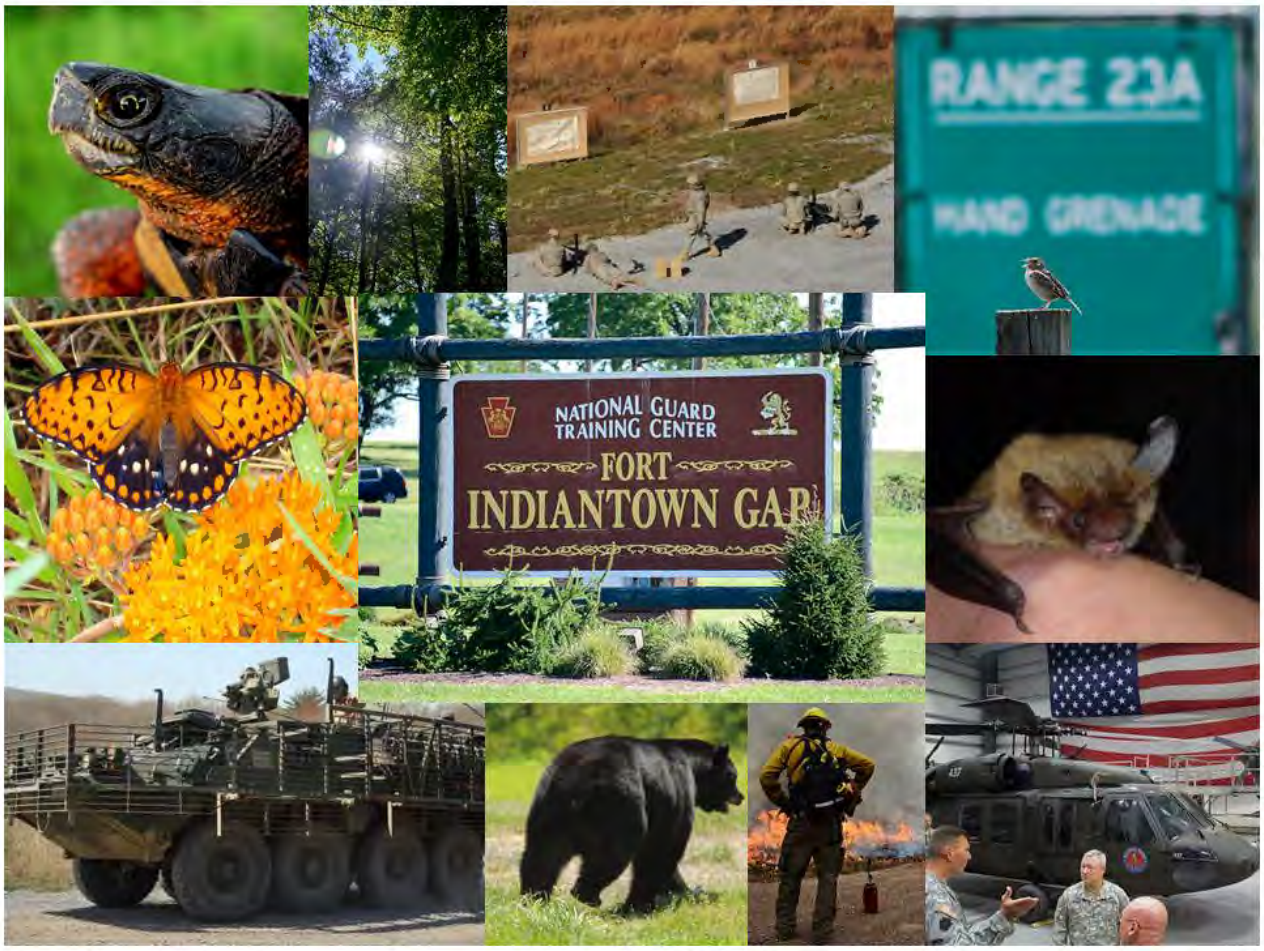
Fort Indiantown Gap National Guard Training Center
Lebanon and Dauphin Counties, Pennsylvania

Integrated Natural Resources Management Plan
2022-2027



Prepared by Pennsylvania Dept. of Military and Veterans Affairs, Environmental Section

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Acknowledgements

This plan was prepared by Pennsylvania Department of Military and Veterans Affairs under the direction of John Fronko (Environmental Program Manager) and Shannon Henry (Conservation Division Chief). Major authors include Nick Hoffman (Ecological Program Specialist), Mark Swartz (Invertebrate Wildlife Program Manager), Joe Hovis (Vertebrate Wildlife Program Manager), JD Lambrinos (Forest Program Manager). Additional authors contributing to content and editing include wildlife biologists Jarrod Derr, Chris Hauer, Virginia Tilden, and Ericka McKinney.

Significant editing and formatting effort provided by Emily Shertzer (Ecological Programs Specialist) made the document cohesive.

Other contributors include Daryl Valley (maps), Dave Walton (ITAM work plan), Tom Marrs (wetland section) and Karen Sattazahn (Status Tool for the Environment Program (STEP) inclusions). David Weisnicht reviewed for the Garrison Command and LTC Andrew O'Connor reviewed for Training Lands Management. Daryl Valley and Emily Shertzer provided NEPA input as needed.

Comments were provided by Eric Beckley (NGB), Pamela Shellenberger and Anthony Tur (USFWS), Alexander Dogonniuck and Richard Shockey (PADCNR), Matthew Caccese (PGC), and Kathy Gipe (PFBC).

Executive Summary

Preparation and implementation of this Integrated Natural Resources Management Plan (INRMP) are required by the Sikes Act and its amendments, as well as several other Federal directives and regulations. The purpose of this plan is to guide natural resource management at Fort Indiantown Gap National Guard Training Center (FIG) from 2022 with annual internal reviews to 2027, at which point a 5-year external review and update will be completed.

The Pennsylvania Army National Guard (PAARNG) anticipates continued use of FIG in perpetuity; therefore, PAARNG must manage FIG to preserve and enhance its carrying capacity. FIG provides centralized training, while reducing the need for travel to distant out-of-state training areas or increased use of localized training sites with their own natural resource concerns. This results in a significant increase in productive training and reduced transportation costs. According to the Range Facilities Management Scheduling System (RFMSS), FIG is the most heavily used National Guard Training Center in the country, despite being one of the smallest in acreage among the thirteen Tier I and II Training Centers the National Guard currently has in its inventory. For comparison, FIG is 11% the land area of Ft. Bragg, but RFMSS shows that FIG conducts approximately 40% of the training as the larger Ft. Bragg. As such, FIG's ranges and training areas are used extensively and require significant investment of resources to sustain and maintain.

This INRMP supports the military mission at FIG by providing for no net loss in the capability of FIG lands to support the military mission and ensure the preparedness of the Armed Forces (Sikes Act 16 USC Section 670a (b)(1)(I)). Combined with other range plans and programs, this INRMP ensures sound land management and compliance with all relevant regulations.

The focus of this plan is on the implementation of goals, objectives, and management guidelines for training area management and ecosystem management at FIG. The management plan is based on ecosystem management with the intention of demonstrating the interrelationships between the military mission and natural resource management.

The purpose of this INRMP is:

- To describe the training site and its physical natural resources.
- To describe the military mission and to determine the potential effects of the mission on natural resources at FIG.
- To provide references, to show the environmental compliance status of the installation and of this plan, and to define responsibilities for the management of natural resources.
- To show the status of baseline inventories of natural resources and monitoring needs for environmental compliance.
- To recommend revegetation and erosion control techniques that will maximize stable soils while ensuring high-quality water resources and training.
- To present methods that will increase the environmental awareness to the PAARNG personnel and the public.

- To provide management guidelines that will be effective in maintaining and improving the sustainability and biological diversity of terrestrial and wetland ecosystems on the training site as well as supporting human needs.
- To provide conservation efforts for species of concern and listed species (both federal and state) to ensure long-term persistence and an overall benefit to the species.
- To provide necessary means for implementation of the plan as well as being user-friendly and translatable to the training site manager.

Benefits to the military mission include long-term sustainability, decreases in encroachment, and increased realism to training scenarios at FIG. This plan will enhance mission realism through more options for training as well as more intensive planning of missions. It will also enhance long-range planning efforts at FIG. Benefits to the environment include reduced soil erosion and vegetation loss, improved water-quality, enhanced populations of at-risk species and other native wildlife and plants, and increased overall knowledge of the operation of the ecosystems on FIG through surveys and monitoring.

Coarse Summary of Changes since the 2016-2021 INRMP

- The recognition of one candidate species (Monarch Butterfly) as well as upcoming USFWS review for several additional species occurring at FIG to determine if they should be listed as either threatened or endangered, pursuant to the Endangered Species Act.
- Detailed discussion of species, their supporting habitats, and potential impacts to the military mission.
- Revised and additional maps to include installation setting, topography, partnerships/opportunities, water resources, and environmentally sensitive areas that could pose constraints on, or restrictions to, training.
- Updated discussion concerning the Army Compatible Use Buffer and partnership.
- Additional information regarding training area management, to include the aerial application of herbicide.
- Consolidation of wetlands and deep-water habitats and their management, as well as clarification on maintaining buffer areas and distances to be consistent with FIG Regulation 350-2.
- The inclusion of an ITAM worklist as Appendix I
- Relocation of maps (now full-page size) from the body of the document to Appendix J

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
FORT INDIANTOWN GAP NATIONAL GUARD TRAINING CENTER
LEBANON AND DAUPHIN COUNTIES, PENNSYLVANIA
2021

This Integrated Natural Resources Management Plan (INRMP) is an updated version of the original 2004 INRMP for Fort Indiantown Gap National Guard Training Center (FIG.) The following document is the result of a review for operation and effect of the previous INRMP and a recommendation by the cooperating agencies to conduct an update and continue implementation. It sets appropriate and adequate guidelines for conserving and protecting the natural resources here on FIG while facilitating and supporting the military mission. This INRMP meets the requirements as set forth by Public Law 105-85, The Sikes Act Improvement Act of 1997 (USC §670 *et seq.;*

SIGNATURES:

Date: 12/9/2021

JOHN FRONKO
Director,
Bureau of Environmental Management

Date: 12/20/2021

LANE MARSHALL
Colonel, PAARNG
Garrison Commander

Date: 6JAN22

MARK J. SCHINDLER
Major General, PAARNG
The Adjutant General

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SIGNATURE:

Sonja Jahrsdoerfer

Date: December 1, 2021

SONJA JAHRSDOERFER
Project Leader
U.S. Fish and Wildlife Service
Pennsylvania Field Office

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
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SIGNATURE:

Date: 11/22/21

CHRISTOPHER URBAN
Chief, Natural Diversity Section
Nongame, Threatened and Endangered Species Coordinator
PA Fish & Boat Commission

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
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SIGNATURE:

Bryan Burhans

Date: 12-2-21

BRYAN BURHANS
Executive Director
PA Game Commission

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
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SIGNATURE:

Greg Podniesinski

Date: 12/1/2021

GREGORY PODNIESINSKI
Section Chief, Natural Heritage Section
PA Department of Conservation and Natural Resources

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
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SIGNATURE:

HAMMETT.ANTHONY.SCOTT.1116575562 Digitally signed by HAMMETT.ANTHONY.SCOTT.1116575562 Date: 2021.11.26 15:32:49 -05'00'

Date: 28 November 2021

Anthony Hammett
Colonel, U.S. Army
Chief, G-9 Army National Guard

Table of Contents

1. Overview

1.a. Purpose

The purpose of the Integrated Natural Resources Management Plan (INRMP) is to provide a plan which integrates installation Natural Resources management with the state and federal military missions as well as a cooperative plan with United States Fish and Wildlife Services (USFWS) and the state under the Sikes Act. The Sikes Act requires that each INRMP provide for:

- No net loss in the capability of military installation lands to support the military mission of the installation.
- Fish and wildlife management, land management, forest management, and fish and wildlife-oriented recreation.
- Fish and wildlife habitat enchancement or modifications.
- Wetland protection, enhancement, and restoration, where necessary for support of fish, wildlife, or plants.
- Integration of, and consistency among, the various activities conducted under the plan.
- Establishment of specific natural resource management goals and objectives and time frames for proposed action.
- Sustained use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources.
- Public access to the military installation that is necessary or appropriate subject to requirements necessary to ensure safety and military security.
- Enforcement of applicable natural resource laws (including regulations).
- Such other activities as the Secretary of the military department determines appropriate (USFWS 2015).

This plan constitutes the major strategic plan for the Conservation Division, Bureau of Environmental Management (BEM) of the Pennsylvania Department of Military and Veterans Affairs (PADMVA) and its partner stakeholders for Fort Indiantown Gap National Guard Training Center (here in referred to as FIG). All actions contemplated in this INRMP are subject to the availability of funds properly authorized and appropriated under federal law. Nothing in this INRMP is intended to be nor shall be construed to be a violation of the Anti-Deficienty Act, 31 USC § 1341.

1.b. Scope

This INRMP covers FIG's lands, leases, and ranges as identified by the federal lease and state property boundaries of the installation. Under DoD, Department of Army (DA), and National Guard Bureau (NGB) policy, an INRMP for statewide facilities and properties is not currently necessary but management strategies mentioned here apply to all PADMVA holdings.

1.c. Goals and Objectives

Goals are listed by target under the numbers below. Objectives are included in Appendix B and may be broken further into sub-objectives. These goals and objectives are meant to be leads for projects listed in Appendix B and included in the Status Tool for the Environment Program (STEP) each year. Objectives must be measurable in accordance with DoD policy. In the case that they are not, sub-objectives will quantify the objective's target.

The overall INRMP goal is to provide a conservation program that sustains military operations and ecosystem health and integrity per guidance by NGB.

1. Training
   Goal: Provide the most durable, safe, and realistic natural training environment possible for the PAARNG and other FIG users.

2. Conservation Division
   Goal: Staff and manage a trained and professional team of natural resources experts to provide for the best interests of the military training environment and the conservation environment and to balance between the two for maximum sustainability. The Conservation Division has two sections – Wildlife and Forestry.

3. Flora and Fauna
   Goal: Monitor, inventory, and manage for the highest possible level of native biodiversity on all taxonomic levels through large-scale ecosystem management with focus on species of concern.

4. Rare Species
   Goal: Provide for the longevity of species identified at any level (regional, state, or federal) as being at risk or under high responsibility including rare, threatened, and endangered animals and plants through active management, conservation, and propagation.

5. Bird Management (Including Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (BGEPA), and Bird/Animal Airstrike Hazard (BASH))
   Goal 5.1: Monitor, inventory, and manage for the highest possible level of native biodiversity on all taxonomic levels through large-scale ecosystem management with focus on species of concern.

   Goal 5.2: MBTA - Follow established policies, regulation, and guidance set forth by USFWS, DoD, and Army concerning migratory birds, and provide for migratory bird conservation during their breeding, wintering, and migration periods.

   Goal 5.3: BGEPA - Follow the regulations set forth by USFWS concerning eagles and provide a safe and beneficial breeding, wintering, and migratory environment.

Goal 5.4: BASH - Provide for the safety and coexistence of both native bird species and military aviation to the greatest extent possible while ensuring the safety of our soldiers, aviators, and support personnel and their equipment.

6. Pest Management
   Goal: Remove or reduce the impacts of pest species regarding cost and efficiency, including non-native species in nature and pests to humans in developed areas, from their host environments at a reasonable level.

7. Water Quality
   Goal: Remove or reduce through cost efficient means, human-induced impacts to surface and groundwater on the installation and immediate surrounding areas including but not limited to streams, wetlands, drinking water wells, and open water bodies.

8. Outdoor Recreation
   Goal: Provide an effective, safe, and enjoyable environment for recreation in natural and urbanized settings on the installation while improving safety, habitat quality, and operational effectiveness.

9. Public Relations
   Goal: Maintain and improve operational effectiveness through a public relations program that provides information on the Conservation Division's programs, military impacts, and installation resources while attracting volunteers, partners, and advocates.

10. Urban and Developed Areas Management
    Goal: Reduce conflict in the human-wildlife interface while providing for interconnectivity between plant and animal populations fragmented by improvements.

11. Forestry
    Goal: Maintain a resilient and diverse forest to support the military training mission and natural diversity.

12. Fire Management
    Goal: Provide for public, firefighter, and soldier safety while maximizing military training opportunities.

1.d. Responsibilities

1.d.1. Installation Stakeholders

The major installation stake holders are the Conservation Division; the Integrated Training Area Management (ITAM) Office; the Directorate of Plans, Operations, Training, and Security (DPOTS); and state and federal engineers. Minor installation stakeholders include the BEM Compliance Division, BEM Planning Division, the Sustainment Office, Division of Installation

Maintenance (DIM), and Range Maintenance. While less involved, all installation bureaus, offices, personnel, and landholdings are governed by this document.

The Conservation Division, Compliance Division, and Planning Division (all in BEM) fall under the Office of Facilities and Engineering (commonly referred to as the "state side" of the installation). The structure of BEM is shown in Figure 1.d.1.

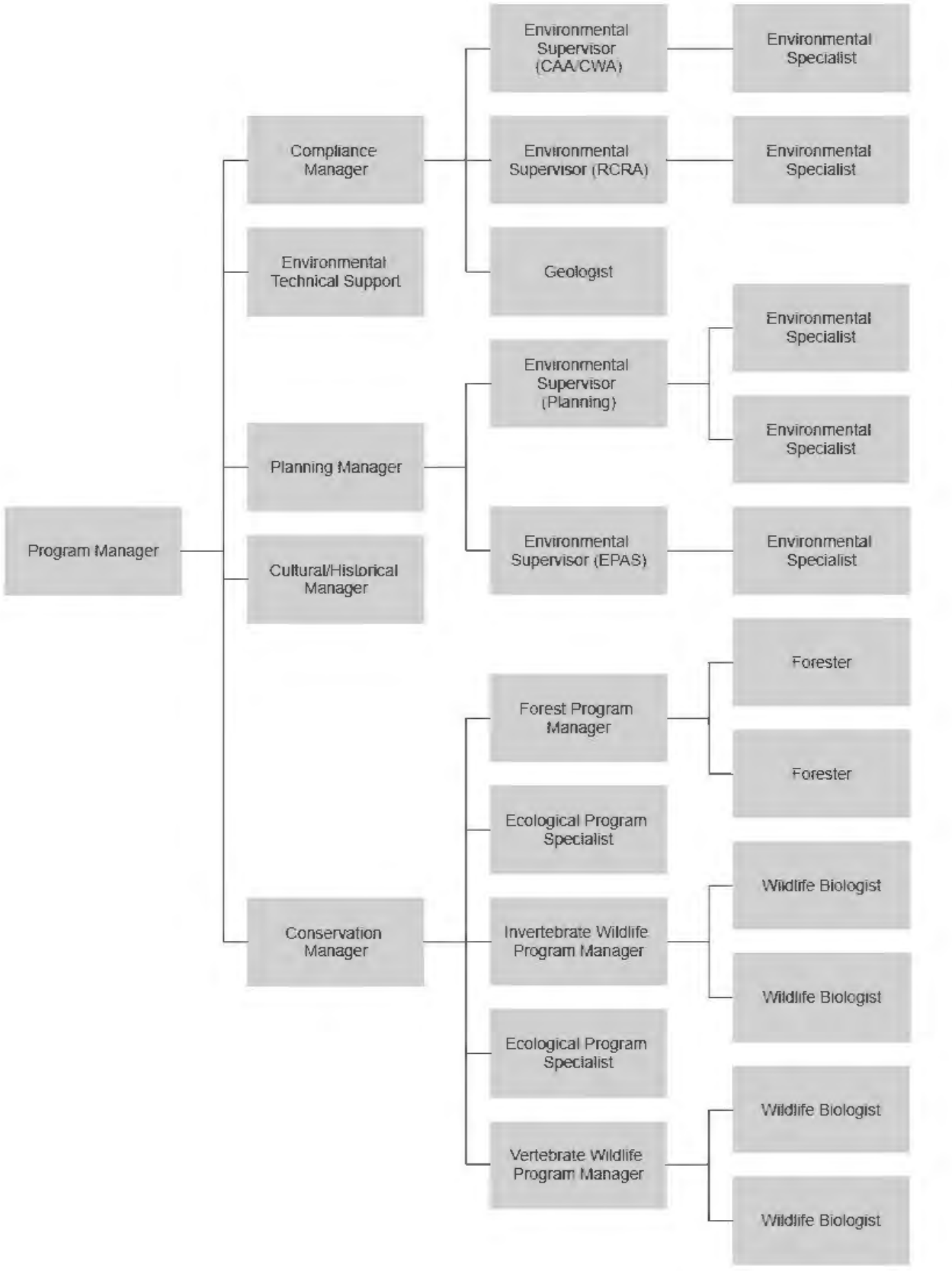

Figure 1.d.1. Personnel Structure of BEM, PADMVA

The DPOTS includes the ITAM Office, Range Control, Range Planning, and Range Maintenance. This group manages training on the installation, including scheduling and conduct of unit training as well as maintenance, design, and construction of range and training area facilities. This branch is commonly referred to as the "federal side" of the installation.

Another major stakeholder is NGB, the higher headquarters for the PAARNG. Two Directorates are involved in the management of natural resources: the ARNG Installations & Environment Directorate (ARNG G-9), and the Operations, Training, and Readiness Directorate (ARNG-TRS). The ARNG G-9 ensures environmental compliance, facilities management, issues policy, tracks and provides funding, provides technical assistance, quality assurance and execution of funds. ARNG-TRS provides policy and resources to create, sustain, and operate training facilities that support the Army National Guard.

1.d.2. External Stakeholders

The external stakeholders for the purposes of this document include regulatory bodies that have jurisdiction over the INRMP's contents. While partners and contracted organizations have a role within the document and projects, they do not constitute an external stakeholder for DoD purposes.

The external stakeholder at the federal level is USFWS. State level stakeholders include the PADCNR, PGC, and PFBC.

USFWS, PGC, PFBC, and PADCNR have jurisdiction over flora and fauna matters with regards to endangered/threatened/migratory species and game species. The Army Corps of Engineers (ACoE), PADEP, and the County Conservation Districts have jurisdiction over surface waters and wetlands including any impacts or permits. The US Department of Agriculture (USDA) and Pennsylvania Department of Agriculture (PADA) control pesticides and some aspects of land management. The US Forest Service (USFS), PADCNR, and PADEP have some regulatory authority over wildland fire including prescribed fire.

Other minor stakeholders include the USDA, USFS, ACoE, PADEP, and PADA. County level stakeholders include the Dauphin (DCCD) and Lebanon County Conservation Districts (LCCD). Non-governmental stakeholders include the Western Pennsylvania Conservancy (WPC) as part of the PA Natural Heritage Program (PNHP.) Other township and county level government offices also have influence. The local offices have some control over wildland fire (i.e. county burn bans) and zoning. As state lands and federal and state controllers, these minor stakeholders hold less jurisdiction over planning and development than they do on other properties in their boundaries. The townships represented on installation property include Cold Springs Township, Lebanon County; East Hanover Township, Dauphin County; East Hanover Township, Lebanon County; Middle Paxton Township, Dauphin County; Union Township, Lebanon County; and West Hanover Township, Dauphin County.

Tribes and Nations were consulted during the development of the INRMP and will be invited to future reviews. Much like other external stakeholders, invitation is a requirement, but attendance is up to their discretion. A written statement can be sent in place of attendance at the

stakeholders' meetings. For this version, formal consultations were sent to all parties of interest. Responses were received from the Oneida Indian Nation and Seneca Nation. Neither had any comments regarding the plan, but the Seneca Nation did request a final/signed copy for their records.

1.e. Authority

The Sikes Act, as amended (16 USC §§ 670a-670o), requires the Secretary of each military department to prepare and implement an integrated natural resources management plan for military installations in the United States that have significant natural resources. FIG implemented its first INRMP in 2002 (Ogden 2002).

An INRMP is a long-term planning document designed to guide the management of natural resources to support the preparedness of the Armed Forces, while protecting and enhancing installation resources for multiple use including recreation, sustainability, and biological integrity. The INRMP shall strive to prevent the net loss in the capability of military installation lands to support the military mission.

The management of natural resources is driven by compliance and stewardship requirements. As federal entities on land leased from the state, DoD and the National Guard are required to comply with all federal laws and most state laws. Stewardship, the responsibility to manage and conserve natural resources for the future, is a major component of the military environmental and training ethic. DoD actively manages military lands for multiple training and testing missions, while implementing policies and programs to reduce impacts to the land and ensuring both environmental and mission sustainability. Environmental regulatory compliance and natural resources stewardship must be of equal importance on military installations.

The INRMP needs to be approved and supported by NGB, USFWS, PGC, PFBC, and PADCNR. With the approval of these agencies, the state will have reached mutual agreement and oversight of the activities contained herein, and all activities as described are considered approved until such a time as all parties agree that the document must be revised. Formal review of this document for operation and effect must take place every 5 years and requires signature from each of the above listed agencies.

1.f. Stewardship and Compliance Discussion

The Conservation and Compliance Sections both fall under BEM's chain of command. This promotes coordination and integration of the principles and strategies of both offices on all installation actions. For example, hazardous materials storage protocols are integrated into the pest management program. The driving force behind both sections is sound and logical stewardship for the earth and the environment. This results in sustainable systems and resource management.

1.g. Review and Revision Process

All contents of this and future INRMPs will be followed by all installation personnel, offices, and partners. The plan will be implemented upon approval by standard signature page(s.) This plan shall be reviewed annually at a meeting of the combined stakeholders. Minor revisions, updates, results, and actions will be published in separate annual reports initiated and written during the annual review. Unless there is need for major revisions, this plan shall continue in perpetuity with the approval from stakeholders at the five-year review.

External partner agencies (USFWS, PGC, PFBC, PADCNR, and NGB) are required to be invited to annual update meetings but are not required to attend. Annual updates, decided upon at the stakeholders' meeting, will be supplied in written form to all stakeholders and partners as addenda. Additional entities wishing to obtain a copy of such addenda can contact the installation's PAO.

During the formal five-year review process, all internal and external stakeholders will be invited to a meeting or series of meetings to discuss the effectiveness and pertinence of the INRMP. Those stakeholders who choose not to attend may send written comment for consideration but will otherwise be treated as consenting to the document as it currently reads. If, during the meeting(s), any stakeholders can show that a major revision is required or a major action has occurred, the formal revision process will begin, and a replacement document will be drafted by installation stakeholders.

Section 2905 of the Sikes Act Improvement Act of 1997 [16 U.S.C. 670a note] requires an opportunity for the public to submit comments on initial INRMPs prepared pursuant to the new Section 101(a)(2) of the Sikes Act [16 U.S.C. 670a(a)(2)]. There is no legal obligation to invite the public either to review or to comment upon the stakeholders' mutually agreed upon decision to continue implementation of an existing INRMP without revision (USFWS 2010).

