland should be considered a medium-level fen system. Based on the 2009 survey results and further comparison to the descriptions provided in Sperduto (2005b), it is now believed that the designation of this wetland as a medium-level fen system was incorrect and that the wetland has characteristics most similar to those of a kettle-hole bog system or a poor-level fen/bog system. As described in Sperduto (2005b) these three systems are similar, but medium-level fen systems are hydrologically open systems (i.e., hydrologically connected to a stream or lake), whereas the other two systems are hydrologically closed.

Two natural communities were represented in Figure 5, a highbush blueberry-mountain holly wooded fen (S3S4) and a large cranberry-short sedge moss lawn (S3). These communities are represented by the outer

tall-shrub zone and the inner low-vegetation zone. The intermediate zone of tall herbaceous species and low shrubs between these two communities represents a transitional area.

Picture 6 Murphy Swamp (LaGory 2011)

Red Oak-Black Birch Wooded Talus

The red oak-black birch wooded talus community (S3S4), located at the base of Joe English Hill (figure 5) had three characteristically distinct areas: (1) dense woodland with large trees and a well-developed, diverse understory at the base of the talus slope; (2) discontinuous areas of mostly large talus rocks that supported scattered shrubs and small trees; and (3) at the highest elevation, a bench with well-developed soil and large trees. The community ended upslope at a sheer cliff largely devoid of vegetation.

Overstory and midstory vegetation in the lower-elevation portions of the community was dominated by large red oak, black birch, and sugar maple with red maple, hophornbeam (*Ostrya virginiana*), and white ash in lower abundance. The diverse shrub and herbaceous layers were comprised of striped maple (*Acer pensylvanicum*), witch hazel, wood fern (*Dryopteris* sp.), wild sarsaparilla, polypody (*Polypodium* sp.), and white snakeroot. Open areas with mostly rock cover supported shrubs including staghorn sumac (*Rhus typhina*) and young black birch (figure 5). Dense foliose lichen covered many of the large boulders in this community.

Picture 7 Joe English Hill, Red Oak-Black Birch Wooded Talus (LaGory 2011)

Appalachian Oak–Pine Rocky Ridge Community

The Appalachian oak-pine rocky ridge community (S3), shown in the figure, was estimated as 5.2 ac (2.1 ha) in size in 1995 and was located upslope of the brow of the cliff that defined the upper boundary of the red oak-black birch wooded talus community. The determination of the uppermost community as dry Appalachian oak hickory forest was determined to be incorrect and that this area should be considered an extension of the Appalachian oak-pine rocky ridge community (Lagory 2009). According to Sperduto and Nichols (2004), dry Appalachian oak-hickory forests are found on glacial till, terraces, dunes, or sand plains, not on rock ridges. Sperduto and Nichols (2004) also list several species of hickory (*Carya* sp.) as characteristic of this community type, but no hickory species were found in either the 1995 or 2009 surveys. As described below, this area had the characteristics of an Appalachian oak-pine rocky ridge community. Combining these two areas results in a total community area of 10.2 ac. This areal estimate is a rough approximation because the exact boundaries of this community have not been determined. This combined oak-dominated community consists of two fairly distinct portions that correspond to the community boundaries in LaGory et al. (1997). These are treated as separate vegetation zones in our discussion here. The communities called oak-pine rocky summit woodland community and southern acidic rocky summit community in LaGory et al. (1997) make up the first, lower-elevation zone. The area delineated as dry transitional oak white pine forest in LaGory et al. (1997) makes up the second, higher-elevation zone.

The first, lower-elevation vegetation zone occurred on a relatively steep slope (approximately 30 degrees) with a substantial amount of rock slabs and exposed bedrock. For much of this zone the overstory was open and dominated by stunted (approximately 20 ft tall) red oaks and black oaks with lesser amounts of white oak, white pine, pitch pine (*Pinusrigida*), eastern red-cedar (*Juniperus virginiana*), and black birch. Standing dead snags of oaks and pines from previous natural and prescribed fires occurred along the northern portion of this zone. Scrub oak formed an often dense midstory; density of scrub oak was highest in the eastern portion of this zone. Understory vegetation was dominated by extensive patches of lowbush blueberry with ground juniper (*Juniperus communis*), grasses, sedges, moss, bare rock, and saplings of canopy species. In addition, several clumps of the fern-leaved false foxglove were observed in exposed areas.

The second, higher-elevation zone was on a fairly level portion of the hill just upslope of zone 1, and supported taller trees. As discussed previously, this zone had been incorrectly classified as dry Appalachian oak-hickory forest in LaGory et al. (2006). The overstory of this zone was dominated by red oak, with lesser

numbers of white oak and white pine. Understory was dominated by lowbush blueberry, grasses, and sedges. This zone had been strongly affected by a series of natural and prescribed fires (a wildfire in 1994 and two prescribed burns in 1999 and 2008), which had altered community structure.

Although past fires have greatly altered zone 2 of this community, overall species composition observed in 2009 in both zones was relatively consistent with that described in the 1995 survey. The most notable change in species composition was the large increase in grass cover since 1995, presumably in response to the reduction in tree canopy. Although this woodland community type is considered fire-adapted and likely requires regular fires for maintenance of community structure and composition (Sperduto and Nichols 2004), reestablishment of the mature tree canopy will probably take decades. No nonnative invasive species or other disturbances were apparent during our survey.

Picture 8 Joe English Hill, Appalachian Oak-Pine Rocky Ridge (Lagory 2011)

Mixed Tall Graminoid-Scrub-Shrub Marsh and Aquatic Bed (Chain Fern Bog)

The Chain Fern Bog is a 1.8-ac horseshoe-shaped wetland system surrounded by upland mixed forest in the northeast portion of NBAFS adjacent to the site boundary and near a heavily used gravel road (figure 5). This wetland was not surveyed in 1995. The wetland is surrounded by a mostly highbush blueberry thicket that also contains maleberry, and, along the upland border, mountain laurel. Within this thick border are occasional lowbush blueberry, red maple, black gum, paper birch, and bracken fern.

Within the shrub border, the wetland is a complex of open water with some floating aquatic macrophytes (at the end of the southwestern arm of the wetland), marshy areas with three-way sedge and buttonbush (at the end of the southeastern arm of the wetland), and drier areas in between with shrubs and trees (mostly highbush blueberry, small red maple, and small black gum). Outflow from the wetland was from the southwestern arm into a small stream channel, but there was no apparent point of inflow.

Based on the descriptions in Sperduto (2005b), the wetland can be considered an emergent marsh-shrub swamp system. This conclusion is based on the wetland's open (i.e., not wooded) vegetative structure, occurrence on a primarily mineral substrate rather than peat, and a hydrogeomorphic setting that is depressional (i.e., occurs in a topographic depression) and open (i.e., hydrologically connected to a stream or lake).

The Chain Fern Bog contains two natural community types: a mixed tall graminoid-scrub-shrub marsh (S4S5), which is a type of shallow emergent marsh, at the end of the southeastern arm, and an aquatic bed community (S4S5) at the end of the southwestern arm. As indicated by their state ranks, neither of these community types is considered rare in the state.

No nonnative invasive species or other disturbances were apparent during our 2009 survey. Although the wetland is adjacent to a heavily traveled gravel road, no sign of sediment or water runoff into the wetland from the road was apparent, and a vegetated buffer separates the wetland from the road. In addition, the wetland's location near the site boundary makes it potentially susceptible to offsite land use impacts. Some houses are located near the wetland just outside of the boundary (figure 5).

Picture 9 Chain Fern Bog (LeGory 2011)

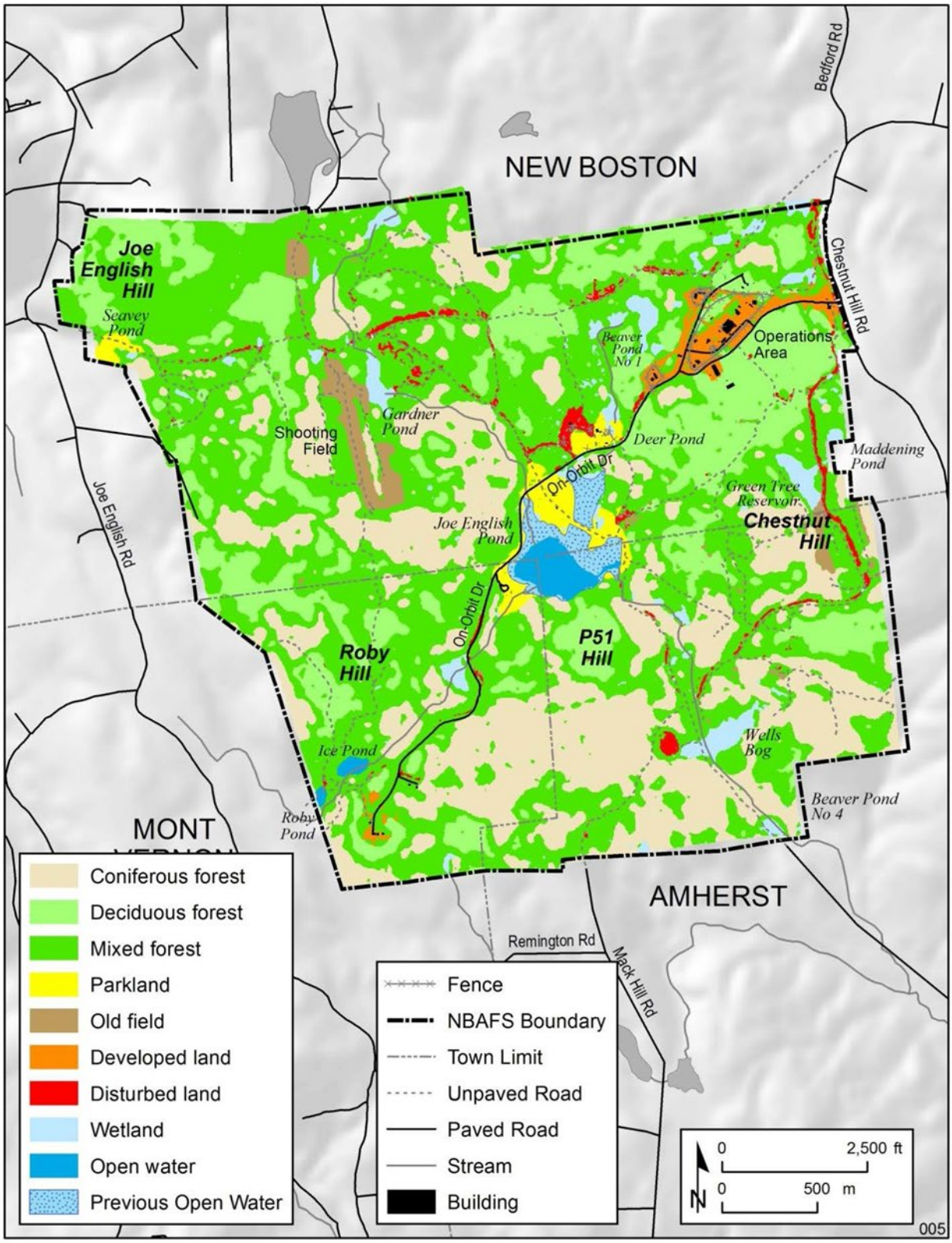


Figure 4 Habitat Types of NBAFS Source: LaGory et al. (1997)

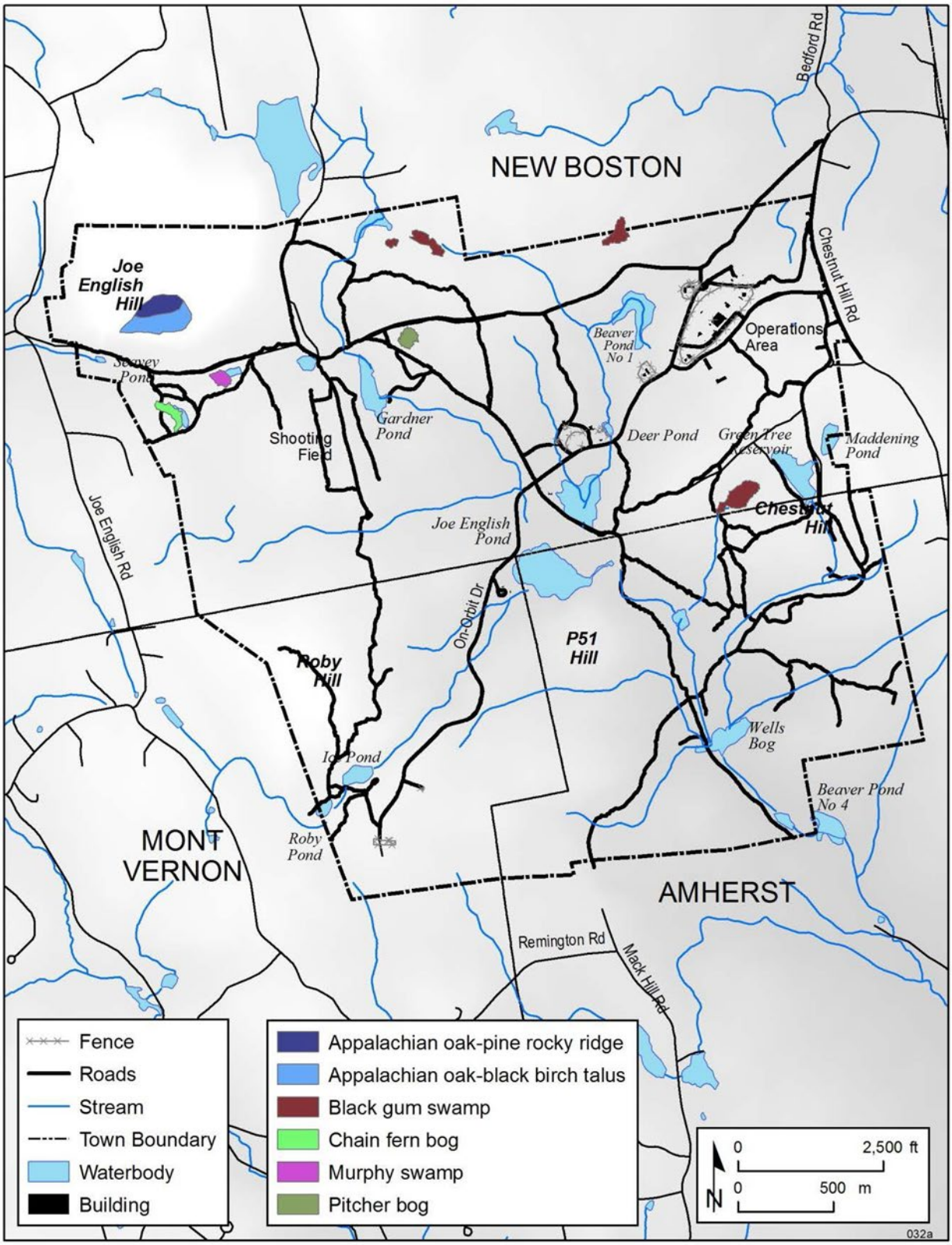


Figure 5 Location of Rare Natural Communities on NBAFS

2.3.2.3 Future Vegetation Cover

NBAFS is expected to remain forested with a mix of Appalachian and Northern Hardwood species and eastern coniferous species. Woodlands and forests are susceptible to climate change. There is a temperature below which the equilibrium state of the forest appears constant, but above which the equilibrium forest cover declines steadily. This threshold represents a point where some degree of loss of the forest is inevitable. As the threshold is exceeded, there is a gradual increase in the committed dieback, with changes that are more progressive than sudden. Therefore, forest vegetation at NBAFS may experience some degree of die-back before impacts are observed.

Slight changes in temperature and precipitation can potentially alter the composition, distribution, and abundance of species, and the products and services they provide. The extent of these changes will also depend on changes in precipitation and fire. Increased drought frequency could also cause major changes in vegetation cover. Losses of vegetative cover coupled with increases in precipitation intensity and climate-induced reductions in soil aggregate stability will dramatically increase potential erosion rates. The combination of eroded sediment transport to streams coupled with changes in the timing and magnitude of minimum and maximum flows can affect water quality, riparian vegetation, and aquatic fauna.

Swamp areas may also be vulnerable to changes. These ecosystems will face increases in air and surface water temperatures, alterations in the magnitude and seasonality of precipitation and run-off, and shifts in reproductive phenology and distribution of plants and animals (Comer et al., 2012). These ecosystems provide linear ecosystem connectivity, link aquatic and terrestrial ecosystems, and create thermal refugia for wildlife: all of these are characteristics that can contribute to ecological adaptation to climate change.

Rising temperatures will enhance soil decomposition, and, together with reductions in rainfall, may also reduce plant productivity in large areas, such as forests and riparian areas. Because riparian systems and the projected impacts of climate change are highly variable geographically, there is a pressing need to develop a place-based understanding of climate change threats to riparian ecosystems at NBAFS. (CSU 2019).

2.3.2.4 Turf and Landscaped Areas

The NBAFS mission area is primarily mowed grass with some native and nonnative tree and shrub plantings. Several seed mixes are used in developed areas of NBAFS (Najjar 1998). A contractor mix is used for lawn areas, and is a mix of turf grasses including annual rye (*Lolium multiflorum*), perennial rye (*Lolium perenne*), Kentucky 31 fescue (*Festuca arundinacea*), creeping red fescue (*Festuca rubra*), and Kentucky bluegrass (*Poa pratensis*). A slope mix is used on steeper slopes to prevent erosion; slope mix consists of grasses and hardy low-growing forbs including hard fescue (*Festuca longifolia*), birdsfoot trefoil (*Lotus corniculatus*), crown vetch (*Coronilla varia*), and white clover (*Trifolium repens*). A conservation mix is used in areas that are mowed less frequently or left unmowed. Species in the conservation mix used at NBAFS include creeping red fescue, annual rye, perennial rye, Kentucky bluegrass, white clover, and red clover (*Trifolium pratense*).

A variety of ornamental tree and shrub species have been planted in developed areas (Najjar 1998). These include Norway maple (*Acer platanoides*), clump birch (*Betula platyphylla*), crabapple (*Malus* spp.), pagoda dogwood (*Cornus alternifolia*), red-twig dogwood (*Cornus sericea*), forsythia (*Forsythia suspensa*), American cranberry bush (*Viburnum opulus*), Korean lilac (*Syringa meyeri*), junipers (*Juniperus* spp.), yews (*Taxus* spp.), mugo pine (*Pinus mugo*), burning bush (*Euonymus alatus*), rhododendron

(*Rhododendron* spp.), azalea (*Azalea* spp.), and Colorado blue spruce (*Picea pungens*). Native species (e.g., white pine and sugar maple) have also been used in landscape plantings in the Operations Area.

2.3.3 Fish and Wildlife

At least fourteen species of fish occur at NBAFS (see Appendix B1, Lists of Plant and Animal Species Observed on New Boston Air Force Station). The most important fish habitat on the station is provided by Joe English Pond, which supports a warmwater fishery. Fish species known to occur in Joe English Pond include American eel (*Anguilla rostrata*), brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), chain pickerel (*Esox niger*), golden shiner (*Notemigonus crysoleucas*), brown bullhead (*Ameiurus nebulosus*), largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), and yellow perch (*Perca flavescens*). Brook trout and rainbow trout are stocked annually. Rainbow trout and brook trout also have been stocked in Ice and Roby Ponds to provide an early spring fishery (PES 1995). Brook trout have also been stocked in Joe English Brook in the spring; however, summer water temperatures approach upper lethal limits for that species (PES 1995). Fisheries survey work was conducted by the US Fish and Wildlife Service Central New England Fisheries Office from 2006-2007. Most waters capable of sustaining fish populations on NBAFS were sampled. Two previously unidentified species were documented; the Banded sunfish (*Enneacanthus obesus*) state listed Special Concern and the bluegill (*Lepomis macrochirus*) were found in the Joe English Brook watershed (Roettiger 2007).

Picture 10 Chain Pickerel

Twenty-three species of reptiles and amphibians have been observed on NBAFS (see the Appendix B1, Lists of Plant and Animal Species Observed on New Boston Air Force Station). Common species include red-backed salamander (*Plethodon cinereus*), red-spotted newt (*Notophthalmus viridescens*), spring peeper (*Pseudacris crucifer*), wood frog (*Rana sylvatica*), pickerel frog (*Rana palustris*), painted turtle (*Chrysemys picta*), and garter snake (*Thamnophis sirtalis*) (LaGory et al. 1997).

Picture 11 Pickerel Frog

A total of 147 species of birds have been observed on NBAFS; 109 of these species are neotropical migrants (see Appendix B1, Lists of Plant and Animal Species Observed on New Boston Air Force Station). Common species on the station included Canada goose (*Branta canadensis*), broad-winged hawk (*Buteo platypterus*), tree swallow (*Tachycineta bicolor*), black-capped chickadee (*Poecile atricapillus*), blue jay (*Cyanocitta cristata*), American crow (*Corvus brachyrhynchos*), American robin (*Turdus migratorius*), cedar waxwing (*Bombycilla cedrorum*), dark-eyed junco (*Junco hyemalis*), and common grackle (*Quiscalus quiscula*). At least 58 bird species breed on NBAFS, and 42 of these are neotropical migrants. The largest numbers of bird species (more than 80 species in each) were observed in wetlands, parkland, mature mixed forest, and mature deciduous forest (LaGory et al. 1997). The fewest species (less than 50 species in each) were observed in developed, disturbed, and young coniferous forest (LaGory et al. 1997).

Thirty one mammal species have been observed on NBAFS (see Appendix B1 titled Lists of Plant and Animal Species Observed on New Boston Air Force Station) (LaGory et al. 1997; LaGory et al. 2002). The eastern chipmunk (*Tamias striatus*), red squirrel (*Tamiasciurus hudsonicus*), coyote, and white-tailed deer are abundant, while the woodchuck (*Marmota monax*), red-backed vole (*Clethrionymys gapperi*), porcupine (*Erethizon dorsatum*), red fox (*Vulpes fulva*), and fisher (*Martes pennanti*) are common.

Although the number of bats captured at NBAFS during surveys in 2002 was relatively low, species diversity was surprisingly high (LaGory et al. 2002). Eight of the nine species whose range includes New Hampshire were captured or detected during the survey. Species captured included the little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), northern long-eared bat (*Myotis septentrionalis*), hoary bat (*Lasiurus cinereus*), red bat (*Lasiurus borealis*), tricolored bat (*Pipistrellus subflavus*), silver-haired bat (*Lasionycteris noctivagans*), and eastern small-footed bat (*Myotis leibii*). Of these species, the red bat is very rare (State Rank S3B), the Tricolored Bat (formerly eastern pipistrelle) is considered critically imperiled (State Rank S1), hoary bat (*Lasiurus cinereus*) is considered very rare S3B), silver-haired bat (*Lasionycteris noctivagans*) is considered very rare (State Rank S3B), northern long-eared bat (*Myotis septentrionalis*) is federally listed as threatened and the small-footed bat is State-listed as endangered. The only New Hampshire bat species not captured or detected in the survey was the federally listed Indiana bat (LaGory et al. 2002). Several bat surveys (2006, 2017 and 2019) conducted since 2002 have documented a similar species assemblage at NBAFS.

2.3.4 Threatened and Endangered Species and Species of Concern

Threatened, endangered, and rare species that are known to occur on NBAFS are listed in Table 3, Federally Listed, State-Listed, and Rare Species of Plants and Animals Found on New Boston Air Force station, New

Hampshire. The Northern Long-eared bat is the only federally threatened species found on New Boston Air Force Station. Several State-listed birds (bald eagle, pied-billed grebe, and northern harrier), several-state listed reptiles (Blanding's turtle, spotted turtle, and eastern hognose snake), and several state listed bat species (Tricolored bat, Northern long-eared bat) have also have been observed or detected on NBAFS. In addition, several animal species that are considered rare (Special Concern or other rank) by the New Hampshire Natural Heritage Bureau (NHNHB) have been observed on NBAFS including: silver haired-bat, hoary bat and wood turtle.

Picture 12 Pink Lady's Slipper

Table 3 Federally Listed, State-Listed, and Rare Species of Plants and Animals Found on New Boston Air Force Station, New Hampshire

Common Name	Scientific Name	Federal Status[1]	State Status[1]	State Rank[2]
Fish				
American eel	*Anguilla rostrata*	NL	NL	S3
Banded sunfish	*Enneaucanthis obesus*	NL	NL	S3
Reptiles				
Spotted turtle	*Clemmys guttata*	NL	LT	S2
Wood turtle	*Glyptemys insculpta*	NL	SC	S3
Blanding's turtle	*Emydoidea blandingii*	NL	LE	S1
Eastern hognose snake	*Heterodon platirhinos*	NL	LE	S1
Smooth green snake	*Opheodrys vernalis*		SC	S3
Birds[3]				
Pied-billed grebe	*Podilymbus podiceps*	NL	LT	S2B
Bald eagle	*Haliaeetus leucocephalus*	NL	SC	S2
Northern harrier	*Circus cyaneus*	NL	LE	S1B
Peregrine Falcon	*Falco peregrinus*	NL	LT	S2
Mammals				
Northern long-eared bat	*Myotis septentrionalis*	LT	LE	S1

Common Name	Scientific Name	Federal Status[1]	State Status[1]	State Rank[2]
Little Brown Bat	*Myotis lucifugis*		LE	S1
Hoary bat	*Lasiurus cinereus*	--	SC	S3B
Tricolored bat	*Pipistrellus subflavus*	--	LE	S1
Silver-haired bat	*Lasionycteris noctivagans*	--	SC	S3B
Eastern small-footed bat	*Myotis leibii*	--	LE	S1

1: LE = listed as endangered; LT = listed as threatened; NL = not listed; NA = not applicable, SC = special concern.

2: State Rank Codes: S1 = Critically imperiled because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction. S2 = Imperiled because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range. S3 = Either very rare and local throughout its range, or found locally (even abundantly at some of its locations) in a restricted range, or vulnerable to extinction throughout its range because of other factors (in the range of 21 to 100 occurrences). S4 = Apparently secure, though it may be quite rare in parts of its range, especially at the periphery. SU = Possibly in peril, but status uncertain; more information needed.

State Rank Modifiers: B = Breeding status for a migratory species. N = Non-breeding status for a migratory species. ? = the rank is uncertain due to insufficient information at the State or global level.

State ranks do not confer any official or legal status to a species. These ranks are assigned by the NHNHB to provide information on the population status of species within the State. State ranks are from NHNHB (2004a, 2004b).

3: Some bird species found on NBAFS that are considered rare in New Hampshire only as breeders are not included in this table because they were not observed during the breeding season.

Each of these species is discussed below. No federally designated critical habitat for threatened or endangered species occurs on NBAFS. No plant species at NBAFS are federally or state listed, no rare species occur on NBAFS. The current status (as of 2/3/21) of USFWS listing actions are show in Table 4.

Table 4 Status of federal listing actions

Common name	Scientific Name	Status	Link to status
Tricolored bat	*Perimyotis subflavus*	under review	https://ecos.fws.gov/ecp/species/10515
Monarch butterfly	*Danaus plexippus*	candidate	https://ecos.fws.gov/ecp/species/9743
Blanding's turtle	*Emydoidea blandingii*	under review	https://ecos.fws.gov/ecp/species/6056
Spotted turtle	*Clemmys guttata*	under review	https://ecos.fws.gov/ecp/species/9264
Wood turtle	*Glyptemys insculpta*	under review	https://ecos.fws.gov/ecp/species/6997
Little brown bat	*Myotis lucifugus*	under review	https://ecos.fws.gov/ecp/species/9051

Spotted turtle (*Clemmys guttata)*

The spotted turtle (State-listed Threatened State rank S2) was observed on NBAFS, near Joe English Pond in June 2000 (figure 6, Location of Rare Reptile Observations on NBAFS; Najjar 2005). This species was not observed or captured during the biodiversity survey (LaGory et al. 1997), a turtle telemetry project that targeted capture of the spotted turtle (Najjar and Drake 2005), or the 2004 Joe English Pond survey. After these studies, however, an individual was captured and equipped with a radio transmitter in 2006, a spotted turtle was captured in the chain fern wetland during 2010 and an additional spotted turtle was captured during 2011 near the baseball field. The spotted turtle is relatively inactive except in early spring

(NatureServe 2003), which may account for the lack of records on NBAFS. Preferred habitat of the spotted turtle is unpolluted, small, shallow bodies of water such as small marshes, marshy pastures, bogs, fens, woodland streams, swamps, small ponds, and vernal pools, especially those habitats with a soft bottom and aquatic vegetation (DeGraaf and Rudis 1986; NatureServe 2003). These habitats are present on NBAFS. Eggs are usually laid from June to July in well-drained soil of marshy pastures or in tussocks; eggs hatch in August (DeGraaf and Rudis 1986).

Picture 13 Spotted Turtle on NBAFS, June 2000

Wood Turtle (*Glyptemys insculpta*)

The wood turtle (State rank S3) has been observed once on NBAFS near the northern boundary of the station in July 1999 along a road near a forested wetland (figure 6). The biodiversity survey (LaGory et al. 1997) did not detect this species on the station. The wood turtle frequents slow-moving meandering streams, but disperses from such habitats and into a variety of upland habitats during the summer (DeGraaf and Rudis 1986). Eggs are laid in May and June in open areas with sandy or gravelly soils.

Blanding's Turtle (*Emydoidea blandingii*)

The Blanding's turtle (State-listed endangered, State rank S1) is regularly observed on NBAFS and is known to successfully nest on the station (figure 6). Although Blanding's turtles were not observed during the biodiversity survey (LaGory et al. 1997). Prior to 2004, 17 records of Blanding's turtles were made, but these were largely based on incidental observations rather than specific surveys or studies, and all were made in the northeastern portion of the station.

Observations of 40 different adult individuals were made from 2004 to 2020; most of these observations were in the northeastern portion of the station. NBAFS natural resources personnel typically track approximately 10 turtles through the field season (April-October) and document their locations. Habitats where turtles have been found on NBAFS include a variety of wetland habitats (cattail marsh, high-bush blueberry wetland, vernal pools and red maple swamp), deciduous forest, pine forest, and open lawn. Forest and lawn areas were apparently being traversed by turtles as they moved between wetlands.

In 2004, two studies were conducted to better understand the occurrence and habitat relationships of Blanding's turtles on NBAFS—a turtle telemetry project (Najjar and Drake 2005a) and an ecological survey of Joe English Pond (ANL unpublished). Collectively, the two studies resulted in surveying wetlands in all portions of the station. No Blanding's turtles were captured in Joe English Pond despite a relatively intensive trapping effort (307 trap-days). Five adult Blanding's turtles (3 females, 2 males) were captured on NBAFS during the 2004 turtle telemetry project; 4 of these were fitted with radio-transmitters and

relocated regularly during the summer and autumn. Another adult Blanding's turtle was captured off site and released on NBAFS in cooperation with NHFGD. Radio telemetry studies have continued annually and have further documented habitat use on NBAFS.

The 2004 radio telemetry study evolved into long term monitoring of Blanding's movement and habitat use. Since 2004, 41 turtles were marked with numbers and pit tagged. DNA samples have been collected on approximately 20 individuals and provided to NH Fish and Game.

A management plan for Blanding's turtle was developed during 2012 based on documented habitat needs and challenges to survival created by improvements. NBAFS also conducted a study looking at road mortality and improvements to designs of roads. An effort has been made to insure no new curbing is installed at NBAFS that would interfere with reptile travel.

Observations from 2004 to 2020 suggest that Blanding's turtles on NBAFS use several wetlands in the northeastern portion of the station. These include Maddening Pond, Green Tree Reservoir, a high-bush blueberry wetland, several cattail marshes, and a beaver-controlled wetland complex. Some movement was observed between wetlands and into terrestrial habitats during the summer. Each transmitter-equipped turtle selected an overwintering site within one of the wetlands occupied during other portions of the year. Because the preferred habitats of Blanding's turtles are in the northeastern portion of the station and near the Operations Area, there is a relatively great potential for vehicle-related mortality especially as adults move towards nesting areas, and newly hatched young move from their nests to wetlands. Blanding's turtles lay their eggs in June and July in sandy soils of upland areas (DeGraaf and Rudis 1986). The observation of hatchlings in the Operations Area suggests that nesting is occurring in the vicinity. Road-crossing is made particularly hazardous by curbs along paved roads in this portion of the station. Curbs make climbing out of the road difficult, especially for small turtles.

Picture 14 Blanding's Turtle on NBAFS, May 2004

Picture 15 Hatching Blanding's Turtle in Roadway on NBAFS, 2004

Eastern Hognose Snake (*Heterodon platirhinos)*

The eastern hognose snake (State-listed endangered, State rank S1) has been regularly observed on NBAFS (figure 6). The hognose snake has a burrowing (fossorial) habit and prefers woodland habitats with sandy soils such as dry open pine forest or deciduous woods; the species can also be found in oldfields (DeGraaf and Rudis 1986). These types of habitat are fairly widespread on NBAFS. Eggs are laid in June and July in soil, especially under or in decaying logs; eggs hatch from July to September.

The occurrence of the eastern hognose snake on NBAFS was first positively confirmed from a roadkill on Campbell Road in 1997 (LaGory et al. 1997). Habitat in the area was early to mid-succession deciduous forest that included red oak, gray birch, red maple, quaking aspen, and striped maple (*Acer pensylvanicum*). From 1997 to 2003 there were 11 confirmed records of the hognose snake on NBAFS. During this time, records were largely based on incidental observations rather than specific surveys or studies. NBAFS staff identified two adult hognose snakes in May 2004 near the station's borrow pit. Two other hognose snakes were captured in June 2004.

The occurrence of hognose snakes on NBAFS prompted a concern for locating and protecting hibernation areas for the species on the station. In September 2004, more intensive searches of apparently suitable habitats were searched in an attempt to capture adults that would be suitable for implantation of a radio-transmitter for a study of movements and habitat use (Najjar and Drake 2005b). Five hatchlings and one juvenile were found during these searches, but none were sufficiently large to accept a transmitter. Most of these were captured near the Boresight Tower located in the southwestern portion of the station (figure 6,). Telemetry studies were initiated in 2005 and continued through 2007 (LaGory et al. 2008) to further elucidate habitat relationships and movement patterns of the eastern hognose snake on NBAFS. A detailed report of the findings was developed by Argonne National Laboratory in *Movement and Habitat Use of Eastern Hognose Snakes at New Boston Air Force Station, New Hampshire*. Generally, hognose were distributed across the installation and used many different habitat types available on NBAFS. The average homerange of the eastern hognose studied was 51.7 hectares +/- 14.7 hectares.

NBAFS Natural Resources staff continue to record and report hognose sightings to NHFGD. One juvenile was identified in 2014 and two snakes were identified in 2016 (one juvenile and one adult).

Picture 16 Eastern Hognose Snake on NBAFS, May 2004

Smooth green snake (*Opheodrys vernalis*)

The smooth green snake (State rank S3) has been observed once on NBAFS (figure 6). The snake was accidentally killed during a prescribed burn spring, 2019 in one of the installation's fields.

Picture 17 Smooth green snake, Photo Jonathan Mays

Smooth green snakes may be found in a variety of open or lightly forested habitats such as pastures, old fields, wet meadows, marsh borders, coastal grasslands, Pine Barrens, blueberry barrens, and grassy hilltops (Klemens 1993, New Hampshire Reptile and Amphibians Reporting Program 2015). Smooth green snakes feed primarily on invertebrates including arthropods, caterpillars, grasshoppers, slugs and earthworms. Females may lay two or more clutches of well-developed eggs a season, usually in July-August, in piles of rotting vegetation or sawdust, rotting logs and stumps or mammal burrows (Ernst and Ernst 2003). Ant mounds, rock crevices and mammal burrows may be used during hibernation (Carpenter 1953, Ernst and Ernst 2003).

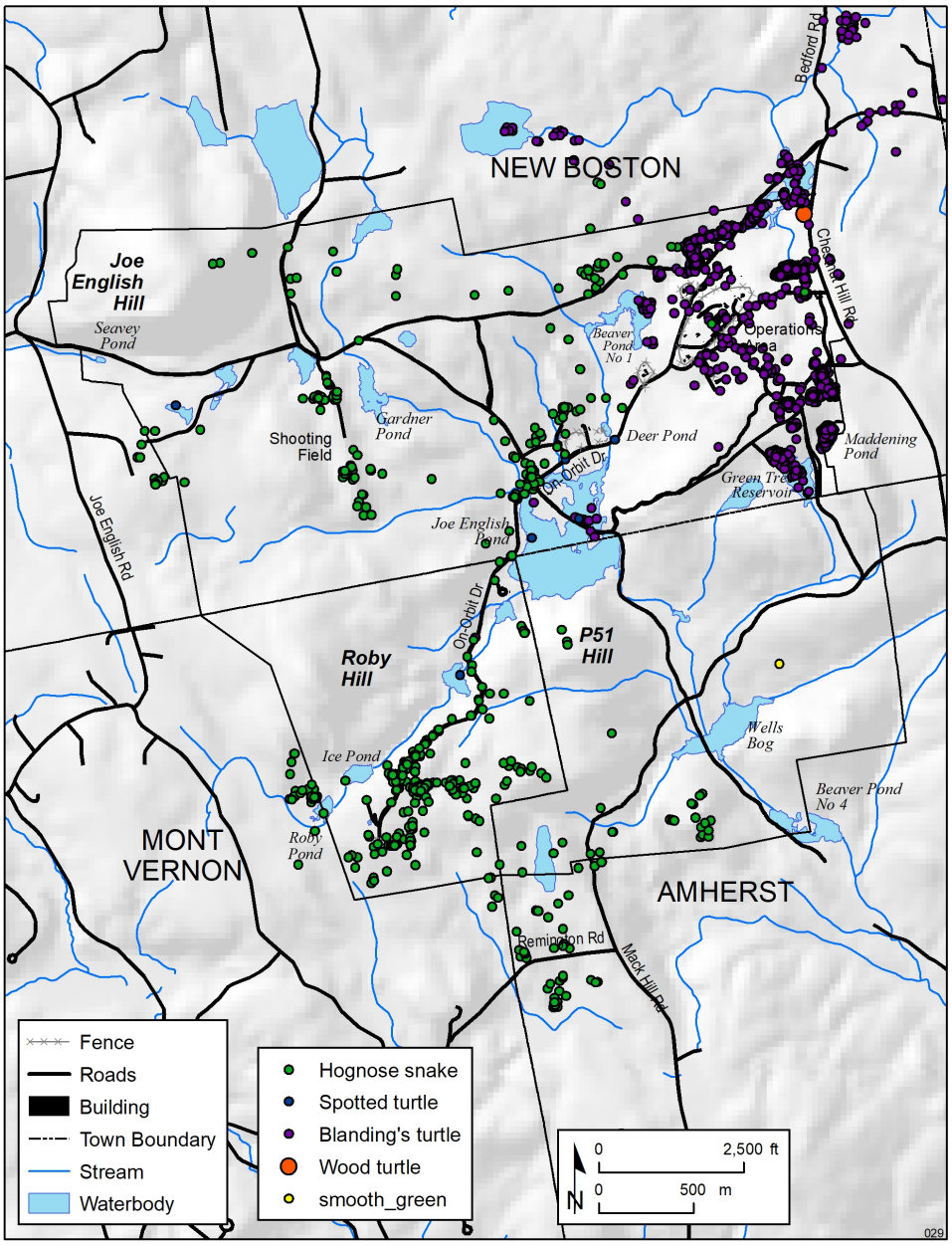


Figure 6 Location of Rare Reptile Observations on NBAFS 2019 and prior

Pied-Billed Grebe (*Podilymbus podiceps*)

The pied-billed grebe (State-listed threatened, State rank S2B) has been observed on NBAFS during the breeding season (LaGory et al. 1997). An adult with two young were observed on June 29, 1994, on Roby Pond (figure titled Locations of Rare Birds Observations on NBAFS) and, given the small size of the young, the nest may have been located on this pond. However, a nest was not found, and the pond does not have the characteristics of typical breeding habitat (LaGory et al. 1997). According to Foss (1994), breeding habitat in New Hampshire consists of open-water wetlands with a minimum size of 12 ac (5 ha) and extensive emergent vegetation in which the floating nest is placed at least 50 ft. (15 m) from the shore; the only wetland on NBAFS possessing these characteristics is Joe English Pond, but pied-billed grebes have not been observed in this location during the breeding season. Searches of Roby Pond for breeding pied-billed grebes were made in 1995 and 1996 and a broadcast of the territorial call of this species was made at Roby Pond and other wetlands in June 1995. None of these attempts were successful in detecting grebes, but several individuals were observed on Joe English Pond during October and November 1994 and 1995. Surveys of Joe English Pond in spring, summer, and autumn 2004 (including the broadcasting of pied-billed grebe calls) did not detect any pied-billed grebes. The breeding status of pied-billed grebes on NBAFS is not clear.