1.h. Management Strategy

FIG Conservation managers employ an adaptive management strategy. Research and monitoring are carefully structured into strategic planning and operations to provide feedback once management actions are implemented. Managers also use the data at hand to drive management planning. Triggers, indicators, and metrics help to identify problems and solutions without lengthy study when possible, but these "shortcuts" are backed by long-term studies with long-term data that demonstrate their usefulness on installation rather than abstractly.

The Conservation Division strives to provide habitat that enhances soldiers training and makes it a target for land management decisions. The benefits from this target include most of the primary and early succession species that the installation needs to protect (eastern regal fritillary butterfly, grassland birds, striped gentian, etc.) and that are uncommon and/or rare throughout the state (PGC and PFBC 2008). The result is a series of rugged grasslands, shrublands, and oak-hickory forests that stand up well to military training, provide cover and concealment, and are valuable throughout the state for their diversity.

1.i. Other Plan Integration

1.i.1. Wildlife Planning

This section provides synopses of each separate management plan written or held by the Wildlife Section. Discussions will also relate how they interact and follow the tenets of this INRMP.

1.i.1.a. Deer Management Plan

The FIG Deer Management Plan was written in 2004 and implemented in 2005; it is currently being updateded and will be finalized in March 2022. This document satisfies PGC requirements for Deer Management Assistance Program (DMAP) harvest coupons that allow overpopulated areas to receive a greater share of harvest pressure than normal. The plan outlines the estimated deer population and the goals, objectives, and measures necessary to maintain sustainable population size throughout the installation.

Deer hunting in Pennsylvania is a very controversial issue with high public involvement. Training and operations safety issues arise from an overabundant deer population including vehicle accidents, disease vectors, landscape damages, and parasites. Pennsylvania is host to several deer-borne ailments, including Lyme disease, Rocky Mountain spotted fever, West Nile virus, and others, that can be transmitted to humans via parasites. Where deer populations are highest are those areas where harvest is restricted partially or wholly due to human activities including range training, impact areas, and hallowed grounds.

1.i.1.b. Bird Airstrike Hazard (BASH) Plan

A BASH Plan was devised by USDA Wildlife Services working with the 193rd Special Operations Wing (SOW) of the Pennsylvania Air National Guard (PAANG) following a Class B BASH incident in 2009. This plan was reviewed and updated in 2019 but is focused on/limited to activity at Bollen Range and therefore does not cover all air operations on installation.

Aircraft training is constant on the installation, including air-to-ground range and drop activities, the Eastern Army Aviation Training Site (EAATS), and Muir Army Airfield (MAAF). Types of aircraft include jets (fighter, attack, and cargo variations), propeller-driven fixed wing (cargo and civilian missions), rotary wings, and unmanned aerial systems (UASs). The installation resides in a Global Important Bird Area for bird migration. These raptors and songbirds are extremely important to global population health and geographic connectivity between breeding and wintering grounds. The installation has a strong responsibility, not to mention legal requirement within the MBTA and BGEPA, to sound stewardship of these birds while also providing for pilot and crew safety during the training mission. While these two can sometimes conflict, they have been working in harmony for over 20 years of tracking and documentation.

With the frequency and variety of aircraft training on the installation, the potential for wildlife strikes is increased. The BASH plan decreases that potential by offering hazard descriptions, research, and alternative strategies for abatement.

1.i.1.c. Endangered Species Management Plan(s) (ESMP)

This INRMP contains species-specific information on each of the federal and state listing decisions and should act as an ESMP if/when listing occurs. Any additional federal or state species not mentioned here or that are insufficient in the eyes of USFWS, state agencies, and NGB in their treatment here will receive a later ESMP attached to this INRMP as an addendum in the annual review process.

1.i.1.d. Mowing Plan

The Mowing Plan for Fort Indiantown Gap National Guard Training Site: For Reducing Costs in Labor and Equipment and Improving Wildlife Habitat (the Mowing Plan) was written in 2005 and implemented in 2006. The plan details a schema to reduce mowing costs and increase habitat value throughout the installation with timetables, field analyses, and compromises between safety, security, budget, training, and natural resources. The plan was initiated by installation leadership and receives consistent leadership support, though implementation can face challenges on a field-by-field basis when soldier requests, maintenance schedules, and the plan all meet in the real world. The plan is based on many of the goals and objectives that sustain the INRMP, and thus the two documents will be consistent in policy and tone.

1.i.2. Forestry Planning

This section provides a synopsis of each separate management plan written or held by the Forestry Section. Discussions will also relate how they interact and follow the tenets of the INRMP.

1.i.2.a. Forest Management Plan

The Forest Management plan was written in 2011 after an analysis of forest inventory and stand data. This plan details the current state of FIG's forest in regard to age class, site quality, and operability/availability for active management. A comparison of timber harvest scheduling methods was completed, and the best choice was determined to be area control by site class. This has set timber harvest goals for the next 20 years on the installation. To make the goals more achievable they will be implemented in 5-year increments by the Forestry staff. Potential revisions to this plan are the addition of a forest inventory plan and input from a more recent analysis done by American Forest Management in 2017. Analysis by American Forest Management include forest inventory design, fire analysis, financial analysis, and 100-year growth projections. The inventory plan will outline the inventory protocols which include Continuous Forest Inventory (CFI), regeneration, fuel loading, and permanent plots. Fort Indiantown Gap is not eligible to participate in the federally funded Conservation Reimbursable Fee Collection Program (CRFCP). Revenue from the sale of Timber goes to the Pennsylvania State Treasury Fund.

1.i.2.b Urban Forest Management Plan

The FIG Community Tree Manual was completed in 2008 by contract. This plan outlines roles and responsibilities of different entities on the installation regarding urban forest management. It also serves as a comprehensive guide to tree planting, pruning, general maintenance and care, as well as provides a suitable list of tree species to be planted on the installation. Personnel training and safety guidelines are also established in this plan. Future revisions to this plan include incorporating into the larger Forest Management plan and including riparian buffers and lawn conversion sections.

1.i.2.c Integrated Wildland Fire Management Plan

The Wildland Fire Management Plan is required for any installation where wildland fire could be a concern. It details various items including fuel types found on the installation, personnel qualification guidelines, wildfire response plans, the use of prescribed fire, and guidelines for operation of various pieces of equipment. The plan was last updated in 2017 and reviewed by the installation commander in 2011. As per new guidance the plan will be reviewed/updated and certified by the Installation Commander annually.

1.i.2.d Annual Prescribed Fire Project Plan

The Annual Prescribed Fire Project Plan is comprised of individual prescribed burn site plans for the installation for the upcoming fiscal year(s). The Forestry, Wildlife, DPOTS and ITAM sections all provide input to the prescribed fire plan. The end goal is to have all burn units on the installation included in the annual plan. This will provide increased flexibility to meet training and ecological needs as identified by DPOTS, Conservation, and ITAM. Each plan is good for three years and units can be burned any number of times during the three-year period. Conservation staff are responsible for writing these plans. The plan discusses areas to be burned during each fiscal year, favorable weather parameters, personnel qualifications and requirements, contingency plans and resources, burn complexity analyses, and desired burn results. The Prescribed Fire Plan will be signed and reviewed every year by the plan authors, technical reviewer, DPOTS (agency administrator), ITAM, and will be appended to the IWFMP (as of 2017 only a template is appended).

1.i.3. Pest Management Planning

This section provides synopses of each separate management plan written or held by the Pest Management Coordinator and the Pest Management Office including statewide plans. Discussions will also relate how they interact and follow the tenets of the INRMP.

1.i.3.a. Integrated Pest Management Plan

The Integrated Pest Management Plan (IPMP) was written in 2005 under contract and was recently revised (2019). The document gives the basic guidelines for pest management on the installation and at all state properties. Contents include basic strategies, necessary certifications, and chemical storage as well as some basic descriptions and biological data on major structural

pest species. The IPMP addresses the basic foundations of installation pest management, to include the structural pest problems found on most installations as well as the natural pest (often invasive species) problems found on the installation.

1.i.3.b. Invasive Species Management Plan

Currently there is only one invasive species management plan for FIG, which addresses the introduced and legally quarantined insect pest, the spotted lanternfly. This plan outlines the management strategy being used by FIG Conservation staff to control population levels and contain the spread of infection. Additional invasive species and associated issues are addressed in the IPMP; the goals and objectives, responsibilities, actions, and strategies have been incorporated into that document and its appendices.

1.i.3. Cultural Resource Planning

The Integrated Cultural Resource Management Plan (ICRMP) is the leading document on all cultural resource planning and management in the same way that the INRMP is that same document for natural resource planning and management. The two work together to form the installation conservation program, and therefore they must support one-another for the installation to remain functional and meet Sikes Act standards. PADMVA's teams have consistently integrated their environmental standards and share common language throughout much of each document. The teams support one another during inadvertent discoveries and on statewide actions.

1.i.4. Compliance Planning

All federal actions to include construction, training, operations, and maintenance activities are evaluated and assessed for potential environmental impacts prior to being implemented. The NEPA process is the systematic examination of possible and probable environmental consequences of implementing a proposed action. Integration of the NEPA process with other army projects and program planning must occur at the earliest possible time to ensure that planning and decision-making reflect army environmental values, such as compliance with environmental regulations, and that these values are evident in army decisions.

The NEPA process does not replace either the procedural or substantive requirements of other environmental statutes and regulations. Rather, it addresses them in one place so that the decision-maker has a concise, comprehensive view of the major environmental issues and requirements. Additionally, the NEPA document identifies how all other applicable regulations were addressed. In addition, the decision-maker can understand the interrelationships and potential conflicts among the environmental components of a proposed action.

There are other plans dealing with specific compliance matters on FIG such as the Operational Noise Plan which addresses noise complaints and the Hazardous & Residual Waste Management Plan which deals with issues like spill response and hazardous waste.

1.i.5. Range and Training Area Planning

FIG's purpose is to provide and maintain the maximum amount of training capabilities within the constraints of the installation, while protecting and maintaining our natural and manmade resources, to meet the training needs of the PAARNG, out-of-state national guard units, Army Reserve units and Active Army units.

This plan establishes the range and maneuver land requirements needed at FIG, as per published doctrine and guidelines, to support the Army's present and future training requirements. FIG's major training capability shortfalls are the result of not enough land and, without a resolution of that issue, most of the related training range shortfalls cannot be addressed. Consequently, the main focus of the FIG Range Complex Master Plan will be on small arms range development, range, training areas and training facilities enhancement, and the sustainment of those ranges, training areas and training facilities. Additional priority is to maintain training areas that have the capacity to support mounted and dismounted maneuver, adding additional maneuver lands as they become available.

1.i.6. Master Planning

Based on a 25-year development strategy, the FIG Master Plan includes a comprehensive implementation plan. This plan provides a road map to meet developing facility and training program needs in alignment with the Master Plan's adaptability to inevitable mission changes over the next 24 years.

FIG's Master Plan outlines six planning objectives: existing facilities management, site image and character, site functionality, future land use, new construction, and sustainable development. The sustainable development objective discusses the Army Compatible Use Buffer program (ACUB), the Joint Land Use Study (JLUS), Leadership in Energy and Environment Design (LEED), and the INRMP. Some of the key environmental considerations for master planning in cantonment include: Prime Farmlands, wetlands and surface water course constraints, Whitetail deer and Canada geese overpopulation, woodchuck damage, floodplains, and public access for recreation.

1.i.7. Installation NEPA History

Over the years, several NEPA documents have been prepared by the PAARNG that have direct influence on this INRMP. In March 2002, the PAARNG completed a document titled *Final Environmental Impact Statement (FEIS) for the Enhanced Training and Operations at the National Guard Training Center FIG*, which addressed the proposed implementation of eleven actions, including improvements to the installation's wastewater treatment plant and ammunition supply point as well as the implementation of the first INRMP. In 2006, the PAARNG completed a document titled *FEIS for the Transformation of the Pennsylvania Army National Guard 56th Brigade into a Stryker Brigade Combat Team*. This document set forth new missions and a major range construction project, and in doing so changed land use and the landscape in several key areas, most notably several core eastern regal fritillary fields. In April 2008, the

PAARNG completed a document titled *Supplemental Environmental Assessment for Establishing a Surface Danger Zone on a Portion of State Game Lands No. 211 in Connection with the Operation of a Multi-Purpose Training Range at the National Guard Training Center – FIG, Pennsylvania*. This project was later "tabled" due to funding constraints. The documents referenced above were prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 U.S. Code [USC] 4321 et seq.), Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 Code of Federal Regulations [CFR] 1500 – 1508), and Army Regulation 200-2, *Environmental Analysis of Army Actions* (32 CFR 651). In addition, these documents were prepared in conjunction with NGB, whose role is to provide review of NEPA documentation and ensure that units and members of the Army National Guard are trained by states in accordance with approved policies and programs of the Secretary of the Army per Department of Defense Directive 5105.77, May 21, 2008.

2. Current Conditions and Use

2.a. Installation Information

2.a.1. General Description

FIG is located on property that is owned by the Commonwealth of Pennsylvania and leased to the Federal government. FIG occupies approximately 17,100 acres in Lebanon and Dauphin Counties, 20 miles northeast of Harrisburg and 10 miles northwest of the city of Lebanon. New York City and Washington, DC are within 150 miles and Philadelphia and Baltimore are within 100 miles of the installation. The nearby junctions of Interstates 78 and 81 as well as 81 and 83 make the location a strategic hub for travel between these metropolitan areas.

The installation includes five townships. Of these, East Hanover, Union, and Cold Spring Townships are in Lebanon County. Most of the Dauphin County landholdings fall in East Hanover Township, but the far western portion of the boundary lies in West Hanover Township.

The installation is split by Blue Mountain, which separates cantonment from the training corridor. Second Mountain, on the northern boundary, forms the basic border with adjacent State Game Lands 211. Interstate 81 and the Indiantown Gap National Cemetery border most of the installation to the south. Significant inholdings include Memorial Lake State Park, a 240-acre PADCNR lake bounded on all sides by cantonment and training areas, and several small landholders along Tomstown Road. See map in Appendix J, page J-1.

2.a.2. Regional Land Uses

Land use in Pennsylvania is regulated at the local level through county and township zoning ordinances and land use regulations. County and township management plans and zoning regulations—the comprehensive plan and the zoning ordinance – determine the type, density and intensity of land use allowable in specific areas. The comprehensive plan is a community visioning document and the means whereby local government can control and influence future

development. The zoning ordinance is then used to implement the comprehensive plan and has the force and effect of the law. It divides the entire community districts known as "zones" which identify the intensity of development and allowable land use.

The southern, eastern, and western boundaries of FIG are abutted by primarily conservation, rural residential and agricultural land uses. The lands directly to the north of the installation are owned and operated by PGC and used for public recreation. Hollywood Casino at Penn National Racetrack opened in 2007 within a mile of the southern boundary of the training corridor. Commercial developments surrounding the casino have mainly stayed between Interstate 81 and the casino entrance, but land prices and zoning are beginning to shift from agricultural use south of the racetrack. Future land use around the installation is projected to remain conservation, rural residential and agricultural with some parcels becoming commercial and industrial. A recently constructed light industrial park is located to the east of the installation in Union Township. The closest urban environments are located approximately 8 miles from the far west end of the installation in Hershey and Hummelstown and the closest major city is Harrisburg, 20 miles to the southwest.

2.a.3. Abbreviated History and Pre-Military Land Use

FIG is located in an area rich in history. Dating back almost 400 years, the area was originally inhabited by the Susquehannock Indians. Known for their physical size and strength, this Native American tribe developed its skills in warfare by using indigenous techniques and European weapons. Despite this advantage, the Iroquois destroyed them and took possession of the land. By the early 1700s, the battle for land raged on between the Iroquois and white settlers. Situated in the Blue Mountains, part of the Appalachian Mountain chain, the area had numerous natural protective boundaries. Original land grants show that four tribes resided in the area, thus the source of the area's name. After the defeat of British by the American troops commanded by General Edward Braddock in 1775, the Native American tribes allied themselves with the French in hopes of reclaiming their territory. Settlers in the Indiantown Gap area were victims of raids that resulted in burned homes, stolen cattle, destruction of crops, and even death. Because the Philadelphia Council offered no support, settlers decided to defend themselves. They built blockhouses, observation towers, and fortified farms. In addition, forts were built along the Susquehanna River to the Delaware River, including Fort Swatara (on present-day Fort Indiantown Gap), Fort Robinson, Fort Hunter, Manada Fort, and Browne's Fort.

The Indiantown Gap area was primarily farmland with mills and furnaces interspersed. The railroad industry was moving in to assist with mining operations and other burgeoning industries. In the early 1880s, a location in the South Mountain near the Cornwall Ore Mines was chosen as the site for a railroad station. The station was situated by "Governor Dick's Mountain," named after Governor Dick, a former slave who worked as a charcoal burner in the area and who lived in a cabin at the foot of this hill. The facility was intended as a planned "playground" of sorts with a manicured rest area. When the board of directors of the Cornwall and Lebanon Railroad chose the location, they renamed it "Mount Gretna" - Gretna for the image and Mount in homage to Governor Dick's Mountain. By 1884, preparations were underway, and five acres of land had been cleared for a picnic area, kitchen, and walled spring. Bridges erected over the dammed springs gave the area a very rustic and scenic appearance. In time, the area would become a

vacation spot. A dam was built across Conewago Creek to form a lake, and dining halls, concession stands, boat docks, and a carousel were added. Soon cottages were built, and a hotel was erected to accommodate numerous individual visitors as well as such large gatherings such as the American Farmer's Encampment (a precursor to large "farm shows") and religious revival meetings.

The Pennsylvania National Guard (PANG) moved into the area in 1885, when it obtained 120 acres west of the Mt. Gretna Park. This land was used for summer encampment for over 50 years. The site was named Camp Gobin in 1886 and renamed Camp Winfield Scott Hancock the following year. Finally referred to as Mt. Gretna, the camp trained several groups of soldiers before shipping them to the Philippines during the Spanish- American War in 1898. Five years later, the camp became a permanent training camp because of its usefulness and its status as the only camp in Pennsylvania which had not experienced outbreaks of typhoid or yellow fever (Carmean 1976).

In 1929, however, changes in the nature of warfare began raising questions about Mt. Gretna's long-term effectiveness as a military training site. The State Military Reservation Commission debated whether it would be more cost-efficient to improve and update Mt. Gretna or purchase new land and move the training camp. The ideal spot, many believed, was Indiantown Gap. Arguments against Mt. Gretna were numerous. The location itself had not been well-planned; the roads were inadequate and unstable; and redeveloping the land for training activities would be expensive since it did not lend itself to such activities. But most importantly, Mt. Gretna's proximity to camping grounds and parks made its artillery activities a threat to the safety of the general population. Indiantown Gap was ideal because of its lack of development, low price, ample resources, and location. After due consideration, the state, under the leadership of Governor Gifford Pinchot (the first Chief of the United States Forest Service), purchased Indiantown Gap for a new training camp in 1931.

Initial construction on the camp was limited, and many soldiers lived in tent towns for several years. But in September 1940, Pennsylvania leased Indiantown Gap to the Federal government for $1 a year, an arrangement which continues today. After this transfer, construction boomed as military leaders prepared to meet the training needs of another world war. Over 13,000 workmen labored on the site, completing 1,145 mobilization buildings, 187 Theatre of Operation buildings, an assortment of guesthouses, chapels, theaters, and a sports arena. The hospital alone covered 45 acres and had 78 buildings. Accompanying the construction of hundreds of buildings was the development of the Field Artillery Range. Covering seven and a half miles and located between the Blue Mountains and the Second Mountain, it was the most impressive range in the state. Development of the site did not end with the range. As amphibious warfare was becoming more common, Army engineers constructed an 80- acre lake for training. Named Memorial Lake, it was dedicated to all the residents of Pennsylvania who had served in World War I (WWI) and those already active in World War II (WWII). The installation was complete in 1941 when the first airplane landed on the newly built Muir Airfield.

Indiantown Gap became the training area for several units. Initially it functioned as the training facility for the 28th Infantry Division of the PAARNG. Between January 1942 and December 1942, the installation fell under the command of the New York Port of Embarkation as a quasi-

staging area for troops preparing for shipment overseas. From July 1942 until the end of WWII, it supported the Transportation Corps Training Center, which trained personnel used in Port Battalions. The 55th Infantry Brigade, the 53rd Field Artillery, the 52nd Cavalry Brigade, and the 109th Infantry all trained at the Gap. Some of the famous divisions that came through Indiantown Gap included the First Division, which participated with the 28th in the assault on Omaha Beach; the 95th Division; parts of the 5th Division; the 3rd and 5th Armored Division; the 77th (Statue of Liberty) Division; and the 37th (Buckeye) Division. The 77th Division gained fame for enabling General Douglas MacArthur to gain ground in Leyte, and the 37th Division carried the burden of some of the U.S.'s earliest campaigns in the Pacific Theatre. In addition to its role as a training center, Indiantown Gap had a prisoner of war camp for German prisoners. After WWII, the installation served primarily as a reception and separation center for troops returning from Europe. Here soldiers were processed through with a discharge rate of over 1,000 per day (AMEC 2002). With this mission complete in 1946, the installation was deactivated to housekeeping status.

In 1951, Indiantown Gap reactivated to training camp status when the U.S. entered the Korean War. The 5th Infantry Division primarily trained at the site until heading for duty in Korea. Over 32,000 soldiers were trained as replacements for those already fighting. In 1953, the installation was placed on inactive status and returned to the Pennsylvania Military District. Between 1957 and 1968, the XXI U.S. Army Corps oversaw an Army Reserve Program on site. The program later moved to Fort George G. Meade in Maryland. In 1975, the installation officially became "Fort Indiantown Gap," and it served for a time as a refugee resettlement camp. This was a very tumultuous period for the site. In 1975, 22,228 Vietnamese and Cambodian refugees were housed at the installation while local organizations processed and placed them in communities across the country. Five years later, 19,094 Cuban refugees came through (Evinger 1998). Unlike their Asian predecessors, these refugees created havoc at FIG. Tensions eventually culminated in a violent standoff between the PAARNG and several buildings of refugees. In 1983, FIG became a sub-installation of Ft. Meade; ten years later, it came under the authority of Ft. Drum in New York.

In 1998, the Base Realignment and Closure (BRAC) program terminated active duty at FIG. At that time the state and the PAARNG took control as it became a National Guard and Army Reserve Training Center. FIG has served since that period as the primary training center for the PANG, the headquarters of the Pennsylvania Army and Air National Guards, the Northeast Counterdrug Training Center, and the premier EAATS for rotary-winged aircraft at MAAF.

2.a.4. Military Mission

Mission Statement

The FIG installation is operated and managed by the FIG Garrison Headquarters. The installation's overarching mission is to provide administrative, logistical, maintenance and family support to active and reserve component units training at the installation, as well as for tenant and off-installation activities in central and eastern Pennsylvania. The installation provides training support to the National Guard, US Army Reserve, and members of all services to meet the ongoing need for a highly trained US military presence throughout the world. To meet this

mission, training facilities that reflect the diverse conditions soldiers will encounter in war are needed, and soldiers must be trained to adapt to the constantly changing conditions of the areas in which they engage in combat to maintain military readiness and preparedness.

There are four primary missions at FIG described in the JLUS:

1. To provide a major year-round training facility and the highest-quality training opportunities for the PAARNG and other military and civilian users.

2. To provide the infrastructure, services, and site logistical support necessary to operate training and support facilities.

3. To provide, operate, maintain, and control facilities and equipment that support the pre-mobilization training of military forces.

4. To provide quality of life services and programs and conduct proactive community relations.

The installation provides state-of-the-art operational training facilities across three training environments (live, virtual, and constructive) in support of the instructional, operational, and pre-mobilization training requirements of organizations within the PAARNG as well as other states' national guard, reserve, and active-duty units. FIG provides facilities and services to U.S. Armed Forces that require land and airspace to practice combat skills and operations on a year-round basis. On average there are about 2,100 soldiers, technicians, state employees, and contractors that work at the installation on a daily basis. It does not appear that FIG's mission will change in the foreseeable future.

Troop Support facilities range from upgraded World War II (WWII)-era temporary buildings to a "state of the art" battalion-sized troop support area. The installation has eighteen administration and supply buildings, eighteen dining facilities, numerous barracks (total bedspace 7,000), Base Enlisted Quarters/Base Officer Quarters (BEQ/BOQ) with 680 beds, and a 600 bed Forward Operating Base (FOB). PAARNG units have over 1,000 pieces of wheeled and tracked equipment available through Unit Training Equipment Site (UTES) for training and a Training Support Center (TSC). The FIG Ammunition Supply Point (ASP) was recently upgraded, adding 12 new bunkers, a new small arms warehouse, and a new administrative building. The entire installation has tactical internet coverage via the fixed tactical internet.

Current Units and Organizations

FIG is the main training site for the PAARNG's 28th Infantry Division (ID). FIG is the home of the PANG Joint Force Headquarters and PADMVA, as well as the 28th Combat Aviation Brigade, Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE), Enhanced Response Force Package (CERFP) and the 3rd Civil Support Team. FIG is the primary training center for the 28th ID's 55th Heavy Brigade Combat Team (HBCT), 2nd Infantry Brigade Combat Team (IBCT), and the 56th Stryker Brigade Combat Team (SBCT), the 213th Area Support Group, and numerous other US Army Reserve (USAR) and National Guard deployable units.

FIG also hosts a variety of specialized training activities and "schoolhouses." EAATS provides both ARNG-unique aviation training and augments the Army's overall aviation training capacity to meet both surge and continuing training needs. EAATS is the second largest helicopter training site in the United States. The 166th Regional Training Institute, Regional Training Site - Medical, the Army Research Laboratory, and the USAR Regional Training Site - Maintenance are also located at FIG.

The Air National Guard has a significant institutional training presence at FIG as well, including the 201st Red Horse Squadron and the Regional Equipment Operator Training School (REOTS). Detachment 1, 193rd Special Operations Wing schedules and operates the live-fire air-to-ground Bollen Range. Bollen Range's primary impact zone covers approximately 2,000-acres and is one of fourteen Air National Guard ranges in the country.

2.a.5. Operations and Activities

With 15,000 members, the PAARNG plays an important role in the nation's defense and supporting the commonwealth in times of need. Its units have taken part in every conflict America has faced, from the Revolutionary War to Operation Iraqi Freedom and the War on Terror. The ability of the installation to provide training for a wide range of army and other service users makes it a significant asset to national security.

Throughput

In Training Year 2020, FIG was the busiest National Guard Major Training Center (MTC) in the United States, hosting a total of 118,029 ground personnel for a total of 526,225 personnel days of training and activity. This compares to a decrease from 2019 (133,256 personnel for 682,315 personnel days) which can be explained by the COVID-19 pandemic. Projected numbers for 2021 are expected to exceed those from both 2020 and 2019. FIG's geographical location, full complement of firing ranges, and ability to employ the Army Digital Training Strategy of live-constructive-virtual integration make it an integral part of the DoD's overall training and readiness capability.

The Air guard flew 541 sorties for 280.58 hours in FY20. Again, this number has decreased since the previous year due to COVID-19. However, the Bollen Air-to-Ground Range is consistently used each week and is still a critical asset for the Northeast. The ability of the installation to provide training for a wide range of Army and other service users makes it a significant asset to national security.

The mosaic of natural communities, and the varied topography found at FIG support a variety of training scenarios. FIG maintains the maximum amount of training capabilities within the physical constraints of the installation, while protecting and maintaining its natural and manmade resources to meet the training needs of the soldiers. Blue Mountain divides the installation into two distinct zones: the cantonment area to the south and the training corridor to the north.

The cantonment area contains numerous functional areas such as operations, educational and simulations, along with maintenance buildings and support facilities, classroom and educational

facilities, dormitories, barracks and other lodging facilities, a medical clinic, chapel, conference center, shopping and dining options, recreational and athletic facilities.

Live-Constructive-Virtual Gaming Training Integration - FIG embraces the Battle Command Training Strategy through the incorporation of live, virtual, constructive, and gaming training opportunities. Live training can be linked to the simulation training using the Fixed Tactical internet located in Area 5. FIG has an extensive list of virtual trainers including an Engagement Skills Trainers (EST 2000), Call For Fire Trainer (CFFT), Mobile-Close Combat Tactical Trainer (M-CCTT), Aviation Combined Arms Tactical Trainer (AVCATT), and Common Driver Trainer (Stryker & Mine Resistant Ambush Protected (MRAP) variants). These simulators have the ability to function as stand-alone trainers, or they can be connected through the MTC, formerly known as the Battle Command Training Center, to facilitate Combined Arms or Joint Operations in a constructive simulation.

The MTC provides a training environment for numerous individual Army Battle Command Systems. Also, the Virtual Battlespace System 2 is a gaming system that is fully interactive in three dimensions providing a synthetic environment suitable for a wide array of military training purposes. The MTC provides extensive simulation capability to battalion, brigade, and division commanders. The MTC is the only one operated by the National Guard that is capable of integrating all components of the Army's live, constructive, virtual, gaming training strategy.

Most of the 50 designated training areas (TA) are located in the main training corridor which consists of over 12,000-acres of land located north of the cantonment area and bounded by Second Mountain to the north and Blue Mountain to the south. TAs offer specific capabilities and amenities to support activities such as bivouac, maneuver, vehicle training, unit tactics, convoy training, weapons firing, and air-to-ground weapons firing. Although most TAs are situated north of Blue Mountain, a few are located adjacent to or within the cantonment area (e.g., the tank trails which connect UTES and the wash facility to the maneuver areas in the training corridor). Field training activities and facilities which occur south of Blue Mountain include: a 50-foot Rappel Tower in TA A-31, a Leadership Reaction Course, an 11-station obstacle course, four Nuclear, Biological and Chemical Chambers for training units on their protective equipment, a water purification set-up site adjacent to Shuey Lake, structure collapse site, and small arms ranges.

Military Operations and Activities

Individual Weapons Systems ranges are located adjacent to MAAF along Range Road. These ranges are suitable for zero, qualification and familiarization on pistols, rifles and shotguns.

A wide array of facilities and training activities occur in the main training corridor to include the following:

Vehicle maneuver areas - There are currently 3,133 acres of heavy maneuver training land and 10,523 acres of light maneuver training land at FIG.

Crew Served Weapons – Range 35, multipurpose machine gun range, is an automated range out to 800 meters for M-240, M-249 or M-60 zero and qualification. Range 36 provides automated scoring for M-2/ MK19 zero and qualification. Familiarization on crew served weapons is allowed on some of the multipurpose ranges.

The Combined Arms Collective Training Facility (CACTF) -A one-kilometer urban village setting that currently contains 12 furnished buildings, a road network, a tunnel / sewer system, and a helicopter landing zone. The facility contains video cameras, sound effects, human urban targets, external lighting, break away doors, and hook ups on buildings for rappelling, and is capable of daylight and limited visibility entry. It assists unit training on entering, clearing, and controlling multiple buildings simultaneously.

Urban assault course (UAC) - A 28-acre facility designed for squad- and platoon-sized training in urban fighting techniques. This facility is used to train individual soldiers, squads, and platoons on tasks necessary to operate within a built-up/urban area. It has five stations:

Station 1 - Individual & Team Task - Technique Trainer - clear a building
Station 2 - Squad & Platoon Task - Technique - enter a building, move tactically & clear a room
Station 3 - Grenadier Gunnery Trainer - grenadier gunnery
Station 4 - Urban Offense/Defense Trainer - urban ops; enter, clear & defend a building
Station 5 - Underground Trainer - reconnoiter

UAC allows the use of the following ammunition:

Station 1 - smoke grenades, practice grenades, grenade simulators, M84 stun grenades, whistling booby traps, 5.56mm blank linked, MILES, SRTA, 5.56mm ball, & non-explosive training demo charges.
Station 2 - Station 1 ammo plus 7.62mm blank linked.
Station 3 - 40mm TP grenades, smoke grenades, 5.56mm blank, short-range training ammo, & ball ammo. (40mm HE grenades will not be used.)
Station 4 - 5.56mm blank, SRTA, smoke grenades, 7.62mm blank linked, M84 stun grenades, & practice grenades. (No live fire training.)
Station 5 - 5.56mm blank (Smoke will not be employed inside the underground trainer.)

Live-fire Shoothouse - A two-story facility with eleven enclosed rooms where personnel can train in dry, blank, and live-fire room and building clearing techniques. It has video cameras and sound effects and is capable of limited visibility training. The facility features moveable walls to customize rooms for different unit purposes. This range allows the use of the following ammunition: 5.56mm blank, SESAMS, SRTA, 5.56mm ball, 9mm, M84 stun grenade, practice grenades, smoke grenades, DET cord, and nonelectrical firing blasting caps.

Live-fire breach exercise facility - Designed to train military and civilians on technical aspects of building breaching techniques and to provide them with immediate feedback. Techniques are taught for doors, windows, demolition of concrete or brick structures using mechanical, ballistic, explosive, or thermal breaching means. This range allows the following ammunition: 5.56mm,

Hand Grenade, Shotgun rounds, RLEM, DET cord, C-4 blocks, and non-electric firing blasting caps.

Live-fire infantry squad battle course – A 1,000-meter course which allows units to develop customized starting points and maneuver routes to fit their training needs. Features at the facility include 2 landing zones, 6 moving infantry targets, 1 moving target, 20 stationary infantry targets, 6 stationary armor targets, 2 trench obstacles, and 5 machine gun/ observation bunkers. This complex is used to train and test infantry squads on the skills necessary to conduct tactical movement techniques; detect, identify, engage and defeat stationary and moving infantry and armor targets in a tactical array. This range allows the use of the following ammunition: 5.56mm, 7.62mm, and 40mm TP. All targets are fully automated, and the event specific target scenario is computer driven and scored from the range operations center. The range operating system is fully capable of providing immediate performance feedback to the using participants. Trenches, bunkers, and target emplacements simulate typical threat scenarios. Mortar simulation device emplacements are located in areas from which unfriendly mortar fire is to be simulated. Helicopter landing areas, designed for heavy use, and located to support aerial insertion and extraction of the squad.

Third world village mock-ups - Used to simulate economically disadvantaged communities. They are built out of modified shipping containers and offer realistic settings for urban close combat operations in the real world.

MK19 / 50 caliber firing range- Offers automated scoring and qualification.

Heavy machine gun range – An automated range which provides zero and qualification training out to 800 meters for the M-240, M-249, and M-60 weapons.

Sniper field fire range – A range which offers 1,000 meter known distance targets and includes a remote enhanced targeting system that allows for both 5.56 and 7.62 ammunition. This range is used to train and test soldiers on the skills necessary to detect, identify, engage and defeat stationary and moving infantry targets in a tactical array. This range is designed to satisfy the training and qualification requirements of the M24 sniper rifle. Primary features include: 40 stationary infantry targets, 8 moving infantry targets, and 4 firing positions. Natural vegetation is required in the target area to provide realistic natural obstacles for the sniper to negotiate.

Aviation Training and Activities

Aviation related training facilities such the Unmanned Aerial System (UAS) facility and airstrip, and MAAF are located southeast of the main training corridor. However, aviation activities can occur over much of the installation as well as some areas surrounding the installation.

MAAF - The sixth busiest airport in Pennsylvania and the second busiest heliport in the US when measured in terms of daily takeoffs and landings, averaging more than 70,000 take-offs and landings per year. The primary operations at MAAF are for rotary-wing aircraft (helicopters). A rotary wing aircraft is an aircraft that derives its lift from the rotation of blades

on an approximately vertical central axis such as a helicopter. The airfield is fully instrumented and has its own air traffic control tower. It is home to EAATS and the 28th Combat Aviation Brigade. EAATS is one of four ARNG aviation training sites that provide both ARNG-unique aviation training and augment the Army's overall aviation training capacity to meet both surge and continuing training needs. At each of these locations, instructors provide a wide range of training for ARNG, Army Reserve, and Active Army aviators to include graduate-level flight training, military occupation specialty/additional skill identifier-producing courses, enlisted professional development courses, and training in support of foreign military sales.

EAATS has a unique national mission. Its focus is on the Army's utility helicopters including the CH-47 Chinook and the UH-60 Black Hawk. EAATS provides critical virtual simulations, procedure training, aircraft qualifications, instructor pilot, and institutional training on utility and cargo helicopters to personnel from all 54 states and territories. Low level night vision goggle training activities occur in FIG's northern training area, which includes airspace above Dehart Dam, SGL and state forests.

MAAF is encompassed by a standard regulatory Class D airspace. FIG's airspace usage is generally limited to military flight and is controlled on a local level by the control tower at the MAAF in the cantonment area. In addition, Army regulations require a 3,500-foot safety arc for ammunition supply points, which prohibits any armed aircraft from entering that restricted airspace. MAAF has safety zones associated with its runway to limit and guide development and protect the safety of the public and pilots while simultaneously allowing for continued economic growth. The DoD has created safety zones around runways and landing areas that are based on historical data where an aircraft accident is most likely to occur, if one should occur. These safety zones are broken down into Clear Zones and Accident Potential Zones I and II, which are based on the dimensions of the runway. The orientation of the safety zones is determined by the typical flight patterns that aircraft take directionally when approaching the runway or landing area.

Training activities focus on low-altitude flight maneuverability, cargo transport, use of night vision equipment, and tactical maneuverability. The flight training area includes closed-loop patterns involving MAAF, training areas and landing zones within the NTA, and flight corridors extending east and north from FIG into the NTA. The closed-loop patterns involving MAAF are generally contained within the FIG boundaries with the exception of a small portion that extends into East Hanover Township in Lebanon County and is bounded by I-81. The NTA encompasses an area outside of FIG that extends from the northwest side of FIG to the northeast / east side of FIG comprising of SGL and private property; it includes three training areas and 25 landing zones.

Rotary-wing aircraft operate "around the clock" at MAAF and surrounding areas. The majority of flights from MAAF involve rotary-wing aircraft training activities that can include testing, observation, low-altitude exercises, cargo carrying, night operations, water bucket training, and tactical aviation training. Most of these flights consist of closed pattern flights that follow a loop south of the runway during the day and north of the runway at night, at 900- to 1,200-feet AGL, and no further than 4,000-feet from the ends or lateral edges of the runway. On the uninhabited areas off the installation and other approved areas in close proximity to MAAF, rotary-wing

aircraft frequently operate at altitudes below 500-feet AGL. Approximately 15% of rotary wing operations departing from MAAF fly specific routes at 600- to 800-feet AGL through Indiantown Gap following State Route 443 on the north side of Blue Mountain (NTA). In addition to the restricted military airspace over FIG, approximately 44,000-acres of SGL to the north support certain flight operations.

Special Use Airspace - The airspace where military activity or unusual flight conditions may occur. The type of special use airspace at FIG comprises restricted airspace designated in areas where flight or ground activities must be confined because they may be considered hazardous to nonparticipating aircraft. There are five designated restricted airspaces at FIG which range from floor elevations at ground level up to 25,000 feet above ground level. These areas are used for weapons testing, observation, low-altitude exercises, cargo carrying, night operations, water bucket training, and tactical aviation training.

Military Training Routes (MTRs) - One-way flight corridors used to practice low-altitude, high speed, and terrain-following training missions. There are three MTRs comprising a 13-mile-wide corridor terminating approximately 6 miles north of FIG over Weiser State Forest. The MTRs have assigned altitudes of ground level to 18,000 feet above ground level for operational speeds in excess of 250 knots.

Bollen Range -Provides pilots with realistic training in attacking ground targets from the air. All fixed-wing bombing and strafing activities are accomplished with inert ordinance; however, some types of training bomb munitions have small propellant charges (equivalent to two shotgun shells) to disperse a marking agent to aid in the scoring process. Rotary-wing aircraft operations are also conducted at the Bollen Range. These operations consist of low-level attacks, less than 100 feet AGL with machine guns, chain guns, or rockets. Bollen Range's primary impact zone covers approximately 2,000-acres and is one of fourteen Air National Guard ranges in the country.

Current Units and Organizations

Military units and home stationed at FIG include:

28th Combat Aviation Brigade -Serves as a heavy aviation unit for PAARNG. It flies UH-60 Blackhawk, AH-64D Apache, and CH-47F Chinook helicopters. The 28th CAB's primary mission is to find and destroy enemy forces to support its combined arms team, but it is also capable of close combat attacks, mobile strikes, reconnaissance, security, air assault, command and control, aerial medical evacuation, air movement, personnel recovery, and aerial mine delivery.

3rd Civil Support Team (CST) and Chemical, Biological, Radiological/Nuclear, and Explosive Enhanced Response Force Package (CERFP)- The 3rd CST provides Pennsylvania and the region with a chemical, biological, radiological, and nuclear response capability in the form of recognition, analysis, prediction, and active monitoring. The CERFP provides search and extraction, decontamination, medical triage, and limited care capabilities in response to chemical, biological, radiological, and nuclear events.

PANG Joint Force Headquarters (JFHQ-PA) - The headquarters for both the Army and Air National Guards of Pennsylvania, providing oversight to all the soldiers and airmen in the state. JFHQ-PA mission is to maintain trained and equipped forces ready to perform as directed by state or federal authorities. It supports homeland defense, defense support to civil authorities and other domestic emergency missions. In addition, the JFHQ-PA provides experience and situational awareness to DoD authorities to facilitate integration of federal and state activities.

628th Aviation Support Battalion – Provides Brigade level logistics, health service support, aviation unit and intermediate level field maintenance support for the Expeditionary Combat Aviation Brigade at Division and Corps.

3622nd Maintenance – Provides field maintenance, including all low density, and limited recovery support to units on an area basis and calibration and repair of general purpose and selected special purpose test, measurement, and diagnostic equipment (TMDE).

Other military support and military affiliated organizations located at the installation include:

166th Regional Training Institute - Among the largest and most technologically advanced of its kind in the Total Army School System, and one of the largest Non-Commissioned Officer Academies in the U.S. Army. It has an average throughput of approximately 6,000 students annually. Some of the Army career fields trained there include cavalry scouts, cannon crewmember, fire support specialist, motor transport operators, and infantrymen.

USAR Regional Training Site - Maintenance - Accredited by the U.S. Army Training and Doctrine Command. It instructs students in effective and efficient maintenance training. Its mission is to "provide training that will sustain all active components and reserve component soldiers, which enables armed forces components to mobilize and deploy units capable of meeting wartime mission requirements on current and force modernization equipment systems in the areas of logistics / maintenance training, MOS qualifier training, additional skill identifier training, and NCO basic and advanced courses.

Pennsylvania Department of Military and Veterans' Affairs - A Pennsylvania state agency which has a dual mission to provide quality services to the commonwealth's veterans and their families, as well as oversee and support the members of the PANG.

Medical Battalion Training Site- Provides students with real-life battlefield simulated training on medical tasks. This state-of-the-art simulation facility includes over 50 human patient simulation devices. Simulations are conducted through the projection of scenario-driven realistic sounds, scents, climate controls and smoke, and an interactive target system. Military and civilian agencies are able to train on mass casuality scenarios.

Medical Simulation Training Center - Provides standardized medical and nonmedical personnel in both classroom and under simulated battlefield conditions.

Unit Training Equipment Site (UTES) - Offers soldiers operator assistance and maintenance support for vehicles, subsystems and weapons. PAARNG units have over 1,000 pieces of wheeled and tracked equipment available through UTES.

Combined Support Maintenance Shop (CSMS) - Offers automotive, heavy mobile, inspection, armament and small-arms repair, electronics, allied trade and recovery support to units on or near FIG.

Central Wash Facility - Capable of cleaning a wide variety of military vehicles, wheeled and tracked, with a newly upgraded system. The facility is equipped with a large wash and a smaller wash, together capable of handling three vehicles at once. All water from the facility is recycled.

Counterdrug Task Force -Directly supports the commonwealth's mission to improve the safety and welfare of its citizens.

The PAANG has a significant institutional training presence at FIG as well, including:

201st Red Horse Squadron -Supports combat air power and provides the commander-in-chief and federal and state authorities well rounded heavy construction and repair capability any time at any location.

Regional Equipment Operator Training School (REOTS)-Trains airmen on heavy equipment.

Detachment 1, 193rd Special Operations Wing -Schedules and operates the live-fire air-to-ground Bollen Range.

203rd Weather Flight - A small, elite unit that analyzes and predicts atmospheric conditions for pilots, war planners, and decision makers.

Lightning Force Academy- Trains Air Force and Air Guard personnel to support the engineering and installation (EI) mission. Students become familiar with practices to accomplish the EI during wartime, including project engineering, management, and total project oversight. Classes include combat restoration, repair, installation and removal/ relocation of communications-electronic equipment.

Common Environmental Impacts

Combat support and combat service support —Various support units often have similar impacts to land as described for bivouac since they use the same sites repeatedly. Support units also have potential to adversely affect land resources via petroleum product spills, improper sanitation, digging activities, and other effects of intensive use of small areas by units with a wide variety of

tasks. Often, the first steps in land degradation from bivouac activities are soil compaction and the loss of ground cover, which can be followed by localized erosion and possible increases in down-watershed stream sedimentation. Ground disturbance associated with bivouac can also impact wildlife resources.

Use of Smoke — Some military operations involve using a cloud of smoke that is artificially generated in order to obscure the enemy's ability to observe friendly activities. Fog oil operations have the potential to create pollution from spills of fog oil or petroleum, oils, or lubricants used by vehicles in the operations. Procedures in support of air quality regulations must be followed to avoid smoke drifting off the installation.

Bivouac — Bivouac sites (temporary encampments) can create damage, particularly if the activity is repeated in the same area, or the unit remains in the same bivouac area for an extended period of time. Often, the first steps in land degradation from bivouac activities are soil compaction and the loss of ground cover, which can be followed by localized erosion and possible increases in down-watershed stream sedimentation. Ground disturbance associated with bivouac can also impact wildlife resources.

Engineer operations — Engineer activities (e.g., digging fighting positions or tank ditches, obstacle removal, construction of FOBs) disturb soil which can affect various natural resources. Demolition can cause noise and dust. Engineer operations have the potential for pollution from spills of petroleum, oils, or lubricants. Other combat engineer activities can be beneficial to natural resources. Combat engineer projects, (*e.g.*, training land rehabilitation, erosion control structure construction, site hardening) can also protect the environment from damage in the future. Digging is prohibited in areas where known cultural resources may be disturbed.

Construction — Construction is constantly occurring at FIG. Impacts to the environment from construction depend largely on the location of the construction. In the Cantonment, construction generally occurs on previously disturbed soil and in areas where wildlife has either already departed or accommodated to human activity. There is the possibility of temporary dust and runoff during construction periods, and new construction may contribute to stormwater runoff. Construction in training areas normally involves a change in the land use and has the potential for greater impacts on wildlife. Erosion and sedimentation plans utilize best management practices to minimize erosion during construction. In both areas, there is a temporary increase in noise during the construction period.

Future Operations

A significant transformation to the FIG mission occurred in 1999, when the Secretary of the Army and the Chief of Staff of the Army modified their vision to develop an Army more capable of "rapid response across the entire spectrum of operations in a joint, interagency and multi-national environment" (AMEC 2006). The result of this vision led to a gradual implementation of new activities at installations across the United States. At FIG, the PAARNG was directed to transform the 56th Brigade of the 28th Infantry Division into the National Guard's only SBCT. This transformation created the need for additional training programs and aviation capabilities, resulting in several new construction projects. Given these changes, real estate acquisition and a

compatible land use strategy that will enable FIG to accommodate mission change and growth over the next 25 years is necessary and is currently being prepared. In addition, new facilities to house several additional UAS platoons with runways for the Army Guard are being planned. A similar unit for the Air Guard is being planned.

2.b. General Physical Environment and Ecosystems

FIG straddles two physiographic subunits of the Ridge and Valley Province: The Great Valley and Blue Mountain Sections. Underlying bedrock is Devonian in age and consists mainly of sedimentary rock, namely sandstones, mudstones, and conglomerates. This porous rock and the position of the installation topographically creates almost all the hydrology that feeds the installation both in groundwater supplies and in surface waters. In the training corridor, FIG maintains all its own surface waters from their source to the installation boundary.

The bedrock is folded into a series of mountains and ridges, starting with Blue Mountain that forms the boundary between cantonment and the training corridor. The northern boundary is formed by the next immediate mountain, Second Mountain. In between are several smaller rock ridges and valleys. The two main watersheds on the installation, the source of Manada Creek and the source of Indiantown Run, divide mid-corridor near the present Range 23 complex.

In the greater Appalachian ecosystem, FIG hosts a variety of vegetation types including native warm-season grasslands, oak-dominated forests, scrub oak barrens, and shrublands. Many of these vegetation types are arrested from serial succession by periodic high-frequency and low-intensity disturbance resulting from military training. This habitat is considered extremely important and increasingly rare within the Commonwealth of Pennsylvania as a whole (PGC and PFBC 2008).

The topographic map features significant landforms, installation boundaries, inholdings and other state- owned properties, and the environmental condition of the landscape. See Appendix J, page J-2.

2.c. General Biotic Environment

Native Eastern grasslands, forests, shrublands, and savannahs characterize the vegetation cover on FIG. Keystone or foundational species include little bluestem (*Schizachyrium scoparium*), broom sedge (*Andropogon virginicus*), and purple-top (*Tridens flavus*) grasses, oak species (*Quercus spp.*), Eastern hemlock (*Tsuga canadensis*), and poverty grasses (*Danthonia spp.*). Other important vegetation constituents include non-natives honeysuckle (*Lonicera spp.*), mile-a-minute (*Persicaria perfoliata*), autumn olive (*Elaeagnus umbellata*), and cold season ornamental grasses and groundcovers.

These vegetation types are inhabited by a large diversity of animal life. Animal diversity stems from disturbance and management treatments, land use patterns, native stock, and geographical placement. Species include eastern regal fritillary butterfly (*Speyeria idalia idalia*), grasshopper sparrow (*Ammodramus savannarum*), Allegheny woodrat (*Neotoma magister*), white-tailed deer

(*Odocoileus virginianus*), native eastern brook trout (*Salvelinus fontinalis*), and wood warblers (Parulidae); especially cerulean warblers (*Setophaga cerulea*), ovenbirds (*Seiurus aurocapilla*), chestnut-sided warblers (*Setophaga pensylvanica*), and yellow-breasted chat (*Icteria virens*).

2.c.1. Threatened and Endangered (T&E) Species and Species of Concern

Federal Listings

The NLEB was FIG's first federally listed species on 2 April 2015 when the listing was published. The monarch butterfly was determined to meet the criteria for listing but, after a thorough review of the best available scientific and commercial information, the USFWS found that listing the monarch butterfly as an endangered or threatened species is warranted but precluded by higher priority actions. This determination occurred in December 2020; its status will be reviewed each year and the Service intends to propose listing the monarch in FY24. The eastern regal fritillary butterfly has not been deemed warranted for listing at this time, but the species status assessment (SSA), which is currently ongoing, will help to inform a future listing decision. The frosted elfin is currently not listed but is being examined proactively by USFWS to evaluate its status. A SSA is scheduled to be completed in FY24. FIG has a historically identified population from the 1990's that is currently being reassessed for occupancy. The GWWA has been petitioned for listing; the USFWS plans to complete the status review in FY24. Similarly, the little brown bat and tri-colored bat have a listing determination scheduled for 2022, while spotted turtles, wood turtles, and the northern red-bellied cooter have a listing determination in 2023. It may take years for these species to be formally listed through the rule-making process.

Three listed species located in the vicinity of the installation have not been found on the installation despite over two decades of ongoing survey efforts. The bog turtle (*Glyptemys muhlenbergii*) occurs in wet meadow habitat in Lebanon County with a federal status of Threatened. Northeastern bulrush (*Scirpus ancistrochaetus*) is a federally Threatened plant that occurs in Northern Dauphin and Schuylkill Counties. The Indiana bat (*Myotis sodalis*) has been found in the general region, but there are no known maternity colonies or capture records within the installation boundary. From 2016-2021, 144 mist-netting surveys (approx. 720 survey hours) were conducted at 94 sites throughout the installation, following USFWS Indiana bat summer survey guidelines. A total of 2,127 bats of nine species were captured during these surveys, including zero Indiana bats. In addition, acoustic surveys were conducted at 8 long-term sites from April-October, 2018-2020, resulting in over 4,300 detector-nights. A total of 306 bat passes were identified as either Indiana bats or little brown bats, representing less than 0.1% of identified bat passes. While Indiana bats have been recorded using acoustics, their calls closely resemble those of little brown bats such that the two species cannot be reliably distinguished from one another. Thus, the occurrence of Indiana bats onsite cannot be confirmed using acoustic methods alone. These species are not believed to occur on installation due to the amount of survey time logged and failure to produce any evidence of a population. New projects that may threaten unknown occurrences require further survey effort when there is potential for harm and habitat to support the species. The habitat for each of the unlikely species is already managed under best management practices for sympatric listed species (spotted turtle, wood turtle, and NLEB) and federally protected wetlands.

State Listings

FIG hosts several state-listed rare species as well as species of concern. These species primarily occur due to the quality and quantity of undeveloped land across a variety of habitats. Currently, FIG has a number and variety of plants, mammals, breeding birds, herptiles, and invertebrates that are tracked by state agencies, many of which rely on early-seral stage, disturbance-dependent habitats. Formal surveys on the highest priority species have been performed on an annual basis since the mid-2000s and have been expanded to include lower priority species.