Picture 18 Pied-billed Grebe (Source: Gough et al. 1998)

Northern Harrier (*Circus cyaneus*)

The northern harrier (Special Concern, State rank S1B) has been observed flying over Joe English Hill during autumn migration (figure titled Locations of Rare Birds Observations on NBAFS), but none have been seen on the station grounds (LaGory et al. 1997). Statewide breeding surveys have not detected this species, but breeding is considered possible in the area (Foss 1994). The northern harrier nests on the ground and hunts small mammals in open habitats such as wetlands or oldfields (DeGraaf and Rudis 1986; Foss 1994).

Whip-Poor-Will (*Caprimulgus vociferus*)

Whip-poor-wills (USFWS Birds of Conservation Concern) were documented (heard) on two occasions on NBAFS during the biodiversity survey in June 1995 and July 1994; both occurrences were in woodlands adjacent to the former Joe English Pond Campground (Figure 7). Surveys for whip-poor-wills have been conducted annually since 1998 during the summer (June or July) by broadcasting a recording of whip-poor-will calls in various locations across the station, and listening for responses. Whip-poor-wills were heard some years, and in the following general locations: Deer Pond Recreation Area, Joe English Pond Campground, Cambell Road, Operations Area, and the top of Joe English Hill. Whip-poor-wills have not been documented during surveys since 2013. Breeding by this species occurs in June and July (Foss 1994) and it is very likely that it breeds on the station in the mixed forest habitats where it has been heard.

Whip-poor-wills prefer open, dry woodlands, often near openings, for nesting and this habitat type is well represented on NBAFS. Nesting whip-poor-wills were documented in southern New Hampshire during recent statewide breeding surveys (Foss 1994).

Picture 19 Whip-poor-will, Wisconsin DNR

Wood Thrush *(Hylocichla mustelina)*

The Wood Thrush is neotropical migrant on the US Fish and Wildlife Service Bird of Conservation Concern list. The species was documented on the installation during the 1994-1995 biodiversity survey and during a variety of years when the installation participated in the Cornell Birds in Forested Landscape project. Wood thrush appear to be wildly distributed in the forest at NBAFS. The Wood Thrush has a widespread breeding distribution across the eastern United States and southern Canada, but it has experienced strong population declines throughout much of its range. During the nonbreeding season it is restricted to a much smaller area in shrinking lowland tropical forests of southern Mexico and Central America. It has been on the Partners in Flight Watch List for over a decade and is listed as threatened in Canada. Its hauntingly beautiful, flute-like song has made it a favorite for birders, and thus a prominent example of declining forest songbirds in North America. The Atlantic Coast and New England, where Wood Thrush are most common, have experienced some of the steepest declines (Partners in Flight 2021).

Picture 20 Wood thrush, USFWS

Canada Warbler (*Cardellina canadensis*)

The Canada Warbler is neotropical migrant on the US Fish and Wildlife Service Bird of Conservation Concern list. The species was documented on the installation during the 1994-1995 biodiversity survey. No other information about presence is available for NBAFS.

The Canada Warbler inhabits shady forest undergrowth year round, making this species vulnerable to forest loss. It spends the majority of the nonbreeding season in northern Andean forests, which are among the most threatened in the world, having experienced a 90% loss due to agricultural expansion (cattle, coffee, coca) and fuel wood production. On the breeding grounds, dense deer (Odocoileus virginianus) populations have resulted in over-browsing of the shrubby layer that Canada Warblers prefer. Additional potential threats include habitat fragmentation from energy development and habitat desiccation from land draining and climate change (Partners in Flight, 2021a).

Picture 21 Canada Warbler, USFWS

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle (State-listed threatened, State rank S2) was observed on five occasions flying over NBAFS during the biodiversity survey (LaGory 1997). All observations were of migrating individuals passing over Joe English Hill in the autumn and none landed on the station grounds. An individual bald eagle was observed during the winter of 1999, feeding on a deer carcass at Joe English Pond. An individual eagle was observed flying on the installation on April 13, 2021, it could not be determined if it landed on the installation. Frequent use of the station grounds is not anticipated because Joe English Pond, the largest pond on NBAFS, is too small to provide suitable foraging or nesting habitat. Optimal habitat is achieved in habitats with 3.9 mi^2 (10 km^2) of contiguous open water (Peterson 1986). Historically, the bald eagle occurred in New Hampshire along large water bodies such as Umbagog Lake, Great Bay, and the Merrimack and Connecticut Rivers (Foss 1994).

Picture 22 Bald Eagle, USFWS Photo

Peregrine Falcon (*Falco peregrinus)*

A pair of Peregrine Falcons (State-listed threatened, State rank S2) were observed using the cliff face of Joe English Hill during March and April 2021. The breeding status of the falcon on base is unknow at the time of writing. The peregrine falcon is a wide-ranging species that uses many different habitats across the United States for breeding, wintering, and migration (White et al. 2002). Nests sites are almost entirely on vertical cliffs or man-made structures that possess physical characteristics similar to cliffs. Open landscapes and air spaces, where peregrine falcons can locate and attack their prey in the air, are important components of most habitat types. Preferred habitats include mountainous terrain, agricultural land, wide river valleys, lake shorelines, ocean coastlines, and islands. The urban environment, with high-rise buildings, major bridges, and tall smokestacks, has become an increasingly important habitat for peregrine falcons within the past quarter century (Cade et al. 1996b). The home range of a territorial individual can be relatively small (100 km2) when prey populations are abundant, but may be much larger (350 to 1,500 km2) when prey populations are more dispersed (White et al. 2002). Peregrine falcons can potentially establish breeding territories anywhere in the United States provided that areas with suitable nest sites and sufficient prey base occur in close proximity. Cliffs are abundant in New Hampshire, and

suitable nesting substrate does not appear to be a limiting factor in peregrine falcon distribution (NHWAP 2015).

Picture 23 Peregrine Falcon USFWS photo

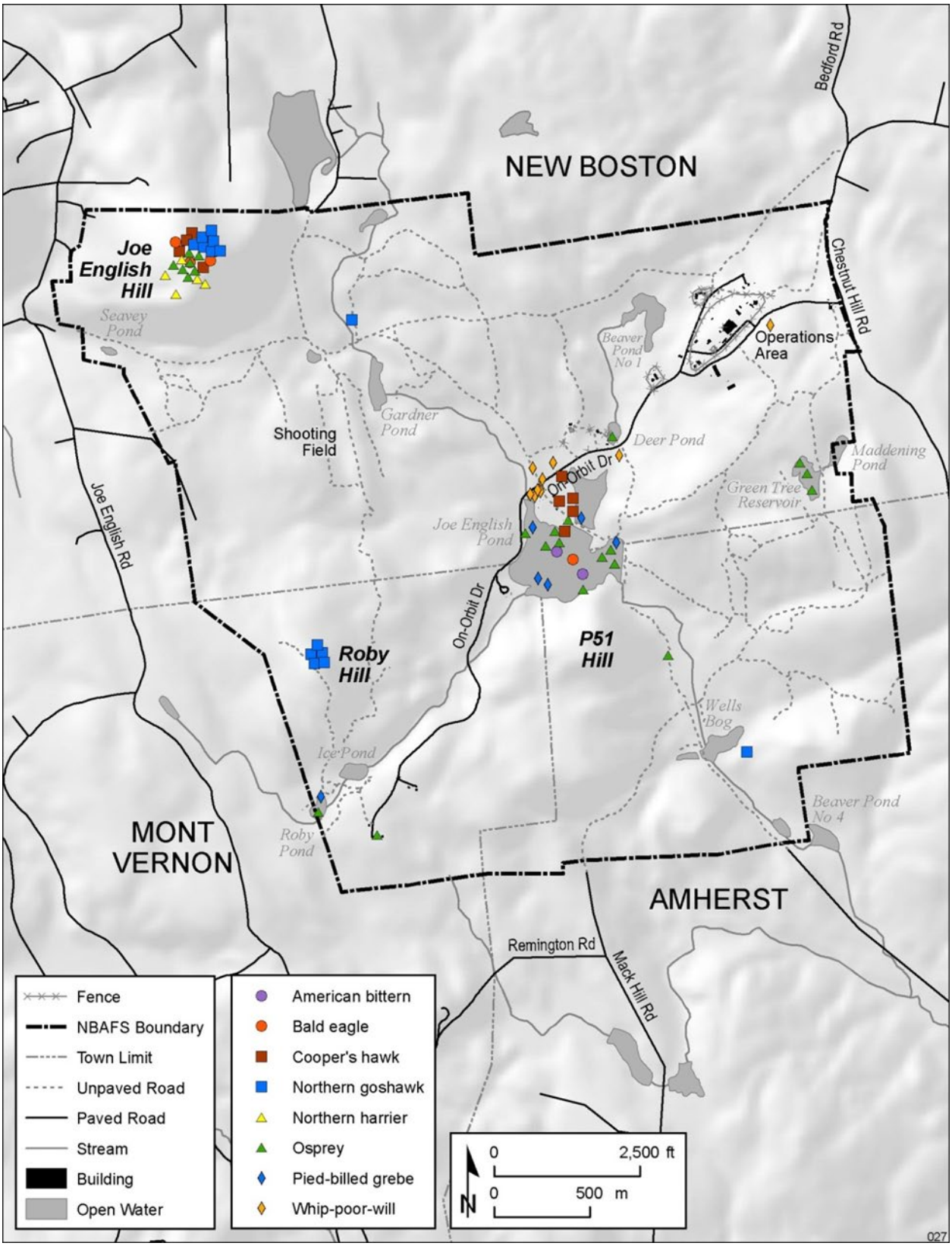


Figure 7 Rare Bird Locations

Tricolored bat (*Perimyotis subflavus*)

Four tricolored bats (State rank S1, SC) were detected using Annabat detectors during a bat survey of NBAFS in 2002 (figure titled Locations of Rare Bat Observations on NBAFS); (LaGory et al. 2002). One tricolored bat call was documented during the 2010-2014 winter acoustic monitoring of Joe English Hill. Tricolored bats were detected during a 2017 acoustic monitoring survey conducted by the University of Montana for the USAF. Tricolored bat calls were detected at three acoustic monitoring sites during 2019 on the southeast portion of NBAFS.

The tricolored bat's state rank indicates that its breeding status is unknown, but any wintering site is critically imperiled or extremely rare (NHNHB 2004b). Two of the four tricolored bats were detected in the northwestern portion of NBAFS, while the other two were detected near the Operations Area. The Operations Area is surrounded by mostly deciduous and mixed forest, but some wetland also occurs in the area. Relatively little is known of the summer roosting and feeding habitat requirements of the tricolored bat, although the species is known to roost in buildings, tree cavities, clusters of dead leaves, and rock crevices (BCI 2001).

Picture 24 Tricolored Bat, Ohio DNR

Eastern Small-Footed Bat (*Myotis leibii*)

The eastern small-footed bat (State-listed as endangered, State rank S1) was captured in two different locations at NBAFS during a bat survey conducted in 2002 (LaGory et al. 2002). Both individuals were female, and one was pregnant. Given the date of the captures (June 23), it is considered unlikely that either individual was in migration. The two sites where the small-footed bats were captured (Figure 8, Locations of Rare Bat Observations on NBAFS) are surrounded by mostly mixed forest (about 50% or more of the area), relatively little coniferous or deciduous forest (less than 20% of each habitat type), and small areas of old-field and wetland habitats.

The two eastern small-footed bats captured on NBAFS were the first reproductive-season captures of this species recorded in New Hampshire. Ten eastern small-footed bats were captured at NBAFS (three in 2006 and seven in 2007). Seven of these (two in 2006 and five in 2007) were equipped with radio transmitters and tracked for 7 to 10 days (LaGory et al. 2008). Eastern smallfooted bats were detected during 2010-2014 winter acoustic surveys and during a 2017 acoustic monitoring survey conducted by the University of Montana.

The published range of the eastern small-footed bat includes only Coos and Grafton Counties in the northernmost portion of the State (UNHCE 1998b; BCI 2001). Small-footed bats are rarely observed outside of their hibernacula and are considered to be one of the most uncommon mammals of the eastern

U.S. (Harvey et al. 1999; BCI 2001), and there is some speculation that the species could be federally listed in the future (BCI 2001).

Eastern small-footed bats most frequently roost in caves or rock outcroppings, but occasionally roost in buildings and behind loose tree bark (UNHCE 1998b; Harvey et al. 1999; BCI 2001). The two sites where small-footed bats were captured are in relatively close proximity to Joe English Hill (Figure 7, Locations of Rare Bat Observations on NBAFS). Rock slabs and crevices are abundant on the southern and eastern sides of Joe English Hill, and it was conjectured that these features may be used by roosting small-footed bats. A two-year telemetry study of small-footed bats, begun in the summer of 2006, confirmed that the species roosts on Joe English Hill. Other rock outcroppings occur on NBAFS, and also may provide roosting areas for this species.

Picture 25 Eastern Small-footed Bat Captured at NBAFS, June 2002

Northern Long-eared Bat (*Myotis septentrionalis*)

Northern Long-eared bats (Federally Threatened, State Endangered, State rank S1) were captured on NBAFS during the 2002 bat survey (LaGory et al. 2002) and four were captured in mist nets during 2006 and 10 during 2007. (LaGory et al. 2008). Northern Long-eared bats were detected with acoustic monitors 38 times between 2010 and 2014 during a project to document overwinter use of Joe English Hill by small-footed bats. One Northern long-eared bat call was identified during a 2017 acoustic monitoring survey conducted by the University of Montana for the USAF.

Northern long-eared is a medium sized bat that can be distinguished from all other myotis within its range by its long, narrow ears and tragus. The northern long-eared bat is widespread, but patchy in distribution; it is restricted to forested areas and is most abundant in the north and in mountainous areas of the south (BCI 2001).

Northern long-eared live in forested areas, especially in mature forests of oak, hickory, maple, hemlock, red cedar, birch, or ponderosa pine. In winter, many northern long-eared bats hibernate in caves and mines, but fewer than 10, and rarely 50 to 100 are normally found in any one site (BCI 2001). In summer, females congregate in groups of 3 to 60 individuals at maternity roosts in snags, tree cavities, and beneath loose bark of the largest available trees (BCI 2001).

The NLEB is a medium sized brown bat that hibernates during the winter and forages and roosts in upland forest habitat during the summer. The NLEB has longer ears than the other bats in the *Myotis* genus and eats insects like moths, flies, beetles, and caddisflies. The NLEB forage primarily through the understory

of forested areas and catch insects, both while in flight using echolocation and by gleaning motionless insects from vegetation.

The NLEB and some other hibernating bat species, have experienced recent rapid population declines. The bats are dying because of a disease called White-nose Syndrome. NLEB hibernate during the winter months in small groups in caves and mines with constant temperatures, high humidity, and no air currents. White-nose Syndrome infects bats during hibernation and is caused by a fungus. Bats with White-nose Syndrome use up energy stores essential for surviving the winter, which results in strange behavior. In some cases bats have been observed to leave their hibernacula too early and perish. Scientists have found 90 to 100 percent declines in bat populations at some hibernacula in the northeast during winter surveys.

Under the federal Endangered Species Act the U.S. Fish and Wildlife Service (USFWS) has listed the northern long-eared bat as a threatened species. Threatened species are animals and plants that are likely to become endangered in the foreseeable future. The goal of the Endangered Species Act is to recover and conserve species that are in danger until the species has recovered and no longer requires the protection of the law. Though the species decline is attributed to White-nose Syndrome, now that the bat is listed as threatened, all actions that may affect the bat need to be considered and reviewed. Along with the listing the USFWS has developed a 4(d) rule. (NHDOT 2021).

Picture 26 Northern Longeared Bat, ANL 2002

Red Bat (*Lasiurus borealis*)

Two red bats (State special concern, State rank S3?B) were captured during a 2002 bat survey of NBAFS using mist nets (LaGory et al. 2002) and two during the 2006-2007 survey (LaGory et al. 2008). A total of 61 calls attributed to red bats were recorded during the June-July 2002 survey. A 2011 transect survey using acoustic detection resulted in 2 calls at 2 of 15 sites (Northeast Ecological Services 2011). Red bats were detected during a 2017 acoustic monitoring survey conducted by the University of Montana for the USAF and during an inhouse acoustic monitoring during 2019.

The red bat is found from the eastern edge of the Rocky Mountains across southern Canada to the Atlantic Coast and south through the central US to central Florida, western Texas, southern New Mexico and northern Mexico. Eastern red bats are one of the most abundant bats in many parts of their range.

Typically, eastern red bats live alone or in family groups consisting of mother and her young, except when they group together while migrating to milder regions where they hibernate. During winter, eastern red bats hibernate in variety of locations including tree hollows and exposed tree trunks, as well as clumps of grass and in leaf litter in southeastern and south central upland forests. During summer, they roost in foliage. Hanging by one foot, wrapped in their furred tail membranes, they are well-concealed and resemble dead leaves. In summer, these bats have been found roosting in a wide variety of deciduous trees, but also in Norway spruce, Scotch pine and red pine and tamarack (BCI 2001).

Picture 27 Red Bat, ANL 2002

Hoary Bat (*Lasiurus cinereus*)

Two Hoary bats (State special concern, State rank S3B) were captured during a 2002 bat survey of NBAFS using mist nets (LaGory et al. 2002). One Hoary bat was captured during 2007 and followed using telemetry equipment. A total of 191 calls attributed to Hoary bats were recorded during the June-July 2002 survey. A 2011 transect survey using acoustic detection resulted in 38 calls at 8 of 15 sites (Northeast Ecological Services 2011). Hoary bats were detected during a 2017 acoustic monitoring survey conducted by the University of Montana for the USAF and during in-house acoustic monitoring during 2019.

The hoary bat occupies the widest range and variety of habitats of any New World bat, living from Argentina and Chile northward through Canada.

The hoary bat is solitary, usually living alone or in family groups, consisting of a mother and her young, except during migration. Males and females mate during the fall.

Hoary bats are rarely seen during winter hibernation. They have been found in Spanish moss, squirrel nests, woodpecker holes, and on the trunks of trees, relying on their fur coloration to provide nearly perfect camouflage. During summer, they prefer tree roosts that are in edge habitats close to feeding grounds. Most females have been found rearing young in deciduous trees, while males seem more likely to also roost in conifers (BCI 2001).

Picture 28 Hoary Bat, ANL 2002

Silver-haired Bat (*Lasionycteris noctivagans*)

Silver-haired bats (State special concern, State rank S3B) were detected during a 2002 bat survey of NBAFS using Annabat acoustic monitoring (LaGory et al. 2002). A total of 51 calls attributed to silver-haired bats were recorded during the June-July 2002 survey. A 2011 transect survey using acoustic detection resulted in 277 calls in 15 sites (Northeast Ecological Services 2011). Silver-haired bats were detected during a 2017 acoustic monitoring survey conducted by the University of Montana for the USAF and during the 2019 in-house acoustic monitoring.

The silver-haired bat is a hardy and widespread species. Mating occurs primarily in the fall prior to migration. Young appear to be raised primarily in the northern third of the US and in Canada, yet pregnant females have been found in mountains as far south as Arizona. During winter silver-haired bats migrate to regions with milder climates, then hibernate. They use a wide variety of locations for this purpose, including small tree hollows, loose tree bark, wood piles, cliff face crevaces, cave entrances and rarely buildings. Males and non-reproductive females often roost alone. Females form small nursery colonies in woodpecker or flicker holes, tree bole cavities, crevices, and under bark of hollow trees, such as basswood and black oak. These roost can be from 4 to 12 m above the ground, are usually on the south side of the tree, and generally are located near water. Maternity colonies may contain 6 to 55 individuals that periodically move among several nearby roosts (BCI 2001).

Picture 29 Silver-haired Bat, Wisconsin DNR

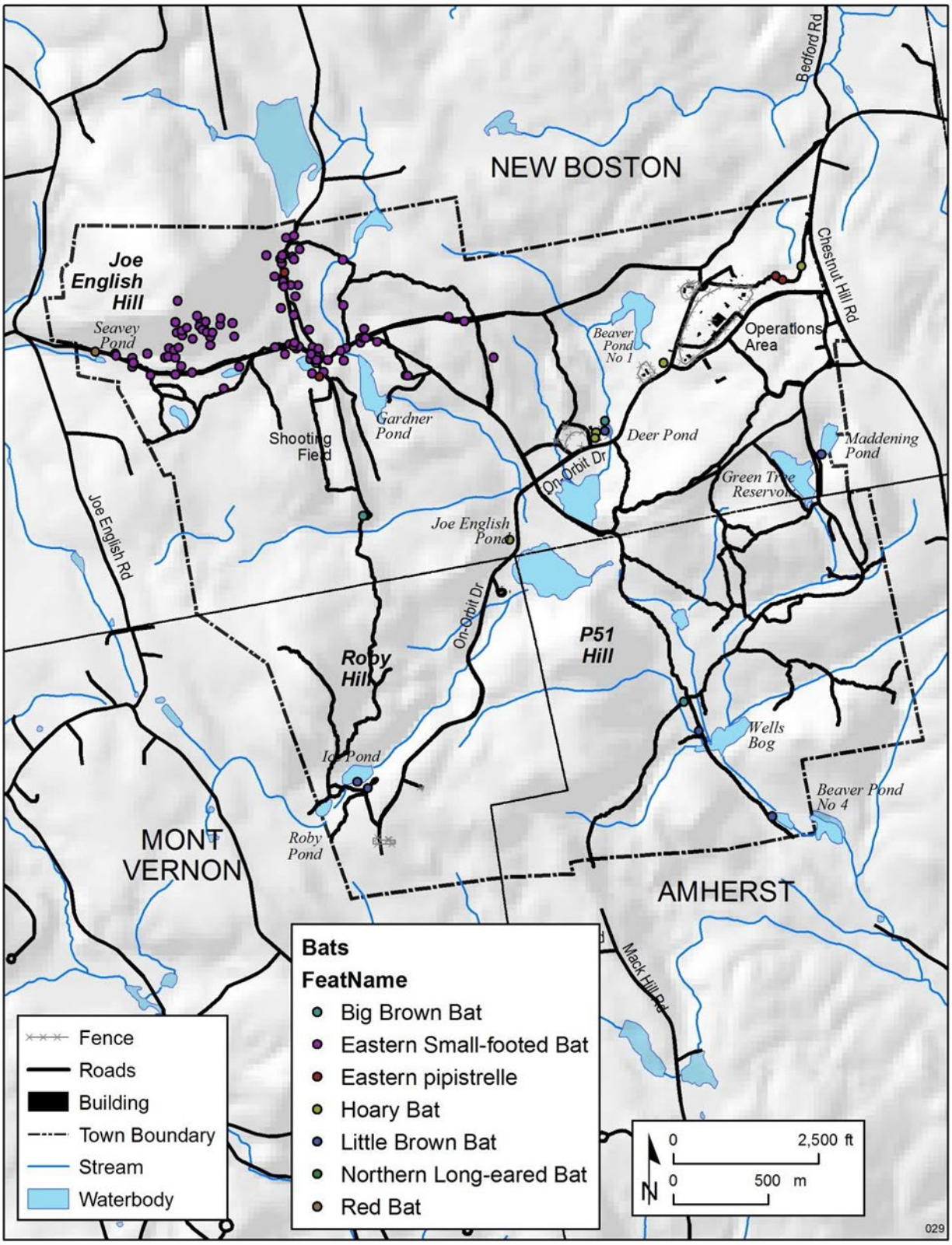


Figure 8 Locations of Rare Bat Observations on NBAFS 2011 and prior

Banded Sunfish (*Enneacanthus obesus*)

Banded sunfish are considered rare in New Hampshire with a state rank of S3. The species was documented in the Wells Bog are of Joe English Brook during fisheries surveys conducted by US Fish and Wildlife Service in 2006 and 2007 (Roettiger 2006 and Roettiger 2007).

This species occurs over sand or mud in sluggish, acidic, heavily vegetated waters, including ponds, pools and backwaters of creeks, small to large rivers, and boggy brooks (Lee et al. 1980, Page and Burr 2011).

Picture 30 Banded Sunfish, NJ Pinelands Commission

American Eel (*Anguilla rostrata*)

American eels are considered rare in New Hampshire with a state rank of S3. A 1987 Fishery management investigation by the US Fish and Wildlife Service indicates an American eel "has been observed in one of the inlets to Joe English Pond". The 1987 and subsequent surveys in 2006 and 2007 failed to capture any American eels.

American eels are the only catadromous fish in North America. The term catadromous refers to fish born in the ocean that mature in fresh water and return to the ocean to spawn (USFWS 2009). The U.S. Fish and Wildlife Service has reviewed the status of the American eel in 2007 and in 2015, finding both times that Endangered Species Act protection for the American eel is not warranted.

Picture 31 American Eel, USFWS

2.3.5 Wetlands and Floodplains

Wetlands of NBAFS were delineated and described in detail in PES (1996). The wetlands delineation project was separated into two tasks. Task 1 included intensive field delineation and on-ground mapping of wetlands using the standard delineation protocols of the U.S. Army Corps of Engineers (Environmental

Laboratory 1987) in a 350 ac study area in and adjacent to the Operations Area (PES 1996). Task 2 involved aerial photography and color infrared photo interpretation and mapping of wetlands for the entire installation.

Picture 32 Joe English Pond

A total of 228 wetlands were identified by PES (1996) that occupied a total of 198 ac (80 ha). These wetlands represented a variety of wetland types including forested, emergent, scrub-shrub, open water, riverine, lacustrine, and mixed wetland types (figure 3). Wetland types differ in hydrology, soils, and plant species composition. Wetland species on NBAFS include cattail (*Typha latifolia*), sedges (*Carex* spp.), rushes (*Juncus* spp.), Virginia chain fern (*Woodwardia virginica*), pitcher plant (*Sarracenia purpurea*), meadowsweet (*Spirea alba*), boneset (*Eupatoreum perfoliatum*), button-bush (*Cephalanthus occidentalis*), leatherleaf (*Chamaedaphne calyculata*), sphagnum moss (*Sphagnum* spp.), sweet gale (*Myrica gale*), three-way sedge (*Dulichium arundinaceum*), red maple (*Acer rubrum*), and black gum (*Nyssa sylvatica*). Wetland monitoring has been conducted on NBAFS annually since 2003 to determine current conditions, existing disturbance, and potential threats.

Wetland complexes occur in the central portion of NBAFS in and around Joe English Pond; in the southeast associated with Joe English Brook and Wells Bog; around Beaver Pond No. 1 in the northeast; and along West Meadow Road south of Joe English Hill (see figure 3, Wetlands of NBAFS). Other wetland complexes include those associated with the drainage between Ice Pond and Joe English Pond in the southwest and the Green Tree Reservoir system in the east central portions of NBAFS, respectively.

A total of 116 forested wetlands (palustrine forested) occupying about 60 ac were identified in the wetland survey (PES 1996). Forested wetlands typically contain an overstory of trees, an understory of saplings or shrubs, and a herbaceous layer (Cowardin et al. 1979); the canopy can be deciduous, coniferous, or mixed forest types. Irregular topography, the forested nature of the station and, in particular, the extensive evergreen forests found in large areas of NBAFS suggest that there may be numerous, isolated forested wetlands that were not identified with the photographic techniques used in the survey (PES 1996).

There are 21 emergent wetlands (palustrine emergent) on NBAFS that occupy a total of 11 ac; many of these have been influenced by beaver activities (PES 1996). Emergent wetlands are characterized by erect, rooted, herbaceous wetland plants that are present for most of the growing season. At NBAFS, the emergent wetlands are predominantly persistent, dominated by vegetation that normally remains standing through the winter months (PES 1996).

Thirty-one scrub-shrub wetlands (palustrine scrub-shrub) totaling 13 ac occur on NBAFS (PES 1996). This type of wetland is dominated by short woody vegetation, and can include young trees or true shrubs. Often, the scrub-shrub community is a successional stage leading toward a forested wetland (Cowardin et al. 1979).

Thirty-three mixed wetlands totaling 36 ac occur on NBAFS. Mixed wetlands contain a variety of vegetation types that prevents a simple classification (e.g., combination of forested and scrub-shrub wetland types). The most common mixed wetlands were a combination of scrub-shrub and emergent marsh wetland types and scrub-shrub and forested wetlands (PES 1996).

NBAFS contains 24 open-water wetlands (palustrine unconsolidated bottom) totaling 35 ac (14 ha; PES 1996). These wetlands are characterized by open water with less than 30% vegetative cover (Cowardin et al. 1979). The open-water wetlands include ponds with relatively steep slopes and little wetland vegetation, or naturally occurring and beaver-created ponds with an abundance of emergent vegetation. Wells Bog and Beaver Pond No. 1 are examples of open water habitats edged by emergent, scrub-shrub or mixed wetland environments (PES 1996). Vernal ponds and other depressions (potentially remnant bomb craters) provide other small open-water bodies (PES 1996).

One riverine wetland (stream segment between Deer Pond and On-Orbit Drive), totaling 0.1 ac, occurs on NBAFS. Most other stream segments were classified as forested or scrub-shrub wetlands on the basis of the dominant shoreline vegetation. Only one lacustrine system (the deep water portion of Joe English Pond) totaling 43 ac was identified (PES 1996).

2.3.6 Other Natural Resource Information

NBAFS is significantly impacted by the presence of invasive species. Terrestrial invasive vegetation species are present primarily in edge, disturbed, opening and field habitat. Locations with significant control effort are shown on figure 9. Invasive species treatment methods and specific vegetation characteristics are provided in Tab 10, NBAFS Invasive Species Control Plan. NBAFS forest are impacted by Hemlock woolly adelgid and Elongate hemlock scale; both are cause mortality in hemlock trees. They are discussed in Tab 6 in detail. Beech scale, introduced in the early 1900s is also present on NBAFS. The insect is causes wounding which allows beech bark disease to enter the tree leading to deformation.

Table 5

Invasive Species of NBAFS	
Scientific name	Common name
Vegetation	
Centaurea stoebe	Spotted knapweed
Berberis thunbergii	Japanese barberry
Cynanchum louiseae	Black swallow-wort
Elaeagnus umbellata Thunb. var. parvifolia	Autumn olive
Frangula alnus	Glossy buckthorn
Euonymus alatus	Burning bush
Reynoutria japonica	Japanese knotweed
Rosa multiflora	Multiflora rose
Lonicera japonica	Japanese honeysuckle
Cirsium vulgare	Bull thistle

Coronilla varia	Crown vetch
Celastrus orbiculatus	Oriental bittersweet
Lythrum salicaria	Purple loosestrife
Birds	
Sturnus vulgaris	European starling
Insects	
Agrilus planipennis	Emerald ash borer (EAB)
Adelges tsugae	Hemlock Woolly Adelgid (HWA)
Fiorinia externa	Elongate Hemlock Scale
Cryptococcus fagisuga	Beech scale

Picture 33 Autumn Olive, Emma Erler, University of New Hampshire, Bugwood.org

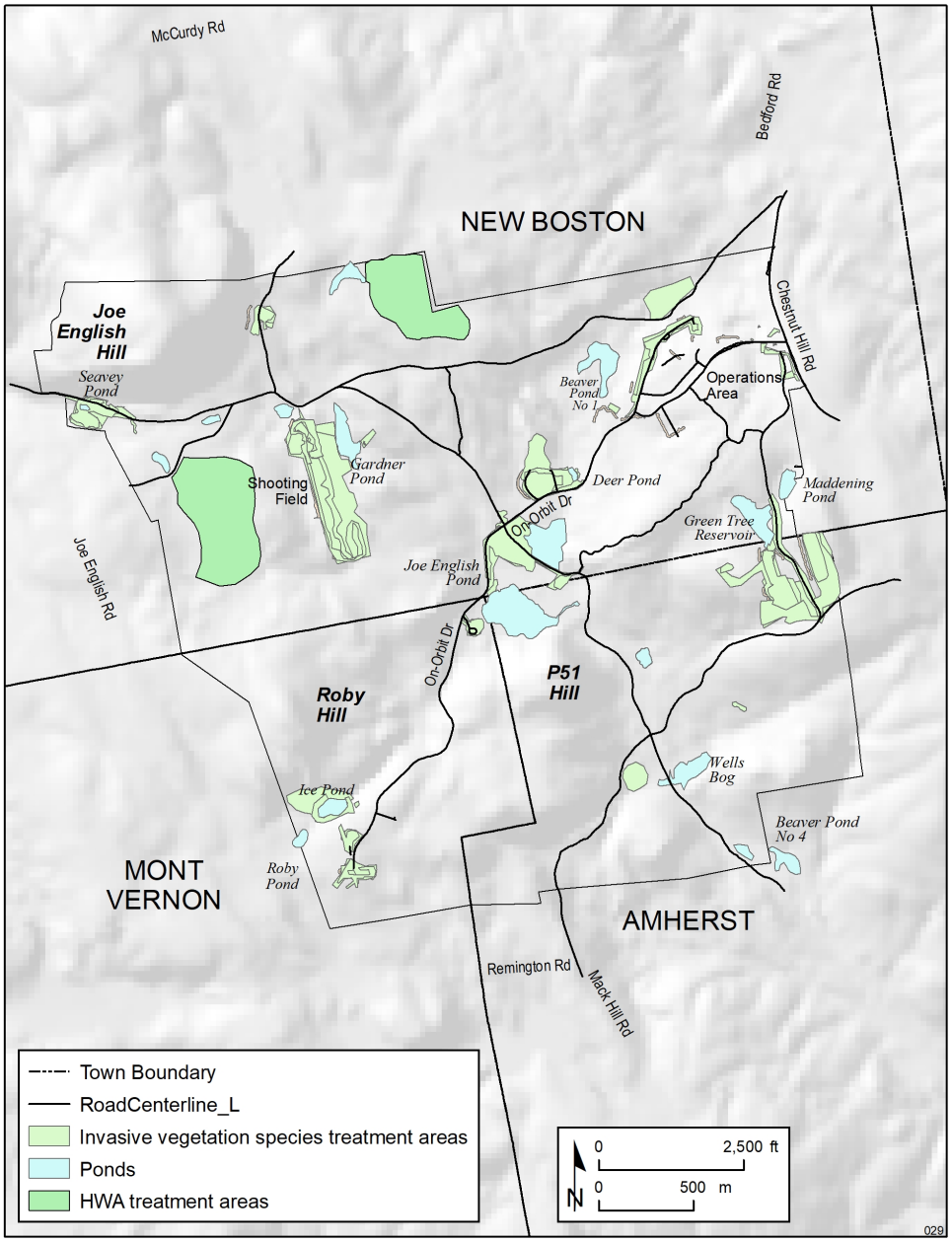


Figure 9, Invasive species treatment areas

2.4 Mission and Natural Resources

2.4.1 Natural Resource Constraints to Mission and Mission Planning

The General Plan provides an overview of constraints to development on NBAFS. These constraints include those related to natural resources as well as manmade and operational constraints. The constraint map developed for the General Plan is presented in figure 10. Constraints Map for NBAFS. Important natural resource constraints include threatened, endangered, and rare species; rare natural communities; wetlands; ponds; and streams. Topography and soils also constrain development to some extent.

Fourteen freshwater ponds, which occupy approximately 100 ac, and 7 mi of streams exist on the station (HB&A 2004; figure 3). Many of the ponds are bordered by wetlands, and the streams by riparian vegetation. Riffle and pool habitats are favorable for many cold-water fish species. Wetland types include forested, emergent, scrub-shrub, mixed, lacustrine, and riverine wetlands. These surface waters and wetlands constrain development on NBAFS (HB&A 2004). Wetlands can be developed or disturbed, but such development is subject to permitting. Construction in wetlands usually results in greater cost, extensive mitigation, engineering problems, and removes or degrades valuable wildlife habitat.

NBAFS is characterized by hilly terrain and depressions formed by glaciers. Elevations range from about 350 ft at Joe English Brook to 1,280 ft at the peak of Joe English Hill. The topography on NBAFS is variable with slopes ranging from 0 to 3% in level areas to as much as 26 to 35% in steep areas. Steep slopes can be a significant constraint to development at NBAFS.

Approximately 90% of NBAFS is covered with fine, dense, and stony soils, but exposed bedrock occurs in places. Although some of these soils are well-drained, they are not particularly suited for agriculture. Except for areas where wetland soils are present, most soils on the station are suitable for construction (HB&A 2004). The presence of bedrock in much of the area can add significantly to facility construction complexity and cost.

There are few erosion hazards on site, although some fine sandy loam soils are highly erodible in exposed, unvegetated, or steep areas (HB&A 2004). For example, the operation of heavy logging equipment during wet weather can damage vegetated areas and lead to erosion. There are also erosion problems associated with the steeper slopes on some gravel roads.