Some of the highest priority species include the eastern regal fritillary, GWWA, Allegheny woodrat, little brown bat, tri-colored bat, eastern small-footed bat, spotted turtle and wood turtle. A complete list of state listed species located at FIG can be found in Table 2.c.1.

Additional information concerning federal and state listed species (to include status, monitoring, management, conservation benefit, management plan implementation, and conservation effort) can be found in Appendix F.

Table 2.c.1. Current State listed and State Watch Species at FIG

Information generated from Pennsylvania Natural Heritage website (http://www.naturalheritage.state.pa.us/). The definitions of state status and state rank abbreviations are listed on at the end of the table, as well as on the aforementioned website.

Scientific Name	Common Name	State Status	State Rank
Plants (from PADCNR)			
Eleocharis compressa	Flat-stemmed spike-rush	PE	S1
Eupatorium godfreyanum	Godfrey's thoroughwort	N	S1S2
Gaylussacia brachycera	Box huckleberry	PT	S1
Gentiana villosa	Striped gentian	TU	S1
Ilex opaca	American holly	PT	S2
Juglans cinerea	Butternut	N	S4
Juncus gymnocarpus	Coville's rush	N	S4
Menziesia pilosa	Minniebush	PR	S3
Morus rubra	Red Mulberry	N	S2
Paronychia fastigiata var. nuttallii	Forked-chickweed	TU	S1S2
Peltigera hydrothyria	Hydrothyria lichen		SNR
Phaseolus polystachios	Wild Kidney Bean	N	S1S2
Phlox ovata	Mountain Phlox	PE	S1
Platanthera ciliaris	Yellow-fringed orchid	TU	S2
Pycnanthemum verticillatum var. pilosum	Hairy mountain mint	TU	SH
Pycnanthemum clinopodioides	Mountain mint	N	SH
Quercus macrocarpa	Bur oak	N	S2S4

Schoenoplectus subterminalis	Water bulrush	N	S3
Trillium cernuum	Nodding trillium	N	S2
Triosteum angustifolium	Horse-gentian	TU	S1
Woodwardia areolata	Netted Chainfern	N	S3
Mammals (from PGC)			
Lasionycteris noctivagans	Silver-haired bat	CR	S1
Myotis leibii	Eastern small-footed bat	PT	S2
Myotis lucifugus	Little brown bat	PE	S1
Myotis septentrionalis	Northern long-eared bat	PE	S1
Neotoma magister	Allegheny woodrat	PT	S2
Nycticeius humeralis	Evening bat		S2
Perimyotis subflavus	Tricolored bat	PE	S1
Breeding Birds (from PGC)			
Anas crecca	Green-winged teal	CR	S1B, S4N, S3M
Ardea alba	Great egret	PE	S2B, S4N, S3M
Ardea herodias	Great blue heron		S5B, S4N, S4M
Chordeiles minor	Common nighthawk	CA	S3B, S4M
Circus hudsonius	Northern harrier	PT	S2B, S3M
Cistothorus platensis	Sedge wren	PE	S1B, S1M
Colinus virginianus	Northern bobwhite	CA	S1
Haliaeetus leucocephalus	Bald eagle	DL	S4B, S5N, S4M
Ixobrychus exilis	Least bittern	PE	S2B, S2M
Melanerpes erythrocephalus	Red-headed woodpecker		S4B, S4N
Nycticorax	Black-crowned night-heron	PE	S2B, S3M
Parkesia noveboracensis	Northern waterthrush	CR	S2B, S3M
Podilymbus podiceps	Pied-billed grebe	CR	S2B,S4N, S4M
Porzana carolina	Sora	CR	S3B, S3M
Rallus limicola	Virginia rail		S3B, S3M
Tyto alba	Barn owl	CA	S2B, S3N
Vermivora chrysoptera	Golden-winged warbler	CA	S2B, S3M
Amphibians and Reptiles (from PFBC)			
Agkistrodon contortrix	Copperhead		S3S4
Anaxyrus fowleri	Fowler's toad		S3S4
Clemmys guttata	Spotted turtle		S3S4
Crotalus horridus	Timber rattlesnake		S3S4
Glyptemys insculpta	Wood turtle		S3S4
Heterodon platirhinos	Eastern hog-nosed snake		S3S4

Opheodrys vernalis	Smooth greensnake		S4
Pseudemys rubriventris	Northern Red-bellied Cooter	PT	S2S3
Regina septemvittata	Queensnake		S3S4
Sceloporus undulatus	Eastern fence lizard		S3
Terrapene carolina	Woodland box turtle		S3S4
Thamnophis sauritus	Eastern ribbonsnake		S3
Fish (from PFBC)			
None			
Invertebrates (from PADCNR)			
Anisota stigma	Spiny oakworm moth		S1S2
Callphrys irus	Frosted elfin		S2
Datana ranaeceps	Post-burn datana moth		S1
Euphyes conspicua	Black dash		S3
Eurytides marcellus	Zebra swallowtail		S3
Lagoa crispata	Black-waved flannel moth		S3
Merope tuber	Earwig scorpionfly		SU
Nastra iherminier	Swarthy skipper		S3
Speyeria idalia	Eastern regal fritillary		S1
Stygobromus allegheniensis	Allegheny cave amphipod		S2S3
Zale lunifera	Pine barrens zale moth		S1

PE **Pennsylvania Endangered** - Plant species which are in danger of extinction throughout most of their natural range within this Commonwealth, if critical habitat is not maintained or if the species is greatly exploited by man. This classification shall also include any populations of plant species that have been classified as Pennsylvania Extirpated, but which subsequently are found to exist in this Commonwealth.

PT **Pennsylvania Threatened** - Plant species which may become endangered throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained to prevent their future decline, or if the species is greatly exploited by man.

PR **Pennsylvania Rare** - Plant species which are uncommon within this Commonwealth because they may be found in restricted geographic areas or in low numbers throughout this Commonwealth.

PX **Pennsylvania Extirpated** - Plant species believed by the Department to be extinct within this Commonwealth. These plants may or may not be in existence outside the Commonwealth. If plant species classified as Pennsylvania Extirpated are found to exist, the species automatically will be considered to be classified as Pennsylvania Endangered.

PV	**Pennsylvania Vulnerable** - Plant species which are in danger of population decline within Commonwealth because of their beauty, economic value, use as a cultivar, or other factors which indicate that persons may seek to remove these species from their native habitats.
TU	**Tentatively Undetermined** - A classification of plant species which are believed to be in danger of population decline, but which cannot presently be included within another classification due to taxonomic uncertainties, limited evidence within historical records, or insufficient data.
PC	Animals that could become endangered or threatened in the future. All of these are uncommon, have restricted distribution or are at risk because of certain aspects of their biology.
N	No current legal status, but is under review for future listing.
S1	Critically Imperiled - Critically imperiled in the nation or state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state.
S2	Imperiled - Imperiled in the nation or state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state.
S3	Vulnerable - Vulnerable in the nation or state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4	Apparently Secure - Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	Secure - Common, widespread, and abundant in the nation or state.
S#S#	Range Rank - A numeric range rank (e.g., S2S3 or S1S3) is used to indicate any range of uncertainty about the status of the species or ecosystem.
SNR	Not Ranked - State conservation status not yet assessed.
SU	Unknown - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

B	Breeding - Conservation status refers to the breeding population of the species in the nation or state/province.
N	Nonbreeding - Conservation status refers to the non-breeding population of the species in the nation or state/province.
M	Migrant - Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the nation or state/province.
CA	Candidate at Risk - Species that although relatively abundant now are particularly vulnerable to certain types of exploitation or environmental modification.
CR	Candidate Rare - Species which exist only in one of a few restricted geographic areas or habitats within Pennsylvania, or they occur in low numbers over a relatively broad area of the Commonwealth.

2.c.2. Fauna

FIG provides access to approximately 12,000 acres for hunting, trapping, and fishing. Although numerous game species can be hunted at FIG, the most common are Pennsylvania's three big game species: the white-tailed deer, black bear, and wild turkey. Ring-necked pheasant are purchased with outdoor recreation funds and stocked to be hunted with other native small game species such as ruffed grouse, eastern cottontail rabbit, and gray squirrel. Furbearers such as red fox, grey fox, coyote and raccoons are the most common species captured by trappers. Brook, rainbow, and brown trout are stocked in the public access waters of FIG, both by the PA Fish & Boat Commission and the IGMR FGCC. Stocked trout are the most common species sought after by anglers on the installation. Native brook trout, small and large mouth bass, and several species of pan-fish are other less commonly sought-after species present in the waters of FIG.

2.c.3. Flora

FIG currently hosts over 800 species of plants spread across many unique plant communities. These communities are generally composed of forests, grasslands, shrublands, and wetlands which, when combined, form a unique and complex mosaic across the landscape. Forests and grasslands occupy most of the installation while shrublands and wetlands as well as intermediate communities comprise of the rest. Surveys on the diversity, abundance, and ecology are conducted annually.

Primary species include typical eastern forest species such as oaks and maples as well as various pines such as white pine and Virginia pine. In open landscapes, keystone species include native

warm season grasses such as little bluestem and broom-sedge and forbs such as milkweeds, thistles, goldenrods and other native wildflowers. Sensitive species such as striped gentian and yellow-fringed orchis occur in grassland habitat while others are wetland dependent. These include golden club, Coville's rush, and four-angled spikerush. American holly and nodding trillium are forest species.

3. Environmental Management Strategy and Mission Sustainability

3.a. Supporting Sustainability of the Military Mission and the Natural Environment

As the mission is dependent on natural resources, so is the mission sustainability dependent on the longevity of those resources. The two, while seeming at odds in certain moments, cooperate and provide synergy when implemented effectively, efficiently, and correctly. The two can be a means to the same end.

3.a.1. Military Mission and Sustainable Land Use Integration

Sustainability is defined by the Army Strategy for the Environment as simultaneously meeting "current as well as future mission requirements world-wide," safeguarding human health, improving quality of life, and enhancing the natural environment (US Army 2004). On the local scale, this translates to preparing, repairing, and enhancing the FIG missionscape for soldier training and the perpetuation of its natural resources.

PADMVA and the National Guard accomplish sustainability by implementing the INRMP through on-site Conservation (natural resource managers) and Sustainable Range Program (SRP) personnel. These personnel perform a dual role of both monitoring the environmental conditions of the training site and physically maintaining and rehabilitating the environment with stewardship programs.

The result of the level of habitat health enjoyed today is due to a cadre of professional and effective soldiers who appreciate the realism of the training environment and the habitat variability FIG provides. By emphasizing biodiversity and native species, the installation landscape is resilient and diverse for simulation and replication of mission conditions worldwide. Resiliency also extends some protection from invasive species, disease, and other natural threats to the resource.

3.a.2. Vegetation Management

Vegetation management is important for the continued viability and availability of maneuver lands at FIG. FIG employs various vegetation management techniques depending on the needs of the training area in question. From small scale brush cutting and removal, to large scale

prescribed burning, and aerial herbicide application, FIG ITAM and the Conservation Division cooperate to reduce nuisance vegetation—whether that be for natural resource needs to control harmful, invasive species, or the Training Site (ITAM) needing to control woody encroachment hindering line of sight, or of nuisance vegetation affecting mounted or dismounted maneuver.

The FIG ITAM program primarily uses mechanical brush grinding in training areas to reduce undergrowth in concealment and bivouac areas. For large, open maneuver areas, aerial herbicide application is used to reduce woody vegetation encroachment, while protecting beneficial grasses and other desirable physiognomic classes of vegetation. FIG ITAM coordinates its herbicide application with the BEM via the NEPA process. In addition to buffering sensitive areas proximal to the areas being treated using GIS data layers in the spraying helicopter, the buffers of the sensitive areas are also able to be aerially marked for an additional, visual safeguard for the pilot applying the product.

Land Rehabilitation and Maintenance (LRAM) used best management practices (BMPs) for erosion control & environmental compliance. The Sustainable Range Program SharePoint site lists dozens of different BMPs, why and how they might be used and specifications for construction; all listed in 32CFR under categorical exclusions in NEPA.

LRAM uses various vegetation management practices. For small projects, simple mechanical removal is used either with a forestry mulcher (Fecon-type machine) or by hand using saws. Otherwise, the ITAM program maintains a vegetation management contract with several prescriptions including mechanical removal, hand removal, brown brush monitoring, boom application of herbicide, etc.

Project approval is via the ITAM Coordinator and the Range Management Authority (RMA). Each project undergoes a NEPA review by BEM and undergoes periodic review and inspection by BEM and the local County Conservation District.

The Range and Training Land Assessment (RTLA) program developed and uses a protocol defining the projects conducted. The purpose of the RTLA is primarily to assess the training lands for viability, accessibility, and availability, and identifies problem areas with respect to maneuver damage, line of sight issues, and erosion. The RTLA coordinator also helps the ITAM Coordinator track the progress and success of LRAM projects.

SRP GIS provides many functions to support the training mission at the installation but will assist in natural resource management only from a project compliance, or an erosion and sedimentation control aspect.

Sustainable Range Awareness is a program designed to inform trainers and users of the training lands about cultural and natural resources, and what to do and who to contact in case of an emergency such as a petroleum, oil, lubricants (POL) spill. It also identifies sensitive species, and the areas they inhabit. This is done by disseminating pertinent information (such as what Seibert Stakes are/why they are important) during daily range coordination briefings, as well as

through the distribution of Soldier Field Cards, which will highlight sensitive areas, issues, and provide contact information. These cards are currently in production (scheduled to be published and received in FY22).

The FIG ITAM Coordinator chairs the monthly SRP Steering Committee, a multi-functional group of trainers, users, and stakeholders of the installation. Environmental and training issues and initiatives are brought to the table and discussed for appropriateness and to deconflict each effort with training, ensuring the proper environmental procedures are being followed. The committee is made up of representatives from the Training Site, BEM Planning and Conservation Divisions, Air National Guard, DPW, and the CFMO.

3.a.3. Impact to the Military Mission

The primary impact to the military mission from a proper natural resource program is that of a benefit to training durability and realism. Weak, unsupported landscapes quickly degrade in the face of on-the-ground training in the forms of mounted vehicle use, fire, and detonation. A healthy habitat provides species that are robust to these activities and thrive in the faces of the added pressures.

Native grasses, oaks, and pines are able to recover from initial disturbance. The birds, mammals, and insects that use them have demonstrated the ability and desire to occupy the habitat with and without training activity in their midst. While some disturbance-sensitive species are absent from the installation's training grounds and ranges, many disturbance-dependent species (often even more rare in Pennsylvania) require the continuation of the military presence and land-use model.

Occasionally, the maintenance and enhancement of the installation's natural resources does conflict with the immediate desires of a training unit. Fire, herbicide, planting, and hunting are all seasonal activities with short windows that can come into conflict with annual trainings and duty weeks. To this end, the natural resource managers, SRP office, and Range Control staff work together to avoid scheduling barriers and conflicts. In the end, the greater good is performed for not just one unit at one point in time but for all units in perpetuity.

Rare species, such as the eastern regal fritillary, and protected habitats, such as wetlands, cause adaptations to training plans. Any restrictions to the military mission, specific to species or area, are shown and discussed in detail in Appendix G. Some restrictions may be implemented even if a species is not present (but their habitat is). For example, despite extensive searches and 15 years of turtle monitoring, no bog turtles have been found on the installation. However, several areas surveyed at FIG have revealed wetlands associated with potential bog turtle habitat. FIG staff works closely with USFWS personnel to determine the best course of action should a proposed action be located near potential habitat. Recommendations include implementation of avoidance measures and/or conducting a Phase II (presence/absence) study. As mentioned previously, no bog turtles have been located during any of the Phase II surveys at FIG.

Overall, the impact on the military mission is clear: After 80 years of training at FIG, the site remains one of the most heavily used installations, acre for acre, of any in the United States while still looking similar to the environment found here upon purchase in the 1930s. The

landscape and the natural resources programs are not detriments to Army training, but rather they have fostered realistic training situations through several major conflicts on several continents with victorious results. The job here and now is to continue tradition and ensure the same or higher level of success in the future. For an overview of constraints/restrictions to military mission, see map in Appendix J, page J-3.

3.a.4. Relationship to Range Complex Master Plan (RCMP) and Operational Area Plans (OAP)

The RCMP, OAPs and the INRMP are used together to provide guidance as to how natural resources are managed. Training restrictions imposed because of endangered species, wetlands, and other natural resource issues are incorporated into the installation-wide GIS and posted on the landscape with Seibert Stakes or Regal Research Area (RRA) signs. Prohibited activities and sensitive issues are discussed in the range safety briefings and the range safety certification program. Additional restrictions in place for fire sensitivity and fuels danger are incorporated into the RCMP in regard to the fire danger rating system and the use of pyrotechnics.

Any questions or concerns with the interaction between the RCMP, OAP, and the INRMP are brought up in the monthly ITAM meeting, held in conjunction between the Bureau of Environmental Management, the Garrison Commander, both maintenance offices, both engineer offices, DPOTS, and the Master Planning Office. This meeting is where FIG determines management priorities, infrastructure needs, and funding solutions to coordinate effort and reduce duplication and waste.

3.b. Natural Resources Consultation Requirements

PADMVA and the PAARNG are required to consult the ACoE, PADEP, and the local county conservation districts when dealing with matters affecting surface waters and wetlands. This consultation often comes in the form of Clean Water Act (CWA) permits and mitigations. These agencies to date are flexible and willing to find a reasonable agreement in most situations. On all matters of stream crossings, bank and floodplain encroachment, and wetland encroachment, a permit must be in hand or reparations will be considered for damages done.

When there is a major project in planning that reaches the 35% design phase, PADMVA is also required to consult PADCNR concerning possible rare species that may occur in the area. PADCNR performs a geographical database search (called Pennsylvania Natural Diversity Inventory or PNDI) within a given buffer for the line of disturbance. The results may require further consultation with PGC, PFBC, or even the USFWS. To date, the highest level of consultation has been to require Phase I and II surveys for rare species occurrences. These surveys are conducted by either PADMVA Wildlife or contract, and the resulting supporting documentation resolves the issue.

The PADMVA must also consult PGC and PFBC regarding the Outdoor Recreation program, its harvests, and the regulated species. The installation hunting and fishing programs have the

ability to regulate above and beyond the PGC and PFBC requirements, but do not have the ability to undermine or disregard their regulations.

Prescribed fire also has a set of consultations that must be followed, including plan review (30-day review period prior to implementation) and burn day notification to DCNR Bureau of Forestry (BoF) and DEP (24 hours prior to implementation).

3.c. National Environmental Policy Act Compliance

This INRMP is a proposed action that must be reviewed in accordance with NEPA and AR 200-1 prior to implementation of the projects, objectives and goals found within. NEPA was created to identify environmental concerns with human activities and to resolve them to the best degree possible at early stages of project development. The PAARNG uses NEPA to ensure its activities are properly planned, coordinated, and documented. The PAARNG provides NEPA documentation for proposed projects at FIG that are beyond the existing level of documentation developed by the PAARNG for the training site. This additional NEPA documentation can then be used for identifying impacts or potential problems to the natural resources of the FIG.

3.d. Beneficial Partnerships and Collaborative Resource Planning

The current opportunities between PADMVA and outside entities include the eastern regal fritillary reintroduction efforts, fire-related mutual aid agreements, and community involvement. PADCNR BoF and Bureau of State Parks (BoSP), Pennsylvania Department of Transportation (PENNDOT), Pennsylvania Emergency Management Agency (PEMA), PA State Police, and other state agencies inholding or occupying FIG lands are all enrolled in one way or another in the natural resources coverage or partnerships.

3.e. Public Access and Outreach

The installation has a dedication to the public that stretches beyond Right-to-Know laws, recruitment, and answering questions from the press. Community involvement and participation is promoted in events such as annual butterfly tours and March for the Fallen (a walk/run/ruck march of various distances designed to honor those who given the ultimate sacrifice for our nation and also serve as a fundraiser for the PANG Military Museum). PADMVA and the PANG are committed to community involvement and showcasing our special assets.

3.e.1. Public Access and Outdoor Recreation

The general public currently has seasonal access to portions of the installation due to township-owned roads, public features, and trout stocking. Areas of cantonment, 2nd Mountain Hawkwatch, and Indiantown Run are available without a fee and without registration. Specifically, FIG maintains two public recreation lakes, Marquette and Shuey Lakes, as well as a public education wetland across from the Memorial State Park inholding (formerly PADMVA property). NOTE: The installation is not currently a “closed” post with limited access. As of 2016, most of the smaller access roads to FIG were closed off with gates so that installation

access is only allowed from three major roads. This is in preparation for future controlled access/secure perimeter at FIG.

The portion of Indiantown Run from and including St. Joseph Springs to Memorial Lake is open for public fishing due to clauses established in PFBC's regulations on the trout stocking program. Since trout are raised from PFBC-provided fingerlings, they must be made available to the public upon release and any stocked water must be publicly fishable to return the commonwealth's investment. Shuey and Marquette Lakes are also stocked annually. There is no public boating on installation waters, but the Indiantown Gap Military Reservation Fish and Game Conservation Club (IGMR FGCC) can use some small un-motorized rowboats on Marquette Lake.

The registered outdoor recreation program allows further access upon completion of a recreation safety briefing available online Aug-May. Registrants must also pay a fee determined and set forth in FIG Regulation 215-2. The use of a recreation permit allows the user to sign-in online and access off-limits portions of the installation otherwise only open to military training. The briefing ensures registrant safety, and the fee covers recreation program costs that often can't be reimbursed with appropriated funds.

SGL 211 borders the installation to the north. This remote area has only a few reasonable access points, one of which runs through Cold Springs Road and FIG property. This access brings hunters, snowmobilers, and equestrians near or across the installation's borders. Hunting camps and farms bordering FIG that provide hunting access for a fee also attract encroachment onto FIG. Field monitoring and law enforcement keep most of the encroachment activities to a minimum, however.

Public hiking trails have accessed FIG property even before the installation's first dedication ceremony. The Appalachian Trail originally ran through installation but was realigned to the north in the early 1930s to avoid conflicts with the military mission. The Horse-Shoe Trail, connecting the Appalachian Trail and Valley Forge, still runs through the far southwest boundary of the installation in D3B and D3D. The Horse-Shoe Trail Conservancy and PADMVA agreed to reroute parts of the trail to prevent access to the training corridor and active ranges; this agreement has allowed the trail to continue through portions of FIG property without conflict.

3.e.2. Public Outreach

The Wildlife section holds several outreach programs each year, including public tours, informational sessions, lectures, peer tours, publications, hunter education courses, and special events. The key to the outreach program is involvement both from the agency and from the public, whether it's performing the service of public and environmental education or receiving the volunteer labor necessary to complete objectives.

In a typical year, the Wildlife section holds one bird tour (April/May) and several eastern regal fritillary grassland habitat tours (July) for the public. These events have been attended by as few as 8 people to as many as a few hundred. In August and September, outdoor recreation safety briefings speak to approximately 1,000 registrants a year. With 50 volunteers, small, specialized

groups (state agencies, academics, master gardeners, educators, Boy and Girl Scouts, etc.), and recreationists, FIG receives thousands of hours of free labor in return for access opportunities, nature viewing, and environmental education.

All public outreach materials go through the PAO for approval. Similarly, all press and public inquiry must pass through the PAO. PADMVA Natural Resources employees may be requested for speaking engagements via a request form on the PADMVA website.

3.f. Encroachment Partnering

Encroachment restricts the Army's ability to operate installations & training areas. It changes the pattern of land use and habitat growth and impedes the Army's ability to train soldiers. It affects the installation's natural resources by isolating populations, increasing edge effect, and introducing stressors. Encroachment is also a concern for the communities outside the installation boundary line, whose health, safety, and quality of life could be affected by noise and other impacts associated with training activities. The Army Compatible Use Buffer (ACUB) program facilitates partnerships between the Army, conservation organizations, state and local governments, and landowners to limit incompatible land use around Army installations and thus reduce restrictions on daily training activities.

The primary purpose of the FIG ACUB program is to protect current military missions and training, as well as capacity for future missions and training, via land conservation efforts. ACUB projects use of fee-simple/sale real estate purchases, conservation easements, and/or deed restrictions to encumber land for protection in perpetuity. FIG's ACUB program is intended to help protect critical military missions such as the aviation training functions of the Eastern Army Avaition Training Site (EAATS) and its associated facilities at MAAF (the Army's second-busiest heliport behind Fort Rucker) and the live-fire training facilities located throughout FIG's training area, including small and large-caliber ranges and an air-to-ground bombing range, among others. Protection of land under this program assists in reducing the risk of incompatible use of land around FIG that could threaten military training activities. Several secondary benefits are often realized as part of FIG's ACUB projects. Secondary benefits that affect natural resources include such things as habitat protection, forest and timber management, protection of water resources, including watersheds that provide drinking water to communities, and protection of recreational sites and trails, including their viewsheds.

Under its ACUB program, FIG works with its Primary Partner, the Ward Burton Wildlife Foundation (WBWF), and several secondary partners, including The Nature Conservancy (TNC), the Manada Conservancy, the Lebanon County Conservation District, and others to conserve land in pursuit of program and regional conservation goals. FIG participates in regional conservation efforts as a member of the Kittatinny Ridge Coalition (KRC), a cooperative partnership between multiple local, regional, and state-wide conservation organizations. FIG collaborates with members of this partnership to identify threats to military missions and conservation priorities, collaborate on projects of shared interest, and assist coalition members with their respective conservation projects, as applicable. Currently, the largest threats to both the military missions at FIG and the greater Kittainny Ridge ecosystem include commercial and residential development and the accompanying loss of habitat (including

commercial development that may attract additional residential development), and the construction of large-scale energy projects (electric transmission lines, wind turbines, etc.) that often result in habitat fragmentation and harm to military aviation training conducted at low altitudes. FIG has recently participated, via its involvement in the KRC, in a long-term process by DCNR to designate the Kittatinny Ridge as a state-level Conservation Landscape. The KRC anticipates applying for designation as a REPI Sentinel Landscape in 2023, as well. Failure to conserve land and maintain compatible use through theses initiatives would likely result in the loss of aviation training and live-fire abilities at FIG. A lack of targeted conservation programs in the Kittatinny Ridge would further degrade habitat, climate change resilience capacity, recreational opoortunities, and economic activity in the region.

The JLUS is a planning process accomplished through the collaborative efforts of stakeholders in a defined study area in order to identify compatible land uses and growth management guidelines within, and adjacent to, an active military installation. These stakeholders include local community, state, and federal officials, residents, business owners, local tribal governments, nongovernmental organizations, and the military who come together to identify compatible land uses and growth management guidelines within the JLUS study area. The intent of the process is to establish and encourage a working relationship among military installations and their proximate communities to act as a team to prevent and/or reduce encroachment issues associated with current and future missions and local community growth. Currently, primary federal funding is through the Office of Economic Adjustment, although FIG is working with Lebanon County and Dauphin County as well as the townships adjacent to the installation to implement several of the recommendations outlined in the 2015 JLUS. Other funding sources include the REPI program and matching grants from local conservation organizations. See partnership and opportunities map in Appendix J, page J-4.

3.g. State Wildlife Action Plan (SWAP)

Pennsylvania's state comprehensive wildlife plan is known as the Pennsylvania Wildlife Action Plan published in 2008 (PGC and PFBC 2008) and updated in 2015 (PGC and PFBC 2015). The SWAP sets forth a new set of priority species and communities of concern that focus on responsibility as well as rarity. For those species whose breeding range lies mostly within the state, priority is elevated whether the species is rare or common. The highest priority is reserved for those species, such as the eastern regal fritillary butterfly, where conservation concern and regional responsibility are concentrated.

FIG contains some of the largest and highest-quality patches of priority communities within the state, including grasslands, seasonal wetlands, and thicket/shrub habitats. The plants and animals that live in these communities have high numbers of endemic and rare species, some of which provide the only county and state records for their occurrence.

FIG has several species of greatest conservation need (SGCN), (see Table 3.g.1). SGCNs relate to an International Union for Conservation of Nature (IUCN) level 1 threat category, which is to say that they are steeply declining or concentrated in Pennsylvania as a significant portion of their range. This may be at any point in time, not just during breeding season, so that some species concentrate as they pass through the Appalachians during migration, or they might gather

to overwinter in the state in significant numbers. In any case, these species are often considered vulnerable for one reason or another.

Table 3.g.1. PA SWAP Species of Greatest Conservation Need Found at FIG.

Common Name	Scientific Name	Season (Birds Only)
Tundra Swan	*Cygnus columbianus*	Migration
American Black Duck	*Anas rubripes*	Breeding, Migration, Winter
Green-winged Teal	*Anas crecca*	Breeding
Lesser Scaup	*Aythya affinis*	Migration
Long-tailed Duck	*Clangula heymalis*	Migration, Winter
Ruffed Grouse	*Bonasa umbellus*	Breeding, Winter
Pied-billed Grebe	*Podilymbus podiceps*	Breeding
Horned Grebe	*Podiceps auritus*	Winter
Least Bittern	*Ixobrychus exilis*	Breeding
Great Egret	*Ardea alba*	Breeding
Black-crowned Night-heron	*Nycticorax*	Breeding
Bald Eagle	*Haliaeetus leucocephalus*	Breeding, Winter
Northern Harrier	*Circus hudsonius*	Breeding
Sharp-shinned Hawk	*Accipiter striatus*	Breeding, Migration
Northern Goshawk	*Accipiter gentilis*	Migration
Broad-winged Hawk	*Buteo platyperus*	Breeding, Migration
Golden Eagle	*Aquila chrysaetos*	Migration, Winter
Virginia Rail	*Rallus limicola*	Breeding
Sora	*Porzana carolina*	Breeding
Spotted Sandpiper	*Actitis macularius*	Breeding
American Woodcock	*Scolopax minor*	Breeding
Barn Owl	*Tyto alba*	Breeding
Northern Saw-whet Owl	*Aegolius acadicus*	Breeding, Migration
Common Nighthawk	*Chordeiles minor*	Breeding
Eastern Whippoorwill	*Antrostomus vociferus*	Breeding
Chimney Swift	*Chaetura pelagica*	Breeding
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Breeding
American Kestrel	*Falco sparverius*	Breeding
Willow Flycatcher	*Empidonax traillii*	Breeding
Sedge Wren	*Cistothorus platensis*	Breeding
Wood Thrush	*Hylocichla mustelina*	Breeding, Migration
Gray Catbird	*Dumetella carolinensis*	Breeding
Louisiana Waterthrush	*Parkesia motacilla*	Breeding
Northern Waterthrush	*Parkesia noveboracensis*	Breeding
Golden-winged Warbler	*Vermivora chrysoptera*	Breeding
Blue-winged Warbler	*Vermivora cyanoptera*	Breeding
Black-and-white Warbler	*Mniotilta varia*	Breeding
Kentucky Warbler	*Geothlypis formosa*	Breeding
Hooded Warbler	*Setophaga citrina*	Migration
Cerulean Warbler	*Setophaga cerulea*	Breeding, Migration

Blackburnian Warbler	*Setophaga fusca*	Migration
Black-throated Blue Warbler	*Setophaga caerulescens*	Breeding
Prairie Warbler	*Setophaga discolor*	Breeding
Black-throated Green Warbler	*Setophaga virens*	Breeding
Yellow-breasted Chat	*Icteria virens*	Breeding
Eastern Towhee	*Pipilo erythrophthalmus*	Migration
Field Sparrow	*Spizella pusilla*	Breeding
Vesper Sparrow	*Pooecetes gramineus*	Breeding
Grasshopper Sparrow	*Ammodramus savannarum*	Breeding
Scarlet Tanager	*Piranga olivacea*	Breeding
Bobolink	*Dolichonyx oryzivorus*	Breeding
Eastern Meadowlark	*Sturnella magna*	Migration, Winter
Rusty Blackbird	*Euphagus carolinus*	Migration
Red Crossbill	*Loxia curvirostra*	Winter
Allegheny Woodrat	*Neotoma magister*	
Long-tailed Shrew	*Sorex dispar*	
Maryland Shrew	*Sorex cinereus fontinalis*	
Big Brown Bat	*Eptesicus fuscus*	
Tricolored Bat	*Perimyotis subflavus*	
Northern Long-eared Bat	*Myotis septentrionalis*	
Eastern Small-footed Bat	*Myotis leibii*	
Little Brown Bat	*Myotis lucifugus*	
Silver-haired Bat	*Lasionycteris noctivagans*	
Fowler's Toad	*Anaxyrus fowleri*	
Spotted Turtle	*Clemmys guttata*	
Wood Turtle	*Glyptemys insculpta*	
Northern Red-bellied Cooter	*Pseudemys rubriventris*	
Eastern Box Turtle	*Terrapene carolina carolina*	
Eastern Fence Lizard	*Sceloporus undulatus*	
Eastern Hognose Snake	*Heterodon platirhinos*	
Queen Snake	*Regina septemvittata*	
Eastern Ribbonsnake	*Thamnophis sauritus*	
Copperhead	*Agkistrodon contortrix*	
Timber Rattlesnake	*Crotalus horridus*	
Brook Trout	*Salvelinus fontinalis*	
Allegheny Cave Amphipod	*Stygobromus allegheniensis*	
Roadside Skipper	*Amblyscirtes vialis*	
Juniper Hairstreak	*Callophrys gryneus*	
Frosted Elfin	*Callophrys irus*	
Appalachian Azure	*Celastrina neglectamajor*	
Monarch	*Danaus plexippus*	
Baltimore	*Euphydryas phaeton*	
Two-spotted Skipper	*Euphyes bimacula*	
Black Dash	*Euphyes conspicua*	
Zebra Swallowtail	*Eurytides marcellus*	

Leonard's Skipper	*Hesperia leonardus*	
Indian Skipper	*Hesperia sassacus*	
Eyed Brown	*Lethe eurydice*	
Swarthy Skipper	*Nastra iherminier*	
Edwards Hairstreak	*Satyrium edwardsii*	
Coral Hairstreak	*Satyrium titus*	
Eastern Regal Fritillary	*Speyeria idalia idalia*	
Southern Cloudywing	*Thorybes bathyllus*	
Comet Darner	*Anax longipes*	
American Emerald	*Cordulia shurtleffii*	
Atlantic Bluet	*Enallagma doubledayi*	
Harlequin Darner	*Gomphaeschna furcillata*	
Sable Clubtail	*Gomphus rogersi*	
Amber-winged Spreadwing	*Lestes eurinus*	
Golden-winged Skimmer	*Libellula auripennis*	
Band-wing Meadowhawk	*Sympetrum semicinctum*	
Rare Spring Moth	*Heliomata infulata*	
Promiscuous Angle	*Macaria promiscuata*	
Spiny Oakworm Moth	*Anisota stigma*	
Barrens Buckmoth	*Hemileuca maia*	
Pink Streak	*Faronta (Dargida) rubripennis*	
Post-burn Datana Moth	*Datana ranaeceps*	
The Angel	*Olceclostera angelica*	
Splendid Palpita	*Palpita magniferalis*	
Wild Indigo Borer Moth	*Papaipema baptisiae*	
Ash Sphinx	*Manduca jasminearum*	
Small Tolype	*Tolype notialis*	
Pine Barrens Zale	*Zale lunifera*	
Melsheinmer Sake Bearer	*Cicinnus melsheimeri*	
Lead Colored Lichen Moth	*Cisthene plumbea*	
Barrens Itame	*Macaria exonerata*	
A Noctuid Moth 182	*Dichagyris acclivis*	
Pine Barrens Zanclognatha	*Zanclognatha martha*	
Pachard's Lichen Moth	*Cisthene packardii*	
Apple Sphinx	*Sphinx gordius*	
Lilac Borer	*Podosesia syringae*	
Footpath Sallow Moth	*Metaxaglaea semitaria*	
Esther Moth	*Hypagyrtis esther*	
An Oak Moth	*Phoberia ingenua*	
Southern Variable Dart Moth	*Xestia elimata*	
Gray-banded Zale	*Zale squamularis*	

PADMVA and the PANG try to follow state guidelines as often as possible and practical. To that extent, the objectives and methods outlined in the SWAP are in practice at FIG. In some respects, FIG staff has gone above and beyond the guidelines to achieve their own mission

objectives. Certainly, the habitats presented on the installation help the entire state reach the goals of the plan rather than provide obstacles to meeting those goals.

4. Program Elements

4.a. Threatened and Endangered Species Management and Species Benefit, Critical Habitat, and Species of Concern Management

As of 15 May 2021, FIG currently has one listed species under the federal Endangered Species Act (ESA): the NLEB (Threatened). The installation does hold several species with potential for listing in the near future, many of which have been identified in petitions currently or recently brought before USFWS. These species and the most recent determinations are found in Appendix F, Table F.1. Conservation actions and plans are in place for all potentially listed species on the installation, and all species are currently monitored and managed in best-available adaptive management practices.

Indiana bat, bog turtle and northeastern bulrush, although listed, will not be considered here. These species have no recorded presence on the installation determined by years of targeted surveys, and they are considered absent. Should these species be detected at FIG in the future, this section (and Appendix F) will be revised.

4.b. Wetlands and Deep-Water Habitats Management

Wetlands and surface water features were comprehensively surveyed in 1998 with jurisdictional determination granted to the report in 1999 on the condition that individual impacts may need re-inspection (Ogden 1998a, 1998b). Several small project-driven studies and delineations have been completed since that time, but no other installation-wide survey has been performed due to the size of the installation, the amount of hydrology on the installation, and the lack of need for a full-scale determination. Those wetlands that have been resurveyed generally follow the 1998 findings closely. For a map of wetlands and other water resources, see Appendix J, page J-5.

FIG property encompasses the head waters of Indiantown Run, Manada Creek, Vesle Run, Aires Run, and Qureg Run. These streams are all perpetual and are gaining streams, meaning groundwater continues to leach into the stream valley causing the volume of water to “gain” as the stream progresses downhill. Two major man-made lakes Marquette Lake and Shuey Lake and several un-named man-made ponds are also on FIG property. Physical activities and chemical releases performed by PAARNG at FIG as part of daily operations affect both the surface and subsurface water quality. Both groundwater and surface water provide pathways for transport of releases off post. Because of the overriding land ownership, FIG is responsible for the water quality where it flows off the installation.

PAARNG strives to minimize the impact to littoral (lakes and ponds), aquatic(streams), and groundwater environments. These habitats are extremely fertile and provide diversity, energy, and waste management for the rest of the environment. Continuing improvements to trails, training, and tactics minimize water quality degradation.

Wetlands were first protected on the installation by President Carter's Executive Orders 11988 and 11990 of 1977 that required Federal agencies to minimize impacts of federal activities on floodplains (11988) and wetlands (11990). Regulation has been strengthened in various acts and orders since, but the comprehensive control of wetlands and surface waters comes under the Clean Water Act of 1972. Other regulations authored by a variety of agencies, including the Pennsylvania Fish and Boat Commission, Pennsylvania Department of Environmental Protection, Army Corps of Engineers, and the Soil Conservation Districts in Dauphin and Lebanon County, Pennsylvania seek to minimize the degradation of stream and surface water habitat.

FIG is a part of the Swatara Creek watershed, which in turn is part of the Susquehanna River drainage and the Chesapeake Bay watershed. Chesapeake Bay is one of the nation's most unique and critical estuary environments, and the Bay has many environmental initiatives, funding sources, and oversight to try and protect its ecosystems. FIG participates in Chesapeake Bay restoration efforts as a member of the DOD Chesapeake Bay Compact.

Groundwater quality is monitored at various locations across FIG. Groundwater samples are collected as part of a closed landfill monitoring, CERCLA investigation of PFAS compounds, and Operational Range Assessment Program (ORAP). Groundwater elevation mapping and contouring is ongoing but over 30 piezometers have been installed throughout the post to gather depth to groundwater information. Water turbidity monitoring of Manada Creek and Indiantown Run is accomplished by remote data loggers.

A minimum 50 linear foot buffer from the bank full edge of all surface waters, streams, and wetlands is required. In accordance with FIG Regulation 350-2, mounted/vehicular training must maintain a 25-meter buffer. Additionally, specific areas of the post may require greater buffers based on specific protected species habitat investigations. This minimum buffer would be applicable for both Cantonment and the Training Corridor and for all types of encroachment, including general construction activities, range maintenance, or military training. The standardized buffer simplifies implementation and minimizes confusion and allows corrective action to be applied with minimal effort. The buffers can be enhanced by placing signs or Seibert Stakes at the identified boundary.

Ponds and lakes on the installation are internally regulated against watercraft use except in the case of Marquette Lake, on which IGMR FGCC may operate flat-bottomed boats without the use of an engine. The lakes are not considered deep enough by modern safety standards for most aquatic training including obstacle course equipment. Specialized training activities are authorized by Range Control.

4.c. Law Enforcement of Natural Resources Laws and Regulations

All law enforcement on the installation is handled by the cooperative law enforcement agencies (LEA) of the FIG Police Department and the military police on duty. As there are no installation conservation law enforcement officers (CLEO), all immediate natural resource law and regulation enforcement is handled by these LEA agents. If a situation involves state resource

law, LEA or Range Control has the duty to inform a Wildlife/Waterways Conservation Officer (WCO) from either PFBC or PGC according to the resource involved.

The FIG Range Control Office administrates the outdoor recreation programs on installation. These programs have their own regulations that Range Control has some ability to enforce through the privileges they grant. When a state or federal conservation law is involved, Range Control must inform the LEA, PGC, or PFBC for further investigation or prosecution.

LEA has the full abilities of a Commonwealth officer of the peace as described in PA Senate Bill 384 of 2009. These duties include the ability to

> (8) arrest any person who damages, mutilates or destroys the trees, plants, shrubbery, turf, grass, plots, benches, buildings and structures or commits any other offense on the grounds and in the buildings of Fort Indiantown Gap or other designated military installation or facility and prefer charges against such offender under the laws and procedures of this Commonwealth.

4.d. Fish and Wildlife Management

Fish and wildlife management fall under the duties of the PADMVA Wildlife section. The duties include all taxonomic organisms found in nature, including game, rare, common, aquatic, terrestrial, native, and exotic species. The general goal is to promote native species, increase rare species populations, and keep common species common. The means include vigorous stewardship, monitoring, and analysis. In some cases, exotic species may be targeted for removal or declines, as may be native pest species.

The primary regulation guiding fish and wildlife management is the Sikes Act (16 USC 670, et seq.) as amended. Additional regulations are covered in AR 200-1. Other funding and authorization legislation may also apply in a supplemental role.

The overarching goal of the fish and wildlife management is to provide as rich and as high quality a natural environment as can be provided while prioritizing habitat for military training use and the low-intensity high-frequency disturbance that typically occurs during training. To this end, the Conservation Division monitors and manages for common and regionally significant species as well as the game and state and federal rare species that gain more notoriety.

4.e. Forestry Management

The PADMVA Forestry Office is responsible for management of the installation's 10,000 acres of forest as well as urban forest management in the installation's cantonment area. The duties include maintaining a current inventory of forest resources, monitoring growth and yield of the common tree species found in the forest, conducting forest regeneration studies, conducting commercial and non-commercial timber harvests to promote forest health or for military training needs, conducting forest pest surveys, riparian buffer management, and reforestation. Overall, the Forestry Office is trying to promote and maintain a resilient forest landscape that can withstand impacts caused military training, forest insects and disease outbreaks, and climate

change as well as provide suitable habitat for wildlife for years to come. The majority of the forest resource is considered overstocked (>100%) and contains sparse tree regeneration.

Harvest Schedule

The FIG forest has been broken down into areas to receive timber management and areas that are not suitable for timber management. Out of the 10,612 acres of total forestland, 7,536 acres have been determined to be available for timber management by harvesting. The areas excluded from management are those areas that are on steep slopes, in wetland areas, too rocky, or part of an impact area or range complex. Areas outside of the harvest plan will either receive no management or be managed with prescribed fire. Timber sale acreage and priority for a given year is affected by various factors including military training, training requirements, environmental impacts, and contractor availability.

All of the forest stands have been broken down into 3 site classes and 5 age classes. These parameters drive the harvest schedule on FIG. Rotation ages have been set for each site class and are as follows:

- Site Class 1 (high quality): 80 years
- Site Class 2 (medium quality): 100 years
- Site Class 3 (low quality): 120 years

The goal of the harvest plan is to balance age classes by site class and their respective rotation ages over time. Below is a table detailing harvest targets in terms of acreage for a five-year period separated into regeneration cuts and improvement cuts based on two full-time foresters.

Harvest Acres by Site Class (for a 5-year period starting in 2017)			
	Regeneration	Improvement	Total
Site Class I	77	188	266
Site Class II	240	688	928
Site Class III	63	111	173
Total	380	987	1,367

Examples of regeneration harvests include clear-cuts, seed tree, shelterwood (two stage removal or final 2 stages of 3 stage removal), and salvage (depending on the situation). These harvests are targeted to areas with suitable regeneration established or where regeneration can be established relatively easily. Examples of improvement cuts include: TSI, thin from below, thin from above, free thinning, first entry of a 3-stage shelter wood, and salvage (depends on the situation). These harvests are generally intermediate treatments designed to improve stand health, adjust species composition, lower the stocking level, and aid in the establishment of desirable regeneration.

Forest Types Found on Fort Indiantown Gap

Chestnut oak and mixed oak/hickory forest: The majority of forest on installation falls under this category. Overall goals are to maintain greater than 40% stocking of the oak component in the overstory, promote diversity in overstory species composition, and promote oak regeneration

throughout the rotation to limit potential loss of oak due to gypsy moth infestation, fire, or military training impact.

Yellow poplar forest: These forests are characterized as occurring on mesic sites and generally have greater than 40% stocking in yellow poplar. Overall goal is to maintain the yellow poplar component on these high-quality growing sites.

White Pine/Hemlock forest: These forests are mostly found in bottomland and stream corridors north of Blue Mountain. Overall goal is to maintain evergreen cover to protect stream temperatures and water quality.

Miscellaneous Softwoods: These forests are comprised mainly of Virginia and pitch pine with over 50% stocking of either of these two species. Overall goals are to maintain the evergreen canopy for cover and concealment areas for military training as well as to promote pitch pine growth and establishment on installation.

Miscellaneous Hardwoods: These forests are mostly in the bottomland areas on the south side of Blue Mountain and contain an abundance of ash, hickory, and red maple. Overall goal is to maintain tree cover in these riparian areas.

Old Field: These forests are characterized by having mixed species typical of a fallow field such as black locust, black cherry, and Virginia pine. Overall goal of these forests is to aid the successional process in order to promote closed canopy forest.

Benefits to Wildlife

The forests of FIG provide many benefits to the NLEB as well as many of the common game species found in Pennsylvania.

4.f. Vegetative Management

Vegetative management is a cooperative joint effort between the Conservation Division, ITAM, DIM and Range Maintenance. The goal is to provide sustainable native ground cover and canopy structures for realistic military training as well as to support optimal habitat for native species.

Stewardship includes revitalizing native communities such as warm-season grasses and oak forests through active management with fire, soil supplementation, and seeding. The other side of stewardship is discouraging the non-native and invasive species through herbicide, fire, and mechanical removals. These two sides of stewardship must be used in some combination to achieve objectives or the natives will be crowded out of the community.

Fire, prescribed or training-induced, provides benefits that the use of herbicide and mechanical treatments cannot achieve. These include removing litter and duff, a key to seed germination and survival of violets and important wildflowers; invigorating fire-adapted species like little bluestem grass (*Schizachyrium scoparium*); removing invasives with herbicide resistance; and opening interstitial space for rodents, birds, and other taxa. Fire is also easier, cheaper, and faster

to implement than an herbicide-heavy integrated pest management plan. The key to a successful fire-dominated vegetation management program is finding a frequency and achieving a certain intensity that is neither too disturbing nor too light for the target assemblage.

Herbicide provides treatment options throughout the year rather than just the narrow windows in a burning cycle. The chemical is more directed and more effective on certain species than fire that often leaves a mosaic of effects. Chemical treatment also opens more soil to receiving aggressive invaders. Unlike fire, chemical treatments may remain soil-active and must be carefully studied before implementation. Safety concerns are still highly important, although they are less than those found with fire operations.

Mechanical treatment can also be used at any time plants remain exposed at the surface. Equipment and labor are often the largest expenses in any stewardship operation, and they can be especially expensive in mechanical treatment. Mechanical removal is often the least effective and causes the most disturbance impact. Safety concerns depend on the equipment used, but fatal accidents probably occur more often with mechanical treatment than chemical.

Volunteer programs and creative initiatives include the native seed collection program (for PADMVA or contract propagation), the butterfly garden (for a native seed bank repository), IGMR FGCC seeding and soil preparation, and reintroduction partnerships. FIG has some very unique ecotypes and species for the state, and the exceptionality and variety attract participation. These programs mainly support grassland and eastern regal fritillary habitat programs, but they also provide matching monies for grants from organizations like DoD Legacy Program and State Wildlife Grants.

4.g. Migratory Birds Management

The primary drivers for migratory bird management are the Migratory Bird Treaty Act (MBTA, 16 USC 703-711), supported by Executive Order 13186, the Bald and Golden Eagle Protection Act (16 USC 668-668d), and state and federal Endangered Species Acts with amendments (16 USC 1531 et seq.) Other funding and authorization legislation may also apply in a supplemental role.

As of June 2014, a total of 287 bird species have been observed using or passing through the installation. Of those 287 species, 144 are presumed or confirmed breeding species within the installation's many habitats. Not all of those birds are covered under MBTA (upland game species and exotic species are exempt), but a majority are.

Active management for birds on installation is usually wrapped into habitat and community management projects and objectives. Grassland guild birds benefit from grassland habitat projects, and forest guild birds benefit from beneficial forestry practices. The targeted management bird species receive on installation is limited to nest box placements, monitoring counts and projects, the wildland fire program, and some limited public educational and volunteer programs (i.e., the public feeder project, Migratory Bird Day tours, the Pennsylvania Annual Migration Count, Quittapahilla Audubon Society's Christmas Bird Count, etc.).

Passive management includes surface water quality programs including wetland protections and improvements, the mowing plan, the prescribed fire program's seasonality, and certain hunting program regulations. These programs ensure that no take occurs under the MBTA and its guidelines. They also lower disturbance levels around nesting birds and the breeding season.

Incidental migratory bird take from military readiness activities is authorized under MBTA. However, the military proponent must confer with the USFWS if any proposed or ongoing readiness activity may or is likely to adversely affect a population of migratory bird species. If such a threshold occurs, conservation measures are to be implemented to minimize the impact. Assessing the overall impacts of military readiness activities on migratory birds is to be addressed in the NEPA analysis (50 CFR 21.15). Readiness is very strictly defined and generally only applies in the direct actions of training military units. The readiness definition does not extend to any support activities that makes that training possible, just the training itself. Exemption also does not extend to cover intentional (or known) take. Interestingly in the National Guard, readiness and preparation for domestic emergencies and disaster response still falls under the military readiness provision.

A proposed rule for an incidental take (non-readiness) permit system is currently in the rule-making process (US Department of Interior 2021). Without any outline of potential activities covered by the permit, the most likely scenario is that FIG will have to comply with that permit system and get in contact with the USFWS field office or other office handling that permit. There is no current authorization for this take, but USFWS uses prosecutorial discretion on which violations to pursue. Implementing a migratory bird conservation and management program makes it very unlikely the USFWS would pursue any violation given the benefit of such programs outweigh any costs associated with the incident take from non-readiness activities.

Non-native birds and those considered non-migratory game birds are not covered under MBTA. Starling and house sparrow management, amongst other invasive species control, is acceptable and can be considered a conservation measure towards an MBTA program. Some waterfowl and other huntable migratory birds can be dealt with through a depredation permit, but the agency must go through the steps to obtain that permit and implement it legally.

4.h. Invasive Species Management

Invasive species management is a function of pest management, forest and wildlife ecology, and the sustainable range program. To this extent, all major land management offices on installation are involved in the control efforts. The SRP generally covers aerial herbicide and large-scale removal on the ranges and training areas where they prohibit maneuver. Forestry and Wildlife sections have herbicide and mechanical removal on the smaller scale (backpacks, vehicular broadcasts, drum chipping, etc.) and in areas where they present no immediate training hazard. Range maintenance will mechanically remove infestations when they threaten targetry or other major range structures. Environmental conflicts such as ESA effects and permits must be satisfied through the proper procedures with regulatory agencies via the Conservation Office. Additionally, BMPs such as conducting vehicle inspections in order to prevent the transport/spread of the invasive spotted lanternfly, are in effect.

4.i. Pest Management

The pest management program is jointly run under multiple offices and leaders; oversight is the responsibility of the Integrated Pest Management Coordinator as outlined in the Integrated Pest Management Plan. The Pest Management shop is part of the DIM office and takes care of human, building, and equipment pests that threaten health and infrastructure. Conservation Division employees deal mainly with pests that threaten lands, habitats, and organisms. ITAM takes further care of natural resource pests that threaten training lands and equipment. Finally, the medical and safety offices monitor pest vectors for human disease threats and their agents, especially Lyme disease, West Nile virus, and Rocky Mountain spotted fever. Best management practices include sanitation, eliminating food sources/breeding sites, and exclusion; this will prevent pests from becoming established.

4.j. Land Management

Land and soils management is a cooperative joint effort between Conservation Division, ITAM, DIM, Range Maintenance, and Training Site Engineers. The goal is to provide protection to the land and waterways from erosion and sedimentation. Best management practices (BMPs) are used to hold soils in place whenever ground disturbance is necessary (e.g., logging, military construction, land rehabilitation, road grading, etc.). These BMPs include silt fences, straw bales, erosion eels, sedimentation traps, sedimentation ponds, appropriate crowning on trails, ditch turnouts, water bars and any other device referenced in the erosion and sedimentation plan for preventing soils from reaching the waterways. A set of specific BMPs for ground disturbance projects are available that have been cleared with the county conservation districts.