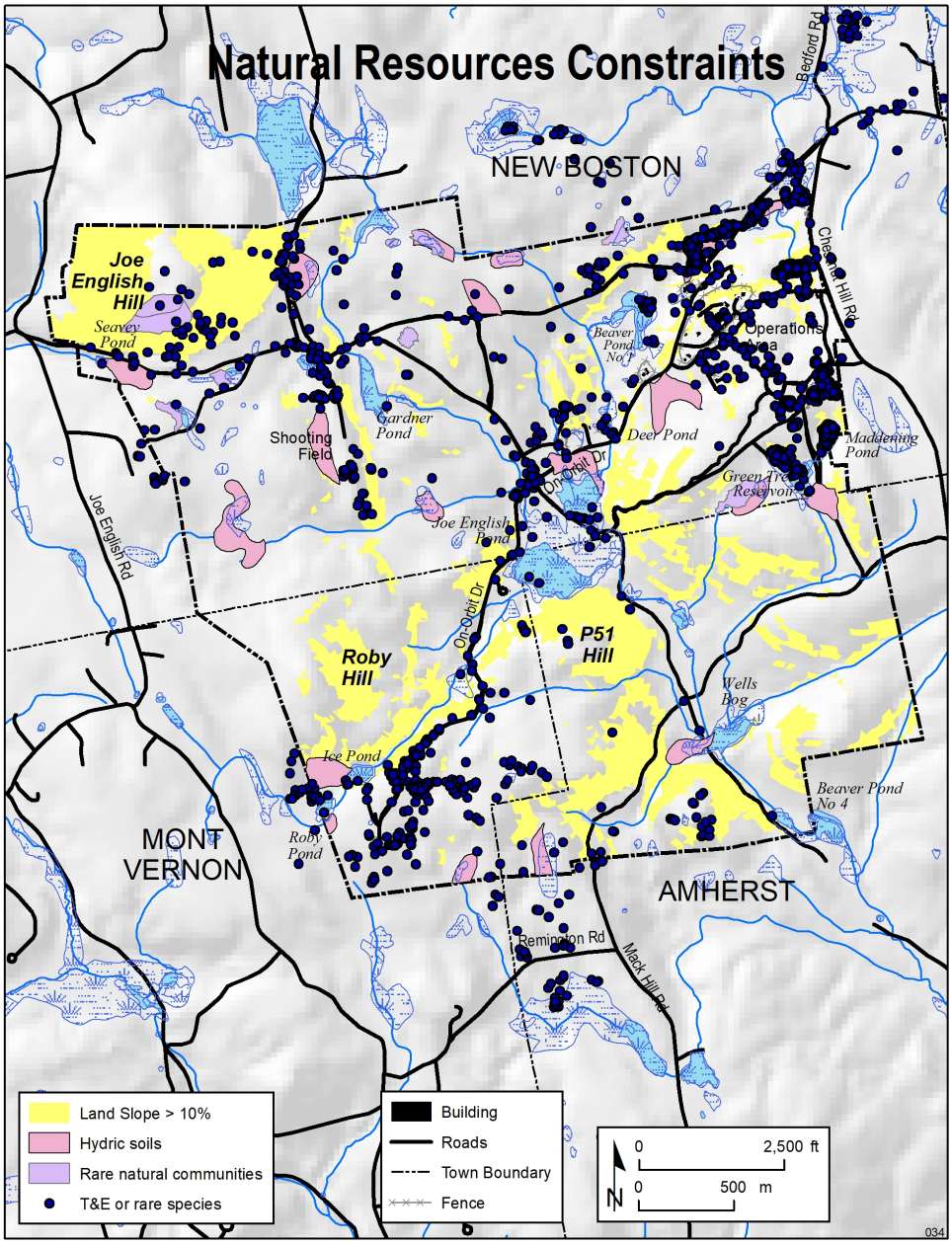


Figure 10 Constraint Map for NBAFS

2.4.2 Land Use

NBAFS is primarily undeveloped forest with historic gravel roads interspursed. Figure 4 Habitat Types of NBAFS shows the land use pattern with the Operations Area located in the Northeastern portion of the installation being the only significant development on the base.

2.4.3 Current Major Mission Impacts on Natural Resources

The current satellite-tracking mission of NBAFS has no major impacts on the environment. Permitted air pollution sources at NBAFS include two large diesel-fuel backup generators at the station's power plant, one generator at Building 164, two generators at SATCOM (Bldg 145) and one generator in Building 104. These generators and other combustion sources are included in annual air emissions inventories for the station.

Wastewater Treatment and Discharge

The wastewater system at NBAFS is a series of simple collection systems with septic tanks for treatment and leach fields for reintroduction into the ground. The main septic system can handle approximately 19,600 GPD, which is more than sufficient for the station's daily needs. When the station decommissioned the wastewater treatment plant, it lost its ability to measure the flows to the septic system. Therefore, the sanitary sewer flows for this assessment are based on the historical data of effluent at the wastewater treatment plant. The average daily volume was calculated to be approximately 3,600 GPD. This was derived by calculating the average of the daily flow numbers for the year preceding the closure of the plant. For the same period, the peak sanitary sewer flow was 17,700 GPD. The peak flow of 17,700 GPD was experienced on May 13, 2006. This coincided with a 100-year rain event that the area experienced. The station reported that there was significant rain damage during this storm that lasted several days, including washed out streets and erosion. The previous day, the treatment plant effluent data indicated about 3,700 GPD of flow through the plant. This dramatic increase in flow (approximately 14,000 gallons in a single day) is cause for concern regarding the capacity of main septic system. The wastewater treatment system had sufficient capacity to handle the increased flow as its maximum capacity was 26,000 GPD; however, this rain event would have nearly overwhelmed the main septic system. (NBAFS General Plan 2016).

Hazardous Materials and Waste

NBAFS stores and uses small amounts of paints, thinners, cements, adhesives, acids, cleaners, and other hazardous materials (HB&A 2004). All hazardous materials are procured and stored by the Hazardous Materials Pharmacy (Hazmart) in Building 120 where they are controlled and tracked by Air Force Enterprise Environmental Safety and Occupational Health Management Information System software. Once purchased, the materials are either stored in the Hazmart for distribution or given directly to various shops for day-to-day use. In most instances, these materials are stored in flammable material storage lockers.

NBAFS is permitted by the State as a small quantity hazardous waste generator (HB&A 2004). All hazardous wastes are stored at their generation points in proper containers and then staged at the Central Accumulation Area before being shipped off site. NBAFS is now using the Defense Reutilization and Marketing Office to arrange transport and disposal of all waste. NBAFS also operates under a Hazardous Waste Management and Spill Response Plan to control any spills of oil or hazardous substances. Future facilities must comply with the permits and the spill response plan.

An Installation Restoration Program (IRP) evaluation indicated no significant health and safety concerns related to the presence of hazardous waste in the soil or groundwater from historic releases (HB&A 2004).

Initially, upon review of the IRP analyses, the New Hampshire Groundwater Protection Bureau indicated no further action would be required for cleanup at any sites at NBAFS. However, the EPA is currently reviewing the Hazardous Ranking System scoring of IRP sites on NBAFS and this review could result in changes to the "no further action" status of some former IRP sites on the installation.

Munitions of Explosive Concern (MEC) formally known as UXO

MEC and Munitions Constituents (MC) remain from the period when NBAFS was used as a bombing and strafing range (see Section 2.1). MEC has been found in many areas of the station, but the highest concentrations are suspected to be in the vicinity of Joe English Pond, which was the primary bombing target area (HB&A 2004). Investigations of the pond bottom indicate the presence of an abundance of MEC, primarily in the deep water areas. In addition, shrapnel has been found in and around the Shooting Field (a former strafing range) and no timber operations are allowed in this area. All camping areas on site have been cleared and most of the installation has been surface cleared, and signs have been posted that indicate off-limits MEC areas. Periodically, MEC has been found on NBAFS that has to be either removed or exploded in place.

The Military Munitions Response Program (MMRP) continues to investigate and manage the risks associated with the remaining MEC and MC on NBAFS. A Record of Decision for Joe English Pond has a Selected Remedy of Land Use Controls (LUCs) and Long Term Management (LTM). A Land Use Control Implementation Plan (LUCIP) is currently under development and will include use restrictions, signage, long term monitoring of the surface water and sediment, annual and five-year reviews. Until the investigations are completed for the remaining MMRP sites and a base-wide LUCIP developed, the MEC management will follow the Base General Plan (Dubner 2021).

MEC remediation activities have potential to adversely affect natural resources on NBAFS, including fish and wildlife; threatened, endangered, and rare species; and wetlands. Impacts to these resources could result from a variety of activities associated with MEC remediation including the draining of wetlands to gain access to MEC, and digging or dredging to extract MEC for proper disposal. These activities have the potential to disrupt ecosystems, reduce the size of existing populations, reduce the long-term carrying capacity of ecosystems, and increasing the invasion of disturbed habitats by nonnative plant species. Consequently, all MEC remediation activities at NBAFS will be planned and implemented in consultation and coordination with the USFWS, NHFGD, and NHNHB. Remediation actions in wetlands do not require a Section 404 dredge-and-fill permit from the U.S. Army Corps of Engineers, when accomplished under CERCLA. All MEC remediation activities and associated mitigation will be planned to minimize risk to important natural resources on NBAFS and to maintain the long-term sustainability of the ecosystems on which they depend.

Military Training

Military training conducted on NBAFS includes tactical maneuvers (force-on-force exercises), helicopter operations, land navigation exercises, emergency response (e.g., simulated vehicle accidents and natural disasters), reconnaissance and combat patrolling, establishment of field camps, and rock climbing and rappelling (ANL 1999a). Military units that have conducted training at NBAFS include the Army National Guard, the Army Reserve, the U.S. Marine Corps, and the Military Air Force Police.

An environmental assessment found that military training would result in only minor localized, short-term, or temporary impacts to the environment and have no significant effect on the human environment (ANL 1999a). Military training impacts are considered very small incremental additions to impacts resulting from ongoing mission operations and recreational activities. A mitigation plan provides specific mitigation

measures for particular environmental issues of concern during military training (ANL 1999b). Maximum troop sizes are limited to 200 persons at any one time, no live ammunition can be used, and vehicles must remain on roads. With the enactment of these mitigation measures, most of the minor impacts would become negligible. The military training program at NBAFS is being updated to incorporate some changes to activities and their locations and will be evaluated in an environmental assessment.

Satellite tracking constitutes the main mission of NBAFS. The radio antennas employed at NBAFS have potential hazards associated with radio frequency (RF) radiation. The measured RF hazards associated with NBAFS antenna systems are minimal (HB&A 2004). Although the systems are capable of transmitting at higher power, administrative precautions (safety training, periodic monitoring, and controlled areas) and engineering (software inhibitors, interlocks, and alarms) provide adequate safety that reduces the potential risk to a minimum. The current mission has no major adverse impact on the environment.

Picture 34 Mission Area

2.4.4 Potential Future Mission Impacts on Natural Resources

The New Hampshire Army National Guard is planning to create a land navigation training course in the Northwest portion on NBAFS. The training area will entail 60 objective stakes installed in the area. No more that 200 troops would participate in the training at any one time. Limited disturbance to natural resources is expected from this activity.

The NHARNG is also proposing to install a 300 meter rifle range and conduct vehicle training. This proposed bed down is in early design and exploration as of January 2021.

3.0 ENVIRONMENTAL MANAGEMENT SYSTEM

The USAF environmental program adheres to the Environmental Management System (EMS) framework and its Plan, Do, Check, Act cycle for ensuring mission success. Executive Order (EO) 13834, *Efficient Federal Operations*; DoDI 4715.17, *Environmental Management Systems*; AFI 32-7001, *Environmental Management*; and International Organization for Standardization (ISO) 14001 standard, *Environmental Management Systems – Requirements with guidance for use*, provide guidance on how environmental programs should be established, implemented, and maintained to operate under the EMS framework.

The natural resources program employs EMS-based processes to achieve compliance with all legal obligations and current policy drivers, effectively manage associated risks, and instill a culture of continual improvement. The INRMP serves as an administrative operational control that defines compliance-related activities and processes.

4.0 GENERAL ROLES AND RESPONSIBILITIES

General roles and responsibilities that are necessary to implement and support the natural resources program are listed in the table below. Specific natural resources management-related roles and responsibilities are described in appropriate sections of this plan.

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	**Installation Role/Responsibility Description**
Installation Commander	Responsible for approval of the Integrated Natural Resources Management Plan and implementation.
AFCEC Natural Resources Media Manager/SME/Subject Matter Specialist (SMS)	Responsible for overall USAF program management
Installation Natural Resources Manager/POC	Responsible for implementation of the INRMP
Installation Security Forces	Responsible for general law enforcement
Installation Unit Environmental Coordinators (UECs); see AFI 32-7001 for role description	
Installation Wildland Fire Program Manager	Installation Natural Resources Manager is the WFPM. See NBAFS Wildland Fire Management Plan for description
Pest Manager	N/A
Range Operating Agency	N/A
Conservation Law Enforcement Officer (CLEO)	N/A, NH Fish and Game provides this function.
National Environmental Policy Act (NEPA)/Environmental Impact Analysis Process (EIAP) Manager	Installation Natural Resources Manager is the EIAP Manager. Responsible for compliance with 32 CFR 989 and the National Environmental Policy Act implementation.
NOAA)/ National Marine Fisheries Service (NMFS)	N/A
US Forest Service	Responsible for implementation of assigned projects through cooperative agreement.
USFWS	Responsible for implementation of assigned projects through cooperative agreement and for INRMP approval.

5.0 TRAINING

USAF installation NRMs/POCs and other natural resources support personnel require specific education, training, and work experience to adequately perform their jobs. Section 107 of the Sikes Act requires that professionally trained personnel perform the tasks necessary to update and carry out certain actions required within this INRMP. Specific training and certification may be necessary to maintain a level of competence in relevant areas as installation needs change, or to fulfill a permitting requirement.

Installation Supplement – Training

- Naval Civil Engineering Corps Officer School sponsored Section 106 training

- DOD sponsored Native American consultation training sponsored by AFCEC
- Wildland fire training, see tab 1, NBAFS Wildland Fire Management Plan
- NRMs at NBAFS must take the course DoD Natural Resources Compliance, endorsed by the DoD Interservice Environmental Education Review Board and offered for all DoD Components by the Naval Civil Engineer Corps Officers School (CECOS). See https://netc.navy.mil/cecos/ for CECOS course schedules and registration information. Other applicable environmental management courses are offered by the Air Force Institute of Technology (https://www.afit.edu), the National Conservation Training Center managed by the USFWS (www.training.fws.gov), and the Bureau of Land Management Training Center (https://www.blm.gov/learn/national-training-center)
- Natural resource management personnel shall be encouraged to attain professional registration, certification, or licensing for their related fields, and may be allowed to attend appropriate national, regional, and state conferences and training courses
- The DoD supported publication Conserving Biodiversity on Military Lands -- A Handbook for Natural Resources Managers (http://dodbiodiversity.org) provides guidance, case studies, and other information regarding the management of natural resources on DoD installations

Natural resources management training is provided to ensure that installation personnel, contractors, and visitors are aware of their role in the program and the importance of their participation to its success. Training records are maintained IAW the Recordkeeping and Reporting section of this plan. Below are key natural resources management-related training requirements and programs:

- New personnel assigned to NBAFS are given a short verbal introduction to NBAFS resources. The briefing is documented on an inprocessing checklist which is signed upon completion.

6.0 RECORDKEEPING AND REPORTING

6.1 Recordkeeping

The installation maintains required records IAW Air Force Manual 33-363, *Management of Records*, and disposes of records IAW the Air Force Records Management System (AFRIMS) records disposition schedule (RDS). Numerous types of records must be maintained to support implementation of the natural resources program. Specific records are identified in applicable sections of this plan, in the Natural Resources Playbook, and in referenced documents.

Installation Supplement – Recordkeeping

Natural resources records are kept on the NBAFS Electronic Records Management (ERM) drive, paper files for older materials are kept in the official file in accordance with AFRIMS.

6.2 Reporting

The installation NRM is responsible for responding to natural resources-related data calls and reporting requirements. The NRM and supporting AFCEC Natural Resources Media Manager and SMS should refer to the Environmental Reporting Playbook for guidance on execution of data gathering, quality control/quality assurance, and report development.

Installation Supplement – Reporting

NBAFS creates annual reports to NH Fish and Game any time a special permit is issued. Reports are typically created annually for Blanding's turtle management.

7.0 NATURAL RESOURCES PROGRAM MANAGEMENT

This section describes the current status of the installation's natural resources management program and program areas of interest. Current management practices, including common day-to-day management practices and ongoing special initiatives, are described for each applicable program area used to manage existing resources. Program elements in this outline that do not exist on the installation are identified as not applicable and include a justification, as necessary.

Installation Supplement – Natural Resources Program Management

The natural resource management program at NBAFS is implemented primarily by the Natural Resources Management Office, which currently consists of the Natural Resources Planner, and is assisted by US Forest Service personnel including a wildilife technician who onsite. NBAFS Natural Resources oversee the management of unimproved lands, timber harvest operations, wildfire management, natural resource inventories, biological studies, threatened and endangered species management, and environmental assessment activities. Natural Resources personnel are also involved in educational outreach activities to NBAFS employees and visitors, especially regarding the occurrence of threatened and endangered species on the station.

NBAFS Natural Resources and Services personnel work closely together to manage the recreational programs at NBAFS. Services manages all camping, boat rentals, and snowmobile rentals.

NBAFS Natural Resources personnel interact with other Federal and State agencies in implementing the natural resource management program on NBAFS. NBAFS has a cooperative agreement with the U.S. Forest Service (USFS) regarding wildfire management on NBAFS. Natural Resources personnel regularly interact with the USFWS, NHFGD, and NHNHB regarding the management of protected species on NBAFS. Both were consulted during development of this INRMP and are signatory agencies on this plan.

7.1 Fish and Wildlife Management

Applicability Statement

This section applies to all USAF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

Activities associated with fish and wildlife resources on NBAFS include fishing, hunting, and wildlife watching (Najjar 1998). Demand for these activities is relatively high because of the station's regular use by non-NBAFS individuals. Hunting, fishing, and other outdoor activities at NBAFS are governed by NBAFS Operating Instruction (OI) 32-7064 (see Appendix B2). NBAFS issued 25 sportsman permits during 2020 (most recent year); which are valid for hunting and fishing. All individuals with DOD credentials currently have access to NBAFS. Individuals in all of these categories have equal access to NBAFS facilities and follow the same use regulations and restrictions. Recreational activities including, hiking, camping fishing and archery hunting are allowed when Force Protection Conditions are normal, Alpha, or Bravo. Higher Force Protection Conditions results in possible suspension of recreational activities.

The NBAFS fishing program is enjoyed by many NBAFS staff and visitors. An installation permit is required to fish, 27 were issued during 2020 in addition to the 25 (2020) sportsmans permits which also allow fishing. Youth under age 18 are not required to obtain a fishing permit. Joe English Pond is the installation's largest waterbody with trout and bass present. Several other ponds on site have fishing opportunities including Roby Pond, Ice Pond, and Deer Pond, Wells Bog, and Green Tree Reservoir.

Although bass have been reported in Green Tree Reservoir, the pond does not support a significant recreational fishery, and is mostly used as a source of minnows for bait (Najjar 1998).

NHFGD and NBAFS Personnel have stocked rainbow and brook trout in station ponds to improve recreational fisheries. Currently Joe English and Ice Pond receive a spring stocking of brook and rainbow trout. Joe English Pond also received a fall stocking or rainbow trout to support winter ice fising. Warmwater species such as largemouth bass, chain pickerel, bluegill, and perch are in Roby and Ice Pond. Joe English Pond supports a population of largemouth bass, and many of these bass reach trophy size.

NBAFS has huntable populations of white-tailed deer, turkey, ruffed grouse (*Bonasa umbellus*), gray squirrels (*Sciurus carolinensis*), and snowshoe hare (*Lepus americanus*). Of these, the white-tailed deer is the most popular game species on NBAFS, and many of these deer reach trophy size. New Hampshire Fish and Game manages deer population by harvest goals in management units. The NH Fish and Game Management Plan 2016-2025 goal for adult buck harvest in unit K is 1.18 adult bucks (1 ½ years or older) per square mile.

NBAFS began collecting information on deer harvests in 1995 (Najjar 1998). In 1996, NBAFS instituted the policy that all wildlife harvested on the station must be reported to the Natural Resources Planner. Data such as weight, sex, and location are collected on harvested animals and used to track harvest patterns and population health. The number of deer harvested has varied annually from 0 (2001) to 11 (1997 and 2002). Since data collection started in 1996 206 deer have been harvested, the average deer weight (using estimated and actual weights) was 125.83 (n-198). Over the period from 1996-2020, 71 female deer were harvested and 135 male deer were harvested. Total harvest over 24 years was 206 deer with an average harvest of 8.6 deer. During 2020 NBAFS hunters harvest five mature bucks for an average harvest of 1.12 bucks per square mile (figure 11). The 2020 harvest was very close to the NH Fish and Game goal for management unit K.

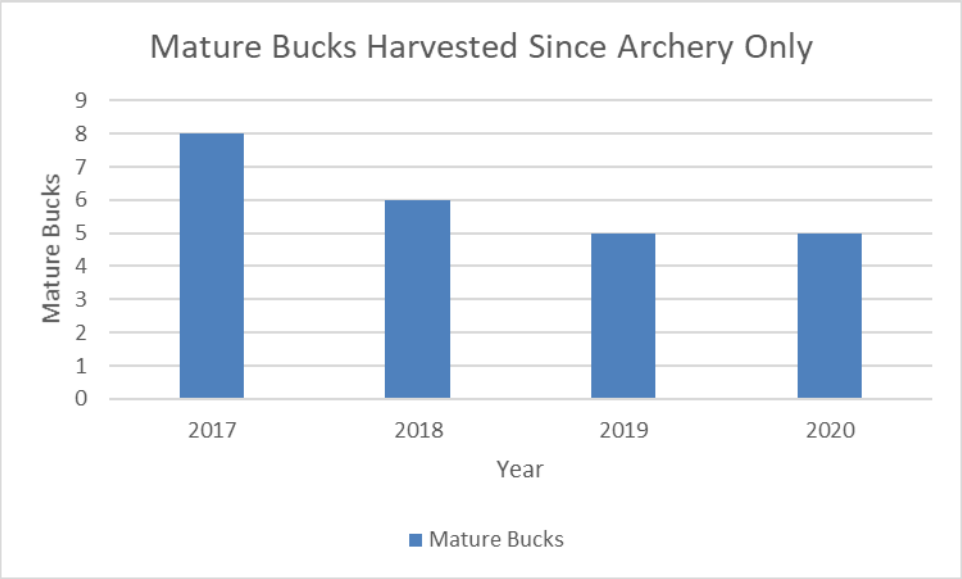


Figure 11 Deer Harvest 2017-2020

The largely undeveloped nature of NBAFS and its use by both NBAFS and non-NBAFS individuals has created a demand for wildlife viewing on the station. Recent outreach programs by Natural Resources personnel have increased awareness and interest in wildlife species on the station and the staff have

benefited from increased reporting of rare and other wildlife species. Natural Resources personnel have established interpretive signs and trails at NBAFS and developed educational literature and guides.

Natural Resources personnel conduct several wildlife habitat improvement projects each year. Recent examples have included prescribed burning of fields, wildlife openings and forest areas. In addition, Natural Resource personnel integrate habitat improvement features into forest-management activities, and several timber harvests have been designed to meet habitat objectives. Examples include small clearcuts to increase browse production, forest thinning to increase mast production, shelterwood cuts to increase age-diversity in forests and reserve tree-cutting to provide raptor perches.

Three wetlands (Green Tree Reservoir, Gardner Pond and Seavy Pond) historically (1960s-1980s) altered with dams to increase waterfowl production and provide recreational opportunity are scheduled for major repairs during 2021(Green Tree and Seavy) or programmed for funding (Gardner). The dams were considered for removal or repair. Repair was ultimately selected due to compliance and cost considerations associated with removal. The ponds will continue to provide habitat for waterfowl and recreational opportunities.

Overall, NBAFS has a limited amount of old-field and early successional forest, but an abundance of mid- and late-successional forest with a mature age structure (Najjar 1998). The 2017 station-wide forest inventory long term trend related to lack of early successional forest species in all age classes. A habitat improvement goal of the Natural Resources Management Office is to increase the area of early successional aspen-birch stands and maintain all of the old-fields at NBAFS. This is accomplished by using a combination of fire, mowing, and timber harvesting. Six small (3-8 acres) clearcuts have been accomplished over the past 5 years (2016-2021) to increase diversity. In addition, NBAFS actively manages for fire-adapted communities through their Wildland Fire Management Program (see NBAFS Wildland Fire Management Plan). Designing clearcut harvest for early successional habitat on NBAFS is challenging due to proximity of cultural resources, wetlands and slopes.

Regeneration of aspen and birch is accomplished by cutting of poletimber or small sawtimber stands at rotations of 50 to 60 years (Najjar 1998). Prescribed burning can encourage aspen seedling regeneration. Retention of some trees in cleared areas will provide important habitat features for a variety of wildlife species including red-tailed hawk (*Buteo jamaicensis*), Cooper's hawk (*Accipiter cooperii*), turkey vulture (*Cathartes aura*), olive-sided flycatcher (*Contopus cooperi*), and common raven (*Corvus corax*). In addition, retention of occasional groups of softwood saplings and poles on dry and wet sites would provide habitat diversity within the aspen-birch canopy.

In accordance with the Migratory Bird Treaty Act and EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, NBAFS avoids or minimizes adverse impacts to migratory birds, and takes active steps to protect birds and restore or enhance their habitat on the station. Forest management and wildland fire management activities are conducted on NBAFS to improve habitat conditions for a variety of plant and animal populations including migratory birds. Although notification has not been necessary in the past, NBAFS would notify the USFWS if unintentional take of migratory birds, reasonably attributable to NBAFS actions, is having, or is likely to have a measurable negative effect on migratory bird populations. Natural resource management activities on NBAFS are expected to provide an overall benefit to migratory bird populations on the station.

7.2 Outdoor Recreation and Public Access to Natural Resources

Applicability Statement

This section applies to all USAF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

The use of land and recreational facilities at NBAFS constitutes a conditional privilege extended by the installation commander. Guidelines for such use are provided in NBAFS OI 32-7064 (provided in Appendix B), and are intended to allow the widest possible use of facilities that is consistent with the station mission and safety and conservation programs. IAW AFM 32-7003, paragraph 3.32.3.1, all of NBAFS is designated restricted access. Access categories are limited to participants listed in section 3.2., precluding general public and other user group access due to several considerations including; contracted security forces staff the installation, all traffic entering NBAFS must go through the space mission area, the mission area has no cantonment area fencing, the installation lacks assigned wildlife law enforcement.

The Natural Resources programs are available to the following access categories in accordance with *Air Force Manual 32-7003 Environmental Conservation*, paragraph 3.32.3.2:

3.3.1. Active Duty Military (includes Reserve on full-time orders and National Guard on active duty (Title 10 status).

3.3.2. Department of Defense Civilians.

3.3.3. Active Duty Military Dependents and Family Members.

3.3.4. Military Retirees.

3.3.5. Department of Defense Civilian Retirees.

3.3.6. Employees of Installation Prime Contractors (defined as a contractor under a 5-year or more term contract).

Individuals in all of these categories have equal access to NBAFS facilities and follow the same use regulations and restrictions.

Authorized recreational activities include camping (tents, recreation vehicles, and recreational trailers), rock climbing, hunting, fishing, trapping, boating (nongasoline), hiking, cross-country skiing, snowshoeing, ice skating, sledding, snowmobiling, archery, and group recreational activities. The station is used regularly during the summer months for recreation, but is open all year. Although many of the undeveloped portions of NBAFS are available for recreational use, most activity occurs at a few locations including the camping grounds and trailer park around Joe English Pond, Ice/Roby Ponds, Seavy Pond, the Deer Pond Recreation Area, and the Community Center (Building 161). These areas occupy about 20 ac (8 ha). NBAFS Natural Resources and Services personnel work closely to manage the recreational programs at NBAFS. Services staff oversee all camping equipment rental, boat rentals, and snowmobile rentals.

Unimproved camping is available at Ice Pond and Joe English Pond. Campsites are reserved on a first come-first served basis. In addition, there are two permanent house trailers available for rental on the western side of Joe English Pond. The maximum length of stay at any individual campsite is 30 days. The normal summer camping season runs from early May to Columbus Day, off-season camping is permitted.

Archery hunting is allowed on NBAFS. All hunting on NBAFS is archery only and must comply with State hunting laws. A $40 station sporting permit is issued to all hunters, who must also possess a valid New Hampshire hunting permit. Fishing is open throughout the year on NBAFS in accordance with State fishing regulations. Boating is authorized on all NBAFS ponds, but boats with motors or anchors are not allowed on any pond on the station. Snowmobiles are the only off-road recreational motor vehicle authorized for use on NBAFS. Snowmobile operation is generally restricted to trails over unplowed roads during the winter. Snowmobiles are available for rental on NBAFS. All-terrain vehicles are used by NBAFS personnel for official duties only. Dispersed recreation on NBAFS occurs in the form of hiking, jogging, snow-

shoeing, cross-country skiing, and wildlife watching. These activities are permitted in all unrestricted areas of the station.

Climate change could impact outdoor recreation over time. Warmer winters may result in shorter seasonal snow cover, which would reduce opportunities for snow-based recreation such as snow-shoeing and cross-country skiing. Some popular fishing species such as brook trout and rainbow trout that have been stocked in many of the fisheries at NBAFS, may no longer be viable in certain ponds or streams if water temperatures rise above the thermal tolerance of the fish.

Hemlock forests, which provide wintering habitat for white-tailed deer and are an important cover species for ruffed grouse, turkey, and snowshoe hare, are threatened by the hemlock wooly adelgid (NHFGD, 2015) and elongate hemlock scale. These species are invasive insects that can cause extensive mortality in hemlock forests, but cannot survive cold winters. As winter temperatures rise, hemlock forests will be more vulnerable, threatening the habitat of many game species.

Climate change is projected to increase prevalence of vector-borne diseases as warmer temperatures increase suitability for carriers such as mosquitoes and ticks. The blacklegged tick (*Ixodes scapularis*), which carries Lyme disease, anaplasmosis, and babesiosis, is increasingly common in New Hampshire (Eaton, 2016). Information regarding best practices to reduce risk of tick bites should be made available to NBAFS and non-NBAFS individuals participating in recreational activities (CSU 2019).

7.3 Conservation Law Enforcement

Applicability Statement

This section applies to all USAF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

NBAFS follows the guidelines for fish and wildlife enforcement law enforcement presented in AFM 32-7003. Under the direction and authority of the NBAFS Commander and Security Forces (NBAFS/DFD) enforce laws and regulations that protect fish, wildlife, and natural resources on NBAFS. The primary responsibilities related to fish and wildlife law enforcement include:

Maintaining law and order on the station;

Enforcing Federal and State fish and game laws in accordance with NBAFS OI 32-7064.

Conducting initial investigation for hunting and fishing violations, incidents, and mishaps; and

Investigating hunting accidents in coordination with NH Fish and Game.

The NH Fish and Game Conservation Officer also patrols NBAFS and is available upon request.

7.4 Management of Threatened and Endangered Species, Species of Concern, and Habitats

Applicability Statement

This section applies to USAF installations that have threatened and endangered species on USAF property. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

A biodiversity survey on NBAFS was conducted from June 1994 to November 1996 to provide information on the ecological resources of the station (LaGory et al. 1997). The study provided information on habitat

distributions and characteristics (including rare natural communities), and plant and animal species with an emphasis on Federally and State-listed threatened and endangered species, species considered rare in the State, and neotropical migrant bird species. The study covered a two-year period to incorporate seasonal and annual variation. Information on rare and protected communities and species collected during the biodiversity study is included in the descriptions of station resources in the section titled Ecosystems and the Biotic Environment.

Since the biodiversity study was completed, a number of surveys have addressed specific information needs and have contributed to an understanding of the status of rare species on NBAFS. Such studies include a survey of the bats of NBAFS (LaGory et al. 2002), a 2004 survey of Joe English Pond, annual surveys for whip-poor-wills and American bitterns, annual telemetry monitoring of the Blanding's turtle, and a multiyear survey of the eastern hognose snake (Najjar and Drake 2005b). Telemetry studies to determine habitat use of the eastern hognose snake (LaGory et al. 2008) and eastern small-footed bat (LaGory et al. 2007) at NBAFS were completed in 2007. Acoustic monitoring of bats has also been implemented at NBAFS to understand bat activity witout the need to capture. A study focusing on winter use of Joe English Hill from 2010-2014 resulted in documentation of winter use by several species including small footed bat (Reynolds 2017).

Northern Long-eared bats (Federally Threatened, State Endangered, State rank S1) were captured on NBAFS during the 2002 bat survey (LaGory et al. 2002) and four were captured in mist nets during 2006 and 10 during 2007. (LaGory et al. 2008). Northern Long-eared bats were detected with acoustic monitors 38 times between 2010 and 2014 during a project to document overwinter use of Joe English Hill by small-footed bats. One Northern long-eared bat call was identified during a 2017 acoustic monitoring survey conducted by the University of Montana for the USAF.

Informal consultations with USFWS are routinely conducted as part of NEPA assessments of actions proposed by the USAF that have the potential to affect the environment. No concerns have been raised by the USFWS in these consultations regarding listed species, and no Biological Opinions have been issued by USFWS for USAF actions on NBAFS.

An important objective of the overall natural resources program at NBAFS is to provide the necessary habitat for the continued existence of protected species at NBAFS. Natural resource management on NBAFS targets the maintenance of habitat diversity on the station using timber management practices and prescribed burning as tools. On the basis of the ecological requirements of rare and protected species on NBAFS, this approach is expected to maintain the viability of these populations and their habitats over the long term. Direct impacts to listed and rare species are minimized through the educational outreach program and project stipulations included for all construction projects. Thus, NBAFS staff and on site contractors are made aware of the possible presence of species of concern and told to notify Natural Resources staff of any observations. In addition, all timber operations, prescribed burns, and construction projects must be approved and overseen by Natural Resources staff.

Management actions taken to protect threatened and endangered species will be influenced by the speed at which the climate changes, the nature of the climatic changes and the ability of the species to respond to those changes. Our understanding of species' response to changing climate is not yet sufficient to be able to predict how an individual species will respond. In addition, the response of sub-populations of a single species may vary. Species can exhibit behavioral, plastic and genetic response to environmental conditions. Genetic variation within a species has been associated with exposure to environmental conditions, however, populations may not be able to undergo selection for preferred traits if environmental conditions change rapidly (Hoffmann & Sgrò, 2011). Behavioral changes, such as host-plant or food source switching, and plastic responses, such as changes in body size associated with longer growing seasons, have already been observed (Iwamura et al., 2013; Ozgul et al., 2010).

Many current T&E management activities are appropriate for increasing resilience or facilitating adaptation to climate change. An ecosystem approach that prioritizes functional diversity, maintenance of habitat, habitat variability and connectivity can help support genetic diversity that may be important for adaptation, and can help species migrate to more favorable habitats. However, when approaching the uncertainty that is inherent with managing species under changing environmental conditions, additional analysis and planning is required.

Research into actionable science used for biodiversity conservation in changing conditions has developed several key principles. Historic patterns used for management decisions are likely to be insufficient for future management challenges (Bierbaum et al., 2013). Proactive approaches that anticipate change can help extend the period over which species can adapt to changing climate and avoid catastrophic declines associated with stochastic events that act on an already stressed ecosystem (CSU 2019).)

7.5 Water Resource Protection

Applicability Statement

This section applies to USAF installations that have water resources. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

There are a number of surface water features on NBAFS including ponds, streams, and wetlands. Most of the site encompasses the Joe English Brook watershed which drains towards the southeast (figure 2, Watersheds of New Boston Air Force Station, New Hampshire). The remainder of the station occupies two minor portions of watersheds that drain towards the northeast and northwest. Surface waters of NBAFS are designated as Class B and as such are considered suitable for swimming and other recreation, fish habitat, and, after adequate treatment, use as a water supply (PES 1995). The only known water quality problem on the station is an annual buildup of coliform bacteria in some impoundments during dry periods in the summer (Najjar 1998). Water resources of NBAFS are described in the section titled Hydrology and the section titled Wetlands and Floodplains.

Potential nonpoint sources of water pollution at NBAFS include runoff from unpaved roads, construction areas, off-road military training activities, and timber harvest sites. Nonpoint source pollution from timber harvesting is regulated by Best Management Practices for Erosion Control on Timber Harvesting Operations in New Hampshire (Cullen 2001). This document presents laws and regulations governing timber harvesting activities that have the potential to degrade water quality. Sedimentation and erosion from construction projects are also regulated by EPA under their stormwater program. Projects that disturb five or more acres (2 or more ha) must be permitted under EPA's General Permit for Stormwater Discharges from Construction Sites (Baseline Construction Permit). This permit requires the use of best management practices for sediment and erosion controls. NBAFS is currently in compliance with both of these policies. A mitigation plan was developed for military training activities that included actions to prevent nonpoint source pollution of surface waters on NBAFS (ANL 1999b).

7.6 Wetland Protection

Applicability Statement

This section applies to USAF installations that have existing wetlands on USAF property. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

AFM 32-7003 requires installations to develop and maintain a current inventory of natural habitats as part of the integrated natural resource planning program. Wetlands are significant natural habitats that must be included in this inventory. Additionally, alteration of wetlands is limited at military installations in accordance with EO 11990 (Protection of Wetlands) and by public law (i.e., the Clean Water Act). There are 228 wetland areas totaling 198 ac on NBAFS.

Wetland monitoring has been conducted on NBAFS to determine current conditions, existing disturbance, and potential threats. Potential sources of impact ton wetlands at NBAFS are similar to the sources of impact to water resources discussed in the section titled Water Resources Protection. These include runoff from unpaved roads, construction areas, off-road military training activities, and timber harvest sites. These impacts are managed through best management practices as described in the section titled Water Resources Protection. Direct impacts to wetlands are avoided to the extent practicable and evaluated in NEPA assessments for any actions having the potential to affect the environment. Findings of No Practical Alternative are prepared, when necessary, to comply with 32 CFR Part 989.

Wetlands at NBAFS are vulnerable to changes associated with projected temperature and precipitation increases. Wetlands in the region will face alterations in the magnitude and seasonality of precipitation and run-off, and shifts in reproductive phenology and distribution of plants and animals (Comer et al., 2012)(CSU 2019).

7.7 Grounds Maintenance

Applicability Statement

This section applies to USAF installations that perform ground maintenance activities that could impact natural resources. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

Approximately 65 acres of NBAFS are considered improved. Most improved grounds are found in and around the Operations Area and recreation areas. Lawns are mowed regularly, and are limed and fertilized occasionally. Many native and locally adapted tree species are planted or occur naturally in developed areas. Trees are pruned as needed, but most trees in the improved areas require little attention. Pesticides are not applied on NBAFS by the roads and grounds shop for landscape management reasons (i.e. weed control). Herbicide is used to maintain grass under the restricted area fence via contract once per year. There is little solid waste generated during grounds maintenance. The developed portions of the installation are infested with invasive species, primarily autumn olive and bittersweet. There is no evidence of non-point source pollution impacts at this time from any fertilizer use on base. There is no permanent irrigation system on the station, but some areas are watered as needed with hoses and portable sprinklers.

7.8 Forest Management

Applicability Statement

This section applies to USAF installations that maintain forested land on USAF property. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

NBAFS actively manages most of its 2,550 ac of forest land for timber harvest (Najjar 1998). About 225 ac are not managed for harvest because of inaccessibility or the presence of wetlands. NBAFS forest have been actively managed since 1985 through harvesting and other management practices including manual thinning and prescribed burning. Proceeds from timber harvests are deposited in the USAF Forestry account. Table 9 shows timber harvest data for the previous 10 years.

The biodiversity survey categorized forest types on NBAFS as coniferous (710 ac), deciduous (540 ac), or mixed (1,300 ac). These forest types are described in 2.3.2.2 Current Vegetation Cover and their distribution is shown in the Figure 4, Habitat Types of NBAFS. Natural Resources staff conducted an inventory of NBAFS forests during the summer of 1996, 2007 and 2017. Data from the 2017 installation survey are presented below.

Timber volume

The trees included in these figures include live trees of acceptable and unacceptable growing stock.

Timber volume is a good estimate of the productivity of forested sites. These figures refer to net volume which is calculated or estimated by deducting from gross volume the loss of sound wood to insects, diseases, or other damage. If the field inventory for this stand did not specifically record timber defects on trees, a default of 0 percent was used. Total timber volume on this 2,800.0 acres stand is approximately 2,226,028 cubic feet of sawtimber plus 6,297,494 cubic feet of pulpwood for a total of 8,523,522 cubic feet. The Net Board-foot Volume averages 6,079.41 board feet per acre. The Net Pulpwood Volume averages 2,249.11 cubic feet per acre. The Net Cubic Volume averages 3,044.12 cubic feet per acre. Gross volume estimates are made using the International 1/4 inch log rule. Total volumes by species are presented in the following table, sorted by net board foot volume (NED output).