Seed mixes have been formulated for Erosion & Sediment (E&S) control specific to the individual projects. A mix for use on ranges to prevent line of sight issues uses low growing grasses, mixes for firebreaks contain mostly clover species, and mixes for immediate rehabilitation use fast growing species such as annual rye. Straw mulch or rolled fabric stabilizers are typically used to cover the seed, and when hydro-seeding on steep slopes, a commercial mulch with a tacking agent is used. The seeding of native warm season grasses is also an important part of rehabilitation as these grasses help hold soil in place even after heavy training. These grasses however take a much longer time to establish and therefore are seeded with other rehabilitation mixes.

4.k. Agricultural Out-leasing

The installation has no agricultural leases. Installation agriculture programs are carried out with installation staff and products are used in conservation programs for the benefit of the installation, PADMVA, and PAARNG (e.g., straw for erosion and sediment control projects, native seed harvest for natural resource programs, etc.). There are no developed fields.

4.l. Geographical Information Systems (GIS) Management

Geospatial data of important elements of the natural resource program are used to create data layers and maps that facilitate environmental planning and impact management programs. GIS

analyses influence management and mission activities and are critical in both daily and long-term management actions. GIS products can depict important management areas of concern and potential conflict with proposed military actions.

All published GIS data, including installation-prepared data and data from contractors, should follow the current approved Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) structure (http://www.sdsfie.org). The current standard datum and projection are Universal Trans Mercator (UTM) World Geodetic System 1984 (WGS 84) for Zone 18 North. Metadata should follow any governance released from NGB and must accompany the file when published. Core elements must be in place and should be written into standard contracting language, however additional attributes can be added as necessary. Protocols should implement workflows that integrate field data seamlessly into proper storage.

Natural resources data are stored in geodatabases, which allow for multiple users and seamless data integration. Data management is generally handled by the Assistant Forest Program Manager or the Assistant Wildlife Program Manager or another member of the installation GIS working group. Content requests by NGB and other federal entities are generated by the installation GIS Working Group.
GIS training is available for those in need. ESRI, the company behind ArcMap, has a plethora of content on their website (learn.arcgis.com). There are also numerous books and YouTube tutorials on the subject (see Ormsby et al. 2001 and Arctur and Zeiler 2004).

4.m. Outdoor Recreation

Primary regulations governing outdoor recreation at the military installation include the Engle Act of 1958 (43 USC 155158), Executive Order 13443 – Facilitation of Hunting Heritage and Wildlife Conservation, the Sikes Act (16 USC 670, et seq.), and the Pittman-Robertson Act (16 USC 669-669k). Internal regulations include AR 200-1 and DoD Memo of 05AUG02 (Disabled Recreation Opportunities). All extractive recreation opportunities on installation (hunting, fishing, and wood-gathering) are directed by FIG Reg. 215-2, which is revised annually and available from either the Conservation Office (Bldg 26-151) or Range Control (Bldg 11-9).

PADMVA strives to provide access and opportunity to all recreation users. All seasons are considered for harvest, though individual species may be regulated above the state's minimum by installation regulations and all recreation closes in restricted areas from the end of May to the beginning of September. This closure coincides with the heaviest military training use of the property, which typically makes public access nearly impossible.

Wildlife viewing stations exist in A-21 (wetland trail), Shuey Lake (shoreline and parking lot), Marquette Lake, and Second Mountain Hawkwatch. The latter is a former helicopter landing zone that was set aside in 1984 for the counting and recording of the raptor migration every year (August through December). Access beyond standard public areas requires the purchase of a permit available through registration online Aug. through May.

4.n. Bird Aircraft Strike Hazard (BASH)

The 193rd SOW of the PAANG, based out of Harrisburg, contracted the first BASH management plan in 2009. This plan has been revised several times, with the most recent being 2019, and states basic best management for airstrike avoidance and resolution. BASH incidents have occurred over installation, on installation, and on mission routes to and from installation. Fixed and rotary wing vehicles are both susceptible and neither should be disregarded in management of the issue. As of 2015, the Army and NGB have not prepared a standard to follow, but Air Force and Navy recommendations and programs are well established. Air Force uses the Smithsonian to identify remains, and to some extent this resource can be utilized by units at FIG. Even a single feather can produce certain species identification.

The restricted airspace over and surrounding FIG is complex. Bollen Range (DET 1 193rd SOW) utilizes the airspace over the training corridor. MAAF controls their operational space over and within a 5-mile radius of the airfield. The Training Site and Range Operations control the airspace over ranges and training lands in the corridor and cantonment when those lands are not in use by Bollen or MAAF.

BASH is best treated by prevention methods, and the Conservation Division takes the matter seriously. Canada goose residency in the general area of MAAF and the flight paths is actively discouraged. Temporary water bodies built around MAAF were drained years ago to discourage geese and ducks from settling in the flight paths. Egg oiling (as opposed to addling) has been a very successful technique in discouraging nesting pairs, possibly even more successful than adult roundups during molt. Geese are driven off the airfield by the FIG Fire Department Crash Response Unit when they land in large flocks on the runways and helipads. Owl and kestrel boxes are discouraged in the immediate vicinity of MAAF or the flight paths.

Most incidents take place in the training airspace or on approach to/from Harrisburg. The 193rd conducted a study using USDA Animal Plant Health Inspection Service to monitor bird flight patterns throughout the year in 2010 to determine the best approaches and timing for avoidance. Pilots usually recon the field before making high-speed maneuvers or air-to-ground runs, and large birds are noted at that time as well as during the exercise from observers in the towers. This system generally works well over installation airspace; hence incidents mainly occur from birds on the other side of Second Mountain in the narrow Stony Valley where they cannot be seen.

The FAA Wildlife Strike Database (http://wildlife.faa.gov) is a way of reporting and tracking air strikes, both at MAAF and statewide. The database records strikes by their home airport, so some data may be "lost" at the flight's origin. Reporting is a simple online form, and it can be edited as additional data (such as the identification of remains or damage cost estimates) become available. The entire process is fairly short in comparison to other means. This database is highly recommended to try and gather better data on strikes, which is necessary to fine tune management.

4.o. Wildland Fire Management

Fire Management is essential to the mission of FIG. The primary goal of the Wildland Fire Management Program is to provide for public and firefighter safety and maximize military training opportunities. The IWFMP and Prescribed Burn Plan discuss in detail how fire is used at Ft. Indiantown Gap. In the past military training has been restricted in an effort to reduce the chance of wildfires. Therefore, in order to promote rather than restrict training activity, fire management is used to reduce the fuels that are a precondition of wildfire. An additional military benefit will be gained by controlling vegetation types that restrict troop movement and/or live fire activities.

The environmental benefit that will result from a proactive wildland fire management program is a more naturally correct state. Historically, periodic fires have played an important role in maintaining or improving biodiversity. Fire management will also reduce the potential for environmentally harmful wildfires.

4.p. Training of Natural Resource Personnel

This section lays out the requirements and opportunities for natural resource personnel training. Certifications may differ amongst personnel given position, responsibilities, and status.

4.p.1. Wildland Fire Training

Details on the wildland fire training policies of PADMVA Natural Resources can be found in the FIG Integrated Wildland Fire Management Plan. Wildland fire certifications and credentials follow the state guidelines for training and certification levels for participating individuals. Alternatively, those with access to federal tasks books and the National Wildfire Coordination Group certification process may participate using those credentials. Transition to NWCG standards is underway. Annual training includes mandated fire refreshers once per year and successful completion of a pack test to prove physical fitness minimums for the fire line in accordance with state standards.

In accordance with current standards in the IWFMP all individuals participating on wildland fire will transition to be certified in first aid and Cardio-pulmonary resuscitation (CPR). First responder or EMT training is beneficial but not required.

4.p.2. Land Management Certifications

Full-time salaried personnel wishing to participate in pesticide programs need to obtain and keep current the appropriate state certification level as issued by PA Department of Agriculture. This includes core certification and the appropriate category certification for the types of applications the staff will encounter (at a minimum, the state's Industrial Weeds/Right of Way or Forest Pest category). The state requires core and category recertification credits every three years to maintain the license. These credits are generally obtainable in one to two days of offsite training usually held within the counties several times annually. PADMVA's pesticide business license is

held by DIM, and all PADMVA applicators should use that business license for their public applicator certification records.

4.p.3. Employee Safety and Disease Surveillance

Natural resources and pest management personnel face a wider array of environmental disease threats than other commonwealth employees. As such, PADMVA has a need to see to employee health on two main issues, with the benefit to the agency of decreased liability and long-term medical costs.

The first concern is Lyme disease and other tick-borne ailments. FIG lands have high occurrences of ticks, with at least three species present including the most typical disease host, the deer tick. The prevalence of Lyme disease in tested ticks collected by the Troop Medical Center has never fallen below the 50% level since the onset of testing in the early 2000s. Natural resource employees usually find ticks on their persons at least once every two weeks, often imbedded. No number of self-checks or appropriate clothing can maintain 100% protection, and indeed, more than half of the Wildlife and Forestry crews have had at least one treatment for possible Lyme infection. The agency should endeavor to provide annual surveillance, based on current medically accepted testing, for each employee and contractor that fall into the greatest liability group, i.e., those who work with natural resources and pest management.

The second concern is rabies. This disease is specific to those handling or called to handle mammals, at least in terms of susceptibility. Some employees, including those in pest management and those in the Wildlife section, involved in the monitoring and management of bats, rodents, and other mammals are highly exposed and require pre-vaccination as a condition of their work. The agency should provide initial vaccines, booster shots as needed, and annual titer surveillance to determine when those boosters are needed. These conditions are essential and industry standard. The alternative is nearly 100% fatality for those exposed without vaccination.

Risk and susceptibility for wildlife vectored diseases is an ever growing and changing topic. This topic should be revisited along with the 5-year review process to determine the necessity and budget for any further cost and life-saving measures or threats that may arise.

4.p.4. Other Certifications and Training

Safety certifications are a must for those using equipment. This includes All-Terrain Vehicle (ATV) Safety Certification before using an ATV on the installation, General Services Administration (GSA) safe driver certification before driving a GSA vehicle, and specialized equipment training on larger stewardship equipment, chainsaws, etc.

State employees must pass a series of trainings available electronically. Those PADMVA employees who qualify are given notice of the need for those trainings during their orientation. All FIG personnel must pass and annually recertify in network security courses before they can obtain a working username and email account. Other annual trainings are determined by job position.

Conferences and meetings with other natural resources professionals, both DoD and non-DoD, are necessary to gain the most up-to-date information and techniques available to the science. With more unknowns than knowns on even the most studied species, staying abreast of current topics and techniques is crucial to both successful management and an efficient team. Information at these types of professional gatherings is both very diverse and yet very detailed. Sending only one team member to report back to the group rarely covers the office needs, especially with multiple tracks of speakers and topics. Sometimes several staff will go to the same event and come back with completely different sets of information for the office's use.

4.q. Floodplains Management

FIG's geographic placement in the foothills of the Appalachian Mountains is such that most of the installation streams are first and second-order and do not have broad floodplains. As mentioned previously in the Wetlands and Deep-Water Habitats Management section, a minimum 50 linear foot buffer from the bank full edge of all surface waters, streams, and wetlands is required. This buffer is a minimum and may be increased in areas as designated by Range Control and PADMVA BEM. In accordance with FIG Regulation 350-2, mounted/vehicular training must maintain a 25-meter buffer. Additionally, specific areas of the post may require greater buffers based on specific protected species habitat investigations. The overarching goal is to prevent direct impact to streams and wetlands from training mission activities.

Some cantonment locations, being in an urbanized setting, do not meet minimum setback requirements. Impacts in these areas are limited as much as possible with no-mow streamside buffers, woodlots, and stream improvements. Where variances are necessary, PADMVA BEM and the responsible office of engineers follow standard ACoE and Commonwealth permitting procedures before implementing the activity or improvement plan.

The hundred-year floodplain is often contained in a woodlot for any streams of size. These woodlots and the wetlands contained within them are high replacement value (5:1 for forest, 3:1 for shrubland) when considered in a mitigation context and should be protected from encroachment.

4.r. Other Leases

Out-leased property at the installation is coordinated through headquarters and does not concern natural resource management. There are no agricultural or extractive industry leases at FIG at this time.

5. Implementation

5.a. Preparing Project Prescriptions

Prescriptions are prepared for the Status Tool for the Environmental Program (STEP) process. Prescriptions must follow goals and objectives set in Section 1. c. Goals and Objectives of this document. Conservation Division managers will prepare these prescriptions and estimate costs ahead of the annual budget submissions set by NGB. These submission periods take place April through July of every year. Prescriptions will be written into Appendix B, which will be reviewed and revised annually without constituting a major action unless such action is deemed necessary and this INRMP is officially revised.

5.b. No Net Loss

As a landholding department smaller than many of the landholding agencies in other Federal departments, DoD strives to maintain use of all its lands through obstacles set in place by regulation. While certain activities may be lost on an acre-by-acre basis, the overall land use for, in FIG's case, military training remains constant. The achievement of no net loss can be achieved through the planning process, the stewardship process, or the mitigation process. The first is the most desirable – to avoid loss in the planning process before implementation costs begin. The third is the least desired– to not only suffer the impact, but also have to acquire the resources to offset that impact is the most expensive option in almost all cases.

The environmental planning process at FIG generally seeks to solve the problems and inefficiencies possible through military training by avoiding impacts. Often the placement or footprint of the activities and their facilities determines the level of impact of a proposed activity. By avoiding sensitive natural resources such as surface waters and wetlands, military activities avoid a heavy footprint downstream. Environmental planning usually steps into a project at the 35-65% design phase. The earlier the environmental review process begins, the fewer problems at the point of implementation.

Stewardship is a constant and daily activity at FIG. Units have a high throughput and footprint on FIG's training landscape, and land has little time to recover between training activities. Woody encroachment, invasive species, E & S issues, and ground hazards can appear that need remediation. To this end, the PAARNG has the cooperative teams of the ITAM office, the Conservation Division, DIM, and Range Maintenance to heal the landscape, invigorate precious vegetative forms like native warm season grasses, and to enhance the habitat from its initial status. These offices perform land reclamation too, adding trainable acreage by removing old threats to maneuvers and military activity

Most directly, mitigation has been used to offset losses, such as wetland impacts, from the construction of ranges and facilities. Mitigation also provides protection in the forms of multiple use ranges (for shifting repetitive uses to alternate sites and thereby lessening the severity of the impact), additional habitat outside a given land use (such as grassland outside fire-prone ranges)

to avoid blanket treatments and mix age classes, and provides effective solutions for resource problems (such as the installation of a berm to protect a cultural resource).

FIG's most frequent encroachments are the 219 acres of eastern regal fritillary research areas and the acreages contained in wetlands and surface waters. These areas are often near the center of activity because of the nature of the installation. RRAs are found on former ranges and, naturally, in open areas conducive to training. Wetlands and surface waters are found throughout installation due to its location at the headwaters of two major tributaries to the Swatara Creek. The answer to these issues is to simply find compatible use.

The first compatible use is dismounted training. If mechanized and motorized vehicles are not in use, the impact to the land is minimal and can avoid any major long-term damage that would threaten sustainability. This means that vehicles must cross waterways at permitted engineered crossings rather than at improvised fords. This also means that the troops must avoid driving through RRAs in the maneuver areas and treat them as mined or off-limits areas, conditions that can be found in the theatre of operations not just the training environment.

The second compatible use is large live-fire ranges. These ranges have very little ground use and have natural occurrences of training-induced fire that helps to maintain the grasslands and their health. While fire cycles, spent munitions, and noise levels must be monitored and occasionally policed or placed into stewardship, military active use can even get heavy and repetitive without a loss in training time or a loss in the natural resource's sustainability. This option is more frequently used now as larger installations have more room for maneuvers, but FIG is specially adapted to live-fire operations (an increasingly rare condition in the northeast). Small arms and air-to-ground are two of the installations most frequent military land use activities.

Other compatible uses include land navigation courses, drop zones, UAS training, and convoy/IED training. These uses concentrate ground activities and minimize the true limits of disturbance. Creativity can place the facilities for these uses out of the way of sensitive habitat. Some of these uses are indifferent to the hydrology of an area as well.

5.c. Cooperative Agreements

5.c.1. Pennsylvania Game Commission

The current PGC agreement provides for PGC and PADMVA cooperation on wildland fire and habitat management projects. PGC also provides law enforcement on PADMVA properties. This agreement has no date of termination.

Currently, cooperation between the PGC and PADMVA consists of primarily wildland fire coordination and habitat management. PGC provides trainees to and has organized training events at FIG wildland fires. PADMVA has also sent supervision, equipment, and labor to PGC-held prescribed fires. Both agencies are primary members of the Keystone Appalachians Fire Learning Network and continue to partner through that organization as well. PGC and PADMVA have partnered under this agreement to provide management and scientific expertise to habitat management projects on lands managed by both agencies.

5.c.2. The Nature Conservancy (TNC)

The original TNC agreements were signed in the early 1990s to allow the state's Natural Heritage Program (then contracted to TNC) to provide installation-wide planning level surveys and document the primary habitats occupied by the eastern regal fritillary butterfly. From that position, TNC eventually created a semi-permanent office at FIG to monitor the eastern regal fritillary and provide management recommendations. This agreement ended in 2006 when TNC decided to end all scientific contracting within the state based on programmatic changes at the state level. The positions created by TNC were transferred to the Penn State University cooperative agreement and eventually to Temple University.

PADMVA-TNC cooperative agreements are now primarily fire-related, with PADMVA joining the TNC-led Fire Learning Network in 2006 and reorganizing in 2009. TNC has provided training and trainees at FIG fires since 2006. TNC is currently a partner in the ACUB program.

5.c.3. PADCNR Bureau of State Forestry

Currently there is no cooperative agreement between DCNR Bureau of Forestry and PADMVA. Meetings could be held in the future with the intent of establishing an agreement as it relates to wildland fire.

5.c.4 ACUB Cooperative Agreement

FIG's ACUB program is based on a Cooperative Agreement (CA) between the WBWF (FIG's ACUB program Primary Partner) and the National Guard Bureau (NGB). This agreement was first signed in 2015 for a five-year period and was reauthorized in 2021 for a period of ten years. The current CA authorizes NGB to obligate federal funds to assist WBWF in implementing FIG's ACUB program via the acquisition of "long-term interests in or title to" land parcels in FIG's vicinity or those lands "ecologically related" to the installation. Under this CA, program funds are available for management of encumbered lands and the natural resources they contain, as applicable and authorized. As of 30 September 2021, FIG and its partners have encumbered approximately 9,300-acres under the ACUB program, utilizing approximately $19M in ARNG and REPI funds, as well as approximately $5.7M in matching funds. See section 3.f of this INRMP for additional information on FIG's ACUB program.

5.d. Funding

Environmental funding is provided by the NGB through its STEP process for the Wildlife Office and a portion of the Forestry Office's annual budget. Additional funding from the facilities office supports the wildland fire program and response. Fees collected from hunting/fishing permits go directly into a fish and wildlife fund, which is managed by a board of trustees from various offices at FIG and used only on natural resource projects such as trout food, pheasants, food for wildlife, seed, and herbicide. The fund also pays for the Outdoor Recreation program online registration and sign in system, currently administered by iSportsman. Additional funds for natural resource projects come in through grants.

Grants

To date, the Conservation Division has applied for funding through several reimbursable or grant programs: PA Wild Resource Conservation Program (WRCP), DoD Legacy, Chesapeake Bay Foundation (CBF), and the Readiness and Environmental Protection Initiative (REPI). WRCP and Legacy grants have been used to fund off-site partnerships, regal rearing, initial planning level surveys in the 1990s, and off-site expert opinion. CBF has paid for stream and waterway enhancements. DoD Legacy, through National Public Lands Day (NPLD) funding mechanisms, has provided for pollinator enhancements like the Range House Butterfly Garden. The REPI program funds ACUB and encroachment buffer programs.

There is one other DoD grant program that has not been successfully awarded to the installation but continues to hold promise for funding in the future. This program is the Strategic Environmental Research and Development Program (SERDP)/Environmental Security Technology Certification Program (ESTCP). SERDP/ESTCP funds projects with real world development of technological solutions for common Defense problems.

Grants have their own schedules and timelines. Many follow the fiscal year of the ultimate granting authority. DoD Legacy thus follows the federal fiscal year with plenty of lag time for the lengthy review and proposal processes. WRCP follows the state fiscal year from 1 July to 30 June. NPLD is a special grant package meant to honor the titular day of 29 September, and the proposal process follows sufficiently so that funds are distributed in time to host the volunteer events.

Reimbursable Accounts

The Conservation Division benefits from three state-funded reimbursable accounts. The first, forestry reimbursable funds (specifically called the State Armory Trust Fund), is made from timber revenue and firewood sales. This money is generated by both commercial timbering contracts and by the fees residential users pay for firewood at our firewood yard. These funds are primarily used for facility improvements with funding considerations for forestry and conservation projects. The second fund is generated by the outdoor recreation access program, part of Morale Welfare and Recreation (MWR). This program generates user cost fees from the sale of installation passes for hunters and anglers, but all money must go to MWR purposes or back into the costs of the natural resources that generate the program's interest (hunting programs, wildlife habitat projects, check stations, etc.). The third type is recycling money generated by the proceeds of recycling brass and other metal left by range use, and by the recycling of common materials from around the installation like aluminum cans and cardboard. These funds go back into the recycling operations or to MWR, which can be used to fund recreation costs.

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Appendix A. List of Acronyms

ACoE	Army Corps of Engineers
ACUB	Army Compatible Use Buffer
AGL	Above Ground Level
ASP	Ammo Supply Point
ATV	All-Terrain Vehicle
AT	Annual Training
AVCATT	Aviation Combined Arms Tactical Trainer
BASH	Bird/Animal Airstrike Hazard
BEM	Bureau of Environmental Management
BEQ	Base Enlisted Quarters
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practice
BoF	Bureau of Forestry
BoSP	Bureau of State Parks
BOQ	Base Officers Quarters
BRAC	Base Realignment and Closure
BWWA	Blue-winged Warbler
CA	Cooperative Agreement
CACTF	Combined Arms Collective Training Facility
CBF	Chesapeake Bay Foundation
CBRNE	Chemical, Biological, Radiological, Nuclear, and Explosives
CERFP	CBRNE Enhanced Response Force Package
CEQ	Council on Environmental Quality
CFFT	Call For Fire Trainer
CFR	Code of Federal Regulations
CLEO	Conservation Law Enforcement Officer
CPR	Cardio-Pulmonary Resuscitation
CWA	Clean Water Act
DA	Department of Army
DCCD	Dauphin County Conservation District
DMAP	Deer Management Assistance Program
DoD	Department of Defense
DPOTS	Directorate of Plans, Operations, Training, and Security
DPTMS	
E&S	Erosion and Sedimentation
EAATS	Eastern Army Aviation Training Site
EMT	Emergency Medical Technician
ESA	Endangered Species Act
ESMP	Endangered Species Management Plan
EST	Engagement Skills Trainer
ESTCP	Environmental Security Technology Certification Program
FEIS	Final Environmental Impact Statement
FIG	Fort Indiantown Gap National Guard Training Center

FOB	Forward Operating Base
GIS	Geographical Information System
GSA	General Services Administration
GWWA	Golden-Winged Warbler
HBCT	Heavy Brigade Combat Team
IBCT	Infantry Brigade Combat Team
ICRMP	Integrated Cultural Resources Management Plan
IGMR FGCC	Indiantown Gap Military Reservation Fish and Game Conservation Club
INRMP	Integrated Natural Resources Management Plan
ID	Infantry Division
IPMP	Integrated Pest Management Plan
ITAM	Integrated Training Area Management
IUCN	International Union for Conservation of Nature
JLUS	Joint Land Use Study
KRC	Kittatinny Ridge Coalition
LCCD	Lebanon County Conservation District
LEA	Law Enforcement Agency
LEED	Leadership in Energy and Environment
MAAF	Muir Army Airfield
MBTA	Migratory Bird Treaty Act
M-CCTT	Mobile-Close Combat Tactical Trainer
MRAP	Mine Resistant Ambush Protected
MTC	Mission Training Center
MTR	Military Training Routes
MWR	Morale, Welfare, and Recreation
NGB	National Guard Bureau
NLEB	Northern Long-eared Bat
NEPA	National Environmental Policy Act
No.	Number
NPLD	National Public Lands Day
NPS	National Park Service
NTA	Northern Training Area
OAP	Operational Area Plans
PA	Pennsylvania
PAANG	Pennsylvania Air National Guard
PAARNG	Pennsylvania Army National Guard
PADA	Pennsylvania Department of Agriculture
PADCNR	Department of Conservation and Natural Resources
PADEP	Pennsylvania Department of Environmental Protection
PADMVA	Pennsylvania Department of Military and Veterans Affairs
PANG	Pennsylvania National Guard
PAO	Public Affairs Office (or Officer)
PARC	Partners in Amphibian and Reptile Conservation
PEMA	Pennsylvania Emergency Management Agency
PENNDOT	Pennsylvania Department of Transportation
PFBC	Pennsylvania Fish and Boat Commission

PGC	Pennsylvania Game Commission
PIF	Partners-in-Flight
PLS	Planning Level Survey
PNDI	Pennsylvania Natural Diversity Inventory
PNHP	Pennsylvania Natural Heritage Program
POL	Petroleum, Oil, Lubricants
PT	Physical Training
REOTS	Regional Equipment Operator Training School
REPI	Readiness and Environmental Protection Initiative
RRA	Regal Research Area
RTLA	Range and Training Land Assessment
SAD	State Active Duty
SBCT	Stryker Brigade Combat Team
SDSFIE	Spatial Data Standards for Facilities, Infrastructure, and Environment
SERDP	Strategic Environmental Research and Development Program
SGCN	Species of Greatest Conservation Need
SGL	State Game Lands
SOW	Special Operations Wing
SP/SPP	Species
SRP	Sustainable Range Program
SSA	Species Status Assessment
STEP	Status Tool for the Environment Program
SWAP	State Wildlife Action Plan
TA	Training Area
TNC	The Nature Conservancy
TSC	Training Support Center
UAC	Urban Assault Course
UAS	Unmanned Aerial System
USAR	United States Army Reserve
USC	United States Code
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Service
UTES	Unit Training Equipment Site
UTM	Universal Trans Mercator
WAATS	Western Army Aviation Training Site
WBWF	Ward Burton Wildlife Foundation
WCO	Wildlife (PGC) or Waterways (PFBC) Conservation Officer
WGS	World Geodetic System
WNS	White-Nose Syndrome
WPC	Western Pennsylvania Conservancy
WRCP	Wild Resource Conservation Program
WWI	World War I
WWII	World War II

Appendix B. Natural Resource Management Prescriptions

Goal	Objective	Recommended Management Action	Responsible Office(s)	Implementation Date(s)
1. Provide the most durable, safe, and realistic natural training environment possible for the PAARNG and other FIG users through natural resource management and implementation of best management practices.	Objective 1.1: Use oaks and native warm-season grasses as keystones for monitoring desired vegetation community cover and habitat suitability while managing for their sustainment.	Monitor grassland and oak-dependent species as indicators for grassland and woodland health	Conservation ITAM	Ongoing (2022-2027)
		Implement grassland habitat management best practices	Conservation ITAM	Ongoing (2022-2027)
		Refine and implement installation mowing plan	Conservation DIM	2022
	Objective 1.2: Treat invasive plant species based on trainers' needs with the ultimate goal of reaching no net loss to training or training opportunities.	Treat invasive species with appropriate BMP for removal and/eradication as needed	Conservation DIM	Ongoing (2022-2027)
	Objective 1.3: Provide for a safe training environment by discouraging thorny, toxic, or otherwise hazardous flora.	Implement pest management plan through division of installation maintenance and ITAM programs	Conservation DIM ITAM	Ongoing (2022-2027)
	Objective 1.4: Use and develop Conservation Division-approved seed mixes that provide durable and sustainable training environments.	Execute through standard contracting requirements and site inspections	Conservation Training Site Engineers ITAM	Ongoing (2022-2027)

		Review and refine seed mixes as necessary	Conservation	Mixes incorporated in 2012, will revise as issues arise
2. Staff and manage a trained and professional team of natural resources experts to provide for the best interests of the military training environment and the conservation environment and to balance between the two for maximum sustainability.	Objective 2.1: Ensure no net loss in the capability of FIG lands. Ensure the employment of an adequate number of trained Conservation staff required to implement the INRMP. Staff will develop and manage the Natural Resources Program and provide support to the existing and projected military mission.	Maintain a sound INRMP in conjunction with stakeholders both internal and external	Conservation	Updated and signed INRMP for 2022-2027
		Implement management plan(s) in a manner to avoid net training land loss	Conservation ITAM SRP	2022
		Provide or send installation personnel for applicable training for job classification and activities	Conservation ITAM DIM	Ongoing (2022-2027)
	Objective 2.2: Maintain quality training lands through damage minimization, mitigation, and restoration.	Ready and maintain equipment necessary for land repair, restoration, and management	DIM ITAM SRP	Ongoing (2022-2027)
		Maintain and restore training lands and their natural resources	DIM ITAM	Ongoing (2022-2027)
	Objective 2.3: Provide for a safe and productive working environment for the Conservation staff and all personnel and users installation wide.	Identify hazard sources (such as historic ranges) to the natural resources program, its staff, and its equipment	Range Control Conservation	Ongoing (2022-2027)
	Objective 2.4: Provide the support and technology necessary to remain competitive and provide leadership in natural resources management statewide, nationally, and across the DoD.	Provide staff and training for those staff to provide natural resource support, oversight, and expertise	Conservation BEM Training Site	Ongoing (2022-2027)

3. Monitor, inventory, and manage for the highest possible level of native biodiversity on all taxonomic levels through large-scale ecosystem management with a focus on species of concern.	Objective 3.1: Monitor – Provide baseline monitoring and general monitoring practices to detect species trends ahead of major declines or increases that can affect military training and other natural resources and ecological processes.	Perform monitoring and quantitative analysis on species and habitats known to have or likely to have impacts on military training and support activities	Conservation	In place and ongoing annually
		Survey for common and rare amphibian and reptile species including installation-wide mark-recapture, visual encounter surveys, and coverboards.	Conservation	In place and ongoing annually
		Implementation of the installation's long-term bat monitoring plan which includes mist-netting, acoustics, radio-telemetry, and emergence counts.	Conservation	In place and ongoing annually
		Camera-trapping surveys for Allegheny woodrats	Conservation	In place and ongoing annually
		Installation-wide bird monitoring using point count and breeding surveys	Conservation	In place and ongoing annually
	Objective 3.2: Inventory – Maintain and/or update current species inventories and other planning-level survey data through periodic recurrence of surveys and inventory projects. Coordinate with PNHP periodically to ensure most current T&E species	Perform inventories and collect/update baseline data on fish	Conservation	Contracted electroshocking survey scheduled for FY22

	occurrence data for FIG. Participate with statewide and regional inventorying efforts to minimize cost and maximize data gathering.	Perform inventories and collect/update baseline data on soils and wetlands	Conservation	Wetland studies contracted for FY22
		Perform inventories and collect/update baseline data on general fauna	Conservation	Rotate through taxonomic guilds with 1-3 projects per year.
		Perform inventories and collect/update baseline data on amphibian and reptile species, conduct surveys statewide	Conservation	Ongoing (2022-2027)
		Perform inventories and collect/update baseline data on native bee fauna	Conservation	Contracted survey for FY22
	Objective 3.3 Management – Manage and maintain wildlife habitat that contributes to sustained populations of resident species and provides seasonal habitats for migratory species while maintaining the current capabilities of FIG to support the military mission.	Continue habitat management projects to keep optimal conditions for specialists in grasslands and oak woodlands	Conservation	Ongoing maintenance and improvements through the wildland fire program
4. Provide for the longevity of species identified at any level (regional, state, or federal) as being at risk or under high	Objective 4.1: Provide for the benefit and health of the state's NLEB populations in hopes of species recovery following White-nose Syndrome (WNS) through sound habitat and population conservation measures such as forest management best practices.	Manage and enhance habitat for NLEB	Conservation	Roost protection and application of forest treatments implemented and ongoing

responsibility including rare, threatened, and endangered animals and plants through active management, conservation, and propagation.		Conduct planning level surveys for NLEB	Conservation	In place and ongoing annually
	Objective 4.2: Monitor habitat use and presence of the NLEB and other bat species at FIG and any statewide facility where listed bats are detected using accepted acoustic and live-capture surveying techniques.	Perform mist-netting, acoustic, and radio-telemetry surveys to determine foraging and roosting habitat requirements	Conservation	In place and ongoing annually
	Objective 4.3: Place and enforce necessary restrictions on roost sites and hibernacula if they are identified. Follow USFWS guidance and agreements concerning acceptable practices, permits, and necessary conservation measures.	Develop a Biological Opinion for NLEB and meet Section 7 requirements	Conservation	Upon completion of the INRMP process (FY22), USFWS will initiate Section 7 discussions.
	Objective 4.4: Avoid, to the extent possible and under the purview of the USFWS, incidental or intentional take of NLEB.	Finalize and implement Section 7 consultations with USFWS	Conservation	Upon completion of the INRMP process (FY22), USFWS will initiate Section 7 discussions.
	Objective 4.5: Increase or maintain eastern regal fritillary population levels from an estimated level of 1,000 individuals. This baseline was established in 2001 after the first mark-recapture study was conducted.	Provide technical expertise, animals, and supplies for repatriating Eastern regal fritillary subspecies to external sites	Conservation	Repatriation effort ongoing annually with ZooAmerica

		Monitor population to establish current levels, identify trends, and demonstrate stability.	Conservation	Regal monitoring projects ongoing for the last 25 years.
		Increase habitat availability and quality to benefit the species through grassland restoration and enhancement	Conservation	Management efforts in target areas are ongoing.
		Use fire as a tool for maximum benefit and efficiency	Conservation	Wildland Fire Management Plan Ongoing
	Objective 4.6: Increase or maintain regal fritillary nectar and larval hosts density from baselines established through previous surveys using the most efficient means possible.	Continue management projects to enhance or maintain host plants	Conservation	In place and ongoing annually
		Use fire as a tool for maximum benefit and efficiency	Conservation	In place and ongoing annually
		Perform monitoring surveys that quantify abundances of host plants	Conservation	In place and ongoing annually
	Objective 4.7: Promote conservation of golden-winged warbler (GWWA) during breeding and migration by taking proactive actions to increase habitat quality and population size and avoiding/minimizing actions that would result in unintentional/incidental take.	Monitor occupation and residency of GWWA through a comprehensive monitoring program, manage with conservation actions for the benefit of the species	Conservation	In place and ongoing annually

	Objective 4.8: Detect and monitor GWWA breeding locations and breeding activities on the installation.	Monitor occupation and residency of GWWA through a comprehensive monitoring program, manage with conservation actions for the benefit of the species	Conservation	Point-counts and breeding surveys conducted annually
	Sub-objective 4.8a: Detect and monitor blue-winged warblers and their hybrids through the breeding season.	Monitor occupation and residency of BWWA through a comprehensive monitoring program, manage with conservation actions for the benefit of the species	Conservation	Point-counts and breeding surveys conducted annually
	Sub-objective 4.8b: Record and analyze signs of interspecies competition and breeding.	Monitor occupation and residency of GWWA through a comprehensive monitoring program, manage with conservation actions for the benefit of the species	Conservation	Point-counts and breeding surveys conducted annually
	Objective 4.9: Maintain young forest and late-seral successional shrublands as breeding sites for GWWA through efficient means, best management practices, and the judicious use of prescribed fire.	Monitor occupation and residency of GWWA through a comprehensive monitoring program, manage with conservation actions for the benefit of the species	Conservation	In place and ongoing annually

	Objective 4.10: Maintain or increase the overall amount of open habitat and abundance of milkweeds (*Asclepias* spp.) for breeding and migratory monarchs.	Monitor grassland specialists through established means	Conservation	Monitoring underway and ongoing as part of the regal fritillary project.
		Manage for monarchs and their preferred host species and guilds	Conservation	In place and ongoing annually
	Sub-objective 4.10a: Monitor monarch use and breeding through means already established for the regal fritillary population (Pollard walks, larval surveys, etc.)	Monitor grassland specialists through established means	Conservation	In place and ongoing annually
	Sub-objective 4.10b: Monitor milkweed presence and population health through vegetation monitoring objectives established in the regal fritillary program (nectar counts/surveys every 5 years).	Monitor grassland specialists through established means	Conservation	Next scheduled survey FY26
	Objective 4.11: Survey for and record the amount of breeding and rearing taking place on the milkweeds within FIG through sampling and efficient means.	Survey host plants for caterpillars and overall availability, implement restoration where hosts are deficient	Conservation	In place and ongoing annually

	Objective 4.12: Determine presence and density of the pathogen Wolbachia and other major diseases affecting the hosted migrant and breeding monarchs. Determine the possibilities and reactions of those diseases spreading into nearby Lepidoptera including the regal fritillary.	Conduct research to determine the levels of Wolbachia present on post, in target taxa, and its effects	Conservation	Surveys will be conducted in FY22
	Objective 4.13: Maintain or increase the installation's Allegheny woodrat population relative to baseline levels established in 2008.	Provide habitat management services to increase suitability, viability, and quality of habitat resources	Conservation	Implement the wildland fire management plan annually
	Objective 4.14: Evaluate the extent of potential threats including habitat loss and fragmentation, reduced food availability, and increased prevalence of disease (i.e. raccoon roundworm) to the installation’s Allegheny woodrat population.	Determine extent of current stressors to the installation's population to direct future management and conservation actions. Conduct vegetation sampling to quantify effects of management practices on Allegheny woodrat habitat. Collect raccoon fecal samples and submit for testing to determine prevalence of raccoon roundworm.	Conservation	Every 3-5 years (next scheduled for FY22-24)
	Objective 4.15: When and where possible, implement forest management practices that increase the quantity and quality of food resources, especially hard and soft mast, within and adjacent to known habitat sites.	Provide habitat management services to increase suitability, viability, and quality of habitat resources	Conservation	Implement the wildland fire management plan annually

	Objective 4.16: Conduct annual monitoring of known and historical habitat sites to determine presence and occupancy and provide the PGC with annual updates.	Provide direct management and monitoring to benefit the species	Conservation	In place and ongoing annually
	Objective 4.17: Determine presence, relative activity levels, and distributions of little brown bats on the installation.	Perform mist-netting, acoustic, and radio-telemetry surveys to determine post-WNS activity and occupancy	Conservation	In place and ongoing annually
	Objective 4.18: Identify critical foraging and roosting habitat for little brown bats on the installation. Provide additional artificial roosting habitat (i.e., bat boxes) in areas of known occurrence.	Perform mist-netting, acoustic, and radio-telemetry surveys to determine foraging and roosting habitat requirements. Repair/replace existing bat boxes and install new boxes.	Conservation	In place and ongoing annually
	Objective 4.19: Conduct annual monitoring of little brown bats using acoustic and live capture methodologies and provide the USFWS and PGC with annual updates.	Perform mist-netting, acoustic, and radio-telemetry surveys to determine post-WNS activity and occupancy	Conservation	In place and ongoing annually
	Objective 4.20: Determine presence, relative activity levels, and distributions of tri-colored bats on the installation.	Perform mist-netting, acoustic, and radio-telemetry surveys to determine post-WNS activity and occupancy	Conservation	In place and ongoing annually
	Objective 4.21: Identify critical foraging and roosting habitat for tri-colored bats on the installation.	Perform mist-netting, acoustic, and radio-telemetry surveys to determine foraging and roosting habitat requirements.	Conservation	In place and ongoing annually

	Objective 4.22: Conduct annual monitoring of tri-colored bats using acoustic and live capture methodologies and provide the PGC with annual updates.	Perform mist-netting, acoustic, and radio-telemetry surveys to determine post-WNS activity and occupancy	Conservation	In place and ongoing annually
	Objective 4.23: Provide best management practices through habitat and population conservation measures aimed at increasing health and longevity of the state's spotted turtle populations.	Update and define wetland boundaries in the training corridor and cantonment, classify for habitat quality	Conservation	Wetland survey contracted for FY22
		Identify and survey additional suitable habitat onsite	Conservation	Reassess known habitats and evaluate new potential sites after wetlands are delineated in FY22
		Maintain beaver presence to provide natural debris that spotted turtles use for brumation and basking (when it does not impair military training)	Conservation	Ongoing
		Protect and maintain nesting habitats. Discourage mowing during the nesting season (May-July)	Conservation	Ongoing
		Protect and maintain wetland habitats. Avoid use of vehicles within and discourage ditching/draining of wetland habitats.	Conservation	Ongoing

	Objective 4.24: Provide best management practices through habitat and population conservation measures aimed at increasing health and longevity of the state's wood turtle populations.	Update and define wetland boundaries in the training corridor and cantonment, classify for habitat quality	Conservation	Wetland survey contracted for FY22
		Minimize direct mortality by improving the current mowing plan to reduce mortalities. Mow roadsides and fields at 8" and during the hot times of the day. Mow inside-out to avoid trapping turtles.	Conservation	Ongoing
	Objective 4.25: Provide best management practices through habitat and population conservation measures aimed at increasing health and longevity of the state's northern red-bellied cooter populations.	Improve knowledge of population, habitat quality, and threats by conducting visual and encounter surveys, Adding individuals to the ongoing turtle mark-recapture study, and monitoring population trends over time.	Conservation	Conduct visual and encounter surveys. Identify nesting habitat (FY22)
		Protect individuals and habitats by identifying threats (pollution inputs, predators, invasive species) and creating plans to mitigate them. Create outreach for public to mitigate poaching and habitat degradation. Engage with FIG law enforcement as appropriate.	Conservation	Conduct visual and encounter surveys. Identify threats. Create plans to reduce/control threats (FY22)

	Objective 4.26: Study the active periods and habitat occupation outside the standard training buffer for streams and wetlands including roads and upland meadows to reduce the potential for conflict with human use and occupation.	Continue radiotelemetry project studying fire effects on behavior and survivorship	Conservation	In place and ongoing annually
		Determine habitat use, movement patterns, and survivorship via trapping, radiotelemetry, and mark-recapture	Conservation	Analyze spotted turtle radio-telemetry data (2015-2018) in FY22 to determine potential impacts to training
	Objective 4.27: Monitor the installation's turtle population(s) through long-term techniques to determine and manage ongoing species and evaluate management effects.	Determine species trends through census techniques. Continue long-term, installation-wide mark/recapture program	Conservation	In place and ongoing annually
		Control or remove invasive and non-native species	Conservation	Conduct assessments to determine necessity for control/removal
	Objective 4.28: Collaborate with other natural resource agencies and participate in regional and national studies when feasible to assess local	Contribute spotted turtle trapping survey data to regional population assessments led by the Smithsonian, MACHAC, and the NE Turtle Working Group.	Conservation	Surveys completed every 3-5 years; last survey completed FY21

	populations and inform future management decisions.	Contribute wood turtle stream survey data to NE Turtle Working Group.	Conservation	FIG study conducted annually. Regional study every 5-10 years. Regional survey last completed in FY21.
	Objective 4.29: Determine if Frosted Elfin butterfly is present on the installation	Conduct surveys, possibly with assistance from USFWS; if presence is confirmed provide updates to include conservation measures	Conservation	Implemented and ongoing
	Objective 4.30: Identify and monitor state-listed species occupation. Provide population levels where possible, and share information with state regulatory agencies (PGC, PFBC, DCNR).	Conduct surveys and analysis for state-listed invertebrates, close data gaps	Conservation	Lepidoptera ongoing; dragonflies, bees, and ants contracted in FY16; no other expected current state-concern invertebrate taxa found on post/in immediate region.
		Conduct surveys and analysis for state listed plants, close data gaps	Conservation	Surveys ongoing as part of cataloging during normal habitat and vegetation monitoring projects.

	Objective 4.31: Manage habitat and promote populations where state-listed species are identified using the best management practices (if available) for those species.	Manage habitat for state-listed species	Conservation	In place and ongoing annually
	Objective 4.32: Recognize responsibility for the species when possible by adjusting scheduling and impacts on the populations and their occupied habitat so long as it doesn't affect military training or higher priority species.	Conduct surveys and analysis and manage habitat for state-listed species	Range Control Conservation	In place and ongoing annually
5. Monitor, inventory, and manage for the highest possible level of native bird biodiversity on all taxonomic levels through large-scale ecosystem	Objective 5.1.1: Monitor in cooperation with the DoD Coordinated Bird Monitoring program, Avian Knowledge Network, and similar departmental and partner programs and objectives.	Monitor all species of birds using military training habitat with special attention for USFWS priority targets	Conservation	In place and ongoing annually
	Objective 5.1.2: Participate in the statewide breeding bird survey every 20 years.	Perform breeding bird atlas for FIG-specific property, update installation lists and CIP data as needed	Conservation	FY2034

management with focus on species of concern.	Objective 5.1.3: Manage for the benefit of native bird species and their opportunities to breed, winter, and migrate through the installation by reducing invasive plant obstructions and increasing high value native habitats as measured through monitoring outlined in objectives 5.1.1 and 5.1.2 for population stability and species diversity.	Reduce mowing and maintenance hazards through implementation of the mowing plan	DIM Conservation	In place and ongoing annually
		Manage for state listed bird species and their habitats through all seasons of habitat availability	Conservation	In place and ongoing annually
5.2. Follow established policies, regulation, and guidance set forth by USFWS, DoD, and Army concerning migratory birds, and provide for migratory bird conservation during their	Objective 5.2.1: Identify and mitigate threats to migratory birds wherever possible and feasible.	Implement mowing plan to reduce bird threats	DIM Conservation	In place and ongoing annually
		Mitigate threats by applying best management techniques	Conservation	In place and ongoing annually
	Objective 5.2.2: Avoid intentional take of MBTA species.	Implement mowing plan to reduce bird threats	DIM Conservation	In place and ongoing annually
	Objective 5.2.3: Address incidental take of MBTA species in the NEPA analysis for any federal action. Avoid incidental take to the greatest extent feasible and practicable.	Implement mowing plan to reduce bird threats	DIM Conservation	In place and ongoing annually

breeding, wintering, and migration periods.		Work with USFWS to determine best path forward in MBTA management and mitigate known and suspected issues	Conservation	Review will be conducted as part of the 2022 INRMP process. Expect to revisit if/when USFWS modifies incidental take permitting for DoD.
	Objective 5.2.4: Provide mitigation and conservation measures, as feasible and practicable, to avoid or minimize adverse impact on migratory birds during ongoing or proposed mission activities.	Implement mowing plan to reduce bird threats	Conservation	In place and ongoing annually
		Work with USFWS to determine best path forward in MBTA management and mitigate known and suspected issues	Conservation	Review will be conducted as part of the 2022 INRMP process. Expect to revisit if/when USFWS modifies incidental take permitting for DoD.
5.3. Follow the regulations set forth by USFWS concerning eagles and provide a safe and beneficial breeding, wintering, and migratory environment.	Objective 5.3.1: Avoid any and all take, incidental or intentional, of eagles or their nests, parts, or products.	Coordinate with USFWS and PGC to avoid issues and permit if necessary	Conservation	Continue to monitor the current pair's nests annually
	Objective 5.3.2: Where perceived or probable take cannot be avoided, complete the permitting process with USFWS and follow the agreed upon conservation measures for mitigation.	Coordinate with USFWS and PGC to avoid issues and permit if necessary	Conservation	As necessary

	Objective 5.3.3: The Conservation Office and the aviators should form a close working relationship to identify the location of nesting eagles, establish buffers, and avoid disruption of the nesting and breeding activity except where permitted by USFWS or where the eagles have demonstrated tolerance.	Establish contacts and form a working group if necessary between MAAF, air users, and Conservation office	MAAF Bollen Range Conservation	2022
Provide for the safety and coexistence of both native bird species and military aviation to the greatest extent possible while ensuring the safety of our soldiers, aviators, and support personnel and their equipment.	Objective 5.4.1: Monitor nesting in and around the air facilities and apply depredation through legal means and measures where it is likely to violate Sub-goal 5.4.	Monitor bird activity and take action when necessary to avoid take or situations that will lead to take	USDA Conservation	Renew contract for FY22
	Objective 5.4.2: Use distraction and disruption measures as necessary to avoid avian use of those areas where takeoff, low hovering, and/or landing are common.	Monitor bird activity and take action when necessary to avoid take or situations that will lead to take	USDA Conservation	Renew contract for FY22
	Objective 5.4.3: Monitor and document depredations and measures taken for BASH. Require and receive a report from any contracted BASH-related actions.	Request copies of reports documenting action taken by contractors.	USDA MAAF Bollen Range Conservation	Part of current FY21 contract

	Objective 5.4.4: Reduce avian habitat around the airfield, including rodent control (attracts raptors), nesting structures, water, and other large bird attractants.	Implement mowing plan to reduce bird threats	DIM Conservation USDA	In place and ongoing annually
6. Remove or reduce, as best possible, the impacts of pest species, including non-native species in nature and human pests in developed areas, from their host environments at a reasonable level in regards to cost and efficiency.	Objective 6.1: Rewrite the Pest Management Plan by 2024	Revise the integrated pest management plan (IPMP) using National Guard Bureau guidance	Conservation	2024
	Objective 6.2: Maintain or reduce from 2020 levels the impacts of pest species to military training and opportunities.	Adhere to guidance contained in existing IPMP	Conservation DIM	In place and ongoing annually
	Objective 6.3: Identify and reduce the impact of human disease-carrying vectors by improving game management, removing invasive hosts, and increasing the role of prescribed fire in dismounted use training areas.	Adhere to guidance contained in existing IPMP	Conservation DIM	In place and ongoing annually
		Implement the deer management plan	Conservation	In place and ongoing annually
	Objective 6.4: Provide above-adequate opportunities to wash down equipment (military, support, and civilian) and remove pest vectors.	Keep open access to wash facility and educate users on regulations	Range Control Training Site	In place and ongoing annually

	Objective 6.5: Monitor and discourage all unapproved feeding and supplemental nutrition activities for wild, feral, and escaped/released domestic animals. Approval must be obtained from the PADMVA Wildlife Section.	Implement the deer management plan	Conservation	In place and ongoing annually
7. Remove or reduce, as best possible, human-induced impacts to surface and groundwater on the installation including but not limited to streams, wetlands, drinking water wells, and open water bodies through cost efficient means.	Objective 7.1: Annually maintain and improve 15-30% of the trails in the trail network to prevent or reduce erosion and/or sediment run off, maintain existing erosion control features, and replace collapsed or damaged storm water culverts with piping adequate for suspected flows.	Monitor sediment load using stream gauges	ITAM Conservation	In place and ongoing annually
		Establish sediment controls, remediate sources, and implement best management practices for stream quality	DIM Training Site Engineers	In place and ongoing annually
	Objective 7.2: In accordance with FIG Regulation 350-2, mounted/vehicular training is prohibited within 25 meters of any stream, drainage swale, wetland, or sedimentation control structure. For all other training/construction/encroachment, maintain a minimum 50-foot from edge of each bank buffer for all defined surface waters and wetlands.	Update and define wetland boundaries in the training corridor and cantonment, classify for habitat quality	ITAM Range Control Conservation	Signs/Seibert stakes have been put in place to designate vehicle off-limit areas.