Table 6 Timber Volumes from 2017 Inventory at NBAFS

Timber volume

Species	Net Board-foot Volume (bd.ft)	% Total	Net Pulpwood Volume (cu.ft)	% Total	Net Cubic Volume (cu.ft)	% Total
eastern white pine (*Pinus strobus*)	5,915,835	35	1,349,835	21	2,094,339	25
northern red oak (*Quercus rubra*)	5,800,021	34	1,999,393	32	2,758,772	32
eastern hemlock (*Tsuga canadensis*)	2,872,853	17	1,121,324	18	1,518,198	18
red maple (*Acer rubrum*)	1,030,723	6	867,190	14	1,011,060	12
sweet birch (*Betula lenta*)	514,277	3	414,887	7	485,073	6
white ash (*Fraxinus americana*)	485,913	3	156,208	2	214,654	3

Timber volume

Species	Net Board-foot Volume (bd.ft)	% Total	Net Pulpwood Volume (cu.ft)	% Total	Net Cubic Volume (cu.ft)	% Total
yellow birch (*Betula alleghaniensis*)	179,181	1	78,703	1	103,833	1
American beech (*Fagus grandifolia*)	121,093	1	138,568	2	152,179	2
white oak (*Quercus alba*)	84,704	0	45,735	1	57,622	1
sugar maple (*Acer saccharum*)	17,745	0	50,849	1	52,989	1
red pine (*Pinus resinosa*)	0	0	15,493	0	15,493	0
paper birch (*Betula papyrifera*)	0	0	53,604	1	53,604	1
black cherry (*Prunus serotina*)	0	0	4,907	0	4,907	0
ash (*Fraxinus*)	0	0	796	0	796	0
Total	17,022,344	100	6,297,494	100	8,523,522	100

Composition

The total basal area of the overstory and understory combined is 126.3 square feet per acre. For the overstory only, acceptable growing stock for timber (AGS) is 85.9 square feet per acre and the basal area of unacceptable growing stock for timber (UGS) is 40.3 square feet per acre.

Table 7 Relative Dominance by Tree Species from 2017 Inventory at NBAFS

Relative Dominance

Species	Basal area (sq.ft/ac)	Relative dominance (%)
northern red oak (*Quercus rubra*)	38.18	30.24
eastern white pine (*Pinus strobus*)	25.23	19.98
eastern hemlock (*Tsuga canadensis*)	24.77	19.62
red maple (*Acer rubrum*)	18.07	14.31
sweet birch (*Betula lenta*)	8.30	6.57
American beech (*Fagus grandifolia*)	3.41	2.70
white ash (*Fraxinus americana*)	2.84	2.25
yellow birch (*Betula alleghaniensis*)	1.82	1.44
paper birch (*Betula papyrifera*)	1.25	0.99
sugar maple (*Acer saccharum*)	1.02	0.81
white oak (*Quercus alba*)	0.91	0.72
red pine (*Pinus resinosa*)	0.23	0.18
black cherry (*Prunus serotina*)	0.11	0.09
ash (*Fraxinus*)	0.11	0.09

Table 8, Average Diameter by Species from 2017 Inventory at NBAFS

Average diameters values (in)

Species	Mean	Medial	Merchantable	Quadratic	Merchantable Quadratic
All species	8.24	14.09	14.69	9.61	11.45
eastern white pine (*Pinus strobus*)	12.20	19.77	20.05	14.16	15.73
red pine (*Pinus resinosa*)	12.00	15.00	15.00	12.65	12.65
white ash (*Fraxinus americana*)	10.65	13.54	13.54	11.30	11.30
eastern hemlock (*Tsuga canadensis*)	8.45	13.13	13.84	9.50	11.16
northern red oak (*Quercus rubra*)	8.22	14.48	14.63	10.12	12.50
white oak (*Quercus alba*)	8.19	12.06	13.07	9.05	11.02
black cherry (*Prunus serotina*)	8.00	8.00	8.00	8.00	8.00
yellow birch (*Betula alleghaniensis*)	7.85	11.09	11.93	8.56	9.81
sweet birch (*Betula lenta*)	7.56	11.05	11.95	8.33	10.16
red maple (*Acer rubrum*)	7.19	9.99	10.75	7.79	9.07
sugar maple (*Acer saccharum*)	6.79	9.44	10.00	7.25	7.81
American beech (*Fagus grandifolia*)	6.50	10.62	11.86	7.27	9.12
paper birch (*Betula papyrifera*)	6.48	7.82	8.15	6.74	7.20
ash (*Fraxinus*)	5.00	5.00	0.00	5.00	0.00

White pine and red oak are the most commercially sought after species on the station. White pine accounts for 35% of the board foot volume on base. The MSD of white pine on NBAFS is 12.2 in., and the merchantable diamter is 20 in. The large diameters of white pine on NBAFS indicate a mature forest. Most of the white pine found on the station is considered to be of good quality (i.e., straight and free of defects).

Red oak is the most valuable tree species found on base, and accounts for 34% board foot volume. Average mean stand diameter for red oak was 8.22in. with a merchantable diameter of 14.63 in.

Hemlock is an important wildlife habitat species; dense young stands provide white-tailed deer with valuable winter habitat (Najjar 1998). Dense hemlock stands are present in the southern portion of the station. Hemlock accounts for 17% of the board foot volume. The MSD for hemlock on NBAFS is 8.45 in.. The average hemlock sawtimber diameter in 2017 was merchantable diameter was 13.84. The continued existence of significant hemlock stands on NBAFS are doubtful due to the infestation of the forest with hemock woolly adelgid and elongate hemlock scale.

Red maple is a highly desirable wildlife browse food (Najjar 1998). White-tailed deer use the current season's growth of red maple as an important source of winter food. The MSD for red maple is 7.19 in., and the merchantable diameter is 10.75 in.

Quaking aspen is another species that is important to wildlife. Aspen provides habitat for a wide variety of wildlife needing young forests, including snowshoe hare, black bear (*Ursus americanus*), white-tailed deer, ruffed grouse, woodcock, and a number of smaller birds and animals. Ruffed grouse use all age classes of aspen-sapling stands for nesting, pole stands for over-wintering and breeding, and older stands for nesting cover and winter food. Currently, aspen accounts for less than 1% of the tree stems on NBAFS; it was not tallied during the 2017 inventory due to scarcity.

NBAFS has established 25 Natural Resource Management Units (figure 12) that are based on natural features (streams, ponds), access (roads), and limitations to access. More intensive forest and habitat inventory on each unit serves as a baseline for planning management activities and future harvesting.

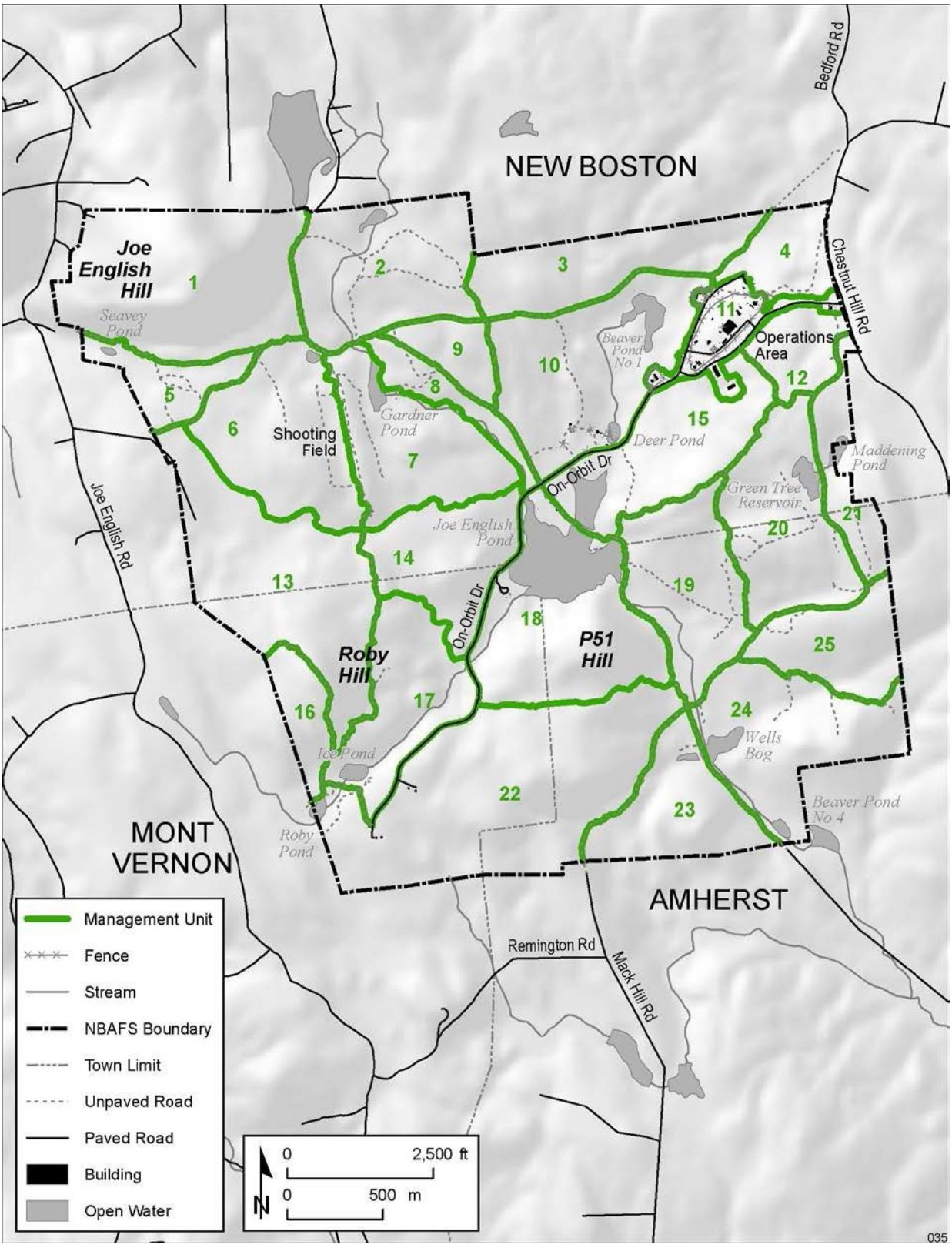


Figure 12 Natural Resources Management Units

Forest Management Goals

The overall goal of forest management at NBAFS is to produce forest products while maintaining a healthy and diverse forest that continues to support the threatened, endangered, and rare species and natural communities that are dependent on them. Properly managed, NBAFS forests will contain a representation of many age classes of trees and diverse ecological communities. In contrast to the 1993 INRMP for NBAFS, which emphasized production of white pine and red oak (the most commercially important species on the station), the 1998 INRMP and the current INRMP emphasize forest health and function. The current INRMP (and previous verisions since 2006) uses a community or ecosystem-based approach in which all species are considered important parts of the forest. To avoid forest fragmentation, no new forest roads are to be constructed. All rare natural communities and threatened, endangered, and rare species are to be protected from the impacts of timber harvesting. Prevention of invasive and nonnative insects and disease are an additional high priority goal for NBAFS forest.

NBAFS forests are being managed on a 100- to 150-yr rotation with retention of older reserve trees to provide a diverse forest with many age classes and species (Najjar 1998). In areas where early successional forest species are desired, rotation lengths can be considerably shorter. Stands will be thinned to recommended stocking levels for specific management goals (e.g. browse production, thermal cover, nesting habitat).

Najjar (1998) estimated the sustained yield for white pine, red oak, and hemlock on NBAFS based on the 1996 forest inventory. The estimated sustained yield per year for these species was 373 mbf, 167 mbf, and 78 mbf, respectively. Attempts to model the sustained yield have not be made since 1996 as annual average harvest are well under the estimated yield and management approach has modified away from timber production.

Forest Management Practices

Even-age and uneven-age forest management practices are used at NBAFS to accomplish forest- and habitat-management goals. Even-age management practices include:

- Clearcutting: removal of the entire stand in one cutting with reproduction obtained by natural seeding from adjacent stands or from trees cut in clearing operation, or by coppice regeneration. This method is used at NBAFS to establish early successional forest types.
- Strip clearcutting: a modified clearcut method in which a long narrow strip of trees is removed and regeneration is obtained by seeding in from trees in adjacent uncut strips. The adjacent uncut trees provide shade and shelter to the seedlings in the cut strips. Strip cutting is an accepted method of regenerating hemlock at rotation age.
- Patch clearcutting: a modified clearcutting method where only small patches of forest are removed, creating small even-aged stands from natural regeneration.
- Shelterwood cutting: removal of a mature stand in a series of cuttings that extend over a relatively short portion of the rotation to allow the establishment of essentially even-aged stands under the partial shelter of seed trees. The shelterwood method is considered the best method of regenerating hemlock. A two-stage shelterwood cutting is considered the most successful method for white pine management. Shelterwood cutting is the simplest method of securing red oak regeneration.

Uneven-age methods consist of the removal of trees, either as single scattered individuals or in small groups at relatively short intervals. This removal is repeated indefinitely to encourage continuous reproduction and maintain an uneven-aged stand. At NBAFS, hemlock regeneration is accomplished by group selection

(Najjar 1998). Mature patches that are scheduled for regeneration are cut in small groups, and openings in the canopy are no larger than one-half the height of dominant trees.

Regeneration methods at NBAFS include shelterwood cuts for white pine, hemlock, and red oak; clearcutting for aspen and birch; and group selection for hemlock. A regeneration cut of about 20 ac (8 ha) is targeted each year on NBAFS. Approximately 5 ac (2 ha) of forest is targeted for clearcut each year to maintain a component of early successional forest.

Reserve trees can be left in a regeneration cut if full sunlight is not necessary (e.g., white pine and hemlock removal cuts). Five to ten reserve trees/ac can be left to provide structural diversity. In clearcuts for aspen regeneration, two or three reserve trees/ac can be left, but too many reserve trees may interfere with regeneration. Regeneration cuts can be conducted with both conventional and whole-tree harvesting methods. Regeneration cuts are to be monitored for adequate regeneration within the first five years after cutting. In the event that regeneration fails, fire may be used to prepare a seed bed for natural regeneration.

Forest Harvest Techniques

Conventional logging at NBAFS involves the manual felling, limbing, and bucking of trees with a chainsaw (Najjar 1998). A cable skidder is used to drag the trees to a road-side staging and processing area where they are cut to product length (generally 8 to 16 ft logs). The remaining branches and leaves (slash) are left in place to decompose. Most environmental damage from conventional logging results from the skidder tires creating deep ruts in soft soil (Najjar 1998). Residual stand damage can be a problem if the temporary skid roads are not layed out to prevent injury to residual trees.

Picture 35 Timber harvest at NBAFS

Whole-tree harvesting is usually performed with a feller-buncher, grapple skidder, and a whole-tree chipper. The feller-buncher is used to cut the trees and place them in stacks for the grapple skidder to pick up, then drag to the roadside landing. At the staging area, trees are cut into logs and the branches and leaves are chipped. Environmental damage from whole-tree harvesting can occur from skidding, resulting in soil disturbance and residual stand damage. This operation requires a large amount of space for the staging area.

With whole-tree harvesting, slash is not left on the forest floor. There is a concern that this practice could lead to nutrient depletion, because branches, twigs, and leaves of trees have much higher nutrient concentrations than do the trunks. By removing this material from the forest, the overall removal of nutrients is increased disproportionately to the yield of usable biomass.

Precommercial thinning is the cutting of undesirable stems with a clearing saw or a chainsaw. Cut stems are left on the forest floor to promote natural decomposition. Pre-commercial thinning does not usually involve any heavy equipment use and is conducted by NBAFS Natural Resources staff and staff from the US Forest Service.

Commercial thinning of merchantable size classes is performed by logging contractors. Trees that are to be removed are designated by Natural Resources staff with paint marks, flagging, or area constraints. Logging contractors are checked several times a week to ensure operations are in compliance with all harvesting laws and to ensure that residual damage is minimal. Thinning can be conducted by both conventional logging and whole-tree harvesting.

All logging operations at NBAFS follow the best management practices manual "New Hampshire Best Management Practices for Erosion Control on Timber Harvesting Operations, 2016" to avoid direct and indirect adverse impacts to cultural resources, wetlands and surface water. Areas to be harvested are screened for the presence of documented archeological sites, threatened, endangered, and rare species.

All timber harvests are planned by the Natural Resources staff at NBAFS. Harvest are carefully developed to avoid adverse impacts to the mission, and to important ecological and water resources. Harvesting is primarily conducted during winter, summer, or autumn to avoid the spring season when damage to wet soils is more likely. All identified archeological sites are avoided when developing harvest, stone walls also are preserved through avoidance and management practices. Timber harvesting is suspended during the bat pup season June-August to protect bats that are unable to fly.

Timber harvest contracts are processed through a USAF contracting office and follow the requirements and process for timber sales that are identified in AFM 32-7003. Logging contractors are responsible for compliance with all State harvesting laws and OSHA compliance. In accordance with State timber harvesting law (RSA 227-J:5) an "Intent to Cut Wood" and "Report of Wood Cut" must be filed by the logging contractor in the town in which the harvest takes place.

NBAFS has harvested on 202 acres over the last 10 years (2011-2021) with a removal of 1,083,430 board feet of timber (see Table 6). Timber harvest volumes have ranged from 57,000 board feet to 338,000 board feet. Recent harvest have focused on removing elongate scale and HWA infested hemlock.

Table 9 Timber Harvest NBAFS 2011-2021

Harvest Name	Year(s)	Total Board Feet	Acres
West Rock, RV, Archery Range	2011	173615	37
HWA	2012	57400	20
Laurel Lane	2013	66195	11
Melendy Farm	2017	97075	10
Mack Hill Clear Cuts	2016	186620	18
Campbell Road	2018-2019	164525	36
Shooting Field South*	2019-2021	338000	70
Total		1083430	202

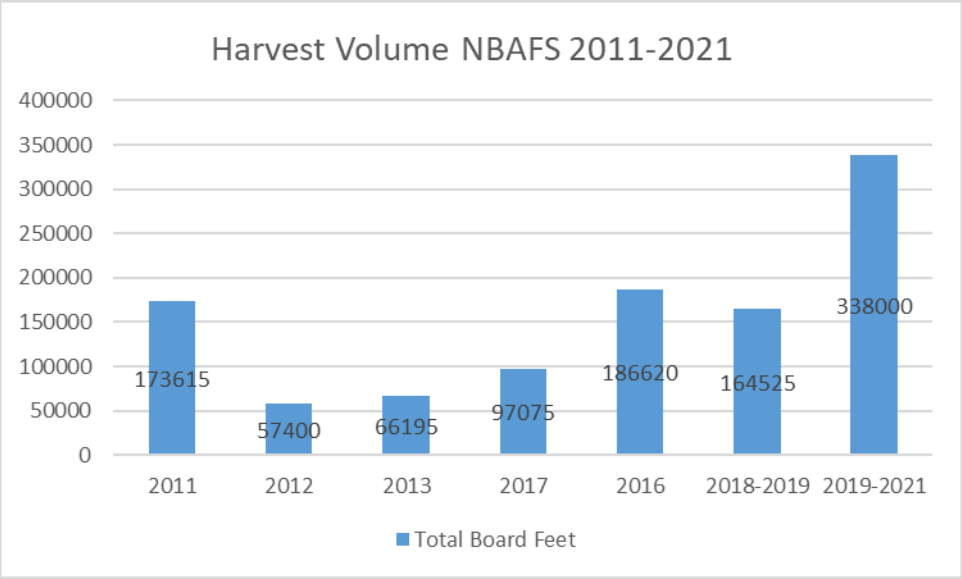


Figure 13 NBAFS Harvest Volumes 2011-2021

Looking forward, NBAFS is planning two harvest in Forest Management Units 18 and 22 in response to HWA and elongate hemlock scale infestations. Several other harvest for habitat improvement will be considered in Unit 2, 6, 13, 19, 20, and 25.

Natural Resources personnel also manage a fuelwood program that is available to all persons who have access to the station. A fee of $50 dollars is charged for a permit that allows the holder to cut up to six cords of fuelwood. Fuelwood lots are marked by Natural Resources staff in locations accessible by vehicle. NBAFS prohibits firewood from being brought on the installation to prevent invasive insects.

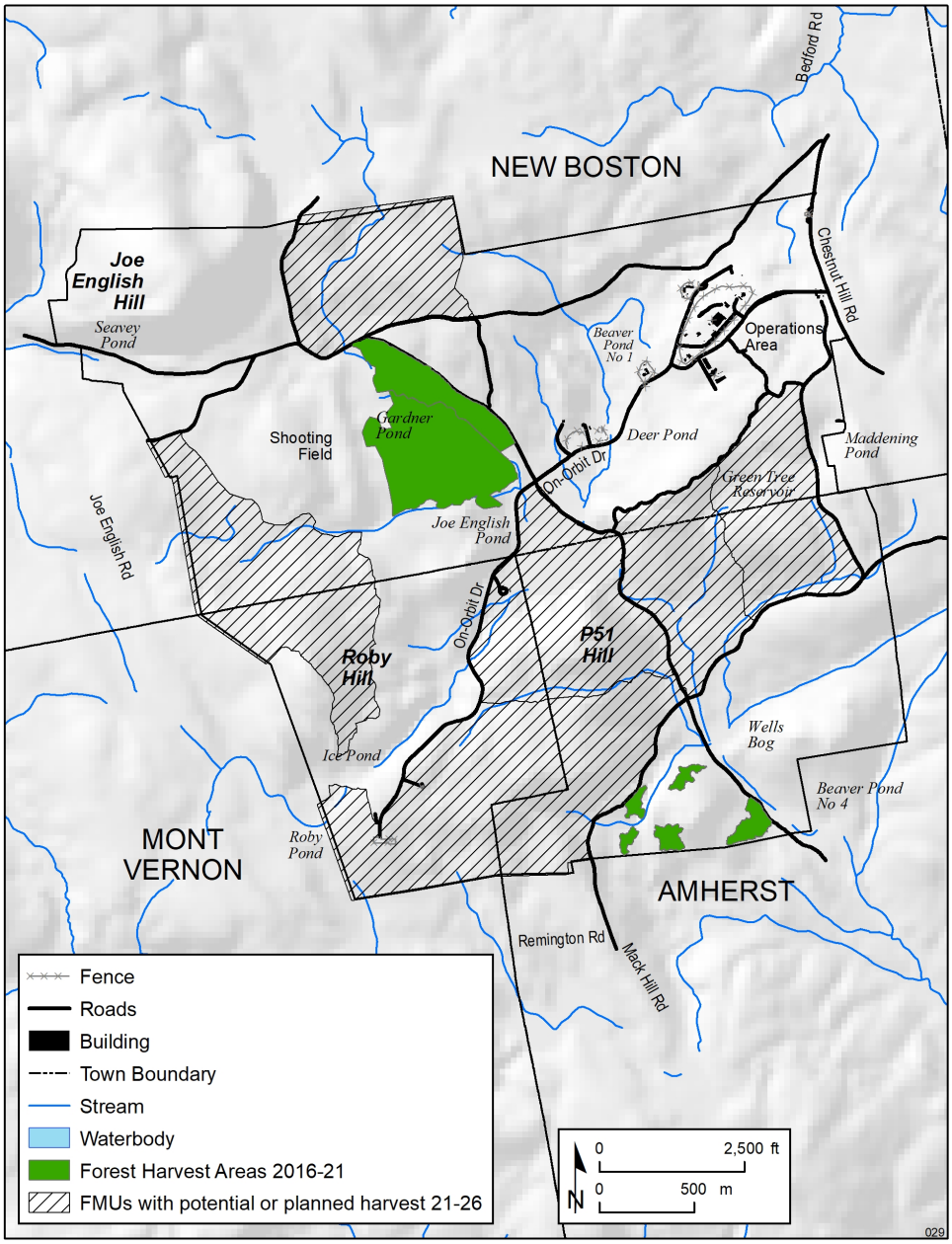


Figure 14 Forest Harvest Units

7.9 Wildland Fire Management

Applicability Statement

This section applies to USAF installations with unimproved lands that present a wildfire hazard and/or installations that utilize prescribed burns as a land management tool. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

A Tier 1 Wildland Fire Management Plan (Tab 1) has been established and approved (June 2019) for NBAFS, the plan is incorporated by reference into this INRMP. The purpose of the plan is to safely suppress wildfire at minimum cost in a way that is consistent with land and resource management objectives at NBAFS, and to provide fire management direction. The plan describes the procedures to be followed in the event of a wildfire, assigns the responsibilities for fire-suppression decisions, defines the qualifications of fire-fighters, identifies interactions with cooperating fire departments in the area, and describes the process for presuppression activities, including the creation and maintenance of firebreaks and the use of prescribed fire for fuel management and meeting resource management objectives.

In addition to prescribed fires, fuels management could be accomplished by mechanical treatment (e.g., use of chainsaws, brushhogs, and mowers to help remove or lop brush or broken treetops, boles, and limbs). Also, woody debris resulting from activities such as roadside clearing could be burned, chipped, or removed to approved disposal areas to avoid fuel accumulations (Bernardy et al. 2003).

The Natural Resources Management Office at NBAFS is responsible for all aspects of wildfire management on the installation. AFCEC provides resources and personnel to execute planned prescribed burns in accordance with the approved NBAFS Wildland Fire Management Plan. A wildland fire module is located at Joint Base McGuire-Dix-Lakehurst in New Jersery that supports NBAFS. DoD civilian Natural Resources employees are the principal wildland firefighting staff at NBAFS; other DoD civilians who are fully trained to National Wildfire Coordinating Group (NWCG) standards and outfitted with personal protective equipment (PPE) could be used to augment Natural Resources staff during emergencies or planned events.

Mutual-aid agreements with Federal, State, and local fire-management agencies are planned to ensure adequate staffing and equipment coverage for wildfire suppression. Aid agreements and yearly operating plans would specify procedures for requesting assistance by any agency involved in the agreement. All fire-management personnel would meet USAF standards. However, the Installation Commander would have the authority to accept the risk of using unqualified firefighters in the event of an emergency.

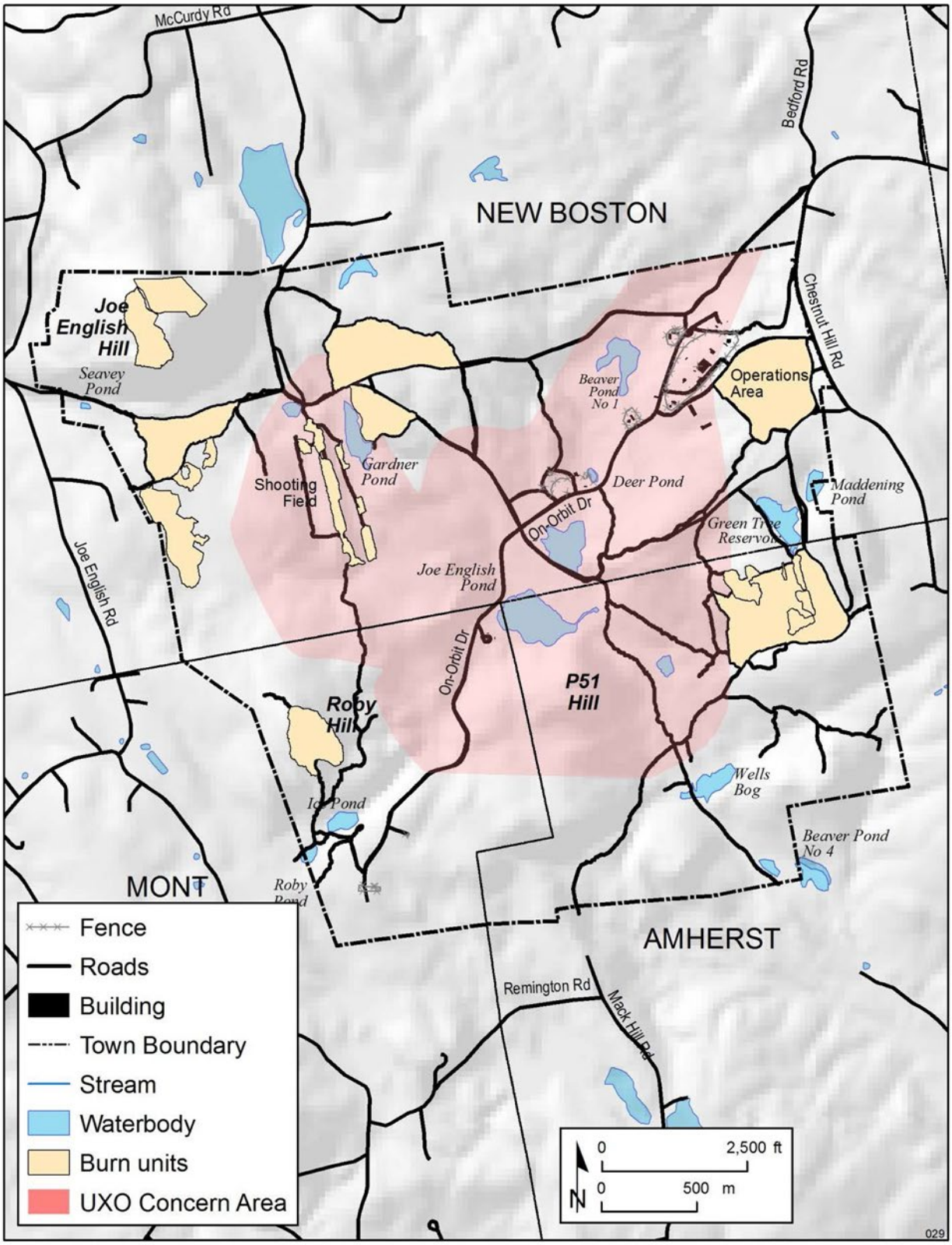


Figure 15 NBAFS Reoccuring Burn Units

Picture 36 Joe English Hill burn

Prior to conducting a prescribed fire, a Prescribed Fire Plan is prepared by a qualified burn boss either from NBAFS or the module at JBMDL. Prescribed fires may be implemented only with trained and qualified personnel under NWCG standards, according to Publication 310-1, *Wildland and Prescribed Fire Qualifications Guide* of the National Fire Protection Association, or approved cooperators' standards. The size and complexity of each prescribed fire project determines the size of the team needed to safely achieve the objectives of the prescribed fire (Bernardy et al. 2003). The frequency of prescribed burns is expected to be every five to twenty years for most areas. Re-occuring burn units at NBAFS are show in figure 15, Re-occuring Burn Units at NBAFS.

All fire-management activities on NBAFS are consistent with the forest-management objectives previously discussed. Prescribed fire techniques can be used to encourage oak or pine regeneration, reduce overstory or understory competition from undesirable tree species or to thin overstocked forest stands. Prescribed fires are planned to ensure that soils are not damaged by extreme heat (Bernardy et al 2003). Preference will be given to using existing man-made and natural fire breaks during wildfire and prescribed fire. Lines constructed during wildfires and prescribed fires will be rehabilitated to ensure that erosion does not occur.

Short-term impacts of prescribed fires on listed and rare species are expected to be offset by long-term habitat improvement (ANL 2003). Impacts to species are expected to be negligible over the long term, as only limited areas would be burned annually in comparison to the amount of suitable habitat available on the station.

Wildfire will remain a minor factor in the land management of NBAFS due to climate change. The mission is unlikely to produce substantial numbers of ignitions, limiting the potential for fire occurrence.

Annual precipitation is projected to increase by 2.3 to 6.0 inches annually, though decreases in monthly precipitation are likely in May and June. This is peak green-up, however, so wildfire potential will likely remain very low during this period of the year given the spring flush of new growth. Monthly maximum temperatures are expected to increase by as much as five degrees F, which could lead to lower relative humidity and commensurate increases in fire behavior. This is most pronounced in April and May in the 2050 scenarios, which is unlikely to cause increased fire activity due to spring green-up conditions, and in September and October, again in the 2050 scenarios. The latter, when combined with projected precipitation decreases in October in the RCP 4.5 scenario, could lead to increased fire behavior in that

month. However, very substantial precipitation increases in September and November are projected in the RCP 4.5 scenario. This makes it unlikely that a dry period long enough to increase fire activity in a meaningful way will occur in October.

Predicted vegetation changes suggest a trend toward more broadleaf domination at the expense of coniferous species. This would further diminish fire behavior potential except under the scenario where oak species become substantially more common. Such a change taken in isolation would elevate fire potential in the spring before green-up and in the fall after the leaves fall for the year. In conjunction with the climate projections, however, there remains little opportunity for meaningful increases in wildfire frequency or intensity and, during some portions of the year, fire activity can be expected to drop relative to current day (CSU 2019).

7.10 Agricultural Outleasing

Applicability Statement

This section applies to USAF installations that lease eligible USAF land for agricultural purposes. This section **IS NOT** applicable to this installation.

Program Overview/Current Management Practices

7.11 Integrated Pest Management Program

Applicability Statement

This section applies to USAF installations that perform pest management activities in support of natural resources management (e.g., invasive species, forest pests, etc.). This section **IS** applicable to this installation.

Program Overview/Current Management Practices

Pests are defined in AFMAN 32-1053, Integrated Pest Management Program, as “arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds, or other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.” USAF installations are directed to develop Integrated Pest Management Programs (IPMP) that promote and support military readiness; installation program planning and maintenance; pollution prevention; conservation of natural resources; and environmental compliance. Successful IPMPs minimize the use of hazardous pesticides by emphasizing monitoring, and sustainable methods of control such as habitat modification, biological control, genetic control, cultural control, mechanical control, physical control, and regulatory control.

There are relatively few pest problems on NBAFS. Pest profiles are developed in the NBAFS IPMP for beaver, birds, vegetation, bees and wasps, ants, mice, bear and nuisance animals (raccoons [*Procyon lotor*], striped skunks [*Mephitis mephitis*], foxes, Canada geese, and woodchucks) (NBAFS 2012). Control of these species involves measures to prevent conditions attractive to pests, modification of conditions to prevent use, manual removal of pests, and use of approved pesticides. On NBAFS, the U.S. Department of Agriculture, Wildlife Services, is used as the principal control agency, but others can be used (e.g., private trappers, private wildlife consultants) in consultation with NHFGD.

An invasive plant species control plan was developed for NBAFS to satisfy requirements of AFM 32-1053, EO 13112, Invasive Species, and the Sikes Act (North Wind, Inc. 2005). Three prohibited invasive species were found at NBAFS during field surveys conducted for the plan, and include autumn olive, Japanese knotweed (*Polygonum cuspidatum*), and Japanese barberry (*Berberis thunbergii*). Six other nonnative invasive species were found at NBAFS during the field survey, and include bull thistle (Cirsium vulgare), sowthistle (*Sonchus arvensis*), spotted knapweed (*Centaurea biebersteinii*), purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), and crown vetch (*Coronilla varia*).

Autumn olive is widespread on NBAFS and represents the most problematic of the invasive species on the station (North Wind, Inc. 2005). It is primarily located along roadways, in recreation areas, and old-fields. Autumn olive was planted by the Boy Scouts of America as part of a revegetation and reclamation project in old-fields and bombing and strafing ranges (North Wind, Inc. 2005). North Wind, Inc. (2004) recommended manual cutting and treatment of stumps with glyphosate or basal-bark treatment.

Japanese knotweed and Japanese barberry are found in only a few locations and could be effectively controlled with herbicide (knotweed) or manual removal (barberry) (North Wind, Inc. 2005). Recommendations for the other invasive species found on NBAFS were provided and included manual removal, herbicide treatment, and restoration of native vegetation to prevent recolonization. Control of these species now before their populations spread could prevent future control problems.

North Wind, Inc. (2005) identified 18 other invasive plant species not found on NBAFS, but known to occur elsewhere in New Hampshire, and made recommendations to prevent their establishment on NBAFS. These included:

- Identify invasive plant populations. Early detection is always the best defense against noxious weeds. Treat intensively when a new or small patch is found. Educate operations and maintenance supervisors and managers on weed identification and the importance of controlling and preventing infestations.
- Require contractors or departments to clean equipment and vehicles with high-pressure air or water prior to use in the project area and before leaving infestation zones in construction areas.
- Use certified invasive weed-free imported materials (e.g., straw bales, erosion-control seed mixes) when and where needed during construction, reclamation, maintenance, and operations.
- Conduct follow-up invasive-weed surveys and weed-control treatments during the growing season following completion of construction and revegetation activities.
- Reseed disturbed sites with native species. In areas where grasses are recommended, use species that are tolerant of broadleaf herbicides, which can later be used to spot treat broadleaf weeds.
- After an area is seeded, establish a maintenance schedule to continue to water and fertilize to promote establishment. Maintenance activities should continue through a minimum of one growing season.
- When tilling for control, till only in the area with invasive plants so roots and seeds do not spread. Always clean equipment and machinery on site after working in such an area to prevent spread.
- In areas that are routinely mowed, set mowing schedules to mow before weeds go to seed, and schedule subsequent mowings often enough to prevent seed production.
- When using herbicides, take into consideration the effects on listed and rare species present in the area to be treated.
- When using mechanical manipulation, take into consideration its effect on introducing opportunistic weeds.

- When using herbicides and mechanical treatments in riparian areas, consider the effects of translocation of herbicides and erosion of streambanks and surrounding watershed areas.
- Consider the effects of control efforts on nontarget species. Assess the risks of invasive plants, erosion, loss of habitat, and visual degradation of an area.
- Analyze cost of control efforts and alternatives. Cost analysis could possibly rule out certain types of mitigation techniques. Review minimal mitigations that could control target species without affecting budget restrictions.

Implementation of the IPMP (NBAFS 2012) and the recommended controls for invasive plant species (North Wind, Inc. 2005) are consistent with the overall natural resources management program at NBAFS. Control of nonnative invasive plant species and animal pests would benefit threatened, endangered, and rare species, and rare natural communities by promoting the maintenance of balanced ecosystems. The Wildland Fire Management Plan would help control nonnative invasive species and encourage the maintenance of fire-adapted native plant communities.

Over the period from 2016-2020 NBAFS has treated 45 – 79 acres of invasive vegetation and 98 acres of hemlock infested with HWA (see Table 10). Treatments have been successful at maintaining native habitats but continued treatment will be necessary to manage invasive species. The local area surrounding NBAFS likely contains extensive invasive species populations with large seed banks.

Table 10 Inavsive Species Treatment NBAFS 2016-2020

Year	Areas	Method	Invasive Species	Acres
2020	No treatments			0
2019	Openings, fields, edges	herbicide foliar, cut stump	AO, BB, OB, MR, JK	76
2019	Hemlock Stands	Tablet in soil	HWA	98
2018	Openings, fields, edges	herbicide foliar, cut stump	AO, JK, BSW, OB, BB, CT	45
2018	Hemlock Stands	Tablet in soil	HWA	98
2017	Openings, fields, edges	herbicide foliar, cut stump	AO, JK, BSW, OB, BB, CT	79
2017	Hemlock Stands	Tablet in soil	HWA	98
2016	Openings, fields, edges	herbicide foliar, cut stump	AO, JK, BSW, OB, BB, CT	77
2016	Hemlock Stands	Tablet in soil	HWA	98
Species codes: AO - Autumn Olive, BB - Burning Bush, OB-Oriental Bittersweet, MR-Multiflora Rose CT-Canadian Thistle, HWA-Hemlock Woolly Adelgid, BSW-Black Swallowwort, JK-Japanese Knotweed				

7.12 Bird/Wildlife Aircraft Strike Hazard (BASH)

Applicability Statement

This section applies to USAF installations that maintain a BASH program to prevent and reduce wildlife-related hazards to aircraft operations. This section **IS NOT** applicable to this installation.

Program Overview/Current Management Practices

7.13 Coastal Zone and Marine Resources Management

Applicability Statement

This section applies to USAF installations that are located along coasts and/or within coastal management zones. This section **IS NOT** applicable to this installation.

Program Overview/Current Management Practices

7.14 Cultural Resources Protection

Applicability Statement

This section applies to USAF installations that have cultural resources that may be impacted by natural resource management activities. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

On NBAFS, there are numerous cultural resources including stone mill foundations and dams near streams and remnants of stone walls, barns and houses, old roads, and lanes in upland areas (HB&A 2004). Prehistoric resources include two sites near East Meadow Road and Wells Bog; both are the remnants of temporary campsites that were used by small groups. Archeological resources include approximately 70 sites. Most of the sites are eligible for inclusion in the National Register of Historic Places (NRHP) and are managed as contributing elements to an archeological district. In addition, there are six Cold War-related properties (Buildings 100, 102, 108/109, 142/143, and the Boresight Tower) that are eligible for the NRHP, possibly as a historic district (Whetsell and McLeod 2000). The USAF received formal concurrence from the NH Division of Historic Resources on the determination of eligibility of the district in 2006.

Protection and management of cultural resources at NBAFS are guided by an Integrated Cultural Resources Management Plan (ICRMP). The ICRMP identifies measures that should be taken to protect cultural resources of the station. These measures apply to actions taken as part of this INRMP. Forest management activities and prescribed burns are designed by NBAFS Natural Resources staff to minimize or eliminate their impacts on cultural resources. The Wildland Fire Management Plan was specifically designed to recognize and minimize impacts to cultural resources sites during wildfire management activities.

Picture 37 Remnants of Historic Joe English Pond Mill

7.15 Public Outreach

Applicability Statement

This section applies to all USAF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

Access to NBAFS is restricted to active duty military; DoD civilians; active duty military dependents and family members; military retirees, DoD civilian retirees; and employees of installation prime contractors. The general public does not have access to NBAFS. Natural Resources personnel conduct a number of outreach activities that target NBAFS visitors and employees. These activities include:

- Developing and distributing brochures that describe natural and cultural resources on NBAFS;
- Developing and distributing identification cards for the Blanding's turtle to NBAFS employees to raise awareness of their presence on the station and in the Operations Area;
- Promoting birding by visitors by publishing and distributing a checklist of the birds of NBAFS that includes information on seasonal occurrence;
- Conducting periodic educational presentations to NBAFS employees regarding threatened, endangered, and rare species likely to be encountered on NBAFS;
- Posting interpretive signs in areas where timber harvest and other forest management activities have recently occurred to raise awareness of natural resource management issues on the station.

Natural Resources personnel have been successful in raising awareness of natural resources issues on the station, particularly with regard to the presence and vulnerability of threatened, endangered, and rare species on NBAFS. Consequently, Natural Resources personnel routinely get reports of sightings of these and other species on the station. These sightings have been an important contribution to a developing understanding of population distribution and movements for several species on the station.

In addition to the above activities, NBAFS Natural Resources personnel notify adjacent property owners, both directly and through public notices, prior to prescribed burning activities when smoke or flames are likely to be visible off the station. These notices are intended to ensure that the public is aware that prescribed burning is taking place and reduce any concerns regarding smoke.

7.16 Climate Change Vulnerabilities

Applicability Statement

This section applies to USAF installations that have identified climate change risks, vulnerabilities, and adaptation strategies using authoritative region-specific climate science, climate projections, and existing tools. This section **IS** applicable to this installation.

Program Overview/Current Management Practices

Climate projections for New Boston Air Force Station (NBAFS) (Table 11) suggest minimum and maximum temperatures will increase over time under two emission scenarios – a moderate carbon emission scenario (Representative Concentration Pathway [RCP] 4.5) and a high emission scenario (RCP 8.5). The potential impact of these two climate change scenarios on the site's natural resources was analyzed using extracted climate data from 2026 to 2035 to represent the decadal average for 2030, and extracted data from 2046 to 2055 for the decadal average for 2050.

For the decade centered around 2030, both of the scenarios project a similar degree of increase in average annual temperature (TAVE) of between 2.1 °F (1.2 °C) and 2.4 °F (1.3 °C) over historic average. The two emission scenario projections show higher warming by 2050, with RCP 4.5 expressing a warming of 3.2 °F (1.8 °C). RCP 8.5 expresses a slightly greater warming of 3.6 °F (2.0 °C) for this period.

Average annual precipitation (PRECIP) varies between emission scenarios and over time due to larger interconnected ocean-atmosphere dynamics associated with the National Center for Atmospheric Research (NCAR) Community Climate System Model (CCSM). For 2030, the RCP 4.5 scenario projects an increase in PRECIP of 11% while RCP 8.5 shows an increase of 5%. For 2050, RCP 4.5 projects an increase in PRECIP of 7% while RCP 8.5 shows a slightly greater increase of 12%.

Table 11. Summary climate data.

Variable	Historical	RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
PRECIP (inches)	50.3	56.0	53.6	52.7	56.3
TMIN (°F)	35.3	37.3	38.2	37.5	38.7
TMAX (°F)	56.9	59.1	60.4	59.5	60.7
TAVE (°F)	46.0	48.0	49.1	48.7	49.6
GDD (°F)	2570	2974	3208	3052	3256
HOTDAYS	2.6	10.4	17.4	16	17.3
WETDAYS	1.0	0.2	0.5	0.3	0.8

Notes: TAVE °F = annual average temperature; TMAX °F = annual average maximum temperature; TMIN °F = annual average minimum temperatures; PRECIP (inches) = average annual precipitation; GDD °F = Average annual accumulated growing degree days with a base temperature of 50 °F; HOTDAYS (average # of days per year) = average number of hot days exceeding 90 °F; WETDAYS (average # of days per year) = annual number of days with precipitation exceeding 2 inches in a day.

Understanding changes in daily intensity and total precipitation for multi-day precipitation events is helpful to evaluate precipitation patterns in addition to assessment of annual averages. Three-day storm events (design storm) were generated from projected precipitation data based on RCP 4.5 and 8.5 emission scenarios for the 2030 and 2050 timeframes. Historical precipitation data were used to calculate a baseline storm event for the year 2000 for comparison.

Climatic deviations from historical conditions could have a significant effect on the health of wildlife populations and ecosystems, posing the second highest threat to wildlife after pollution in New Hampshire (NHFGD, 2015). Increased air temperatures contribute to increased stream temperature, which may cause stress to native coldwater species such as brook trout (*Salvelinus fontinalis*) (Culler et al., 2018). Sedimentation and decreased water depth from erosion, which can be amplified by increased storm intensity or in post-fire conditions, may also contribute to higher water temperatures and degraded fish ecosystem. Warmer water temperatures will favor species with a higher thermal tolerance such as yellow perch (*Perca flavescens*) and largemouth bass (*Micropterus salmoides*) (Eaton & Scheller, 1996) and may negatively impact amphibians with narrow tolerances for temperature and moisture regimes (Olson & Saenz, 2013).

The majority of species at NBAFS were classified as low-risk in the New Hampshire climate change wildlife risk assessment (NHFGD, 2015). However, climate change is expected to cause ecosystem

alterations within the hemlock hardwood pine forest community. Cold or snow adapted specialists, such as the snowshoe hare, are more vulnerable to changes in forest composition or snowpack and may ultimately shift their range toward more suitable ecosystem (Sultaire et al., 2016). Meanwhile, new species that currently inhabit regions further south, may become common at NBAFS as they shift their range northward. Biological events which are correlated with temperature such as spring budburst, insect emergence, and migratory bird arrival are occurring earlier in the year and this trend is expected to continue (Carey, 2009; Yue, Unger, Keenan, Zhang, & Vogel, 2015). These phenological shifts have the potential to decouple the timing of migratory peaks or hatching with food abundance.

Individual species will likely react to these changing variables in unique ways which are expected to drive changes in the composition of plant and animal communities. Nonnative, invasive species (including pathogens and disease) whose range was historically limited by temperature, are expected to continue to spread northward and flourish with warmer temperatures (NHFGD, 2015). Hemlock wooly adelgid is an invasive insect that deforests hemlock trees and, if untreated, can cause mortality (USEPA, 2016). Hemlock provides a food source and valuable wintering and nesting ecosystem for many species, so loss of this ecosystem would have detrimental impacts on wildlife (CSU2019).

7.17 Geographic Information Systems (GIS)

Applicability Statement

This section applies to all USAF installations that maintain an INRMP, since all geospatial information must be maintained within the USAF GeoBase system. The installation is required to implement this element.

Program Overview/Current Management Practices

A geographic information system (GIS) is used by Natural Resources staff to assist in natural resources inventory and management. This GIS incorporates up-to-date geographic and attribute data for the station. The GIS provides the ability to analyze and model pertinent natural resource information to ensure compatibility between the military mission and natural resource management. Applications are used to manage biodiversity and assist in preparation of required operational requests to ensure regulatory compliance. This capability is critical to the success of an integrated natural resources management program because it provides a methodology for baseline measurement, tracking of progress, problem identification, and identification of solutions (Najjar 1998). Currently NBAFS uses ESRI ArcGIS software for all GIS applications. Environmental data sets are maintained by AFCEC (currently under contract with Colorado State University) with updates from the installation. Data is created and maintained to Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) .

8.0 MANAGEMENT GOALS AND OBJECTIVES

The installation establishes long term, expansive goals and supporting objectives to manage and protect natural resources while supporting the military mission. Goals express a vision for a desired condition for the installation's natural resources and are the primary focal points for INRMP implementation. Objectives indicate a management initiative or strategy for specific long or medium range outcomes and are supported by projects. Projects are specific actions that can be accomplished within a single year. Also, in cases where off-installation land uses may jeopardize USAF missions, this section may list specific goals and objectives aimed at eliminating, reducing, or mitigating the effects of encroachment on military missions. These natural resources management goals for the future have been formulated by the preparers of the INRMP from an assessment of the natural resources, current condition of those resources, mission requirements,

and management issues previously identified. Below are the integrated goals for the entire natural resources program.

The installation goals and objectives are displayed in the 'Installation Supplement' section below in a format that facilitates an integrated approach to natural resource management. By using this approach, measurable objectives can be used to assess the attainment of goals. Individual work tasks support INRMP objectives. The projects are key elements of the annual work plans and are programmed into the conservation budget, as applicable.

Installation Supplement – Management Goals and Objectives

8.1 Special Concern, Threatened and Endangered Species

Goals, objectives, and projects associated with the management of threatened, endangered, and rare species on NBAFS focus on increasing our understanding of distributions, habitat use, and habitat needs; development of management strategies to sustain or improve habitat conditions; and ensuring that populations of these species continue to exist or expand on NBAFS.

Goal TE-1: Sustain existing populations of federally and state listed bats on NBAFS.

- Objective TE-1: Manage and protect small footed bat roost habitat on Joe English Hill in consultation with New Hampshire Fish and Game Department
    - Project TE-1: Update bat management plan as necessary to ensure protection of Small footed bat roost habitat. Time frame: continuous
    - Project TE-1.1 Collect bat acoustic monitoring data annually using in-house monitors with assistance from cooperators. Send data to cooperator for analysis. Participate in larger efforts (i.e.., NABat) in cooperation with USFWS and NH Fish and Game. Time frame: continuous

Goal TE-2: Sustain existing populations of Blanding's turtle on NBAFS.

- Objective TE-2.1: Monitor habitat use and movements of Blanding's turtle on NBAFS.
    - Project TE-2.1: Continue monitoring study of Blanding's turtles (including recapture and replacement of radio transmitters to ensure continued operation, installation of transmitters on additional turtles, and trapping) and other rare/listed turtles to determine seasonal habitat use and movements. Update installation GIS with location data and provide annual reports to NH Fish and Game. Time frame: continuous.
- Objective TE-2.2: Implement management strategy for Blanding's turtle.
    - Project TE-2.2.1: Implement management plan for Blanding's turtles and their habitats. Create nesting habitat for Blanding's to provide alternative to road shoulders. Evaluate success with camera traps or by other means. Time frame: FY21-25.
    - Project TE-2.2.2: Minimize installation of new roadside curbs, evaluate removal or modification of existing curbs, and evaluate new culvert technology to minimize impacts on Blanding's turtle movements on NBAFS. Time frame: continuous.

- Project TE-2.2.3: Remove predators from known Blanding's nesting areas through lethal means. Time-frame: annual.

Goal TE-3: Sustain existing populations of eastern hognose snake on NBAFS.

- Objective TE-3.1: Determine the habitat use and movements of eastern hognose snake on NBAFS.

    - Project TE-3.1: Continue monitoring eastern hognose snakes to determine seasonal habitat use and movements in accordance with management plan. Project includes documenting any other rare snakes or amphibians encountered. Gather morphometric data for snakes encountered and place PIT tag in individuals. Update installation GIS with geographic location data and provide NH Fish and Game with annual report. Time frame: annual.

Goal TE-4: Sustain existing populations of listed and rare bird species on NBAFS.

- Objective TE-4.1: Determine the status, distribution, and habitat associations of American bittern, Cooper's hawk, northern goshawk, and whip-poor-will on NBAFS.

    - Project TE-4.1: Conduct annual surveys for American bittern, Cooper's hawk, northern goshawk, and whip-poor-wills during June and July to monitor status, distributions, and habitat associations. Time frame: annual.

    - Project: TE-4.2: Conduct annual breeding bird surveys to monitor status, distributions, and habitat associations of neotropical migrants.

    - Project: TE: 4.3: Conduct annual presence absence survey of Joe English Hill for Peregrine Falcon. Attempt do document breeding status.

Goal TE-5: Sustain rare and native fish populations.

- Objective TE-5.1: Determine the status, distribution, and habitat associations of banded sunfish, native brook trout, American eel and other native fish on NBAFS.

    - Project TE-5.1: Conduct annual fisheries survey in NBAFS ponds and streams with focus on native brook trout, American eel and banded sunfish. Produce annual report with species encountered, geographic data, water chemistry and recommendations for habitat improvement and management Time-frame: annual

8.2 Wetlands

Goals, objectives, and projects associated with wetland management on NBAFS focus on sustaining high-quality wetland habitats by monitoring trends, identifying threats, and restoring degraded wetlands. Wetlands at NBAFS perform important ecological functions such as maintenance of water quality, flood control, and groundwater recharge, and also provide habitat for plant and animal species including listed and rare species. Degradation could be caused by invasive nonnative plants, natural succession, encroachment of human developments, and runoff from developed or disturbed areas. Monitoring wetland change and developing response actions before problems intensify are important components of the NBAFS INRMP.

Goal WE-1: Maintain existing wetland communities on NBAFS.

- Objective WE-1.1: Monitor NBAFS wetlands.
    - Project WE-1.1.1: Continue implementation of qualitative wetlands monitoring protocol. Time frame: annual.
    - Project WE-1.1.2: Collect water quality data in conjunction with fisheries survey project on NBAFS waters capable of supporting fish. Time frame: annual.
- Objective WE-1.2: Prevent degradation of existing NBAFS wetlands through implementation of Best Management Practices (BMP) for forest roads.
    - Project WE-1.2: Implement wetland restoration activities from NBAFS wetland study (Assessment of Threats to Wetland Integrity 2013). Time frame: FY 2021-FY2026.
    - Project WE-1.2.1: Maintain all gravel forest roads (over 10 miles) in accordance with NH BMP manual. Install gates on roads not intended for routine travel to prevent erosion. Time-frame: Annual maintenance. Install gates during 2021.
    - Project WE-1.2.2: Repair existing Gardner Pond, Green Tree and Seavy Pond Dams to prevent sediment release and fluctuations in water levels that may cause down-stream impacts. Time-frame: Green Tree and Seavy CY 2021, Gardner Pond CY22 or 23.

8.3 Rare Natural Communities

Goals, objectives, and projects associated with the management of rare natural communities on NBAFS focus on sustaining high-quality rare natural communities by monitoring trends, identifying threats, and restoring degraded communities if needed. Although no degradation is currently known to have occurred on NBAFS, degradation could be caused by invasive nonnative plants, natural succession, encroachment of human developments, and runoff from developed or disturbed areas. Monitoring community change and developing response actions before problems intensify are important components of the NBAFS INRMP.

Goal NC-1: Maintain existing rare natural communities on NBAFS.

- Objective NC-1.1: Manage existing rare natural communities on NBAFS.
    - Project NC-1.1: Avoid significant disturbance in NBAFS rare natural communities when possible. Time frame: continuous.
    - Project NC-1.2: Conduct prescribed burn with low intensity fire in the Joe English Hill area to maintain oak forest. Time-frame: 2021-2022

8.4 Forest Management

Because over 90% of NBAFS is forested, forest management is the dominant tool for natural resource management on the station. Goals, objectives, and projects associated with forest management at NBAFS target the development of an overall forest management program that integrates the varied and sometimes disparate needs of a variety of forest-dependent species.

Goal FO-1: Provide sustainable forest management and high-quality habitat for forest-dependent species on NBAFS.

- Objective FO-1.1: Update data on existing NBAFS forest types, distributions, and age structure.
    - Project FO-1.1.1: Continue to perform base wide forest inventories for Natural Resource Management units on an approximate 10-year rotation. Time frame: continuous.
    - Project FO-1.1.2: Update GIS to include forest attributes determined in Project FO-1.1.1. Time frame: continuous.
- **Objective FO-1.2:** Provide habitat for forest-dependent wildlife species on NBAFS.
    - Project FO-1.2.1: Perform prescribed burns on 10-50 acre blocks as identified in Wildland Fire Management Plan. Time frame: continuous.
    - Project FO-1.2.2: Evaluate forest attribute data assembled in Project FO-1.1.2, and other observations, to determine current availability of early-succession habitat and potential locations of suitable sites for conversion and implement two to three clearcuts that are 5 to 15 ac in size every 5-10 years. (Note: clearcuts for this project count against overall totals identified for Project FO-2.1.1). Time frame: continuous.

Goal FO-2: Continue commercial forest operations on NBAFS.

- Objective FO-2.1: Manage timber resources for sustained yield.
    - Project FO-2.1.1: Regenerate 10 to 20 ac of forest areas periodically primarily through shelterwood cutting with some of the overstory trees permanently reserved. Time frame: periodic (2-5 harvest every 10 years).
    - Project FO-2.1.2: Thin approximately 20 to 50 ac of forest periodically. Focus harvest on removal of hemlock declining from hemlock woolly adelgid. Time frame: periodic (2-5 harvest every 10 years).

8.5 Invasive-Nonnative Plant and Insect Species

Currently, invasive nonnative plant species problems at NBAFS are limited to the impact of several plant species that are difficult to control. The most problematic vegetation species are autumn olive and oriental bittersweet, but other invasive nonnative species occur at relatively low density and could be effectively controlled before their populations expand.

Invasive insect species including Hemlock woolly adelgid (HWA), Elongate hemlock scale and Emerald ash borror are prevelant on NBAFS. These insect species are causing ecosystem level changes and difficult to manage.

Goal IN-1: Eliminate or control invasive nonnative plant species on NBAFS

- Objective IN-1.1: Eliminate or control existing problem species on NBAFS.
    - Project IN-1.1: Implement a control plan for existing invasive nonnative plant species based on the recommendations presented in North Wind (2005) and monitor success of control efforts. Treat all fields annually by mowing, burning and herbicide. Treat road

edges and other openings annually. Target 20 to 40 acres treated per year. Time frame: annual.

- Project IN-1.2: Update/revise control plan for invasive species at NBAFS. Time-frame: FY25

- Project IN-1.3: Implement HWA management plan, treat hemlock (20-40 acres), release predatory beetles when available. Time-frame: annual

- Objective IN-1.2: Prevent inadvertent introduction and spread of invasive nonnative plant species on NBAFS.

  - Project IN-1.2: Implement recommendations of North Wind (2005) to prevent the inadvertent introduction and spread of invasive nonnative plant species based on recommendations in North Wind, Inc. (2005), eliminate the use of nonnative species in plantings, and use only plants of local origin when possible. Specify prevention of invasive species by washing equipment and using invasive free landscaping materials in all contracts. Ensure any military activities have provisions to prevent invasive species introduction or transport. Time frame: continuous.

8.6 Outdoor Recreation

Outdoor recreation at NBAFS involves hunting, fishing, and wildlife observation. Goals, objectives, and projects associated with outdoor recreation at NBAFS are related to developing a more well-established nonconsumptive nature-oriented recreational program (e.g., hiking, birding) that capitalizes on opportunities for outdoor education. In addition, management of hunting and fishing programs can result in high-quality hunting and fishing experiences for staff and visitors.

Goal OR-1: Encourage consumptive and nonconsumptive recreational activities that provide educational opportunities for military (active and retired), DOD employees and visitors.

- Objective OR-1.1: Maintain interpretive outdoor recreation program at NBAFS. Provide archery hunting, fishing and other outdoor recreational opportunities for NBAFS users.

  - Project OR-1.1.1: Maintain a self-guided nature trail originating at Joe English Pond Campground. Time frame: Annual.

  - Project OR-1.1.4: Maintain archery range at Green Tree field. Time frame: continuous.

  - Project OR-1.1.3: Maintain hiking/recreation trail network on Joe English Hill, Hill 51 and in southwest portion of base. Provide maps to installation users, mark trails with standard trail marking using tree paint (approximately 4 miles of trails). Time frame: annual.

Goal OR-2: Provide high-quality hunting and fishing experiences.

- Objective OR-2.1: Sustain or enhance populations of game species on NBAFS.

  - Project OR-2.1.1: Continue to collect hunter harvest and usage data. Time frame: annual.

- Objective OR-2.2: Sustain or enhance game fish populations on NBAFS.

- Project OR-2.2.1: Stock Roby Pond, Ice Pond, Deer Pond, Joe English Pond and Joe English Brook with trout. Time frame: annual.

- Project OR-2.2.2: Perform periodic fish surveys for game and rare fish on NBAFS. Time frame: as needed.

8.7 REMEDIATION ACTIVITIES

Remediation activities could result in significant adverse impacts to natural resources on the station. Goals, objectives, and projects associated with remediation activities address the restoration of disturbed habitats to predisturbance conditions.

Goal RE-1: Minimize the effects of remediation activities on natural resources of NBAFS

- Objective RE-1.1: Minimize the extent of impacts and restore sites disturbed by remediation activities to predisturbance conditions and functions.

    - Project RE-1.1.1: Work with USAF Restoration staff to ensure inclusion of natural resources considerations during the remediation planning and contracting process, and complete consultation with USFWS, NHFGD, and NHNHB prior to the initiation of a remediation plan to ensure that remediation and restoration activities are consistent with the INRMP and Sikes Act requirements. Time frame: continuous.

9.0 INRMP IMPLEMENTATION, UPDATE, AND REVISION PROCESS

9.1 Natural Resources Management Staffing and Implementation

Implementation of the NBAFS INRMP is under the direction of the Natural Resources Planner (23 SOPS/CEA) at NBAFS. The NBAFS Natural Resources Planner oversees the development of the plans and programs described in the INRMP, and ensures that those plans and programs are implemented in a timely manner. Data collection and studies to support the INRMP are conducted by the Natural Resources Planner, other Natural Resources personnel, and cooperators from other Federal, State, and local agencies. The NBAFS Natural Resources Planner will maintain regular communications with the USFWS, NHFGD, and installation organizations regarding natural resource issues.

NBAFS has one funded GS-0401 position assigned to Natural Resources. The position is assigned natural resources, cultural resources and NEPA duties. The postion is augmented by interagency staff from the US Forest Service and US Fish and Wildlife Service who work on specific projects funded through the USAF Conservation Program. Prior to FY 22 standard USAF programming allowed the budgeting, funding and ultimatly staffing by interagency personnel. A man-power study in the 2000s determined that NBAFS should be authorized four additional positions in addition to the current position.

Natural Resources personnel should attend professional meetings (e.g., National Military Fish and Wildlife Association, Society of American Foresters, The Wildlife Society, Partners in Amphibian and Reptile Conservation) to maintain contact with other natural resources professionals and to keep abreast on the status of resources, management approaches, and survey protocols. Personnel should also maintain contact with regional professionals as INRMP projects are implemented to ensure consistency and acceptance in the broader scientific and resource management community. The current GS-0401 position is acquisition coded and requires significant training and continuing education credits to maintain mandatory certification.

Natural resoures personnel at NBAFS are responsible for managing the installations response to wildfire and other emergencies. All personnel must meet NWCG standards for the position in which they serve. The Wildland Fire Management Plan details the necessary training and experience required.

9.2 Monitoring INRMP Implementation

Implementation of the NBAFS INRMP will be monitored at the end of each fiscal year by determining the status of each project planned for that year as identified in the work plans. Projects not completed in a given year will be carried over for completion in subsequent years.

9.3 Annual INRMP Review and Update Requirements

A review of INRMP-related activities will be conducted by Natural Resources staff with USFWS and NH Fish and Game at the end of each fiscal year to document compliance with the INRMP. The Natural Resources Planner (as delegated by the commander) will certify that the review has been completed.

The INRMP requires annual review, IAW DoDI 4715.03 and AFMAN 32-7003, to ensure the achievement of mission goals, verify the implementation of projects, and establish any necessary new management requirements. This process involves installation natural resources personnel and external agencies working in coordination to review the INRMP. If the installation mission or any of its natural resources management issues change significantly after the creation of the original INRMP, a major revision to the INRMP is required. The need to accomplish a major revision is normally determined during the annual review with USFWS, the appropriate state, and NOAA (if required). The NRM/POC documents the findings of the annual review in an Annual INRMP Review Summary and obtains signatures from the coordinating

agencies on review findings. By signing the Annual INRMP Review Summary, the collaborating agency representatives assert concurrence with the findings. If any agency declines to participate in an on-site annual review, the NRM submits the INRMP for review along with the Annual INRMP Review Summary document to the agency via official correspondence and request return correspondence with comments/concurrence.

The USFWS, the state, NOAA (if applicable), and the NRM/POC conduct an Annual INRMP Review Meeting. This meeting takes place in person with respective representatives for each agency. Individuals may telephone or video call if they cannot attend in person. During this meeting the NRM/POC updates the external stakeholders/parties with the end of the year execution report and coordinates future work plans and any necessary changes to management methods, etc. All parties review the INRMP and begin preliminary collaborative work on updating the INRMP (new policies, procedures, impacts, mitigations, etc.) as applicable.

10.0 ANNUAL WORK PLANS

The INRMP Annual Work Plans are included in this section. These projects are listed by fiscal year, including the current year and four succeeding years. For each project and activity, a specific timeframe for implementation is provided (as applicable), as well as the appropriate funding source and priority for implementation. The work plans provide all the necessary information for building a budget within the USAF framework. Priorities are defined as follows:

- High: The INRMP signatories assert that if the project is not funded the INRMP is not being implemented and the USAF is non-compliant with the Sikes Act; or that it is specifically tied to an INRMP goal and objective and is part of a "Benefit of the Species" determination necessary for Endangered Species Act (ESA) Sec 4(a)(3)(B)(i) critical habitat exemption.
- Medium: Project supports a specific INRMP goal and objective and is deemed by INRMP signatories to be important for preventing non-compliance with a specific requirement within a natural resources law or by EO 13112, *Exotic and Invasive Species*. However, the INRMP signatories would not contend that the INRMP is not being implemented if not accomplished within the programmed year due to other priorities.
- Low: Project supports a specific INRMP goal and objective, enhances conservation resources or the integrity of the installation mission, and/or supports long-term compliance with specific requirements within natural resources law; but is not directly tied to specific compliance within the proposed year of execution.

Annual Work Plans - Work Plans should extend out to current year plus 4 additional years

Resource Category	Goal	Objective	Occurrence	FY	OPR	Funding Source	Priority Level	PB28 Code*	Standard Title*	Project Number	Description
Invasive	IN1	IN1.1	Annual	2021	CEI	Cons	Med	INRP	MGT, INVASIVE SPECIES	RNGFA53216121	Sound adaptive management requires annual monitoring of invasive species areas that have been controlled in the current season and previous season and to determine if that control method was effective, if not then a new management scheme needs to be implemented. This project will map (25 acres) areas controlled using GIS and complete a field datasheet and photo-points (10 digital data) per control areas to determine effectiveness of treatments. Invasive species to be controlled this season is the autumn olive trees in 25 acres of NBAFS management areas.
Habitat Management Species Management	OR 2 TE 5 WE 1	OR 2.2 TE 5.1 WE 1.1	Annual	2021	CEI	Cons	Med	INRP	MGT, HABITAT, AQUATIC	RNGFA53216121	Implements approved New Boston Air Force Station INRMP Goal OR-2: Provide high-quality hunting and

Threatened and Endangered											fishing experiences, Objective OR-2.2: Sustain or enhance game fish populations on NBAFS. Objective TE-5.1, Determine the status, distribution, and habitat associations of banded sunfish, native brook trout, American eel and other native fish on NBAFS Project TE-5.1: Perform periodic fish surveys for game and rare fish on NBAFS.
Habitat Management Species Management Threatened and Endangered Wetland Management	TE 1 TE 2 TE 3 TE 4 WE 1 FO 1 FO 2	TE 1 TE 2.1 TE 2.2 TE 3.1 TE 4.1 TE 4.2 TE 4.3 WE 1.1 FO 1.1 FO 1.2 FO 2.1	Annual	2021	CEI		High	INRP	Interagency /Intraagency, Government, Sikes Act Interagency/ Intraagency, Government, Sikes Act	RNGFA53216119	Required to support installation Environmental Programs. Implements approved New Boston INRMP Section 8 goals and objectives. Several State-listed birds (bald eagle, pied-billed grebe, osprey, and northern harrier), several State-listed reptiles (eastern hognose snake, Blandings turtle and spotted turtle), and a State-listed bat (small-footed bat) also have been observed on NBAFS. In addition, several animal

											species that are considered rare by the NHNHB have been observed on NBAFS. These include several moths and butterflies, wood turtle, American bittern, Tricolored bat, Northern long-eared bat, Red bat, Silver haired-bat, and the Hoary bat. More specifically: TE 2.1 Continue monitoring Blanding's Turtles (NH E), TE 2.2.1 Implement management plan for Blanding's turtles and their habitats (includes employee removing predators). TE 3.1, Determine habitat use by Eastern Hognose Snake (NH E), TE 4.1 annual survey for American Bittern, whip-poor wills, Project TE-1.1 Collect bat acoustic monitoring data annually using in-house monitors with assistance from cooperators. Send data to cooperator for analysis. Participate in larger efforts (i.e.., NABat)

											in cooperation with USFWS and NH Fish and Game.WE-1.2: Implement wetland restoration activities, Project FO-1.1.1: Continue to perform base wide forest inventories, FO-2.1.1: Regenerate 10 to 20 ac of forest areas periodically, FO-2.1.2: Thin approximately 20 to 50 ac of forest periodically, IN-1.1: Implement a control plan for existing invasive nonnative plant species (includes mowing).
Habitat Management Species Management Threatened and Endangered Wetland Management	TE 1 TE 2 TE 3 TE 4 WE 1 FO 1 FO 2	TE 1 TE 2.1 TE 2.2 TE 3.1 TE 4.1 TE 4.2 WE 1.1 FO 1.1 FO 1.2 FO 2.1	Annual	2021	CEI			MMA	EQUIPMENT PURCHASE / MAINTAIN, CN	RNGFA5321616	NBAFS Natural Resources manages three snowmobiles, three ATVs, one Mark 3 pump and a BB 3 slip-on pump. All require annual maintenance and unscheduled parts replacement to ensure safe operation.
Habitat Management Species Management	TE 1 TE 2 TE 3	TE 1 TE 2.1 TE 2.2 TE 3.1	Annual	2021	CEI			MMA	SUPPLIES, CN	RNGFA53210399	Required to support Conservation activities.

Threatened and Endangered Wetland Management	TE 4 WE 1 FO 1 FO 2	TE 4.1 WE 1.1 FO 1.1 FO 1.2 FO 2.1									
Invasive	IN1	IN1.1	Annual	2022	CEI	Cons	Med	INRP	MGT, INVASIVE SPECIES	RNGFOS700522 (RNGFA5322612 1)	Sound adaptive management requires annual monitoring of invasive species areas that have been controlled in the current season and previous season and to determine if that control method was effective, if not then a new management scheme needs to be implemented. This project will map (25 acres) areas controlled using GIS and complete a field datasheet and photo-points (10 digital data) per control areas to determine effectiveness of treatments. Invasive species to be controlled this season is the autumn olive trees in 25 acres of TBD management areas.
Habitat Management Species Management	OR 2 TE 5	OR 2.2 TE 5.1 WE 1.1	Annual	2022	CEI	Cons	Med	INRP	MGT, HABITAT, AQUATIC	RNGFOS719022 (RNGFA5322	Implements approved New Boston Air Force Station INRMP Goal OR-2: Provide

Threatened and Endangered	WE 1										high-quality hunting and fishing experiences, Objective OR-2.2: Sustain or enhance game fish populations on NBAFS. Objective TE5.1, Determine the status, distribution, and habitat associations of banded sunfish, native brook trout, American eel and other native fish on NBAFS Project TE-5.1: Perform periodic fish surveys for game and rare fish on NBAFS.
Habitat Management Species Management Threatened and Endangered Wetland Management	TE 1 TE 2 TE 3 TE 4 WE 1 FO 1 FO 2	TE 1 TE 2.1 TE 2.2 TE 3.1 TE 4.1 TE 4.2 WE 1.1 FO 1.1 FO 1.2 FO 2.1	Annual	2022	CEI		High	INRP	MGT, HABITAT	RNGFOS711022 (RNGFA5322611 9)	Required to support installation Environmental Programs. Implements approved New Boston INRMP Section 8 goals and objectives. Several State-listed birds (bald eagle, pied-billed grebe, osprey, and northern harrier), several State-listed reptiles (eastern hognose snake, Blandings turtle and spotted turtle), and a State-listed bat (small-footed bat) also have been observed on NBAFS. In

											addition, several animal species that are considered rare by the NHNHB have been observed on NBAFS. These include several moths and butterflies, wood turtle, American bittern, Tricolored bat, Northern long-eared bat, Red bat, Silver haired-bat, and the Hoary bat. More specifically: TE 2.1 Continue monitoring Blanding's Turtles (NH E), TE 2.2.1 Implement management plan for Blanding's turtles and their habitats (includes employee removing predators). TE 3.1, Determine habitat use by Eastern Hognose Snake (NH E), TE 4.1 annual survey for American Bittern, whip-poor wills, Project TE-1.1 Collect bat acoustic monitoring data annually using in-house monitors with assistance from cooperators. Send data to cooperator for analysis. Participate in

											larger efforts (i.e.., NABat) in cooperation with USFWS and NH Fish and Game.WE-1.2: Implement wetland restoration activities, Project FO-1.1.1: Continue to perform base wide forest inventories, FO-2.1.1: Regenerate 10 to 20 ac of forest areas periodically, FO-2.1.2: Thin approximately 20 to 50 ac of forest periodically, IN-1.1: Implement a control plan for existing invasive nonnative plant species (includes mowing).
Habitat Management Species Management Threatened and Endangered Wetland Management	TE 1 TE 2 TE 3 TE 4 WE 1 FO 1 FO 2	TE 1 TE 2.1 TE 2.2 TE 3.1 TE 4.1 WE 1.1 FO 1.1 FO 1.2 FO 2.1	Annual	2022	CEI		Med	MMA	EQUIPMENT PURCHASE / MAINTAIN, CN	RNGFOS071322 (RNGFA5322817)	NBAFS Natural Resources manages three snowmobiles, three ATVs, one Mark 3 pump and a BB 3 slip-on pump. All require annual maintenance and unscheduled parts replacement to ensure safe operation.
Habitat Management Species Management	TE 1 TE 2	TE 1 TE 2.1 TE 2.2	Annual	2022	CEI		Med	MMA	SUPPLIES, CN	RNGFOS100422 (RNGFA532	Required to support Conservation activities.

Threatened and Endangered Wetland Management	TE 3 TE 4 WE 1 FO 1 FO 2	TE 3.1 TE 4.1 WE 1.1 FO 1.1 FO 1.2 FO 2.1									
Wetland Management	WE 1	WE 1.2	Non-reoccuring project	2022	CEI		Med	WTLD	MGT, WETLANDS /FLOODPLAINS	RNGFA5322915	Management, restoration, or enhancement of wetland habitats associated with Gardner Pond IAW the goals and objectives of New Boston Air Force Station INRMP approved in accordance with the Sikes Act. Project will include repair of existing failing dam structure, UXO support and associated permit applications.
Threatened and Endangered	TE 1	TE 1	Annual	2022	CEI	Cons	High	T&E	MGT, SPECIES-T&E	RNGF225631 (RNGFA5322711 9)	Species management including detailed analysis of acoustic monitoring data collect in-house or by other government personel at NBAFS. Intent is to monitor presence of federally listed Northernlong-eared bat and several other state listed bats. Projects

											implements TE Goal and objective.
Invasive	IN1	IN1.1	Annual	2023	CEI	Cons	Med	INRP	MGT, INVASIVE SPECIES	RNGF700523 (RNGFA53236121)	Sound adaptive management requires annual monitoring of invasive species areas that have been controlled in the current season and previous season and to determine if that control method was effective, if not then a new management scheme needs to be implemented. This project will map (25 acres) areas controlled using GIS and complete a field datasheet and photo-points (10 digital data) per control areas to determine effectiveness of treatments. Invasive species to be controlled this season is the autumn olive trees in 25 acres of TBD management areas.
Habitat Management Species Management Threatened and Endangered	OR 2 TE 5 WE 1	OR 2.2 TE 5.1 WE 1.1	Annual	2023	CEI	Cons	Med	INRP	MGT, HABITAT, AQUATIC	RNGF719023 (RNGFA53236119)	Implements approved New Boston Air Force Station INRMP Goal OR-2: Provide high-quality hunting and fishing experiences, Objective OR-

											2.2: Sustain or enhance game fish populations on NBAFS. Objective TE5.1, Determine the status, distribution, and habitat associations of banded sunfish, native brook trout, American eel and other native fish on NBAFS Project TE-5.1: Perform periodic fish surveys for game and rare fish on NBAFS.
Habitat Management Species Management Threatened and Endangered Wetland Management	TE 1 TE 2 TE 3 TE 4 WE 1 FO 1 FO 2	TE 1 TE 2.1 TE 2.2 TE 3.1 TE 4.1 TE 4.2 WE 1.1 FO 1.1 FO 1.2 FO 2.1	Annual	2023	CEI	Cons	High	INRP	MGT, HABITAT	RNGF711023 (RNGFA53236119)	Required to support installation Environmental Programs. Implements approved New Boston INRMP Section 8 goals and objectives. Several State-listed birds (bald eagle, pied-billed grebe, osprey, and northern harrier), several State-listed reptiles (eastern hognose snake, Blandings turtle and spotted turtle), and a State-listed bat (small-footed bat) also have been observed on NBAFS. In addition, several animal species that are considered rare by the

											NHNHB have been observed on NBAFS. These include several moths and butterflies, wood turtle, American bittern, Tricolored bat, Northern long-eared bat, Red bat, Silver haired-bat, and the Hoary bat. More specifically: TE 2.1 Continue monitoring Blanding's Turtles (NH E), TE 2.2.1 Implement management plan for Blanding's turtles and their habitats (includes employee removing predators). TE 3.1, Determine habitat use by Eastern Hognose Snake (NH E), TE 4.1 annual survey for American Bittern, whip-poor wills, Project TE-1.1 Collect bat acoustic monitoring data annually using in-house monitors with assistance from cooperators. Send data to cooperator for analysis. Participate in larger efforts (i.e.., NABat) in cooperation with USFWS and NH Fish

											and Game.WE-1.2: Implement wetland restoration activities, Project FO-1.1.1: Continue to perform base wide forest inventories, FO-2.1.1: Regenerate 10 to 20 ac of forest areas periodically, FO-2.1.2: Thin approximately 20 to 50 ac of forest periodically, IN-1.1: Implement a control plan for existing invasive nonnative plant species (includes mowing).
Habitat Management Species Management Threatened and Endangered Wetland Management	TE 1 TE 2 TE 3 TE 4 WE 1 FO 1 FO 2	TE 1 TE 2.1 TE 2.2 TE 3.1 TE 4.1 WE 1.1 FO 1.1 FO 1.2 FO 2.1	Annual	2023	CEI		Med	MMA	EQUIPMENT PURCHASE / MAINTAIN, CN	RNGFOS071323 (RNGFA5323817O)	NBAFS Natural Resources manages three snowmobiles, three ATVs, one Mark 3 pump and a BB 3 slip-on pump. All require annual maintenance and unscheduled parts replacement to ensure safe operation.
Habitat Management Species Management Threatened and Endangered	TE 1 TE 2 TE 3 TE 4	TE 1 TE 2.1 TE 2.2 TE 3.1 TE 4.1 WE 1.1	Annual	2023	CEI		Med	MMA	SUPPLIES, CN	RNGFOS100423 (RNGFA5323815)	Required to support Conservation activities.

Wetland Management	WE 1 FO 1 FO 2	FO 1.1 FO 1.2 FO 2.1									
Threatened and Endangered	TE 1	TE 1	Annual	2023	CEI	Cons	High	T&E	MGT, SPECIES-T&E	RNGF235631 (RNGFA532271l9)	Species management including detailed analysis of acoustic monitoring data collect in-house or by other government personnel at NBAFS. Intent is to monitor presence of federally listed Northernlong-eared bat and several other state listed bats. Projects implements TE Goal and objective.
Invasive	IN1	IN1.1	Annual	2024	CEI	Cons	Med	INRP	MGT, INVASIVE SPECIES	RNGF700522 (RNGFA5324612l)	Sound adaptive management requires annual monitoring of invasive species areas that have been controlled in the current season and previous season and to determine if that control method was effective, if not then a new management scheme needs to be implemented. This project will map (25 acres) areas controlled using GIS and complete a

											field datasheet and photo-points (10 digital data) per control areas to determine effectiveness of treatments. Invasive species to be controlled this season is the autumn olive trees in 25 acres of TBD management areas.
Habitat Management Species Management Threatened and Endangered	OR 2 TE 5 WE 1	OR 2.2 TE 5.1 WE 1.1	Annual	2024	CEI	Cons	Med	INRP	MGT, HABITAT, AQUATIC	RNGF247190 (RNGFA53246119)	Implements approved New Boston Air Force Station INRMP Goal OR-2: Provide high-quality hunting and fishing experiences, Objective OR-2.2: Sustain or enhance game fish populations on NBAFS. Objective TE5.1, Determine the status, distribution, and habitat associations of banded sunfish, native brook trout, American eel and other native fish on NBAFS Project TE-5.1: Perform periodic fish surveys for game and rare fish on NBAFS.
Habitat Management Species Management	TE 1 TE 2 TE 3	TE 1 TE 2.1 TE 2.2 TE 3.1	Annual	2024	CEI	Cons	High	INRP	MGT, HABITAT	RNGF247110 (RNGFA53246119)	Required to support installation Environmental Programs. Implements approved New Boston

Threatened and Endangered Wetland Management	TE 4 WE 1 FO 1 FO 2	TE 4.1 TE 4.2 WE 1.1 FO 1.1 FO 1.2 FO 2.1									INRMP Section 8 goals and objectives. Several State-listed birds (bald eagle, pied-billed grebe, osprey, and northern harrier), several State-listed reptiles (eastern hognose snake, Blandings turtle and spotted turtle), and a State-listed bat (small-footed bat) also have been observed on NBAFS. In addition, several animal species that are considered rare by the NHNHB have been observed on NBAFS. These include several moths and butterflies, wood turtle, American bittern, Tricolored bat, Northern long-eared bat, Red bat, Silver haired-bat, and the Hoary bat. More specifically: TE 2.1 Continue monitoring Blanding's Turtles (NH E), TE 2.2.1 Implement management plan for Blanding's turtles and their habitats (includes employee removing predators).

											TE 3.1, Determine habitat use by Eastern Hognose Snake (NH E), TE 4.1 annual survey for American Bittern, whip-poor wills, Project TE-1.1 Collect bat acoustic monitoring data annually using in-house monitors with assistance from cooperators. Send data to cooperator for analysis. Participate in larger efforts (i.e.., NABat) in cooperation with USFWS and NH Fish and Game.WE-1.2: Implement wetland restoration activities, Project FO-1.1.1: Continue to perform base wide forest inventories, FO-2.1.1: Regenerate 10 to 20 ac of forest areas periodically, FO-2.1.2: Thin approximately 20 to 50 ac of forest periodically, IN-1.1: Implement a control plan for existing invasive nonnative plant species (includes mowing).

Habitat Management Species Management Threatened and Endangered Wetland Management	TE 1 TE 2 TE 3 TE 4 WE 1 FO 1 FO 2	TE 1 TE 2.1 TE 2.2 TE 3.1 TE 4.1 WE 1.1 FO 1.1 FO 1.2 FO 2.1	Annual	2024	CEI		Med	MMA	EQUIPMENT PURCHASE / MAINTAIN, CN	RNGF240713 (RNGFA5324817)	NBAFS Natural Resources manages three snowmobiles, three ATVs, one Mark 3 pump and a BB 3 slip-on pump. All require annual maintenance and unscheduled parts replacement to ensure safe operation. During FY 24 the slip-on fire pump is scheduled for replacement requiring a on-time budget increase.
Habitat Management Species Management Threatened and Endangered Wetland Management	TE 1 TE 2 TE 3 TE 4 WE 1 FO 1 FO 2	TE 1 TE 2.1 TE 2.2 TE 3.1 TE 4.1 WE 1.1 FO 1.1 FO 1.2 FO 2.1	Annual	2024	CEI		Med	MMA	SUPPLIES, CN	RNGF241004 (RNGFA5324815)	Required to support Conservation activities.
Threatened and Endangered	TE 1	TE 1	Annual	2024	CEI	Cons	High	T&E	MGT, SPECIES-T&E	RNGF245631 (RNGFA5322711 9)	Species management including detailed analysis of acoustic monitoring data collect in-house or by other government personnel at NBAFS. Intent is to monitor presence of federally listed

											Northernlong-eared bat and several other state listed bats. Projects implements TE Goal and objective.
Invasive	IN1	IN1.1	Annual	2025	CEI	Cons	Med	INRP	MGT, INVASIVE SPECIES	RNGF257005 (RNGFA53256121)	Sound adaptive management requires annual monitoring of invasive species areas that have been controlled in the current season and previous season and to determine if that control method was effective, if not then a new management scheme needs to be implemented. This project will map (25 acres) areas controlled using GIS and complete a field datasheet and photo-points (10 digital data) per control areas to determine effectiveness of treatments. Invasive species to be controlled this season is the autumn olive trees in 25 acres of TBD management areas.
Habitat Management Species Management	OR 2 TE 5 WE 1	OR 2.2 TE 5.1 WE 1.1	Annual	2025	CEI	Cons	Med	INRP	MGT, HABITAT, AQUATIC	RNGF257190 (RNGFA53256119)	Implements approved New Boston Air Force Station INRMP Goal OR-2: Provide high-quality hunting and

Threatened and Endangered											fishing experiences, Objective OR-2.2: Sustain or enhance game fish populations on NBAFS. Objective TE5.1, Determine the status, distribution, and habitat associations of banded sunfish, native brook trout, American eel and other native fish on NBAFS Project TE-5.1: Perform periodic fish surveys for game and rare fish on NBAFS.
Habitat Management Species Management Threatened and Endangered Wetland Management	TE 1 TE 2 TE 3 TE 4 WE 1 FO 1 FO 2	TE 1 TE 2.1 TE 2.2 TE 3.1 TE 4.1 TE 4.2 WE 1.1 FO 1.1 FO 1.2 FO 2.1	Annual	2025	CEI	Cons	High	INRP	MGT, HABITAT	RNGF257110 (RNGFA5325119)	Required to support installation Environmental Programs. Implements approved New Boston INRMP Section 8 goals and objectives. Several State-listed birds (bald eagle, pied-billed grebe, osprey, and northern harrier), several State-listed reptiles (eastern hognose snake, Blandings turtle and spotted turtle), and a State-listed bat (small-footed bat) also have been observed on NBAFS. In addition, several animal

											species that are considered rare by the NHNHB have been observed on NBAFS. These include several moths and butterflies, wood turtle, American bittern, Tricolored bat, Northern long-eared bat, Red bat, Silver haired-bat, and the Hoary bat. More specifically: TE 2.1 Continue monitoring Blanding's Turtles (NH E), TE 2.2.1 Implement management plan for Blanding's turtles and their habitats (includes employee removing predators). TE 3.1, Determine habitat use by Eastern Hognose Snake (NH E), TE 4.1 annual survey for American Bittern, whip-poor wills, Project TE-1.1 Collect bat acoustic monitoring data annually using in-house monitors with assistance from cooperators. Send data to cooperator for analysis. Participate in larger efforts (i.e.., NABat)

											in cooperation with USFWS and NH Fish and Game.WE-1.2: Implement wetland restoration activities, Project FO-1.1.1: Continue to perform base wide forest inventories, FO-2.1.1: Regenerate 10 to 20 ac of forest areas periodically, FO-2.1.2: Thin approximately 20 to 50 ac of forest periodically, IN-1.1: Implement a control plan for existing invasive nonnative plant species (includes mowing).
Habitat Management Species Management Threatened and Endangered Wetland Management	TE 1 TE 2 TE 3 TE 4 WE 1 FO 1 FO 2	TE 1 TE 2.1 TE 2.2 TE 3.1 TE 4.1 WE 1.1 FO 1.1 FO 1.2 FO 2.1	Annual	2025	CEI		Med	MMA	EQUIPMENT PURCHASE / MAINTAIN, CN	RNGF250713 (RNGFA5325817)	NBAFS Natural Resources manages three snowmobiles, three ATVs, one Mark 3 pump and a BB 3 slip-on pump. All require annual maintenance and unscheduled parts replacement to ensure safe operation.
Habitat Management Species Management	TE 1 TE 2 TE 3	TE 1 TE 2.1 TE 2.2 TE 3.1	Annual	2025	CEI		Med	MMA	SUPPLIES, CN	RNGF251004 (RNGFA5325815)	Required to support Conservation activities.

Threatened and Endangered Wetland Management	TE 4 WE 1 FO 1 FO 2	TE 4.1 WE 1.1 FO 1.1 FO 1.2 FO 2.1									
Threatened and Endangered	TE 1	TE 1	Annual	2025	CEI	Cons	High	T&E	MGT, SPECIES-T&E	RNGF255631 (RNGFA53257119)	Species management including detailed analysis of acoustic monitoring data collect in-house or by other government personnel at NBAFS. Intent is to monitor presence of federally listed Northernlong-eared bat and several other state listed bats. Projects implements TE Goal and objective.
Invasive species	IN 1	IN 1.1	One time survey	2025	CEI	CONS	Med	INRP	Plan Update, Other		Conduct invasive species survey and update 2004 invasive species control plan for NBAFS.

***Natural Resources Standard Titles by PB28 Code (excluding CZT/CZC titles):**

INRP	MMA	T&E	MNRA	WTLD
P&F, CN	Mgt, Species	Mgt, Habitat	Compliance Public Notification	Mgt, Wetlands / FloodPlains
Interagency/Intraagency, Government, Sikes Act	Interagency/Intraagency, Government, Sikes Act	Mgt, Species	Plan Update, Other	Monitor Wetlands

Interagency/Intraagency, Government, Sikes Act, CLEO	Outsourced Environmental Services, CN	Mgt, Invasive Species	Recordkeeping, Other	Interagency/Intraagency, Government, Sikes Act
Outsourced Environmental Services, CN	Supplies, CN	Mgt, Nuisance Wildlife	Outreach	Outsourced Environmental Services, CN
Supplies, CN	Supplies, CN, CLEO	Interagency/Intraagency, Government, Sikes Act		
Supplies, CN, CLEO	Vehicle Leasing, CN	Interagency/Intraagency, Government, Sikes Act, CLEO		
Equipment Purchase / Maintain, CN		Outsourced Environmental Services, CN		
Vehicle Leasing, CN		Supplies, CN		
Vehicle Fuel & Maintenance, CN		Supplies, CN, CLEO		
Mgt, Wildland Fire		Equipment Purchase / Maintain, CN		
Plan Update, INRMP		Vehicle Leasing, CN		
Plan Update, Other		Vehicle Fuel & Maintenance, CN		
Mgt, Habitat		Plan Update, Other		
Mgt, Species		Environmental Services, CN		
Mgt, Invasive Species				
Mgt, Nuisance Wildlife				
Recordkeeping, Other				
Environmental Services, CN				

11.0 REFERENCES

11.1 Standard References *(Applicable to all USAF installations)*

- AFMAN 32-7003, *Environmental Conservation*
- Sikes Act
- eDASH Natural Resources Program Page
- Natural Resources Playbook
- DoDI 4715.03, *Natural Resources Conservation Program*
- AFI 32-1015, *Integrated Installation Planning*
- AFI 32-10112, *Installation Geospatial Information and Services (IGI&S)*

11.2 Installation References

1. Acoustical Society of America. 1983. American National Standard Specification for Sound Level Meters. ANSI S1.4-1983, New York, N.Y., Feb.
2. Acoustical Society of America. 1985. American National Standard Specification for Sound Level Meters. ANSI S1.4A-1985, Amendment to ANSI S1.4-1983, New York, N.Y., June.
3. ANL: See Argonne National Laboratory.
4. Argonne National Laboratory. 1990. Environmental Assessment for the Conduct of Military Training, New Boston Air Force Station, New Hampshire. Argonne National Laboratory, Environmental Assessment and Information Sciences Division, Argonne, Ill., July.
5. Argonne National Laboratory. 1999a. Environmental Assessment of Military Training Activities at New Boston Air Station, New Hampshire. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., May.
6. Argonne National Laboratory. 1999b. Mitigation Plan for Military Training Activities at New Boston Air Station, New Hampshire. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., May.
7. Argonne National Laboratory. 2003. Environmental Assessment for a Wildland Fire Management Plan at New Boston Air Force Station, New Hampshire. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., Nov.
8. Argonne National Laboratory. 2004a. Environmental Assessment for Repair of Joe English Pond Dam at New Boston Air Force Station, New Hampshire. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., Dec.
9. Argonne National Laboratory. 2004b. Environmental Assessment for Construction and Operation of a Septic System at New Boston Air Force Station, New Hampshire. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., Apr.
10. Argonne National Laboratory. 2007. Environmental Assessment for Training Activities at New Boston Air Station, New Hampshire. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., Dec
11. Bailey, R.G. 1995. Description of the Ecoregions of the United States. Misc. Publ. 1391. U.S. Department of Agriculture, Forest Service, Washington, D.C.
12. Bailey, R.G. 1996. Ecosystem Geography. Springer-Verlag, New York, N.Y.
13. Bailey, R.G. 1998. Ecoregions Map of North America—Explanatory Note. Misc. Publ. 1548. U.S. Department of Agriculture, Forest Service, Washington, D.C.
14. Bat Conservation International. 2001. Bats in Eastern Woodlands, Bat Conservation International.
15. BCI: See Bat Conservation International.
16. Bent, A.C. 1958. Life Histories of North American Birds of Prey. Vol. 1. U.S. National Museum, Bulletin No. 167

17. Bernardy, B., N. Phillips, and S. Najjar. 2003. Wildland Fire Management Plan for New Boston Air Force Station, New Hampshire. U.S. Department of Agriculture, Forest Service, Green Mountain National Forest, Oct.
18. Bierbaum, R., Smith, J. B., Lee, A., Blair, M., Carter, L., Chapin, F. S., … Verduzco, L. (2013). A comprehensive review of climate adaptation in the United States: more than before, but less than needed. Mitigation and Adaptation Strategies for Global Change, 18(3), 361–406. http://doi.org/10.1007/s11027-012-9423-1
19. BLM: See U.S. Bureau of Land Management.
20. Bond, R.W., and J.F. Handler. 1981. Soil Survey of Hillsborough County, New Hampshire, Eastern Part. U.S. Department of Agriculture, Soil Conservation Service, Oct.
21. Cade, T. J., M. Martell, P. Redig, G. Septon, and H. B. Tordoff. 1996b. Peregrine falcons in urban North America. Pp. 3-13 in Raptors in human landscapes (D. M. Bird, D. E. Varlan, and J. J. Negro, eds.). Academic Press, London, U.K.).
22. Carpenter, C. C. 1953. A study of hibernacula and hibernating associations of snakes and amphibians in Michigan. Ecology 34:74-80.
23. Carey, C. (2009). The impacts of climate change on the annual cycles of birds. Philosophical Transactions of the Royal Society B: Biological Sciences, 364(1534), 3321–3330. http://doi.org/10.1098/rstb.2009.0182
24. Comer, P. J., Young, B., Schulz, K., Kittel, G., Unnasch, B., Braun, D., … Hak, J. (2012). Climate Change Vulnerability and Adaptation Strategies for Natural Communities: Piloting methods in the Mojave and Sonoran deserts. Report to the U.S. Fish and Wildlife Service. NatureServe, Arlington, VA. Report to the U.S. Fish and Wildlife Service. NatureServe, Arlington, VA. Arlington.
25. Covell, C., Jr. 1984. A Field Guide to Moths—Eastern North America. The Peterson Field Guide Series, Houghton Mifflin Company, Boston, Mass.
26. Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31. U.S. Department of the Interior, U.S. Fish and Wildlife Service, Government Printing Office, Washington, D.C.
27. CSU CEMML 2019, Enterprise Wide Climate Change Analysis for INRMPS, Colorado State University CEMML Ft Collins, March
28. Cullen, J.B. 2001. Best Management Practices for Erosion Control on Harvesting Operations in New Hampshire. State of New Hampshire, Department of Resources and Economic Development, Concord, N.H. Jan.
29. Culler, L. E., Wood, Z. T., Diaz, J., Fey, S. B., Timmins, D., & Ayres, M. P. (2018). Streams in an uninhabited watershed have predictably different thermal sensitivities to variable summer air temperatures. Freshwater Biology, 63(7), 676–686. http://doi.org/10.1111/fwb.13105
30. DeGraaf, R.M., and D.D. Rudis. 1986. New England Wildlife: Habitat, Natural History, and Distribution. General Technical Report NE-108, U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station.
31. DoD. (2014). DoD 2014 Climate Adaptation Roadmap, 16.
32. Dubner 2021, Personal communication from B. Dubner (USAF.) to S.J.Najjar (US Space Force.), Feb 24.
33. Eaton, A. (2016). Biology and management of ticks in New Hampshire. Durham, NH. Retrieved from https://wildlife.state.nh.us/wildlife/documents/ticks-biology-mgt.pdf
34. Eaton, J. G., & Scheller, R. M. (1996). Effects of climate warming on fish thermal habitat in streams of the United States. Limnology and Oceanography, 41(5), 1109–1115. http://doi.org/10.4319/lo.1996.41.5.1109

35. Environmental Laboratory. 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1, U.S. Army Corps of Engineers, Vicksburg, Miss., Jan.
36. ENSR Consulting and Engineering. 1993. Natural Resources Management Plan for New Boston Air Force Station, New Hampshire. ENSR Consulting and Engineering, Acton, Mass., July.
37. EPA: See U.S. Environmental Protection Agency.
38. Ernst, C. H. and E. M. Ernst. 2003. Snakes of the United States and Canada. The Smithsonian
39. Institution. Washington, D.C., USA and London, England.
40. Foss, C.R. 1994. Atlas of Breeding Birds in New Hampshire. Audubon Society of New Hampshire, Chalford Publishing Company, Dover, N.H.
41. Gent, P. R., & Danabasoglu, G. (2011). The Community Climate System Model version 4. Journal of Climate, 24, 4973–4991.
42. Gough, G.A., Sauer, J.R., Iliff, M. 1998. Patuxent Bird Identification Infocenter. Version 97.1. Patuxent Wildlife Research Center, Laurel, Maryl. Available at http://www.mbr-pwrc.usgs.gov/ Infocenter/infocenter.html (accessed March 18, 2005).
43. Harvey, M.J., J.S. Altenbach, and T.L. Best. 1999. Bats of the United States. Arkansas Game and Fish Commission.
44. HB&A. 2004. General Plan—New Boston Air Force Station, New Hampshire. HB&A, Colorado Springs, Colo., April.
45. Hempel, S., Frieler, K., Warszawski, L., Schewe, J., & Piontek, F. (2013). A trend-preserving bias correction; the ISI-MIP approach. Earth System Dynamics, 4(2), 219–236. http://doi.org/10.5194/esd-4-219-2013
46. Hibbard, K. A., Meehl, G. A., Cox, P. M., & Friedlingstein, P. (2007). A strategy for climate change stabilization experiments. Eos, 88(20), 217–221. http://doi.org/10.1029/2007EO200002
47. Hoffmann, A. A., & Sgrò, C. M. (2011). Climate change and evolutionary adaptation. Nature, 470(7335), 479–485. http://doi.org/10.1038/nature09670
48. Hurrell, J. W., Holland, M. M., Gent, P. R., Ghan, S., Kay, J. E., Kushner, P. J., … Marshall, S. (2013). The community earth system model: A framework for collaborative research. Bulletin of the American Meteorological Society, 94(9), 1339–1360. http://doi.org/10.1175/BAMS-D-12-00121.1
49. Iwamura, T., Possingham, H. P., Chadès, I., Minton, C., Murray, N. J., Rogers, D. I., … Fuller, R. A. (2013). Migratory connectivity magnifies the consequences of habitat loss from sea-level rise for shorebird populations. Proceedings. Biological Sciences / The Royal Society, 280(1761), 20130325. http://doi.org/10.1098/rspb.2013.0325
50. Kaufman, K. 1990. Advanced Birding. The Peterson Field Guide Series, Houghton Mifflin Company, Boston, Mass.
51. Klemens, M. W. 1993. Amphibians and reptiles of Connecticut and adjacent regions. State Geological
52. and Natural History Survey of Connecticut. Bulletin No.112. Connecticut Department of
53. Environmental Protection, Hartford, Connecticut, USA
54. LaGory, K.E., R.A. Van Lonkhuyzen, H. Su, L.R. Reitsma, D.S. Conant, D.H. Miller, S.A. Fogleman, and B.B. Steele. 1997. Biodiversity Survey of New Boston Air Station, New Hampshire. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., Sept.
55. LaGory, K.E., D.S. Reynolds, and J.A. Kuiper. 2002. A Survey of the Bats of New Boston Air Force Station, New Hampshire. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., Dec.
56. LaGory, K.E., L.J. Walston, C. Goulet, C. Andrews, R.A. Van Lonkhuyzen, and M. Nesta. 2008. Movement and Habitat use of Eastern Hognose Snakes at New Boston Air Force Station, New

Hampshire, New Hampshire. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., Jan.
57. LaGory, K.E., L.J. Walston, D.S. Reynolds, and C. Andrews. 2008. Radiotelemtry Study
58. of Eastern Small-Footed Bats and a Hoary Bat at New Boston Air Force Station, New Hampshire, New Hampshire. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., Sep.
59. K.E. LaGory, C.T. Goulet, R.A. Van Lonkhuyzen, and L.J. Walston, Jr. 2011, Status of Rare Natural Communities at New Boston Air Force Station, New Hampshire. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., May.
60. •Lee, D. S., C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister, and J. R. Stauffer, Jr. 1980. Atlas of North American freshwater fishes. North Carolina State Museum of Natural History, Raleigh, North Carolina. i-x + 854 pp.
61. Liebich, R.E., and M.P. Cristoforo. 1988. "The Use of Audibility Analysis to Minimize Community Noise Impact of Today's Smaller Generation Facilities Located near Residential Areas." Presented at American Power Conference 50th Annual Meeting, Chicago, Ill., Apr.
62. McNab, W.H. and P.E. Avers. 1994. Ecological Subregions of the United States. WSO-WSA-5. U.S. Department of Agriculture, U.S. Forest Service. Available at http://www.fs.fed.us/land/ pubs/ecoregions/ (accessed Feb. 14, 2005).
63. Moss, R. H., Babiker, M., Brinkman, S., Calvo, E., Carter, T., Edmonds, J., … Zurek, M. (2008). Technical Summary: Towards New Scenarios for Analysis of Emissions, Climate Change, Impacts and Response Strategies. IPCC Expert Meeting Report, 25. http://doi.org/10.1086/652242
64. Moss, R. H., Edmonds, J. A., Hibbard, K. A., Manning, M. R., Rose, S. K., van Vuuren, D. P., … Wilbanks, T. J. (2010). The next generation of scenarios for climate change research and assessment. Nature, 463(7282), 747–756. http://doi.org/10.1038/nature08823
65. NHFGD, N. H. F. and G. D. (2015). Wildlife risk assessment. New Hampshire Wildlife Action Plan. Concord, NH.
66. Najjar, S.J. 1998. Integrated Natural Resources Management Plan for United States Air Force 23rd Space Operations Squadron New Boston Air Station, New Hampshire. 23 SOPS/ MAFCVN, New Boston Air Force Station, N.H., Apr.
67. Najjar, S.J. 2005. Memo from S.J. Najjar (Natural Resources Planner, 23 SOPS/MAFCVN, New Boston Air Force Station, N.H.) to K.E. LaGory (Environmental Assessment Division, Argonne National Laboratory, Argonne, Ill.), Feb. 22.
68. Najjar, S.J., and S. Drake. 2005a. New Boston Air Force Station Rare Turtle 2004 Project Results. New Boston Air Force Station, N.H., Feb.
69. Najjar, S.J., and S. Drake. 2005b. New Boston Air Force Station Eastern Hognose Snake 2004 Project Results. New Boston Air Force Station, N.H., Jan.
70. NatureServe. 2003. Spotted Turtle. In NatureServe Explorer: An Online Encyclopedia of Life [web application]. Version 1.8. NatureServe, Arlington, Va. Available at http://www. natureserve.org/explorer (accessed: Feb. 21, 2005).
71. NBAFS: See New Boston Air Force Station.
72. New Boston Air Force Station. 2004. Air Force Space Command Small Installation Integrated Pest Management (IPM) Plan, 23rd Space Operations Squadron, New Boston Air Force Station, New Hampshire. New Boston Air Force Station, N.H., Jan.
73. New Hampshire Department of Transportation. 2021. Northern Long-eared Bat, https://www.nh.gov/dot/org/projectdevelopment/environment/units/program-management/long-eared-bat.htm (accessed Feb. 16, 2021)

74. New Hampshire Natural Heritage Bureau. 2004a. Plant Tracking List Including Species Listed as Threatened or Endangered under the New Hampshire Native Plant Protection Act of 1987, New Hampshire Natural Heritage Bureau, Department of Resources and Economic Development, Division of Forests and Lands, Concord, N.H., July.
75. New Hampshire Natural Heritage Bureau. 2004b. Animal Tracking List Including Species Listed as Threatened or Endangered under the New Hampshire Endangered Species Conservation Act of 1979, New Hampshire Natural Heritage Bureau, Department of Resources and Economic Development, Division of Forests and Lands, Concord, N.H., July.
76. NHNHB: See New Hampshire Natural Heritage Bureau.
77. New Hampshire Reptile and Amphibian Reporting Program (RAARP) and NH Wildlife Sightings
78. databases. Maintained by the New Hampshire Fish and Game Department, Nongame and Endangered
79. Species Program, Concord New Hampshire (Accessed: December, 2014)
80. North Wind, Inc. 2005. Invasive Plant Species Control Plan, New Boston Air Force Station, New Hampshire. North Wind, Inc. Idaho Falls, Idaho, Sept.
81. Olson, D. H., & Saenz, D. (2013). Climate change and amphibians. Retrieved from https://www.fs.usda.gov/ccrc/topics/amphibians-and-climate-change
82. Opler, P.A., and V. Malikul. 1992. A Field Guide to Eastern Butterflies. The Peterson Field Guide Series, Houghton Mifflin Company, Boston, Mass.
83. Opler, P.A., H. Pavulaan, and R.E. Stanford, coord. 1995. Butterflies of North America. U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, N.D. Available at http://www.npwrc.usgs.gov/resource/distr/lepid/bflyusa/bflyusa.htm (accessed Feb. 16, 2004).
84. O'Rourke, D.J., and J. Elliott. 2003. The New Hampshire Tracking Station A-Side Antenna—Photographs, Written Historical and Descriptive Data, Measured Drawings. New Hampshire Historical Architectural and Engineering Documentation New Hampshire Tracking Station A-Side Antenna. Argonne National Laboratory, Feb.
85. Ozgul, A., Childs, D. Z., Oli, M. K., Armitage, K. B., Blumstein, D. T., Olson, L. E., … Coulson, T. (2010). Coupled dynamics of body mass and population growth in response to environmental change. Nature, 466(7305), 482–485. http://doi.org/10.1038/nature09210
86. Partners in Flight 2021, Wood Thrush, https://partnersinflight.org/species/canada-warbler/ (accessed March 26, 2021).
87. Partners in Flight 2021, Canada Warbler, https://partnersinflight.org/species/wood-thrush (accessed March 26, 2021).
88. •Page, L. M., and B. M. Burr. 2011. Peterson field guide to freshwater fishes of North America north of Mexico. Second edition. Houghton Mifflin Harcourt, Boston. xix + 663 pp.
89. PES: See Parsons Engineering Science, Inc.
90. Parsons Engineering Science, Inc. 1995. Environmental Assessment for Unexploded Ordnance Clearance at Joe English Pond, New Boston Air Force Station. Preliminary Final Report. Parsons Engineering Science, Inc., Boston, Mass., June.
91. Parsons Engineering Science, Inc. 1996. Wetlands Delineation Report. Parsons Engineering Science, Inc., Boston, Mass., Sept.
92. Pierce, D. W., Cayan, D. R., & Thrasher, B. L. (2014). Statistical Downscaling Using Localized Constructed Analogs (LOCA)*. Journal of Hydrometeorology, 15(6), 2558–2585. http://doi.org/10.1175/JHM-D-14-0082.1
93. Peterson, A. 1986. Habitat Suitability Models: Bald Eagle (Breeding Season). Biological Report 82 (10.126), U.S. Fish and Wildlife Service, Washington, D.C., Oct.

94. Ramsdell, J.V., and G.L. Andrews. 1986. Tornado Climatology of the Contiguous United States, NUREG/CR-4461 and PNL-5697. Pacific Northwest Laboratory, Richland, Wash., May.
95. Reynolds, S.D., Shoemaker, K., von Oettingen, S., and Najjar, S. High Rates of Winter Activity and Arousals in Two New England Bat Species: Implications for a Reduced White-nose Syndrom Impact? Notheastern Naturalist 24:B188-208
96. Roettiger T. 2006. New Boston Air Force Station Fish Survey Results Summer 2006, CNEFRO 2006-1. Nashua N.H.
97. Roettiger T. 2007. New Boston Air Force Station Fish Survey Results Summer 2007, CNEFRO 2007-2. Nashua N.H.
98. Ruffner, J.A., editor. 1985. Climates of the States: National Oceanic and Atmospheric Administration Narrative Summaries, 3rd ed. Gale Research Company, Detroit, Mich.
99. Sanborn, P. 1998. Personal communication from P. Sanborn (Department of Environmental Services, Air Resources Division, Concord, N.H.) to Y.-S. Chang (Environmental Assessment Division, Argonne National Laboratory, Argonne, Ill.), Nov. 19.
100. Sperduto, D.D. 1994. A Classification of the Natural Communities of New Hampshire – April 1994 Approximation. New Hampshire Natural Heritage Inventory, Concord, N.H., April.
101. Sperduto, D.D. 2004. Wetland Ecological Systems of New Hampshire. New Hampshire Natural Heritage Bureau, Department of Resources and Economic Development, Division of Forests and Lands, Concord, N.H., June.
102. Sperduto, D.D. 2005. Memo from D.D. Sperduto (New Hampshire Natural Heritage Bureau, Concord, N.H.) to K.E. LaGory (Environmental Assessment Division, Argonne National Laboratory, Argonne, Ill.), March 2.
103. Sperduto, D.D., and W.F. Nichols. 1999. Fern-Leaved False-Foxglove (Aureolaria pedicularia var. intercedens) at the New Boston Air Station, N.H. New Hampshire Natural Heritage Inventory and the Nature Conservancy, Concord, N.H., Jan.
104. Sperduto, D.D., and W.F. Nichols. 2004. Natural Communities of New Hampshire. New Hampshire Natural Heritage Bureau, Department of Resources and Economic Development, Division of Forests and Lands, Concord, NH. Pub. UNH Cooperative Extension, Durham, N.H.
105. Sultaire, S. M., Pauli, J. N., Martin, K. J., Meyer, M. W., Notaro, M., & Zuckerberg, B. (2016). Climate change surpasses land-use change in the contracting range boundary of a winter-adapted mammal. Proceedings of the Royal Society B: Biological Sciences, 283(1827), 9. http://doi.org/10.1098/rspb.2015.3104
106. Sydeman, W. J., García-Reyes, M., Schoeman, D. S., Rykaczewski, R. R., Thompson, S. A., Black, B. A., & Bograd, S. J. (2014). Climate change and wind intensification in coastal upwelling ecosystems. Science, 345(6192), 77–80. http://doi.org/10.1126/science.1251635
107. Thornton, P., Thornton, M., & Mayer, B. (2012). DAYMET: Daily Surface Weather on a 1 km Grid for North America. 1980–2008. … Center, Oak Ridge, T, N. Doi. http://doi.org/10
108. UNHCE: See University of New Hampshire Cooperative Extension.
109. University of New Hampshire Cooperative Extension. 1998a. Rare Plants of New Hampshire, False-Foxglove, Fern-Leaved False-Foxglove. Fact Sheet. University of New Hampshire Cooperative Extension, Jan. Available at http://ceinfo.unh.edu/Wildlife/Pubs/r_foxglv.pdf (accessed Feb. 16, 2004).
110. University of New Hampshire Cooperative Extension. 1998b. Rare Wildlife of New Hampshire, Small-Footed Bat. Fact Sheet. University of New Hampshire Cooperative Extension. Available at http://ceinfo.unh.edu/Wildlife/Pubs/res_bat.pdf (accessed Feb. 28, 2005).
111. USAF: See U.S. Air Force.

112. U.S. Air Force. 2001. Environmental Assessment for Demolition of Buildings 117, 125, and 129 at New Boston Air Station, New Hampshire. U.S. Air Force, 23 SOPS/MAFCVN, New Boston Air Force Station, N.H., Mar.
113. U.S. Air Force. 2004. Fact Sheet—23rd Space Operations Squadron. U.S. Air Force. Available at https://www. schriever.af.mil/50sw/fact_sheets/23SOPSfs.doc (accessed Feb. 9, 2005).
114. U.S. Bureau of Land Management. 1999. Environmental Assessment of the Frostfire Prescribed Burn. U.S. Bureau of Land Management, BLM Northern Field Office, Fairbanks, Alaska, and BLM Alaska Fire Service, Ft. Wainwright, Alaska, No. AK-AFS-EA-99-AA03, April. Available at http://www.fs.fed.us/pnw/fera/frostfire/EA.PDF (accessed Mar. 8, 2005).
115. USCB: See U.S. Census Bureau.
116. U.S. Census Bureau. 2004. New Hampshire Quick Facts. U.S. Census Bureau. Available at http://quickfacts. census.gov/qfd/states/33/33011.html (accessed Feb. 10, 2005).
117. U.S. Environmental Protection Agency. 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. EPA 550/9 74 004, Office of Noise Abatement and Control, Washington, D.C., Mar.
118. USEPA, U. S. E. P. A. (2016). What climate change means for New Hampshire. United States Environmental Protection Agency. Retrieved from https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-nh.pdf
119. USGCRP. (2017). Climate Science Special Report: Fourth National Climate Assessment, Volume I. (D. J. Wuebbles, D. W. Fahey, K. A. Hibbard, D. J. Dokken, B. C. Stewart, & T. K. Maycock, Eds.). Washington, DC. http://doi.org/10.7930/J0J964J6
120. von Oettingen, S. 2003. Memo from S. von Oettingen (U.S. Fish and Wildlife Service, Concord, N.H.) to S. Sovaiko (New Boston Air Force Station, N.H.), May 12.
121. US Fish and Wildlife Service 2009, The American Eel. US Fish and Wildlife Service. Available at http://www.fws.gov/northeast/newsroom/facts.html (accessed Jun. 27, 2013).
122. Whetsell, R.C., and C.M. McLeod. 2000. Integrated Cultural Resource Management Plan for New Boston Air Force Station, New Boston, Mont Vernon, Amherst, New Hampshire. U.S. Department of Agriculture Forest Service, Northeastern Area State and Private Forestry.
123. White, C.M., N.J. Clum, T.J. Cade, and W.G. Hunt. 2002. Peregrine Falcon (Falco peregrinus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/660.doi:10.2173/bna.660
124. Whitney, G.G. 1994. From Coastal Wilderness to Fruited Plain—A History of Environmental Change in Temperate North America, 1500 to the Present. Cambridge University Press, Cambridge, England.
125. Wood, R.A, editor. 1996. Weather of U.S. Cities—A Guide to the Recent Weather Histories of 268 Key Cities and Weather Observation Stations in the United States and Its Island Territories. 5th ed. Gale Research Company, Detroit, Mich
1. Yue, X., Unger, N., Keenan, T. F., Zhang, X., & Vogel, C. S. (2015). Probing the past 30-year phenology trend of US deciduous forests. Biogeosciences, 12(15), 4693–4709. http://doi.org/10.5194/bg-12-4693-2015

12.0 ACRONYMS

12.1 Standard Acronyms *(Applicable to all USAF installations)*

- eDASH Acronym Library

- Natural Resources Playbook – Acronym Section
- U.S. EPA Terms & Acronyms

12.2 Installation Acronyms

1. NHNHB New Hampshire Natural Heritage Bureau
2. NBAFS New Boston Air Force Station
3. NHFGD New Hampshire Fish and Game Department
4. USFWS US Fish and Wildlife Service

13.0 DEFINITIONS

13.1 Standard Definitions (Applicable to all USAF installations)

- Natural Resources Playbook – Definitions Section

13.2 Installation Definitions

-

14.0 APPENDICES

14.1. Standard Appendices

Appendix A. Annotated Summary of Key Legislation Related to Design and Implementation of the INRMP

Federal Public Laws and Executive Orders	
National Defense Authorization Act of 1989, Public Law (P.L.) 101-189; Volunteer Partnership Cost-Share Program	Amends two Acts and establishes volunteer and partnership programs for natural and cultural resources management on DoD lands.
Defense Appropriations Act of 1991, P.L. 101-511; Legacy Resource Management Program	Establishes the "Legacy Resource Management Program" for natural and cultural resources. Program emphasis is on inventory and stewardship responsibilities of biological, geophysical, cultural, and historic resources on DoD lands, including restoration of degraded or altered habitats.
EO 11514, *Protection and Enhancement of Environmental Quality*	Federal agencies shall initiate measures needed to direct their policies, plans, and programs to meet national environmental goals. They shall monitor, evaluate, and control agency activities to protect and enhance the quality of the environment.
EO 11593, *Protection and Enhancement of the Cultural Environment*	All Federal agencies are required to locate, identify, and record all cultural resources. Cultural resources include sites of archaeological, historical, or architectural significance.
EO 11987, *Exotic Organisms*	Agencies shall restrict the introduction of exotic species into the natural ecosystems on lands and waters which they administer.
EO 11988, *Floodplain Management*	Provides direction regarding actions of Federal agencies in floodplains, and requires permits from state, territory and Federal review agencies for any construction within a 100-year floodplain and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for acquiring, managing and disposing of Federal lands and facilities.

Federal Public Laws and Executive Orders	
EO 11989, *Off-Road vehicles on Public Lands*	Installations permitting off-road vehicles to designate and mark specific areas/trails to minimize damage and conflicts, publish information including maps, and monitor the effects of their use. Installations may close areas if adverse effects on natural, cultural, or historic resources are observed.
EO 11990, *Protection of Wetlands*	Requires Federal agencies to avoid undertaking or providing assistance for new construction in wetlands unless there is no practicable alternative, and all practicable measures to minimize harm to wetlands have been implemented and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.
EO 12088, *Federal Compliance with Pollution Control Standards*	This EO delegates responsibility to the head of each executive agency for ensuring all necessary actions are taken for the prevention, control, and abatement of environmental pollution. This order gives the U.S. Environmental Protection Agency (US EPA) authority to conduct reviews and inspections to monitor federal facility compliance with pollution control standards.
EO 12898, *Environmental Justice*	This EO requires certain federal agencies, including the DoD, to the greatest extent practicable permitted by law, to make environmental justice part of their missions by identifying and addressing disproportionately high and adverse health or environmental effects on minority and low-income populations.
EO 13112, *Invasive Species*	To prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.
EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*	The USFWS has the responsibility to administer, oversee, and enforce the conservation provisions of the Migratory Bird Treaty Act, which includes responsibility for population management (e.g., monitoring), habitat protection (e.g., acquisition, enhancement, and modification), international coordination, and regulations development and enforcement.
United States Code	
Animal Damage Control Act (7 U.S.C. § 426-426b, 47 Stat. 1468)	Provides authority to the Secretary of Agriculture for investigation and control of mammalian predators, rodents, and birds. DoD installations may enter into cooperative agreements to conduct animal control projects.
Bald and Golden Eagle Protection Act of 1940, as amended; 16 U.S.C. 668-668c	This law provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds. The 1972 amendments increased penalties for violating provisions of the Act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to arrest and conviction for violation of the Act.

Federal Public Laws and Executive Orders	
Clean Air Act, (42 U.S.C. § 7401– 7671q, July 14, 1955, as amended)	This Act, as amended, is known as the Clean Air Act of 1970. The amendments made in 1970 established the core of the clean air program. The primary objective is to establish Federal standards for air pollutants. It is designed to improve air quality in areas of the country which do not meet federal standards and to prevent significant deterioration in areas where air quality exceeds those standards.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (Superfund) (26 U.S.C. § 4611–4682, P.L. 96-510, 94 Stat. 2797), as amended	Authorizes and administers a program to assess damage, respond to releases of hazardous substances, fund cleanup, establish clean-up standards, assign liability, and other efforts to address environmental contaminants. Installation Restoration Program guides cleanups at DoD installations.
Endangered Species Act (ESA) of 1973, as amended; P.L. 93-205, 16 U.S.C. § 1531 et seq.	Protects threatened, endangered, and candidate species of fish, wildlife, and plants and their designated critical habitats. Under this law, no federal action is allowed to jeopardize the continued existence of an endangered or threatened species. The ESA requires consultation with the USFWS and the NOAA Fisheries (National Marine Fisheries Service) and the preparation of a biological evaluation or a biological assessment may be required when such species are present in an area affected by government activities.
Federal Aid in Wildlife Restoration Act of 1937 (16 U.S.C. § 669–669i; 50 Stat. 917) (Pittman-Robertson Act)	Provides federal aid to states and territories for management and restoration of wildlife. Fund derives from sports tax on arms and ammunition. Projects include acquisition of wildlife habitat, wildlife research surveys, development of access facilities, and hunter education.
Federal Environmental Pesticide Act of 1972	Requires installations to ensure pesticides are used only in accordance with their label registrations and restricted-use pesticides are applied only by certified applicators.
Federal Land Use Policy and Management Act, 43 U.S.C. § 1701–1782	Requires management of public lands to protect the quality of scientific, scenic, historical, ecological, environmental, and archaeological resources and values; as well as to preserve and protect certain lands in their natural condition for fish and wildlife habitat. This Act also requires consideration of commodity production such as timbering.
Federal Noxious Weed Act of 1974, 7 U.S.C. § 2801–2814	The Act provides for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.
Federal Water Pollution Control Act (Clean Water Act [CWA]), 33 U.S.C. §1251–1387	The CWA is a comprehensive statute aimed at restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Primary authority for the implementation and enforcement rests with the US EPA.
Fish and Wildlife Conservation Act (16 U.S.C. § 2901–2911; 94 Stat. 1322, PL 96-366)	Installations encouraged to use their authority to conserve and promote conservation of nongame fish and wildlife in their habitats.

Federal Public Laws and Executive Orders	
Fish and Wildlife Coordination Act (16 U.S.C. § 661 et seq.)	Directs installations to consult with the USFWS, or state or territorial agencies to ascertain means to protect fish and wildlife resources related to actions resulting in the control or structural modification of any natural stream or body of water. Includes provisions for mitigation and reporting.
Lacey Act of 1900 (16 U.S.C. § 701, 702, 32 Stat. 187, 32 Stat. 285)	Prohibits the importation of wild animals or birds or parts thereof, taken, possessed, or exported in violation of the laws of the country or territory of origin. Provides enforcement and penalties for violation of wildlife related Acts or regulations.
Leases: Non-excess Property of Military Departments, 10 U.S.C. § 2667, as amended	Authorizes DoD to lease to commercial enterprises Federal land not currently needed for public use. Covers agricultural outleasing program.
Migratory Bird Treaty Act 16 U.S.C. § 703–712	The Act implements various treaties for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful without a valid permit.
National Environmental Policy Act of 1969 (NEPA), as amended; P.L. 91-190, 42 U.S.C. § 4321 et seq.	Requires federal agencies to utilize a systematic approach when assessing environmental impacts of government activities. Establishes the use of environmental impact statements. NEPA proposes an interdisciplinary approach in a decision-making process designed to identify unacceptable or unnecessary impacts on the environment. The Council of Environmental Quality (CEQ) created Regulations for Implementing the National Environmental Policy Act [40 Code of Federal Regulations (CFR) Parts 1500– 1508], which provide regulations applicable to and binding on all Federal agencies for implementing the procedural provisions of NEPA, as amended.
National Historic Preservation Act, 16 U.S.C. § 470 et seq.	Requires federal agencies to take account of the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (NRHP). Provides for the nomination, identification (through listing on the NRHP), and protection of historical and cultural properties of significance.
National Trails Systems Act (16 U.S.C. § 1241–1249)	Provides for the establishment of recreation and scenic trails.
National Wildlife Refuge Acts	Provides for establishment of National Wildlife Refuges through purchase, land transfer, donation, cooperative agreements, and other means.
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd–668ee)	Provides guidelines and instructions for the administration of Wildlife Refuges and other conservation areas.
Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001–13; 104 Stat. 3042), as amended	Established requirements for the treatment of Native American human remains and sacred or cultural objects found on Federal lands. Includes requirements on inventory, and notification.
Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.)	Makes it unlawful for the USAF to conduct any work or activity in navigable waters of the United States without a federal permit. Installations should coordinate with the U.S. Army Corps of Engineers

Federal Public Laws and Executive Orders	
	(USACE) to obtain permits for the discharge of refuse affecting navigable waters under National Pollutant Discharge Elimination System (NPDES) and should coordinate with the USFWS to review effects on fish and wildlife of work and activities to be undertaken as permitted by the USACE.
Sale of certain interests in land, 10 U.S.C. § 2665	Authorizes sale of forest products and reimbursement of the costs of management of forest resources.
Soil and Water Conservation Act (16 U.S.C. § 2001, P.L. 95-193)	Installations shall coordinate with the Secretary of Agriculture to appraise, on a continual basis, soil/water-related resources. Installations will develop and update a program for furthering the conservation, protection, and enhancement of these resources consistent with other federal and local programs.
Sikes Act (16 U.S.C. § 670a–670l, 74 Stat. 1052), as amended	Provides for the cooperation of DoD, the Departments of the Interior (USFWS), and the State Fish and Game Department in planning, developing, and maintaining fish and wildlife resources on a military installation. Requires development of an INRMP and public access to natural resources and allows collection of nominal hunting and fishing fees. NOTE: AFI 32-7064 sec 3.9. Staffing. As defined in DoDI 4715.03, use professionally trained natural resources management personnel with a degree in the natural sciences to develop and implement the installation INRMP. (T-0). 3.9.1. Outsourcing Natural Resources Management. As stipulated in the Sikes Act, 16 U.S.C. § 670 et. seq., the Office of Management and Budget Circular No. A-76, Performance of Commercial Activities, August 4, 1983 (Revised May 29, 2003) does not apply to the development, implementation and enforcement of INRMPs. Activities that require the exercise of discretion in making decisions regarding the management and disposition of government owned natural resources are inherently governmental. When it is not practicable to utilize DoD personnel to perform inherently governmental natural resources management duties, obtain these services from federal agencies having responsibilities for the conservation and management of natural resources.
DoD Policy, Directives, and Instructions	
DoD Instruction 4150.07 *DoD Pest Management Program* dated 29 May 2008	Implements policy, assigns responsibilities, and prescribes procedures for the DoD Integrated Pest Management Program.
DoD Instruction 4715.1, *Environmental Security*	Establishes policy for protecting, preserving, and (when required) restoring and enhancing the quality of the environment. This instruction also ensures environmental factors are integrated into DoD decision-making processes that could impact the environment, and are given appropriate consideration along with other relevant factors.
DoD Instruction (DoDI) 4715.03, *Natural Resources Conservation Program*	Implements policy, assigns responsibility, and prescribes procedures under DoDI 4715.1 for the integrated management of natural and cultural resources on property under DoD control.
OSD Policy Memorandum – 17 May 2005 – *Implementation of Sikes Act*	Provides supplemental guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD. The guidance covers lands occupied by tenants or lessees or being used

Federal Public Laws and Executive Orders	
Improvement Amendments: Supplemental Guidance Concerning Leased Lands	by others pursuant to a permit, license, right of way, or any other form of permission. INRMPs must address the resource management on all lands for which the subject installation has real property accountability, including leased lands. Installation commanders may require tenants to accept responsibility for performing appropriate natural resource management actions as a condition of their occupancy or use, but this does not preclude the requirement to address the natural resource management needs of these lands in the installation INRMP.
OSD Policy Memorandum – 1 November 2004 – *Implementation of Sikes Act Improvement Act Amendments: Supplemental Guidance Concerning INRMP Reviews*	Emphasizes implementing and improving the overall INRMP coordination process. Provides policy on scope of INRMP review, and public comment on INRMP review.
OSD Policy Memorandum – 10 October 2002 – *Implementation of Sikes Act Improvement Act: Updated Guidance*	Provides guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD and replaces the 21 September 1998 guidance Implementation of the Sikes Act Improvement Amendments. Emphasizes implementing and improving the overall INRMP coordination process and focuses on coordinating with stakeholders, reporting requirements and metrics, budgeting for INRMP projects, using the INRMP as a substitute for critical habitat designation, supporting military training and testing needs, and facilitating the INRMP review process.
USAF Instructions and Directives	
32 CFR Part 989, as amended, and AFI 32-7061, Environmental Impact Analysis Process (EIAP)	Provides guidance and responsibilities in the EIAP for implementing INRMPs. Implementation of an INRMP constitutes a major federal action and therefore is subject to evaluation through an Environmental Assessment or an Environmental Impact Statement.
AFI 32-1015, *Integrated Installation Planning*	This publication establishes a comprehensive and integrated planning framework for development/redevelopment of Air Force installations..
AFMAN 32-7003, *Environmental Conservation*	Implements AFPD 32-70, *Environmental Quality;* DoDI 4715.03, *Natural Resources Conservation Program*; and DoDI 7310.5, *Accounting for Sale of Forest Products*. It explains how to manage natural resources on USAF property in compliance with Federal, state, territorial, and local standards.
AFMAN 32-7003, *Environmental Conservation*	This Manual implements AFPD 32-70 and DoDI 4710.1, *Archaeological and Historic Resources Management.* It explains how to manage cultural resources on USAF property in compliance with Federal, state, territorial, and local standards.
AFI 32-10112 *Installation Geospatial Information and Services (IGI&S)*	This instruction implements Department of Defense Instruction (DoDI) 8130.01, Installation Geospatial Information and Services (IGI&S) by identifying the requirements to implement and maintain an Air Force Installation Geospatial Information and Services program and Air Force Policy Directive (AFPD) 32-10 Installations and Facilities.
AFPD 32-70, *Environmental Quality*	Outlines the USAF mission to achieve and maintain environmental quality on all USAF lands by cleaning up environmental damage resulting from past activities, meeting all environmental standards

Federal Public Laws and Executive Orders	
	applicable to present operations, planning its future activities to minimize environmental impacts, managing responsibly the irreplaceable natural and cultural resources it holds in public trust and eliminating pollution from its activities wherever possible. AFPD 32-70 also establishes policies to carry out these objectives.
Policy Memo for Implementation of Sikes Act Improvement Amendments, HQ USAF Environmental Office (USAF/ILEV) on January 29, 1999	Outlines the USAF interpretation and explanation of the Sikes Act and Improvement Act of 1997.

14.2. Installation Appendices

Appendix B

APPENDIX B1. Lists Of Plant and Animal Species

OBSERVED ON NEW BOSTON AIR FORCE STATION

Table B-1. Plant Species Observed on New Boston Air Force Station, New Hampshire

Scientific Name	Common Name	State Status and Rank
Acalypha rhomboidea	Rhombic copper-leaf	--
Acer pensylvanicum	Striped maple	--
Acer rubrum	Red maple	--
Acer saccharum	Sugar maple	--
Achillea millefolium	Common yarrow	--
Agalinis tenuifolia	Slender agalinis	--
Agrostis sp.	Bent grass	--
Alnus incana	Speckled alder	--
Alnus serrulata	Smooth alder	--
Ambrosia artemisiifolia	Ragweed	--
Amelanchier laevis	Smooth serviceberry	--
Amphicarpa bracteata	Hog peanut	--
Anaphalis margaritacea	Pearly everlasting	--
Andropogon gerardii	Big bluestem	--
Andropogon scoparius var. *scoparius* f. *calvescens*	Broomgrass	--
Anemone quinquefolia	Wood anemone	--
Anemone virginiana	Tall anemone	--
Apios americanus	Common ground nut	--
Apocynum androsaemifolium	Spreading dogbane	--
Aquilegia canadensis	Canada columbine	--
Arabis glabra	Tower mustard	--
Aralia hispida	Bristly sarsaparilla	--
Aralia nudicaulis	Wild sarsaparilla	--
Arisaema triphyllum	Jack-in-the-pulpit	--
Aristida basiramea	Triple-awned grass	--
Aronia arbutifolia	Red chokeberry	--
Aronia melanocarpa	Black chokeberry	--
Artemisia vulgaris	Mugwort	--
Asclepias exaltata	Poke milkweed	--
Asclepias incarnata	Swamp milkweed	--
Asclepias syriaca	Common milkweed	--
Asplenium platyneuron	Ebony spleenwort	--
Aster acuminatus	Whorled wood aster	--
Aster divaricatus	Common white heart-leaved aster	--
Aster ericoides	Squarrose white aster	--
Aster lanceolatus	Eastern lined aster	--
Aster lateriflorus	Goblet aster	--
Aster linariifolius	Stiff aster	--
Aster macrophyllus	Big-leaved aster	--
Aster novi-belgii	New York aster	--
Aster puniceus	Bristly aster	--
Aster radula	Low rough aster	--
Aster racemosus	Small-headed aster	--

Table B-1 (Cont.)

Scientific Name	Common Name	State Status and Rank
Aster sagittifolius	Arrow-leaved aster	--
Aster umbellatus	Tall flat-topped white aster	--
Aster undulatus	Clasping heart-leaved aster	--
Athyrium filix-femina	Lady fern	--
Aureolaria pedicularia var. *intercedens*	Fern-leaved false foxglove	--
Bartonia virginica	No common name	--
Bazzania sp.	Leafy liverwort	--
Berberis thunbergii	Japanese barberry	--
Betula alleghaniensis	Yellow birch	--
Betula lenta	Black birch	--
Betula papyrifera	Paper birch	--
Betula populifolia	Grey birch	--
Bidens cernua	Bur-marigold	--
Bidens connata	Purplestem beggars-tick	--
Bidens frondosa	Devil's beggars-tick	--
Boehmeria cylindrica	False-nettle	--
Botrychium dissectum	Lace-frond grape-fern	--
Botrychium simplex	Little grape-fern	--
Brachyelytrum erectum	Grass	--
Brachyelytrum erectum var. *septentrionale*	Short-husks	--
Calamagrostis canadensis var. *canadensis*	Blue-joint	--
Calla palustris	Water arum	--
Cardamine pensylvanica	Pennsylvania bittercress	--
Carex albicans	Sedge	--
Carex arctata	Sedge	--
Carex canescens	Sedge	--
Carex communis	Sedge	--
Carex crinita	Sedge	--
Carex debilis	Sedge	--
Carex folliculata	Sedge	--
Carex gracillima	Sedge	--
Carex intumescens	Sedge	--
Carex laxiflora	Sedge	--
Carex leptalea	Sedge	--
Carex lupulina var. *lupulina*	Sedge	--
Carex lurida	Sedge	--
Carex pedunculata	Sedge	--
Carex pensylvanica	Sedge	--
Carex pseudocyperus	Sedge	--
Carex rostrata	Beaked sedge	--
Carex rugosperma	Sedge	--
Carex swanii	Sedge	--
Carex trisperma	Three-seeded sedge	--

Table B-1 (Cont.)

Scientific Name	Common Name	State Status and Rank
Carex utriculata	Sedge	--
Castanea dentata	Chestnut	--
Ceanothus americanus	New Jersey tea	--
Celastrus scandens	American bittersweet	--
Cephalanthus occidentalis	Button-bush	--
Cerastium vulgatum	Mouse-ear chickweed	--
Chamaedaphne calyculata	Leatherleaf	--
Chelidonium majus	Celandine	--
Chelone glabra	White turtle-head	--
Chenopodium album	Lamb's quarters	--
Chenopodium gigantospermum	Maple-leaved goosefoot	--
Chimaphila maculata	Spotted wintergreen	--
Chimaphila umbellata	Pipsissewa	--
Chrysanthemum leucanthemum	Ox-eye daisy	--
Chrysosplenium americanum	Water-mat	--
Cicuta bulbifera	Bulbiferous water hemlock	--
Circaea lutetiana	Common enchanter's nightshade	--
Clematis virginiana	Virgin's bower	--
Clintonia borealis	Clintonia lily	--
Commandra umbellata	Bastard toadflax	--
Comptonia peregrina	Sweet fern	--
Convolvulus arvensis	Field bindweed	--
Conyza canadensis	Horseweed	--
Coptis groenlandica	Goldthread	--
Cornus alternifolia	Alternate-leaved dogwood	--
Cornus amomum	Knob-styled dogwood	--
Cornus obliqua	Narrowleaf dogwood	--
Cornus rugosa	Round-leaved dogwood	--
Corydalis sempervirens	Pale corydalis	--
Corylus cornuta	Beaked hazelnut	--
Crataegus sp.	Hawthorn	--
Cuscuta gronovii	Common dodder	--
Cyperus strigosus	False nutsedge	--
Cypripedium acaule	Pink lady's slipper	--
Cystopteris fragilis	Fragile fern	--
Danthonia compressa	Woodland oat-grass	--
Danthonia spicata	Poverty oat-grass	--
Daucus carota	Queen Anne's lace	--
Decodon verticillatus	Water-willow	--
Dennstaedtia punctilobula	Hay-scented fern	--
Deschampsia cespitosa	Tufted hair-grass	--
Deschampsia flexuosa	Wavy hair-grass	--
Desmodium canadense	Canadian tick-trefoil	--

Table B-1 (Cont.)

Scientific Name	Common Name	State Status and Rank
Desmodium glabellum	Tick-trefoil	--
Dianthus armeria	Deptford pink	--
Dianthus deltoides	Maiden pink	--
Diervilla lonicera	Bush honeysuckle	--
Digitaria sp.	Crab grass	--
Diphasiastrum complanatum	Ground-cedar	--
Diphasiastrum digitatum	Southern ground-cedar	--
Diphasiastrum tristachyum	Wiry ground-cedar	--
Diphasiastrum x *zeilleri*	Hybrid ground-cedar	--
Drosera intermedia	Spatulate-leaved sundew	--
Drosera rotundifolia	Round-leaved sundew	--
Dryopteris carthusiana	Spinulose wood-fern	--
Dryopteris clintoniana	Clinton's wood-fern	--
Dryopteris cristata	Crested wood-fern	--
Dryopteris intermedia	Glandular wood-fern	--
Dryopteris marginalis	Marginal wood-fern	--
Dryopteris x *boottii*	Boott's wood-fern	--
Dulichium arundinaceum	Three-way sedge	--
Elaeagnus umbellata[2]	Autumn olive	--
Eleocharis acicularis	Needle spike-rush	--
Eleocharis palustris	Spike-rush	--
Epifagus virginiana	Beech-drops	--
Epigaea repens	Trailing arbutus	--
Epilobium coloratum	Eastern willow-herb	--
Epipactis helleborine	Helleborine	--
Equisetum hyemale	Common scouring-rush	--
Equisetum sylvaticum	Woodland horsetail	--
Erechtites hieracifolia	Fireweed	--
Erigeron strigosus	Rough fleabane	--
Eriocaulon aquaticum	Pipewort	--
Eriophorum tenellum	Conifer cotton-grass	--
Eupatorium dubium	Three-nerved joe-pye weed	--
Eupatorium maculatum	Joe-pye weed	--
Eupatorium perfoliatum	Boneset	--
Eupatorium rugosum	White snakeroot	--
Euphorbia maculata	Milk purslane	--
Euthamia graminifolia	Common flat-topped goldenrod	--
Fagus grandifolia	American beech	--
Festuca pratensis	Meadow fescue	--
Festuca rubra var. *rubra* f. *rubra*	Red fescue	--
Fimbristylis autumnalis	Sedge	--
Fragaria virginiana	Thick-leaved wild strawberry	--

Table B-1 (Cont.)

Scientific Name	Common Name	State Status and Rank
Fraxinus americana	White ash	--
Galium asprellum	Rough bedstraw	--
Galium palustre	Marsh bedstraw	--
Gaultheria hispidula	Creeping snowberry	--
Gaultheria procumbens	Wintergreen	--
Gaylussacia baccata	Black huckleberry	--
Gaylussacia frondosa	Dangleberry	--
Gentiana linearis	Narrow-leaved gentian	--
Geranium robertianum	Herb-Robert	--
Glyceria borealis	Northern float-grass	--
Glyceria canadensis	Rattlesnake manna-grass	--
Glyceria melicaria	Slender manna-grass	--
Glyceria septentrionalis	Floating manna-grass	--
Glyceria striata	Fowl manna-grass	--
Gnaphalium uliginosum	Low cudweed	--
Hamamelis virginiana	Witch hazel	--
Hedyotis caerulea	Bluets	--
Helianthemum canadense	Frostweed	--
Hieracium aurantiacum	Orange-red king devil	--
Hieracium caespitosum	Yellow king devil	--
Hieracium paniculatum	Panicled hawkweed	--
Humulus lupulus	Hops	--
Hydrocotyle americana	Marsh pennywort	--
Hypericum canadense	St. John's-wort	--
Hypericum ellipticum	St. John's-wort	--
Hypericum gentianoides	Orange-grass	--
Hypericum mutilum	Dwarf St. John's-wort	--
Hypericum perforatum	Common St. John's-wort	--
Hypericum punctatum	Spotted St. John's-wort	--
Hypericum virginicum	Marsh St. John's-wort	--
Ilex verticillata	Swamp winterberry	--
Impatiens capensis	Orange touch-me-not	--
Iris versicolor	Larger blue flag	--
Isoetes echinospora	Spiny-spored quillwort	--
Juglans cinerea	Butternut	--
Juncus canadensis	Rush	--
Juncus marginatus	Rush	--
Juncus tenuis	Path rush	--
Juniperus communis	Common juniper	--
Juniperus virginiana	Eastern red cedar	--
Kalmia angustifolia	Sheep laurel	--
Kalmia latiflolia	Mountain laurel	--

Table B-1 (Cont.)

Scientific Name	Common Name	State Status and Rank
Lactuca canadensis	Tall lettuce	--
Lechea intermedia	Pinweed	--
Leersia oryzoides	Rice cut-grass	--
Lemna minor	Lesser duckweed	--
Lepidium virginicum	Poor-man's pepper	--
Lespedeza capitata	Bush clover	--
Lespedeza hirta	Hairy lespedeza	--
Lespedeza intermedia	Wand lespedeza	--
Lilium philadelphicum	Wood lily	--
Linaria canadensis	Annual toadflax	--
Lindera benzoin	Spice-bush	--
Lindernia dubia	False pimpernel	--
Lobelia cardinalis	Cardinal flower	--
Lobelia inflata	Indian tobacco	--
Lobelia spicata	Spiked lobelia	--
Lolium perenne	Darnel	--
Lolium temulentum	Darnel	--
Lonicera canadensis	Fly honeysuckle	--
Ludwigia palustris	Water primrose	--
Luzula multiflora	Wood-rush	--
Lycopodium annotinum	Stiff clubmoss	--
Lycopodium clavatum	Staghorn clubmoss	--
Lycopodium inundatum	Bog clubmoss	--
Lycopodium lagopus	Clubmoss	--
Lycopodium obscurum	Princess pine	--
Lycopus americanus	Cut-leaved water-horehound	--
Lycopus uniflorus	Northern water-horehound	--
Lyonia ligustrina	Maleberry	--
Lysimachia quadrifolia	Whorled loosestrife	--
Lysimachia terrestris	Yellow loosestrife	--
Lythrum salicaria	Purple loosestrife	--
Maianthemum canadense	Canada mayflower	--
Medeola virginiana	Indian cucumber-root	--
Melampyrum lineare	Cow-wheat	--
Mentha arvensis	Field mint	--
Mimulus ringens	Monkey flower	--
Mitchella repens	Partridge-berry	--
Mollugo verticillata	Carpetweed	--
Monotropa hydropithys	Pinesap	--
Monotropa uniflora	Indian pipe	--
Muhlenbergia uniflora	Fall drop-seed	--
Myrica gale	Sweet gale	--

Table B-1 (Cont.)

Scientific Name	Common Name	State Status and Rank
Najas flexilis	Northern water nymph	--
Nemopanthus mucronatus	Common mountain holly	--
Nuphar variegata	Spatterdock	--
Nymphaea odorata	Fragrant water lily	--
Nymphoides cordata	Little floating heart	--
Nyssa sylvatica	Black gum	--
Oenothera biennis	Common evening-primrose	--
Oenothera parviflora	Small-flowered evening-primrose	--
Onoclea sensibilis	Sensitive fern	--
Oryzopsis asperifolia	Rough mountain-rice	--
Osmunda cinnamomea	Cinnamon fern	--
Osmunda claytoniana	Interrupted fern	--
Osmunda regalis	Royal fern	--
Ostrya virginiana	Eastern hop-hornbeam	--
Oxalis stricta	Common yellow wood-sorrel	--
Panax trifolium	Dwarf ginseng	--
Panicum capillare var. *capillare*	Old-witch grass	--
Panicum clandestinum	Panic-grass	--
Panicum rigidulum var. *rigidulum*	Panic-grass	--
Panicum virgatum	Switchgrass	--
Parthenocissus quinquefolia	Virginia creeper	--
Parthenocissus vitacea	Grape woodbine	--
Phleum pratense	Timothy grass	--
Phlox paniculata	Summer phlox	--
Picea mariana	Black spruce	--
Pinus resinosa	Red pine	--
Pinus rigida	Pitch pine	--
Pinus strobus	Eastern white pine	--
Plantago major	Common plantain	--
Poa pratensis	Kentucky bluegrass	--
Pogonia ophioglossoides	Rose pogonia	--
Polygala paucifolia	Flowering wintergreen	--
Polygala polygama	Bitter milkwort	--
Polygala sanguinea	Milkwort	--
Polygonatum biflorum	Solomon's-seal	--
Polygonatum pubescens	Solomon's-seal	--
Polygonella articulata	Jointweed	--
Polygonum arenastrum	Dooryard knotweed	--
Polygonum arifolium	Halberd-leaved tear thumb	--
Polygonum aviculare	Knotweed	--
Polygonum careyi	Smartweed	--
Polygonum cespitosum	Smartweed	--

Table B-1 (Cont.)

Scientific Name	Common Name	State Status and Rank
Polygonum cilinode	Fringed bindweed	--
Polygonum convolvulus	Black bindweed	--
Polygonum cuspidatum	Japanese knotweed	--
Polygonum lapathifolium	Dock-leaved smartweed	--
Polygonum pensylvanicum	Pennsylvania smartweed	--
Polygonum persicaria	Lady's thumb	--
Polygonum punctatum	Dotted smartweed	--
Polygonum sagittatum	Arrow-leaved tear thumb	--
Polygonum scandens	False buckwheat	--
Polypodium virginianum	Common polypody	--
Polystichum acrostichoides	Christmas fern	--
Pontederia cordata	Pickerel weed	--
Populus tremuloides	Quaking aspen	--
Portulaca oleracea	Common purslane	--
Potamogeton epihydrus	Ribbonleaf pondweed	--
Potamogeton oakesianus	Oakes' pondweed	--
Potentilla argentea	Silvery cinquefoil	--
Potentilla canadensis	Running cinquefoil	--
Potentilla recta	Rough-fruited cinquefoil	--
Potentilla simplex	Old-field cinquefoil	--
Prenanthes trifoliolata	Gall-of-the-earth	--
Proserpinaca palustris	Common mermaid-weed	--
Prunella vulgaris	Self-heal	--
Prunus pensylvanica	Pin cherry	--
Prunus serotina	Wild black cherry	--
Prunus virginiana	Choke cherry	--
Pteridium aquilinum	Bracken fern	--
Pyrola elliptica	Shinleaf	--
Quercus alba	White oak	--
Quercus coccinea	Scarlet oak	--
Quercus ilicifolia	Bear oak	--
Quercus rubra	Red oak	--
Quercus velutina	Black oak	--
Ranunculus bulbosus	Bulbous buttercup	--
Ranunculus hispidus	Hispid buttercup	--
Raphanus raphanistrum	Charlock	--
Rhexia virginica	Meadow-beauty	--
Rhododendron canadense	Rhodora	--
Rhododendron prinophyllum	Rosebud azalea	--
Rhus copallina	Shining sumac	--
Rhus glabra	Smooth sumac	--
Rhus typhina	Staghorn sumac	--
Rhynchospora sp.	Beakrush	--

Table B-1 (Cont.)

Scientific Name	Common Name	State Status and Rank
Ribes glandulosum	Skunk currant	--
Ribes triste	Swamp red currant	--
Robinia pseudoacacia	Black locust	--
Rorippa nasturtium-aquaticum	Watercress	--
Rosa multiflora	Multiflora rose	--
Rosa nitida	Northeastern rose	--
Rosa palustris	Swamp rose	--
Rosa virginiana	Virginia rose	--
Rubus allegheniensis	Common blackberry	--
Rubus hispidus	Swamp dewberry	--
Rubus idaeus	Red raspberry	--
Rubus occidentalis	Black raspberry	--
Rubus odoratus	Purple-flowering raspberry	--
Rubus setosus	Bristly blackberry	--
Rudbeckia hirta	Black-eyed susan	--
Rumex acetosella	Red sorrel	--
Sagittaria engelmanniana	Acid-water arrowhead	--
Sagittaria latifolia	Broad-leaved arrowhead	--
Salix sp.	Willow	--
Sambucus canadensis	Common elderberry	--
Sambucus pubens	Red-berried elder	--
Sarracenia purpurea	Pitcher plant	--
Sassafras albidum	Sassafras	--
Satureja vulgaris	Wild basil	--
Saxifraga virginiensis	Early saxifrage	--
Scheuchzeria palustris	Pod-grass	--
Scirpus americanus	Olney threesquare	--
Scirpus atrovirens	Black bulrush	--
Scirpus cyperinus	Wool-grass	--
Scleranthus annuus	Annual knawel	--
Scutellaria galericulata	Marsh skullcap	--
Scutellaria lateriflora	Mad-dog skullcap	--
Selaginella rupestris	Rock spikemoss	--
Senecio aureus	Heart-leaved ragwort	--
Sisyrinchium atlanticum	Blue-eyed grass	--
Sium suave	Water-parsnip	--
Smilacina racemosa	False solomon's-seal	--
Smilax herbacea	Greenbrier	--
Smilax rotundifolia	Greenbrier	--
Solanum dulcamara	Bittersweet	--
Solanum nigrum	Black nightshade	--
Solidago bicolor	Silver rod	--
Solidago caesia	Axillary goldenrod	--

Table B-1 (Cont.)

Scientific Name	Common Name	State Status and Rank
Solidago canadensis	Canada goldenrod	--
Solidago juncea	Early goldenrod	--
Solidago nemoralis	Gray goldenrod	--
Solidago puberula	Dusty goldenrod	--
Solidago squarrosa	Big-leaved goldenrod	--
Sorbus americana	Mountain ash	--
Sparganium americanum	Bur-reed	--
Sparganium chlorocarpum	Bur-reed	--
Spergularia rubra	Sand-spurrey	--
Sphagnum magellanicum	Sphagnum moss	--
Spiraea alba	Meadowsweet	--
Spiraea latifolia	Smooth meadowsweet	--
Spiraea tomentosa	Steeplebush	--
Spiranthes cernua	Nodding ladies-tresses	--
Taxus canadensis	American yew	--
Thalictrum polygamum	Tall meadow-rue	--
Thalictrum pubescens	Tall meadow-rue	--
Thelypteris novaboracensis	New York fern	--
Thelypteris palustris	Marsh fern	--
Thelypteris phegopteris	Beech fern	--
Thelypteris simulata	Massachusetts fern	--
Tiarella cordifolia	Foam flower	--
Tilia americana	Basswood	--
Toxicodendron radicans	Poison ivy	--
Toxicodendron vernix	Poison sumac	--
Trichostema dichotomum	Bluecurls	--
Trientalis borealis	Starflower	--
Trifolium arvensis	Rabbit-foot clover	--
Trifolium aureum	Palmate hop-clover	--
Trifolium hybridum	Alsike clover	--
Trifolium pratense	Red clover	--
Trifolium repens	White clover	--
Trillium undulatum	Painted trillium	--
Tsuga canadensis	Eastern hemlock	--
Typha latifolia	Common cattail	--
Utricularia intermedia	Northern bladderwort	--
Utricularia geminiscapa	Mixed bladderwort	--
Utricularia vulgaris	Common bladderwort	--
Uvularia sessilifolia	Wild oats	--
Vaccinium angustifolium	Lowbush-blueberry	--
Vaccinium corymbosum	Highbush-blueberry	--
Vaccinium macrocarpon	Large cranberry	--

Table B-1 (Cont.)

Scientific Name	Common Name	State Status and Rank
Vaccinium vacillans	Hillside-blueberry	--
Veratrum viride	False hellebore	--
Verbena hastata	Common vervain	--
Verbena urticifolia	White verbena	--
Veronica officinalis	Common speedwell	--
Veronica scutellata	Marsh speedwell	--
Viburnum acerfolium	Maple-leaf viburnum	--
Viburnum alnifolium	Hobblebush	--
Viburnum cassinoides	Withe-rod	--
Viburnum dentatum	Arrow-wood	--
Viburnum recognitum	Northern arrow-wood	--
Vicia cracca	Cow vetch	--
Vicia tetrasperma	Four-seeded vetch	--
Viola blanda	Sweet white violet	--
Viola lanceolata	Strap-leaved violet	--
Viola sagittata	Arrowhead violet	--
Viola sororia	Dooryard violet	--
Vitis labrusca	Fox grape	--
Vitis novae-angliae	New England grape	--
Vitis riparia	Frost grape	--
Wisteria floribunda	Japanese wisteria	--
Woodsia ilvensis	Rusty cliff-fern	--
Woodwardia virginica	Virginia chain-fern	--

Source: LaGory et al. (1997).

Table B-2. Moth Species Observed on New Boston Air Force Station, New Hampshire

Family/Scientific Name	Common Name	State Rank
Geometridae		
Anacamptodes ephyraria	Pale-winged gray	--
Anacamptodes vellivolata	Large purplish gray	--
Anavitrinella pampinaria	Common gray	--
Besma quercivoraria	Oak besma	--
Campaea perlata	Pale beauty	--
Caripeta angustiorata	Brown pine looper moth	--
Caripeta piniata	Northern pine looper moth	--
Cyclophora packardi	Packard's wave	--
Cyclophora pendulinaria	Sweetfern geometer	--
Dysstroma citrata	No common name	--
Ecliptopera silaceata albolineata	No common name	--
Epirrhoe alternata	White-banded toothed carpet	--
Euchlaena irraria	Least-marked euchlaena	--
Euchlaena serrata	The saw-wing	--
Euchlaena tigrinaria	Mottled euchlaena	--
Eugonobapta nivosaria	Snowy geometer	--
Eulithis explanata	White eulithis	--
Euphyia unangulata intermediata	Sharp-angled carpet	--
Eupithecia ssp.	No common name	--
Eutrapela clemataria	Curve-toothed geometer	--
Horisme intestinata	Brown bark carpet	--
Hypagyrtis esther	Esther moth	--
Hypagyrtis unipunctata	One-spotted variant	--
Iridopsis larvaria	Bent-line gray	--
Itame loricaria julia	No common name	--
Itame pustularia	Lesser maple spanworm moth	--
Lambdina fiscellaria	Hemlock looper moth	--
Lomographa semiclarata	Bluish spring moth	--
Lomographa vestaliata	White spring moth	--
Lytrosis unitaria	Common lytrosis	--
Melanolophia canadaria	Canadian melanolophia	--
Metanema inatomaria	Pale metanema	--
Metarranthis duaria	Ruddy metarranthis	--
Metarranthis obfirmaria	Yellow-washed metarranthis	--
Orthonama obstipata	The gem	--
Oxydia vesulia transponens	No common name	--
Petrophora divisata	Common petrophora	--
Plagodis alcoolaria	Hollow-spotted plagodis	--
Plagodis serinaria	Lemon plagodis	--
Probole amicaria	Friendly probole	--
Prochoerodes transversata	Large maple spanworm moth	--

Table B-2 (Cont.)

Family/Scientific Name	Common Name	State Rank
Protoboarmia porcelaria	Porcelain gray	--
Scopula limboundata	Large lace-border	--
Semiothisa bisignata	Red-headed inchworm moth	--
Semiothisa minorata	Minor angle	--
Semiothisa pinistrobata	White pine angle	--
Semiothisa signaria dispuncta	Pale-marked angle	--
Tetracis cachexiata	White slant-line	--
Tetracis crocallata	Yellow slant-line	--
Xanthorhoe ferrugata	Red twin-spot	--
Lasiocampidae		
Malacosoma americanum	East tent caterpillar moth	--
Malacosoma disstria	Forest tent caterpillar moth	--
Phyllodesma americana	Lappet moth	--
Tolype laricis	No common name	--
Saturniidae		
Dryocampa rubicunda	Rosy maple moth	--
Sphingidae		
Ceratomia undulosa	Waved sphinx	--
Hemaris thysbe	Hummingbird clearwing	--
Lapara bombycoides	Northern pine sphinx	--
Paonias excaecatus	Blinded sphinx	--
Sphinx poecila	No common name	--
Xylophanes tersa	Tersa sphinx	--
Arctiidae		
Cisseps fulvicollis	Yellow-collared scape moth	--
Grammia virgo	Virgin tiger moth	--
Halysidota tessellaris	Banded tussock moth	--
Haploa clymene	Clymene moth	--
Holomelina ferruginosa	Rusty holomelina	--
Holomelina laeta treatii	Joyful holomelina	--
Holomelina opella	Tawny holomelina	--
Hypoprepia fucosa	Painted lichen moth	--
Phragmatobia assimilans	Large ruby tiger moth	--
Spilosoma virginica	Virginian tiger moth	--
Noctuidae		
Abagrotis alternata	Greater red dart	--
Acronicta haesitata	Hesitant dagger moth	--
Acronicta hasta	Speared dagger moth	--

Table B-2 (Cont.)

Family/Scientific Name	Common Name	State Rank
Acronicta increta	No common name	--
Acronicta lobeliae	Lobelia dagger moth	--
Acronicta ovata	Ovate dagger moth	--
Allotria elonympha	False underwing	--
Amphipyra pyramidoides	Copper underwing	--
Anomogyna badicollis	Northern variable dart	--
Apharetra purpurea	Blueberry sallow	
Autographa precationis	Common looper moth	--
Balsa labecula	White-blotched balsa	--
Bellura gortynoides	White-tailed diver	--
Bleptina caradrinalis	Bent-winged owlet	--
Bomolocha baltimoralis	Baltimore bomolocha	--
Caenurgina crassiuscula	Clover looper moth	--
Callopistria cordata	Silver-spotted fern moth	--
Catocala andromedae tristis	Andromeda underwing	--
Catocala connubialis	Connubial underwing	--
Catocala ilia	Ilia underwing	--
Catocala praeclara	Praeclara underwing	--
Catocala relicta	White underwing	--
Catocala sordida	Sordid underwing	--
Catocala ultronia	Ultronia underwing	--
Cerma cerintha	Tufted bird-dropping moth	--
Chaetaglaea sericea	Silky sallow	--
Chrysanympha formosa	Formosa looper moth	--
Chytonix palliatricula	Cloaked marvel	--
Colocasia propinquilinea	Closebanded yellowhorn	--
Cosmia calami	American dun-bar	--
Diarsia jucunda	Smaller pinkish dart	--
Drasteria grandirena	No common name	--
Elaphria festivoides	Festive midget	--
Enargia decolor	No common name	--
Epiglaea apiata	No common name	--
Euagrotis illapsa	Snowy dart	--
Eucirroedia pampina	Scalloped sallow	--
Feltia jaculifera	Dingy cutworm moth	--
Graphiphora haruspica	No common name	--
Herptagrotis phyllophora	No common name	--
Homorthodes furfurata	No common name	--
Hypersstrotia secta	Black-patched graylet	--
Hyppa xylinoides	Common hyppa	--
Idia aemula	Common idia	--
Idia americalis	American idia	--
Idia diminuendis	Orange-spotted idia	--

Table B-2 (Cont.)

Family/Scientific Name	Common Name	State Rank
Idia lubricalis	Glossy black idia	--
Idia rotundalis	No common name	--
Idia scobialis	Smoky idia	--
Iodopepla u-album	No common name	--
Lacinipolia implicata	Implicit arches	--
Leucania pseudargyria	False wainscot	--
Leuconycta diphteroides	Green leuconycta	--
Noctua pronuba	No common name	--
Nola cilcoides eurypennis	Blurry-patched nola	--
Nola pustulata	No common name	--
Orthodes crenulata	Rustic quaker	--
Oruza albocostaliata	The white-edge	--
Pangrapta decoralis	Decorated owlet	--
Panthea furcilla	Eastern panthea	--
Papaipema eupatori	No common name	--
Parallelia bistriaris	Maple looper moth	--
Phlogophora periculosa	No common name	--
Platyperigea multifera	Speckled rustic	--
Polia detracta neoterica	Disparaged arches	--
Polia purpurissta	Purple arches	--
Polygrammate hebraeicum	The hebrew	--
Protolampra brunneicollis	Brown-collared dart	--
Raphia frater	The brother	--
Renia flavipunctalis	No common name	--
Sunira ralla	No common name	--
Tricholita signata semitropicae	Signate quaker	--
Trichosilia geniculata	No common name	--
Ulolonche modesta	No common name	--
Xestia bicarnea	Pink-spotted dart	--
Xestia dolosa	Greater black-letter dart	--
Xestia normaniana	Norman’s dart	--
Xestia smithii	Smith’s dart	--
Zanclognatha jacchusalis	No common name	--
Zanclognatha laevigata	Variable zanclognatha	--
Zanclognatha ochreipennis	Wavy-lined zanclognatha	--

Adapted from: LaGory et al. (1997).

Table B-3. Butterfly and Skipper Species Observed on New Boston Air Force Station, New Hampshire

Family/Scientific Name	Common Name	State Rank
Papilionidae		
Papilio canadensis	Canadian swallowtail	--
Papilio glaucus	Tiger swallowtail	--
Papilio polyxenes	Black swallowtail	--
Papilio troilus	Spicebush swallowtail	--
Pieridae		
Colias philodice	Clouded sulphur	--
Pieris rapae	Cabbage butterfly	--
Lycaenidae		
Celastrina ladon	Spring azure	--
Everes comytas	Eastern tailed blue	--
Lycaena phlaeas	American copper	--
Satyrium calanus	Banded hairstreak	--
Nymphalidae		
Cercyonis pegala	Common wood nymph	--
Coenonympha tullia	Common ringlet	--
Danaus plexippis	Monarch	--
Enodia anthedon	Northern pearly eye	--
Limenitis antipoda astyanax	Red-spotted purple	--
Limenitis archippus	Viceroy	--
Limenitis arthemis arthemis	White admiral	--
Megisto cymela	Little wood satyr	--
Nymphalis antipoda	Mourning cloak	--
Nymphalis vau-album	Compton's tortoiseshell	--
Phyciodes selenis	Pearl crescent	--
Satyrodes appalachia	Appalachian brown	--
Satyrodes eurydice	Meadow-eyed brown	--
Speryeria atlantis	Atlantis fritillary	--
Speyeria aphrodite	Aphrodite fritillary	--
Speyeria cybele	Great spangled fritillary	--
Hesperiidae		
Ancyloxpha numitor	Least skipper	--
Atrytone logan	Delaware skipper	--
Epargyreus clarus	Silver-spotted skipper	--
Erynnis icelus	Dreamy duskywing	--
Erynnis juvenalis	Juvenal's duskywing	--
Euphyes vestris	Dun skipper	--

Table B-3 (Cont.)

Family/Scientific Name	Common Name	State Rank
Pholisora catullus	Common sootywing	--
Poanes massasoit	Mulberry wing	S1S3
Polites mystic	Long dash	--
Pompeius verna	Little glassywing	SU
Wallengrenia egeremot	Northern broken dash	--

Adapted (2021) from: LaGory et al. (1997).

Table B-4. Bird Species Observed on New Boston Air Force Station, New Hampshire

Common Name	Scientific Name	Federal Status	State Status	State Rank[1]	Neo-tropical Migrant
Pied-billed grebe	*Podilymbus podiceps*	--	LT	S2B	--
Double-crested cormorant	*Phalacrocorax auritus*	--	--	--	NTM
American bittern	*Botaurus lentiginosus*	--	--	S3B	NTM
Great blue heron	*Ardea herodias*	--	--	--	--
Green heron	*Butorides virescens*	--	--	--	--
Canada goose	*Branta canadensis*	--	--	--	--
Wood duck	*Aix sponsa*	--	--	--	--
Green-winged teal	*Anas crecca*	--	--	--	NTM
American black duck	*Anas rubripes*	--	--	--	--
Black duck - Mallard hybrid		--	--	--	--
Mallard	*Anas platyrhynchos*	--	--	--	NTM
Blue-winged teal	*Anas discors*	--	--	--	NTM
Ring-necked duck	*Aythya collaris*	--	--	--	NTM
Hooded merganser	*Lophodytes cucullatus*	--	--	--	NTM
Common merganser	*Mergus merganser*	--	--	--	--
Turkey vulture	*Cathartes aura*	--	--	--	NTM
Osprey	*Pandion haliaetus*	--			--
Bald eagle	*Haliaeetus leucocephalus*	--	SC	S2	--
Northern harrier	*Circus cyaneus*	--	LE	S1B	NTM
Sharp-shinned hawk	*Accipiter striatus*	--	--	--	NTM
Cooper's hawk	*Accipiter cooperi*	--	--	--	NTM
Northern goshawk	*Accipiter gentilis*	--	--	S3	NTM
Red-shouldered hawk	*Buteo lineatus*	--	--	--	NTM
Broad-winged hawk	*Buteo platypterus*	--	--	--	NTM
Red-tailed hawk	*Buteo jamaicensis*	--	--	--	NTM
American kestrel	*Falco sparverius*	--	SC	S3B	NTM
Ruffed grouse	*Bonasa umbellus*	--	--	--	--
Wild turkey	*Meleagris gallopavo*	--	--	--	--
Virginia rail	*Rallus limicola*	--	--	--	NTM
Killdeer	*Charadrius vociferous*	--	--	--	NTM
Greater yellowlegs	*Tringa melanoleuca*	--	--	--	NTM
Solitary sandpiper	*Tringa solitaria*	--	--	--	NTM
Spotted sandpiper	*Actitis macularia*	--	--	--	NTM
Common snipe	*Gallinago gallinago*	--	--	--	NTM
American woodcock	*Scolopax minor*	--	--	--	--
Herring gull	*Larus argentatus*	--	--	--	--
Mourning dove	*Zenaida macroura*	--	--	--	NTM
Black-billed cuckoo	*Coccyzus erythropthalmus*	--	--	--	NTM
Yellow-billed cuckoo	*Coccyzus americanus*	--	--	--	NTM
Barred owl	*Strix varia*	--	--	--	--
Whip-poor-will	*Caprimulgus vociferus*	--			NTM
Chimney swift	*Chaetura pelagica*	--	--	--	NTM

Table B-4 (Cont.)

Common Name	Scientific Name	Federal Status	State Status	State Rank	Neo-tropical Migrant
Ruby-throated hummingbird	*Archilochus colubris*	--	--	--	NTM
Belted kingfisher	*Ceryle alcyon*	--	--	--	NTM
Yellow-bellied sapsucker	*Sphyrapicus varius*	--	--	--	NTM
Downy woodpecker	*Picoides pubescens*	--	--	--	--
Hairy woodpecker	*Picoides villosus*	--	--	--	--
Northern flicker	*Colaptes auratus*	--	--	--	NTM
Pileated woodpecker	*Dryocopus pileatus*	--	--	--	--
Eastern wood pewee	*Contopus virens*	--	--	--	NTM
Yellow-bellied flycatcher	*Empidonax flaviventris*	--	--	--	NTM
Alder flycatcher	*Empidonax alnorum*	--	--	--	NTM
Willow flycatcher	*Empidonax traillii*	--	--	--	NTM
Least flycatcher	*Empidonax minimus*	--	--	--	NTM
Eastern phoebe	*Sayornis phoebe*	--	--	--	NTM
Great-crested flycatcher	*Myiarchus crinitus*	--	--	--	NTM
Eastern kingbird	*Tyrannus tyrannus*	--	--	--	NTM
Tree swallow	*Tachycineta bicolor*	--	--	--	NTM
Northern rough-winged swallow	*Stelgidopteryx serripennis*	--	--	--	NTM
Bank swallow	*Riparia riparia*	--	SC	S3B	NTM
Cliff swallow	*Hirundo pyrrhonota*	--	LT	S3B	NTM
Barn swallow	*Hirundo rustica*	--	--	--	NTM
Blue jay	*Cyanocitta cristata*	--	--	--	--
American crow	*Corvus brachyrhynchos*	--	--	--	--
Common raven	*Corvus corax*	--	--	--	--
Black-capped chickadee	*Parus atricapillus*	--	--	--	--
Tufted titmouse	*Parus bicolor*	--	--	--	--
Red-breasted nuthatch	*Sitta canadensis*	--	--	--	--
White-breasted nuthatch	*Sitta carolinensis*	--	--	--	--
Brown creeper	*Certhia americana*	--	--	--	NTM
House wren	*Troglodytes aedon*	--	--	--	NTM
Winter wren	*Troglodytes troglodytes*	--	--	--	--
Golden-crowned kinglet	*Regulus satrapa*	--	--	--	--
Ruby-crowned kinglet	*Regulus calendula*	--	--	--	NTM
Eastern bluebird	*Sialia sialis*	--	--	--	NTM
Veery	*Catharus fuscescens*	--	--	--	NTM
Swainson's thrush	*Catharus ustulatus*	--	--	--	NTM
Hermit thrush	*Catharus guttatus*	--	--	--	NTM
Wood thrush	*Hylocichla mustelina*	--	--	--	NTM
American robin	*Turdus migratorius*	--	--	--	NTM
Gray catbird	*Dumetella carolinensis*	--	--	--	NTM
Northern mockingbird	*Mimus polyglottos*	--	--	--	NTM
American pipit	*Anthus rubescens*	--	SC	S2B	NTM

Table B-4 (Cont.)

Common Name	Scientific Name	Federal Status[1]	State Status[1]	State Rank[1]	Neo-tropical Migrant[2]
Cedar waxwing	*Bombycilla cedrorum*	--	--	--	NTM
Northern shrike	*Lanius excubitor*	--	--	--	--
European starling	*Sturnus vulgaris*	--	--	--	--
Solitary vireo	*Vireo solitarius*	--	--	--	NTM
Yellow-throated vireo	*Vireo flavifrons*	--	--	--	NTM
Warbling vireo	*Vireo gilvus*	--	--	--	NTM
Philadelphia vireo	*Vireo philadelphicus*	--	--	--	NTM
Red-eyed vireo	*Vireo olivaceus*	--	--	--	NTM
Blue-winged warbler	*Vermivora pinus*	--	--	--	NTM
Brewster's warbler (hybrid)		--	--	--	NTM
Tennessee warbler	*Vermivora peregrina*	--	--	--	NTM
Orange-crowned warbler	*Vermivora celata*	--	--	--	NTM
Nashville warbler	*Vermivora ruficapilla*	--	--	--	NTM
Northern parula	*Parula americana*	--	--	--	NTM
Yellow warbler	*Dendroica petechia*	--	--	--	NTM
Chestnut-sided warbler	*Dendroica pensylvanica*	--	--	--	NTM
Magnolia warbler	*Dendroica magnolia*	--	--	--	NTM
Cape May warbler	*Dendroica tigrina*	--	--	--	NTM
Black-throated blue warbler	*Dendroica caerulescens*	--	--	--	NTM
Yellow-rumped warbler	*Dendroica coronata*	--	--	--	NTM
Black-throated green warbler	*Dendroica virens*	--	--	--	NTM
Blackburnian warbler	*Dendroica fusca*	--	--	--	NTM
Pine warbler	*Dendroica pinus*	--	--	--	NTM
Prairie warbler	*Dendroica discolor*	--	--	--	NTM
Palm warbler	*Dendroica palmarum*	--	--	--	NTM
Bay-breasted warbler	*Dendroica castanea*	--	--	--	NTM
Blackpoll warbler	*Dendroica striata*	--	--	--	NTM
Black-and-white warbler	*Mniotilta varia*	--	--	--	NTM
American redstart	*Setophaga ruticilla*	--	--	--	NTM
Ovenbird	*Seiurus aurocapillus*	--	--	--	NTM
Northern waterthrush	*Seiurus noveboracensis*	--	--	--	NTM
Louisiana waterthrush	*Seiurus motacilla*	--	--	--	NTM
Common yellowthroat	*Geothylpis trichas*	--	--	--	NTM
Wilson’s warbler	*Wilsonia pusilla*	--	--	--	NTM
Canada warbler	*Wilsonia canadensis*	--	--	--	NTM
Scarlet tanager	*Piranga olivacea*	--	--	--	NTM
Northern cardinal	*Cardinalis cardinalis*	--	--	--	--
Rose-breasted grosbeak	*Pheucticus ludovicianus*	--	--	--	NTM
Indigo bunting	*Passerina cyanea*	--	--	--	NTM
Rufous-sided towhee	*Pipilo erythrophtalmus*	--	--	--	NTM
American tree sparrow	*Spizella arborea*	--	--	--	--
Chipping sparrow	*Spizella passerina*	--	--	--	NTM

Table B-4 (Cont.)

Common Name	Scientific Name	Federal Status	State Status	State Rank	Neo-tropical Migrant
Field sparrow	*Spizella pusilla*	--	--	--	--
Savannah sparrow	*Passerculus sandwichensis*	--	--	--	NTM
Song sparrow	*Melospiza melodia*	--	--	--	NTM
Lincoln's sparrow	*Melospiza lincolnii*	--	--	--	NTM
Swamp sparrow	*Melospiza georgiana*	--	--	--	NTM
White-throated sparrow	*Zonotrichia albicollis*	--	--	--	NTM
White-crowned sparrow	*Zonotrichia leucophrys*	--	--	--	NTM
Dark-eyed junco	*Junco hyemalis*	--	--	--	NTM
Bobolink	*Dolichonyx oryzivorus*	--	--	--	NTM
Red-winged blackbird	*Agelaius phoeniceus*	--	--	--	NTM
Eastern meadowlark	*Sturnella magna*	--	T	S3B	NTM
Rusty blackbird	*Euphagus carolinus*	--	SC	S3B	--
Common grackle	*Quiscalus quiscula*	--	--	--	--
Brown-headed cowbird	*Molothrus ater*	--	--	--	NTM
Northern oriole	*Icterus galbula*	--	--	--	NTM
Purple finch	*Carpodacus purpureus*	--	--	--	NTM
House finch	*Carpodacus mexicanus*	--	--	--	--
Common redpoll	*Carduelis flammea*	--	--	--	--
Pine siskin	*Carduelis pinus*	--	--	--	NTM
American goldfinch	*Carduelis tristis*	--	--	--	NTM
Evening grosbeak	*Coccothraustes vespertinus*	--	--	--	--
House sparrow	*Passer domesticus*	--	--	--	--

Adapted (2021) from: LaGory et al. (1997).

NTM = species is a neotropical migrant; -- = species is not a neotropical migrant.

Table B-5. Fish, Amphibian, Reptile, and Mammal Species Observed on New Boston Air Force Station, New Hampshire

Species	Scientific Name	Federal Status[1]	State Status	State Rank
Fishes				
American eel	*Anguilla rostrata*	--	SC	S3
Brook trout	*Salvelinus fontinalis*	--	--	--
Rainbow trout	*Oncorhynchus mykiss*	--	--	--
Chain pickerel	*Esox niger*	--	--	--
Golden shiner	*Notemigonus crysoleucas*	--	--	--
Brown bullhead	*Ameiurus nebulosus*	--	--	--
Largemouth bass	*Micropterus salmoides*	--	--	--
Banded sunfish	*Enneacanthus obesus*	--	SC	S3
Bluegill	*Lepomis macrochirus*	--	--	
Creek chubsucker	*Erimyzon oblongus*	--	--	
Margined madtom	*Noturus insignis*	--	--	
Pumpkinseed	*Lepomis gibbosus*	--	--	--
Yellow perch	*Perca flavescens*	--	--	--
White sucker	*Catostomus commersoni*	--	--	
Amphibians[2]				
Spotted salamander	*Ambystoma maculatum*	--	--	--
Red-spotted newt	*Notophthalmus viridescens*	--	--	--
Red-backed salamander	*Plethodon cinereus*	--	--	--
Two-lined salamander	*Eurycea bislineata*	--	--	--
American toad	*Bufo americanus*	--	--	--
Spring peeper	*Hyla crucifera*	--	--	--
Gray treefrog	*Hyla versicolor*	--	--	--
Wood frog	*Rana sylvatica*	--	--	--
Pickerel frog	*Rana palustris*	--	--	--
Bullfrog	*Rana catesbiana*	--	--	--
Green frog	*Rana clamitans*	--	--	--
Reptiles				
Snapping turtle	*Chelydra serpentina*	--	--	--
Musk turtle	*Sternotherus odoratus*	--	--	--
Spotted turtle	*Clemmys guttata*	--	LT	S2
Wood turtle	*Glyptemys insculpta*	--	SC	S3
Painted turtle	*Chrysemys picta*	--	--	--
Blanding's turtle	*Emydoidea blandingii*	--	LE	S1
Northern water snake	*Nerodia sipedon*	--	--	--
Redbelly snake	*Storeria occipitomaculata*	--	--	--
Eastern hognose snake	*Heterodon platirhinos*	--	LE	S1
Garter snake	*Thamnophis sirtalis*	--	--	--
Ribbon snake	*Thamnophis sauritus*	--	--	-
Smooth green snake	*Opheodrys vernalis*	--	SC	

Mammals

Common Name	Scientific Name	Federal Status	State Status	State Rank	Neo-tropical Migrant
Short-tailed shrew	*Blarina brevicauda*		--	--	--
Little brown bat	*Myotis lucifugus*		--	--	S1
Big brown bat	*Eptesicus fuscus*		--	--	--
Northern long-eared bat	*Myotis septentrionalis*		--	SC	S1
Hoary bat	*Lasiurus cinereus*		--	SC	S3B
Red bat	*Lasiurus borealis*		--	SC	S3?B
Tricolored bat	*Pipistrellus subflavus*		--	SC	S1
Silver-haired bat	*Lasionycteris noctivagans*		--	SC	S3B
Eastern small-footed bat	*Myotis leibii*		--	LE	S1
Snowshoe hare	*Lepus americanus*		--	--	--
Eastern chipmunk	*Tamias striatus*		--	--	--
Woodchuck	*Marmota monax*		--	--	--
Red squirrel	*Tamiasciurus hudsonicus*		--	--	--
Beaver	*Castor canadensis*		--	--	--
White-footed mouse	*Peromyscus leucopus*		--	--	--
Muskrat	*Ondatra zibethicus*		--	--	--
Red-backed vole	*Clethrionomys gapperi*		--	--	--
Meadow vole	*Microtis pennsylvanicus*		--	--	--
Porcupine	*Erethizon dorsatum*		--	--	--
Coyote	*Canis latrans*		--	--	--
Red fox	*Vulpes vulpes*		--	--	--
Black bear	*Ursus americanus*		--	--	--
Raccoon	*Procyon lotor*		--	--	--
Fisher	*Martes pennanti*		--	--	--
Long-tailed weasel	*Mustela frenata*		--	--	--
Mink	*Mustela vison*		--	--	--
Striped skunk	*Mephitis mephitis*		--	--	--
River otter	*Lutra canadensis*		--	--	--
Bobcat	*Felis rufus*		--	--	--
White-tailed deer	*Odocoileus virginianus*		--	--	--
Moose	*Alces alces*		--	--	--

Source: PES (1995); LaGory et al. (1997, 2002). Table adapted in 2021 with species code update and additional species

APPENDIX B2. NBAFSI 32-7064, Natural Resouces Instruction

NBAFSOI 32-7064 (2016)fix para6.7.2.p

15.0 ASSOCIATED PLANS

Tab 1 – Wildland Fire Management Plan

New Boston
Air Force Station

WILDLAND FIRE MANAGEMENT PLAN

Tab 2 – Bird/Wildlife Aircraft Strike Hazard (BASH) Plan

N/A to NBAFS

Tab 3 – Golf Environmental Management (GEM) Plan

N/A to NBAFS

Tab 4 – Integrated Cultural Resources Management Plan (ICRMP)

U. S. AIR FORCE

INTEGRATED CULTURAL RESOURCES MANAGEMENT PLAN

New Boston Air Force Station

30-Sep-20

Template Version JUNE 2020

Tab 5 – Integrated Pest Management Plan (IPMP)

INTEGRATED PEST MANAGEMENT PLAN FOR NEW BOSTON AFS, NH

Prepared by Stephen Najjar, Natural Resources Planner

JULY 12, 2018

U.S. AIR FORCE
23 SOPS/CEI

Tab 6 – Hemlock Woolly Adelgid Plan (HWA)

NEW BOSTON AIR FORCE STATION
HEMLOCK WOOLLY ADELGID
MANAGEMENT PLAN

10/22/2014

Tab 7 – Blanding's Turtle Management Plan

New Boston Air Force Station NH Blanding's Turtle Management Plan

March 8, 2012

Introduction

Blanding's turtles are a state listed endangered turtle found on New Boston Air Force Station (NBAFS). The Blanding's habitat use, nesting areas and seasonal movement have been document by use of telemetry beginning in 2004 (figure 1). Approximately 30 adult Blanding's have been documented; with many individuals followed through multiple seasons. There is concern that Blanding's turtle populations in New Hampshire may exist in very low densities and that the species is declining due to a variety of factors including habitat loss and fragmentation, and increased road building and consequent increases in road kill (Innis et al., 2008). Congdon et al., (2000) published data that have implicated predation by raccoons, fox, coyotes, opossums and skunks as a major causal factor in nesting failure.

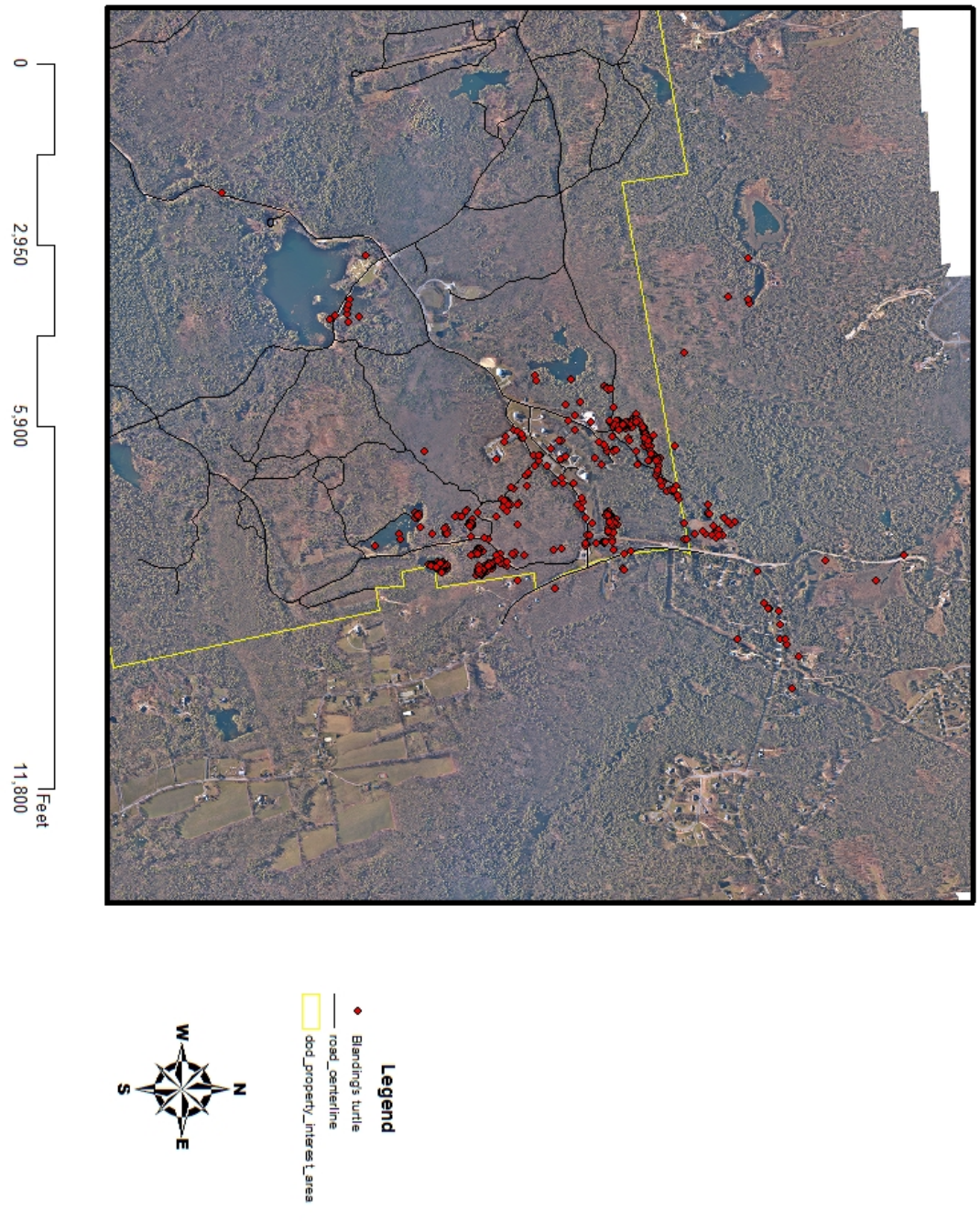
Threats specific to NBAFS

Predation

Predation appears to be the main impediment to successful reproduction at NBAFS; incidental observations point to skunks being a major cause of turtle nest destruction near known Blanding's turtle nesting sites.

Road-kill

Mortality caused by road-kill has been well documented at NBAFS. Two adults have been found road killed on Bedford/Chestnut Hill Road adjacent to the installation, one juvenile on Bedford Road west of Klondike Corner, and several hatchlings were documented road-killed on base since 2004.


Blanding's Locations 2004-2011
0
2,950
5,900
11,800
Feet
Legend
Blanding's turtle
road_centerline
dod_property_interest_area
N
E
S
W

Natural Resources Activities

Several of the natural resources management activities have some potential to result in Blanding's mortality including logging and prescribed fire. In the *Massachusetts Forestry Conservation Management Practices for Blanding's Turtles* (draft) publication maintaining forested habitat in association with vernal pools and wetlands is considered essential for the conservation of Blanding's Turtles. The impacts of timber harvesting are recognized as having significantly fewer lasting effects as compared to other permanent changes in land use, such as residential and commercial development. The publication indicates, "Certain precautions should be taken during timber harvesting in order to maintain the long-term viability of Blanding's Turtle populations within forested areas. The greatest concern during forestry operations are turtles being run over and crushed by motorized logging equipment. This could occur when turtles are moving between wetland types, nesting, estivating, or hatchlings are emerging and moving to wetlands. Direct mortality could also occur when wetlands are being harvested. Habitat modification surrounding vernal pools is also a concern."
Currently NBAFS does not harvest in wetlands and typically and typically avoids wetland impacts when developing timber harvests. Harvesting near vernal pools and other wetlands has been limited through the use of buffers of limited percentage of basal area harvested. Logging is not seasonally restricted at NBAFS and turtles could be unintentionally run over by harvesting equipment or log trucks. The area of highest use by Blanding's at NBAFS has not been harvested since at least 1960; the area was clear-cut around 1959 for a line of sight.

The use of prescribed fire could result in unintentional take of Blanding's. The burn units closest to the areas of highest Blanding's activity were burned in November, which is outside the peak period of terrestrial movement. Other burn units near the Green Tree and Maddening Ponds area closest to know Blanding's habitat are typically burned in early spring; the units have no document use by Blanding's but the possibility exists of unintentionally burning a turtle.

Grounds maintenance activities

NBAFS Roads and Grounds maintain mowed lawns in improved areas on base. The restricted area has a documented nesting site north of Building 100. During terrestrial nesting movement in early June adult Blanding's are subject to lawn-mowing equipment. After emergence in September and October

hatchlings are subject to lawn-mowing equipment. Other potential road maintenance that could impact Blanding's include road grading in nesting areas and removal of beaver debris from culverts or disturbing beaver dams during hibernation.

Management goals

- ***Reduce nest predation***
- ***Eliminate further road-kill of adults and hatchlings***
- ***Reduce risk of harm from Natural Resources activities***
- ***Reduce risk of harm from grounds maintenance activities***
- ***Continue documentation of Blanding's through tagging and telemetry***

Implementation

Goal: Reduce nest predation

Reduction of nest predation will be accomplished through predator removal and nest screening. Skunks, raccoons, fox, opossum and coyotes will be removed from known nesting areas in the Northeast portion of NBAFS through shooting and trapping. An annual depredation permit from NH Fish and Game will be required to implement predator reduction activities. Possibly enlist help from USDA Wildlife Services for predator removal activities.

Goal: Reduce further road-kill

Road-kill of adults has been documented on state and town roads adjacent to NBAFS. NBAFS will advocate through NH Fish and Game for placement of signs during peak movement times in areas which Blanding's are present. Additionally NBAFS is beginning to implement the recommendations in *Options to Reduce Road Mortality of Blanding's Turtles at New Boston Air Force Station, New Hampshire*. Where possible vertical curbing has been eliminated as pavement modification projects take place and new curbing is being limited to Cape Cod style curbing.

New projects proposed at NBAFS which would increase traffic or create new roads should be analyzed carefully for impacts to Blanding's. No additional traffic should be routed through the area between Building 103 and Green Tree Reservoir because of high Blanding's use.

Goal: Reduce risk of harm from Natural Resources activities

Timber harvesting on NBAFS occurs sporadically usually on 2-3 year intervals. Stand entrance is typically no more frequent that 10-15 years and silvicultural practices typically include thinning in even

aged stands, single tree selection in mixed forest and small clear-cuts. Timber harvest design in recent years has included recognizing significant vernal pools and protecting them by providing a no harvest buffer around them or by removing a limited amount of the basal area. Skid trails are developed to avoid wetland crossing thereby negating the possibility of crushing hibernating turtles. No timber harvest is planned in the core Blanding's area in the Northeast portion of the installation due to the poor timber quality.

Prescribed burns implemented by NBAFS do have limited potential to take Blanding's turtles. Burns typically are conducted outside the core habitat in the Northeast portion of the base. If the units in the northeast portion of the installation are burned again they will be conducted in early spring (April) or late fall (November) to reduce the possibility of burning Blanding's. Additionally the burn crew will be briefed to look out for turtles in the burn area.

Goal: Reduce risk of harm from grounds maintenance activities

Some of the risk to Blanding's from grounds maintenance activities can be controlled by scheduling road maintenance activities outside the nesting season. Road grading in know nesting areas should be limited to avoid June-Oct when eggs in the nest are present. Removal of beaver debris must be limited to ice off conditions when turtles are normally active (April-October).

Lawn mowing in known Blanding's nesting areas and travel routes should be minimized during the nesting season (June 1-20) to prevent adult being hit by a mower. Alternately, Natural Resources staff can periodically check the area for presence of Blanding's.

Goal: Continue documentation of Blanding's through tagging and telemetry

The continuation of long term monitoring of Blanding's at NBAFS should provide information of the relative success of management activities. Monitoring from 2004-2010 has documented a relative scarcity of juvenile age Blanding's on the installation and problems with nesting success. Through the use of PIT tags and telemetry on subset of the population we should be able to establish increases in reproduction and continue to identify threats.

References

Congdon J.J., Nagel, R.D., Kinney, O.M., Oentoski, M., Avery, H.W., Van Loben Sels, R.C., and Tinkle, D.W., 2000, Nesting Ecology and Embryo Mortality: Implications for Hatchling Success and Demography of Blanding's Turtles (Emydoidea blandingii), Chelonian Conservation and Biology, 3(4): 569-579

Innis, R.J., Babbit, K.L., and Kanter, J.J., 2008, Home Range and Movement of Blanding's Turtles (*Emydoidea blandingii*) in New Hampshire, Northeastern Naturalist, 15(3):431-444

Natural Heritage and Endangered Species Program. 2007. *Massachusetts Forestry Conservation Management Practices for Blanding's Turtles. Draft (August 2007).* Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts, USA.

Walston, J.L. & LaGory K. E., 2010, *Options to Reduce Blanding's Turtle Mortality at New Boston Air Force Station New Hampshire,* Environmental Science Division, Argonne National Laboratory, Argonne IL

Tab 8 – Hognose Snake Management Plan

New Boston Air Force Station NH Eastern Hognose Snake Management Plan

July 3, 2013

Introduction

Eastern hognose snakes were identified on NBAFS during the late 1990s by Natural Resources staff. A multi-year telemetry study was implemented starting in 2004 through 2007. A report was developed by Argonne National Labs detailing hognose movements during 2006 and 2007 (LaGory et al. 2008). During the period from 2004-2008 hognose utilized much of NBAFS, both mortality and reproduction was also documented.

Threats specific to NBAFS

Recreation

Eastern Hognose are subject to being road-killed and killed by people with snake phobias.

Military Training

Military training activities may result in road-kills.

Natural Resources Activities

Prescribed burning and timber harvesting activities could result in hognose mortality. Long-term benefits from habitat management probably outweigh the short-term risk associated with these activities.

Management goals

- ***Protect overall habitat***
- ***Document and mark individuals***

Implementation

Goal: Protect overall habitat

Limit recreational development in areas with higher hognose usage as document in LaGory et al. 2008. Educate recreational users about snakes and limit unnecessary road use by recreational visitors through the placement of new gates on roads.

Goal: Document and mark individuals

Natural Resource personnel will document all hognose incidentally encountered at NBAFS. Adult and sub-adult hognose will be implanted with PIT tags if possible. Locations will be collected for inclusion in the installation GIS.

References

LaGory, K.E., L.J. Walston, C. Goulet, C. Andrews, R.A. Van Lonkhuyzen, and M. Nesta. 2008. *Movement and Habitat use of Eastern Hognose Snakes at New Boston Air Force Station, New Hampshire, New Hampshire*. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., Jan.

Tab 9 – Small-footed Bat Management Plan

New Boston Air Force Station NH Small-footed Bat Management Plan

July 3, 2013

Introduction

Eastern Small-footed bat are a state listed endangered bat found on New Boston Air Force Station (NBAFS). The bats were first identified in a 2002 installation wide bat survey (LaGory et al. 2002). Subsequently bats were captured and followed in a radio telemetry study ending in 2007 (LaGory et al. 2008). During the study Joe English Hill was identified as the primary roost site on NBAFS. A post white-nose study in 2013 resulted in several bats being captures and two fitted with transmitters (one male and one female). The female roost site was identified in the Joe English Hill cliff face by Natural Resources personnel.

Threats specific to NBAFS

Recreation

Joe English Hill was a popular rock climbing site for southern New Hampshire. NBAFS prior to 2001 allowed organized groups to climb the face with USAF permission. Additionally some level of illegal climbing occurred and potentially continues. Currently all recreational rock climbing on Joe English has been prohibited by a Commander's policy letter.

Military Training

Joe English Hill has been used by military units to practice assault climbing and repelling. Training activity has been minimal due to UXO remediation activities. Eventually military training activities on the cliff may increase leading to possible disturbance of the bats.

Natural Resources Activities

Prescribed burning on Joe English Hill has occurred to the north of the cliff faces used by the Eastern Small-footed bat. A prescribed burn was planned for the area surrounding the cliff face to maintain oak and other fire dependent species. After informal consultation with NH Fish and Game the burn was deferred due to concerns about direct and indirect impacts to the bat.

Management goals

- ***Protect roost site***
- ***Periodically study population***

Implementation

Goal: Protect roost site

Limit recreational access to Joe English Hill for rock climbing; continue to allow low levels of military climbing. Consult with NH Fish and Game to develop additional protection measures.

Limit prescribed burns to areas away from roost sites and avoid indirect impacts from smoke.

Goal: Periodically study population

Sponsor surveys and academic studies on Eastern Small-footed bats at NBAFS. Conduct survey on 10 year or less interval to document presence of bats and document any changes in health status (presence of scarring related to white nose, etc).

References

LaGory, K.E., L.J. Walston, D.S. Reynolds, and C. Andrews. 2008. *Radiotelemtry Study of Eastern Small-Footed Bats and a Hoary Bat at New Boston Air Force Station, New Hampshire, New Hampshire*. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., Sep.

LaGory, K.E., D.S. Reynolds, and J.A. Kuiper. 2002. *A Survey of the Bats of New Boston Air Force Station, New Hampshire*. Argonne National Laboratory, Environmental Assessment Division, Argonne, Ill., Dec.

Tab 10 – Invasive Species Control Plan

Invasive Plant Species Control Plan
New Boston Air Force Station, New Hampshire

Prepared for:
Air Force Space Command (HQ AFSPC/CEVP)
150 Vandenberg Street
Peterson Air Force Base, Colorado 80914

Prepared under contract:
FA8903-04-D-8695

Prepared by:
North Wind, Inc.
P.O. Box 51174
Idaho Falls, Idaho 83405

NWI-ID-2005-036

May 2005