8. Provide an effective, safe, and enjoyable environment for recreation in natural and urbanized settings on post while improving safety, habitat quality, and operational effectiveness.	Objective 8.1: Reduce white-tailed deer population in urbanized portions of cantonment to roughly 20 deer per square mile while maintaining or adjusting to meet the same targets in the training corridor.	Implement the deer management plan	Conservation	In place and ongoing annually
	Objective 8.2: Maintain or increase the accuracy and accountability of harvest reporting.	Implement the automated hunter registration and check-in system	Conservation	In place and ongoing annually
	Objective 8.3: Develop an effective conservation law enforcement program in the training corridor using internal or external authorities.	Implement the automated hunter registration and check-in system	Conservation Range Control	In place and ongoing annually
		Implement the deer management plan	Conservation	In place and ongoing annually
	Objective 8.4: Provide opportunities for disabled veteran hunts on the installation annually.	Disabled veterans' hunts have been operated by the Fish and Game Conservation Club.	Conservation	In place and ongoing annually
	Objective 8.5: Provide greater opportunities and suitability for disabled and youth hunting on the installation.	Implement the deer management plan	Conservation	In place and ongoing annually
	Objective 8.6: Provide ample opportunities for trappers and hunters to manage the furbearer populations to avoid pest control issues, e.g. foxes, raccoons, and coyotes in cantonment.	Supported through the outdoor recreation program and its funding per Sikes Act requirements.	Conservation	In place and ongoing annually

	Objective 8.7: Maintain/improve watchable wildlife opportunities including birds, mammals, insects, and herps.	Supported through the outdoor recreation program and the Second Mountain Hawkwatch Association.	Conservation	In place and ongoing annually
Maintain and improve operational effectiveness through a public relations program that provides information on the Conservation Division's programs, military impacts, and installation resources while attracting volunteers, partners, and advocates.	Objective 9.1: Continue to provide multiple PADMVA outdoor education programs including the regal fritillary butterfly tours, volunteer service projects, and similar programs.	Walks have been provided by DMVA since 2006 and TNC before that. Costs are simply staff time and labor, already included in other STEP projects.	Conservation	In place and ongoing annually
	Objective 9.2: Provide up to date information related to Forestry, Wildlife, and Outdoor Recreation through the PAO, peer reviewed journals, and/or the FTIG iSportsman Announcement page.	Continue to effectively communicate Conservation-related information to the public	Conservation	In place and ongoing annually
	Objective 9.3: Continue to maintain community support and involvement through publicized volunteer events that are mutually beneficial through environmental interpretation and ecological stewardship.	Work with local area nature groups and civic organizations to address their requests as they approach. Consistently provide content for local nature fairs and several national or regional conferences.	Conservation	In place and ongoing annually

Reduce conflict in the human-wildlife interface while providing for interconnectivity between plant and animal populations fragmented by improvements.	Objective 10.1: Increase hunting and trapping opportunities in cantonment and other population problem areas by maximizing hunter effort and opportunity in these areas through Managed Woodlot Program, Deer Management Assistance Program and Disabled Hunter Program.	Revise deer management plan and implement strategies	Conservation	FY22
	Objective 10.2: Manage urban trees to mitigate for insect/pathogen infestation and human life and health hazards.	Implement urban tree management plan	Conservation	Ongoing as funds are available
	Objective 10.3: Reduce edge and island effects where possible by using proactive measures during range and facility development.	Coordinate with project managers/participate in planning process of MILCON projects	Conservation	Implement if/when MILCON is proposed.
	Objective 10.4: Reduce mowing and pesticide use where they are unnecessary or strictly for aesthetics to reduce costs and provide habitat and natural corridors for animal travel. Consider prescription fire, lawn conversion to ecological habitat, and annual dormant season, or rotational mows as alternatives.	Implement mowing plan to mow only where necessary and in appropriate season	Conservation DIM	In place and ongoing annually
	Objective 10.5: Remove unnecessary wire and barriers once they become obsolete or ineffective to protect wildlife, equipment, and personnel. Cover or remove all open pipes.	Work with DIM to remove obsolete hazards and impediments.	Conservation DIM	In place and ongoing annually

	Objective 10.6: Maintain a comprehensive urban tree inventory for flagging hazards, noting condition, and scheduling maintenance as needed.	Conduct vegetation community planning survey and timber inventory	Conservation	Inventory 1/3 of urban forest each year.
	Objective 10.7: Improve and maintain water quality in the Susquehanna Watershed by enhancing and creating riparian buffers.	Continue to identify riparian areas and monitor plant condition	Conservation	In place and ongoing annually
Maintain a resilient and diverse forest to support the military training mission and natural diversity.	Objective 11.1: Maintain current forest resource data including inventory, plots, stands, and other vital information. Monitor and update this data on a regular basis.	Conduct vegetation community planning survey and timber inventory	Conservation	Ongoing implementation with funds available.
	Objective 11.2: Implement the forest management strategy to enhance the military training mission through timber sales, minor forest product sales, timber stand improvement, best management practices, erosion and watershed management, and other appropriate means.	Implement the forest management plan and manage the habitat using best practices	Conservation	Ongoing implementation with funds available.
	Objective 11.3: Control invasive species to maximize native species for their resiliency and benefits to military training.	Implement the forest management plan and manage the habitat using best practices	Conservation	Ongoing implementation with funds available.

	Objective 11.4: Apply ecosystem management principles to aid in restoration of forest resources after adverse impacts caused by the military training mission and forest insect and disease outbreaks.	Implement the forest management plan and manage the habitat using best practices	Conservation	When needed based on impacts to forest
Provide for public, firefighter, and soldier safety while maximizing military training opportunities.	Objective 12.1: Maintain a readied, trained, certified, and self-sufficient wildland fire operations crew, equipment, and support for prescription fire use and wildland fire response.	Conduct training as necessary to round out crew, follow state standards for task books and training courses	Conservation	Continue annual fire training programs
	Sub-objective 12.1a: When needed and available, seasonal employees will be hired from mid-March to mid-November to assist with wildland fire operations in order to maintain the current capabilities of FIG to support the military mission. Seasonal employees are also able to meet other operation need in the Conservation Division.	Staff wildland fire operations	Conservation	Ongoing implementation with funds available.
	Sub-objective 12.1b: Inspect and replace PPE and equipment as needed.	Inspect and replace equipment	Conservation	Evaluate need annually
	Objective 12.2: Use advanced means of ignition such as helicopter and terra-torch operations for efficiency and completion of burn objectives	Implement wildland fire management plan	Conservation	Ongoing implementation with funds available.

	Objective 12.3: Maintain records and proper bookkeeping for the individual certification of the crew both to adhere to NWCG standards as well as to train additional crew and command multiple-organization fire teams.	Conduct training as necessary to round out crew, follow state standards for task books and training courses	Conservation	Update records as fires occur.
	Objective 12.4: Create and maintain a wildland-fire defensible perimeter (including necessary internal breaks) around the post including measures for managing wild and training-induced fire as well as maintaining the installation with prescription fire where and when appropriate.	Implement the wildland fire management plan	Conservation	Ongoing implementation with funds available.
	Sub-objective 12.4a: Maintain a defensible fire perimeter at the top of Blue Mountain north of the small arms ranges to reintroduce the use of tracers and night firing operations along Range Road and to protect private landowners from wildland fire issues.	Implement the wildland fire management plan. Maintain existing fire break.	Conservation	In place and ongoing annually
	Sub-objective 12.4b: Examine the wildland fire risk and potential for any new range or live-fire facility and incorporate firebreaks into the initial design	Implement fire-wise planning into current and future ranges	Conservation	As needed when new ranges or infrastructure are built

	Objective 12.5: Reduce maintenance cost through fire management as opposed to chemical or mechanical treatment for vegetative growth, fuels reduction, and pest management as well as ecological benefits.	Implement pest and burn plans	Conservation	In place and ongoing annually
	Objective 12.6: Demonstrate benefits of fire for fire-adapted species including species and communities of concern and their associated habitats.	Implement the wildland fire management plan	Conservation	In place and ongoing annually
	Objective 12.7: Create and maintain open areas through fire management.	Implement the wildland fire management plan	Conservation	In place and ongoing annually

Appendix C. Results of Planning Level Surveys

This list encompasses the known species found on Fort Indiantown Gap in Dauphin and Lebanon Counties, Pennsylvania. Where possible, species are listed in phylogenetic order based on the Integrated Taxonomic Information System lists (ITIS 2011). Genera and species may appear in alphabetic order under phylogenetically ordered families when taxa are too numerous to track. Plant kingdom order was determined by Rhoads and Block (2000). Class Aves order was determined by the American Ornithological Union (AOU 2011). Fungi are classified in accordance with MycoBank (International Mycological Association 2011).

All species have been recorded during planning level surveys by qualified biologists. Speculative species are not included, but this list should not be considered complete due to their exclusion. When possible, voucher specimens have been taken and stored in a proper setting (see individual reports for locations and dates).

Planning level surveys have included massive flora and fauna cataloging efforts (TNC 1995, 2000, 2003, 2005), pre-construction and NEPA-driven surveys (Zappalorti et al. 1995; Zappalorti 1999; Torocco et al. 2004, 2005; Hart 2001, 2002; BCMI 2004), directed research (Cromp 2005; Bills and Kim 2006; Becker and Brittingham 2005; Reinert 1999, 2001; Schoss et al. 2003; SAIC 1999; USGS 2005; Ecoanalysts 2007, 2008, 2009, 2010), and PADMVA Wildlife projects and observer efforts (2000-present). A number of new species are found and recorded each year, making this list dynamic.

FUNGI

Basidiomycota
Agricomycotina
Hericiaceae
Hericium erinaceus — Lion's Mane

Eumycota (True Fungi)
Ascomycotina
Helotiaceae
Bisporella citrina — Lemon Cup
Leotiaceae
Leotia lubrica — Jelly Babies Asco
Pezizaceae
Peziza sp. nr. badia — Bay Cup (ID Pending)
Sarcoscyphaceae
Sarcoscypha coccinea — Scarlet Cup

Basidiomycotina
Amanitaceae
Amanita pantherina — Panther Amanita
Auriculariaceae

Auricularia mesenterica	Bracket Jelly
Auriscalpiaceae	
Clavicorona sp. nr. pyxidata	Crown-tipped Coral Fungus (ID Pending)
Boletaceae	
Boletus badius	Bay Bolete
Boletus chrysenteron	Red-cracking Bolete
Boletus reticulatus	Summer Bolete
Boletus sp.	Bolete (ID Pending)
Phylloporus rhodoxanthus	Gilled Bolete
Strobilomyces floccopus	Old Man of the Woods
Cantharellaceae	
Cantharellus cibarius	Common Chanterelle
Cantharellus cinnabarinus	Cinnibar Chanterelle
Craterellus cornucopioides	Black Trumpet
*Gomphus floccosus**	Scaly Vase Chanterelle
Clavariaceae	
Clavulinopsis helvola	Yellow Spindle Coral
Clavulinaceae	
Clavulina sp. nr. cristata	White Coral, Crested Coral (ID Pending)
Cortinariaceae	
Cortinarius iodes	Spotted Cort
Crepidotaceae	
Crepidotus sp.	Pleurotoid Mushroom (ID Pending)
Dacrymycetaceae	
Calocera viscosa	Antler Jelly
Ganodermataceae	
Ganoderma lucidum	Varnished Polypore
Hygrophoraceae	
*Hygrophorus friesii**	No Common Name
Hygrophoropsidaceae	
Hygrophoropsis aurantiaca	False Chanterelle
Lepiotaceae	
Macrolepiota procera	Parasol Lepiota
Lycoperdaceae	
Lycoperdon perlatum	Common Puffball
Marasmiaceae	
Marasmius rotula	Pinwheel Marasmius
Phallaceae	
Mutinus elegans	Elegant Stinkhorn
Polyporaceae	
Laetiporus sulphureus	Chicken-of-the-woods, Sulfur Shelf
Trametes versicolor	Turkey-tail Polypore
Tyromyces chioneus	White Cheese Polypore
Russulaceae	
Lactarius subpurpureus	No Common Name
Russula sp.	No Common Name

Sclerodermataceae	
Scleroderma citrinum	Common Earthball
Tricholomataceae	
Hygrocybe cantharellus	No Common Name
Xeromphalina campanella	No Common Name

PLANTAE (Plants)

Spore-Bearing Vascular Plants

Selaginellaceae (Spikemoss Family)	
Selaginella apoda	Meadow Spike-Moss (Native)
Isoetaceae (Quillwort Family)	
Isoetes sp.	Quillwort (Native)
Lycopodiaceae (Clubmoss Family)	
Huperzia lucidula	Shining Clubmoss (Native)
Lycopodium clavatum var. *clavatum*	Common Clubmoss (Native)
Lycopodium dendroideum	Round-Branched Ground-Pine (Native)
Lycopodium obscurum	Flat-Branched Ground-Pine (Native)
Diphasiastrum digitatum	Running-Pine (Native)
Ophioglossaceae (Adder's-Tongue Family)	
Botrychium dissectum	Cut-Leaved Grape-Fern (Native)
Botrychium virginianum	Rattlesnake Fern (Native)
Equisetaceae (Horsetail Family)	
Equisetum arvense	Field Horsetail (Native)
Equisetum sylvaticum	Woodland Horsetail (Native)
Osmundaceae (Royal Fern Family)	
Osmunda cinnamomea	Cinnamon Fern (Native)
Osmunda claytoniana	Interrupted Fern (Native)
Osmunda regalis var. *spectabilis*	Royal Fern (Native)
Polypodiaceae (Fern Family)	
Dennstaedtia punctilobula	Hayscented Fern (Native)
Pteridium aquilinum var. *latiusculum*	Bracken Fern (Native)
Thelypteris noveboracensis	New York Fern (Native)
Thelypteris palustris var. *pubescens*	Marsh Fern (Native)
Phegopteris hexagonoptera	Beech Fern (Native)
Woodwardia areolata	Netted Chainfern (Native)
Asplenium platyneuron	Ebony Spleenwort (Native)
Asplenium rhizophyllum	Walking Fern (Native)

Onoclea sensibilis	Sensitive Fern (Native)
Athyrium filix-femina var. *angustum*	Northern Lady Fern (Native)
Dryopteris carthusiana	Spinulose Wood Fern (Native)
Dryopteris cristata	Crested Wood Fern (Native)
Dryopteris intermedia	Common Wood Fern (Native)
Dryopteris marginalis	Marginal Shield Fern (Native)
Polystichum acrostichoides	Christmas Fern (Native)
Polypodium appalachianum	Appalachian Polypody (Native)
Polypodium virginianum	Rock Polypody (Native)

Gymnosperms

Pinaceae (Pine Family)

Pinus pungens	Table Mountain Pine (Native)
Pinus rigida	Pitch Pine (Native)
Pinus strobus	White Pine (Native)
Pinus sylvestris	Scotch Pine (Eurasia)
Pinus virginiana	Virginia Pine (Native)
Tsuga canadensis	Eastern Hemlock (Native)

Cupressaceae (Cypress Family)

Juniperus virginiana	Red-Cedar (Native)

Monocots

Acoraceae (Sweet Flag Family)

Acorus calamus	Sweet Flag (Native)

Araceae (Arum Family)

Symplocarpus foetidus	Skunk-Cabbage (Native)
Arisaema triphyllum ssp. *triphyllum*	Jack-In-The-Pulpit (Native)
Arisaema triphyllum ssp. *stewardsonii*	Jack-In-The-Pulpit (Native)
Spirodela polyrhiza	Greater Duckweed (Native)
Lemna minor	Duckweed (Native)

Hydrocharitaceae (Frog's Bit Family)

Elodea canadensis	Waterweed (Native)
Najas sp.	Naiad (Unknown)

Alismataceae (Water-Plantain Family)

Sagittaria latifolia var. *latifolia*	Duck-Potato (Native)
Alisma subcordatum	Water-Plantain (Native)

Potamogetonaceae (Pondweed Family)

Potamogeton diversifolius	Snailseed Pondweed (Native)
Potamogeton foliosus	Leafy Pondweed (Native)

Dioscoreaceae (Yam Family)	
Dioscorea villosa	Wild Yam (Native)
Colchicaceae (Colchicum Family)	
Uvularia perfoliata	Bellwort (Native)
Uvularia sessilifolia	Sessile-Leaved Bellwort (Native)
Melanthiaceae (Death Camas Family)	
Trillium cernuum var. *cernuum*	Nodding Trillium (Native)
Veratrum viride	False Hellebore (Native)
Smilacaceae (Catbrier Family)	
Smilax glauca	Catbrier (Native)
Smilax herbacea	Carrion-Flower (Native)
Smilax rotundifolia	Greenbrier (Native)
Liliaceae (Lily Family)	
Medeola virginiana	Indian Cucumber-Root (Native)
Erythronium americanum	Trout-Lily (Native)
Tulipa sylvestris	Dutch-Lily (Europe)
Lilium philadelphicum	Wood Lily (Native)
Lilium superbum	Turk's-Cap Lily (Native)
Orchidaceae (Orchid Family)	
Cypripedium acaule	Pink Lady's-Slipper (Native)
Isotria verticillata	Whorled-Pogonia (Native)
Goodyera pubescens	Downy Rattlesnake-Plantain (Native)
Spiranthes cernua	Nodding Ladies'-Tresses (Native)
Spiranthes lacera var. *gracilis*	Northern Slender Ladies'-Tresses (Native)
Platanthera ciliaris	Yellow-Fringed Orchis (Native)
Platanthera clavellata	Clubspur Orchid (Native)
Platanthera lacera	Ragged Fringed Orchid (Native)
Epipactis helleborine	Bastard Hellebore (Europe)
Liparis liliifolia	Lily-Leaved Twayblade (Native)
Hypoxidaceae (Star-Grass Family)	
Hypoxis hirsuta	Yellow Star-Grass (Native)
Iridaceae (Iris Family)	
Sisyrinchium angustifolium	Narrow-Leaved Blue-Eyed-Grass (Native)
Sisyrinchium montanum	Blue-Eyed-Grass (Native)
Sisyrinchium mucronatum	Slender Blue-Eyed-Grass (Native)
Iris germanica	Bearded Iris (Europe)
Iris versicolor	Northern Blue Flag (Native)

Hemerocallidaceae (Day-Lily Family)	
Hemerocallis fulva	Orange Day-Lily (Asia)
Alliaceae (Onion Family)	
Narcissus pseudonarcissus	Daffodil (Europe)
Allium canadense	Wild Onion (Native)
Allium cernuum	Nodding Wild Onion (Native)
Allium vineale	Field Garlic (Europe)
Hyacinthaceae (Hyacinth Family)	
Ornithogalum nutans	Star-Of-Bethlehem (Europe)
Muscari botryoides	Grape-Hyacinth (Europe)
Asparagaceae (Asparagus Family)	
Asparagus officinalis	Garden Asparagus (Europe)
Ruscaceae (Butcher's-Broom Family)	
Maianthemum racemosum	False Solomon's-Seal (Native)
Maianthemum canadense	Mayflower (Native)
Polygonatum biflorum var. *biflorum*	Smooth Solomon's-Seal (Native)
Polygonatum pubescens	Hairy Solomon's-Seal (Native)
Sparganiaceae (Bur-Reed Family)	
Sparganium americanum	American Bur-Reed (Native)
Sparganium eurycarpum	Broadfruit Bur-Reed (Native)
Typhaceae (Cat-Tail Family)	
Typha angustifolia	Narrow-Leaved Cat-Tail (Native)
Typha latifolia	Common Cat-Tail (Native)
Juncaceae (Rush Family)	
Luzula acuminata var. *acuminata*	Hairy Woodrush (Native)
Luzula multiflora	Field Woodrush (Native)
Juncus acuminatus	Sharp-Fruited Rush (Native)
Juncus brevicaudatus	Narrow-Panicled Rush (Native)
Juncus bufonius	Toad Rush (Native)
Juncus dudleyi	Dudley's Rush (Native)
Juncus effusus (including varieties)	Soft Rush (Native)
Juncus gymnocarpus	Pennsylvania Rush (Native)
Juncus marginatus var. *marginatus*	Grass-Leaved Rush (Native)
Juncus subcaudatus	Woodland Rush (Native)
Juncus tenuis var. *tenuis*	Path Rush (Native)
Cyperaceae (Sedge Family)	
Scirpus atrovirens	Black Bulrush (Native)
Scirpus georgianus	Georgia Bulrush (Native)

Scirpus hattorianus	Mosquito Bulrush (Native)
Scirpus cyperinus	Wool-Grass (Native)
Scirpus pendulus	Nodding Bulrush (Native)
Scirpus polyphyllus	Leafy Bulrush (Native)
Schoenoplectus purshianus	Weakstalk Bulrush (Native)
Schoenoplectus tabernaemontani	Soft-Stemmed Bulrush (Native)
Eleocharis acicularis	Needle Spike-Rush (Native)
Eleocharis engelmannii	Engelmann's Spike-rush (Native)
Eleocharis erythropoda	Bald Spike-Rush (Native)
Eleocharis obtusa	Blunt Spike-Rush (Native)
Eleocharis palustris	Creeping Spike-Rush (Native)
Eleocharis quadrangulata	Four-Angled Spike-Rush (Native)
Eleocharis tenuis var. *tenuis*	Slender Spike-Rush (Native)
Cyperus bipartitus	Slender Flatsedge (Native)
Cyperus brevifolius	Short-Leaved Spikesedge (Asia)
Cyperus lupulinus	Great Plains Flatsedge (Native)
Cyperus strigosus	False Nutsedge (Native)
Dulichium arundinaceum	Three-Way Sedge (Native)
Rhynchospora capitellata	Capillary Beak-Rush (Native)
Carex albicans	Whitetinge Sedge (Native)
Carex communis	Fibrousroot Sedge (Native)
Carex pensylvanica	Pennsylvania Sedge (Native)
Carex umbellata	Parasol Sedge (Native)
Carex scabrata	Eastern Rough Sedge (Native)
Carex trichocarpa	Hairyfruit Sedge (Native)
Carex digitalis	Slender Woodland Sedge (Native)
Carex laxiculmis var. *laxiculmis*	Spreading Sedge (Native)
Carex platyphylla	Silver Sedge (Native)
Carex folliculata	Northern Long Sedge (Native)
Carex granularis var. *granularis*	Meadow Sedge (Native)
Carex glaucodea	Blue Sedge (Native)
Carex grisea	Inflated Narrow-Leaved Sedge (Native)
Carex debilis var. *rudgei*	White Edge Sedge (Native)
Carex gracillima	Graceful Sedge (Native)
Carex prasina	Drooping Sedge (Native)
Carex blanda	Eastern Woodland Sedge (Native)
Carex gracilescens	Slender Sedge (Native)
Carex laxiflora	Broad Looseflower Sedge (Native)
Carex styloflexa	Bent Sedge (Native)
Carex intumescens	Great Bladder Sedge (Native)
Carex lupulina	Hop Sedge (Native)
Carex crinita var. *crinita*	Short-Hair Sedge (Native)
Carex gynandra	Nodding Sedge (Native)
Carex stricta	Upright Sedge (Native)
Carex torta	Twisted Sedge (Native)
Carex willdenowii	Willdenow's Sedge (Native)

Carex leptalea	Bristle-Stalked Sedge (Native)
Carex bushii	Bush's Sedge (Native)
Carex hirsutella	Hairy-Leaved Sedge (Native)
Carex swanii	Swan's Sedge (Native)
Carex virescens	Ribbed Sedge (Native)
Carex frankii	Frank's Sedge (Native)
Carex squarrosa	Squarrose Sedge (Native)
Carex baileyi	Bailey's Sedge (Native)
Carex hystericina	Bottlebrush Sedge (Native)
Carex lurida	Shallow Sedge (Native)
Carex bromoides	Brome-Like Sedge (Native)
Carex trisperma	Three-Seeded Sedge (Native)
Carex annectens	Yellow-Fruit Sedge (Native)
Carex vulpinoidea var. *vulpinoidea*	Fox Sedge (Native)
Carex normalis	Greater Straw Sedge (Native)
Carex scoparia	Broom Sedge (Native)
Carex tribuloides	Blunt Broom Sedge (Native)
Carex cephalophora	Oval-Leaved Sedge (Native)
Carex muhlenbergii	Sand Bracted Sedge (Native)
Carex radiata	Eastern Star Sedge (Native)
Carex rosea	Rosy Sedge (Native)
Carex atlantica ssp. *atlantica*	Bog Sedge (Native)
Carex seorsa	Weak Stellate Sedge (Native)
Carex laevivaginata	Smoothsheath Sedge (Native)
Carex stipata var. *stipata*	Owlfruit Sedge (Native)

<u>Poaceae (Grass Family)</u>

Pseudosasa japonica	Bamboo (Japan)
Leersia oryzoides	Rice Cutgrass (Native)
Leersia virginica	Rice Cutgrass (Native)
Brachyelytrum erectum	Bearded Shorthusk, Long-awned Wood Grass (Native)
Glyceria melicaria	Slender Mannagrass (Native)
Glyceria striata	Fowl Mannagrass (Native)
Arrhenatherum elatius	Tall Oatgrass (Europe)
Festuca obtusa	Nodding Fescue (Native)
Festuca rubra	Red Fescue (Europe)
Holcus lanatus	Velvet Grass (Europe)
Phalaris arundinacea	Reed Canary-Grass (Native)
Agrostis gigantea	Redtop (Europe)
Agrostis perennans	Upland Bent (Native)
Agrostis scabra	Hairgrass (Native)
Phleum pratense	Timothy (Europe)
Lolium perenne	Perennial Ryegrass (Europe)
Schedonorus arundinaceus	Tall Fescue (Europe)
Vulpia octoflora	Six-Weeks Fescue (Native)

Sphenopholis nitida	Wedgegrass (Native)
Sphenopholis obtusata var. *obtusata*	Prairie Wedgegrass (Native)
Sphenopholis obtusata var. *major*	Slender Wedgegrass (Native)
Sphenopholis pensylvanica	Swamp-Oats (Native)
Dactylis glomerata	Orchardgrass (Europe)
Anthoxanthum odoratum	Sweet Vernalgrass (Eurasia)
Cinna arundinacea	Wood Reedgrass (Native)
Poa alsodes	Woodland Bluegrass (Native)
Poa annua	Annual Bluegrass (Eurasia)
Poa compressa	Canada Bluegrass (Europe)
Poa pratensis	Kentucky Bluegrass (Europe)
Poa trivialis	Rough Bluegrass (Europe)
Bromus inermis	Smooth Brome (Europe)
Bromus japonicus	Japanese Chess (Eurasia)
Bromus pubescens	Canada Brome (Native)
Bromus sterilis	Barren Brome (Europe)
Bromus tectorum	Downy Chess (Europe)
Hordeum jubatum	Foxtail-Barley (Native)
Hordeum vulgare	Barley (Eurasia)
Elymus hystrix	Bottlebrush-Grass (Native)
Elymus repens	Quackgrass (Eurasia)
Elymus riparius	Riverbank Wild-Rye (Native)
Secale cereale	Rye (Eurasia)
Phragmites australis	Common Reed (Native)
Tridens flavus	Purpletop (Native)
Eragrostis capillaris	Lacegrass (Native)
Eragrostis cilianensis	Stinkgrass (Europe)
Eragrostis pectinacea	Tufted Lovegrass (Native)
Eragrostis pilosa	Indian Lovegrass (Native)
Eragrostis spectabilis	Purple Lovegrass (Native)
Eleusine indica	Goosegrass (Old World Tropics)
Sporobolus compositus	Composite Dropseed (Native)
Sporobolus vaginiflorus	Poverty Dropseed (Native)
Muhlenbergia frondosa	Wirestem Muhly Grass (Native)
Muhlenbergia schreberi	Nimblewill Dropseed (Native)
Danthonia compressa	Northern Oatgrass (Native)
Danthonia spicata	Poverty Oatgrass (Native)
Aristida dichotoma	Churchmouse Threeawn (Native)
Aristida oligantha	Prairie Threeawn (Native)
Digitaria ischaemum	Smooth Crabgrass (Eurasia)
Digitaria sanguinalis	Northern Crabgrass (Europe)
Echinochloa crusgalli var. *crusgalli*	Barnyard-Grass (Eurasia)
Echinochloa muricata	Barnyard-Grass (Native)
Dichanthelium acuminatum	Hairy Panic Grass (Native)
Dichanthelium boscii	Bosc's Panic Grass (Native)
Dichanthelium clandestinum	Deer-Tongue Grass (Native)

Dichanthelium commutatum	Variable Panic Grass (Native)
Dichanthelium depauperatum	Poverty Panic Grass (Native)
Dichanthelium dichotomum	Cypress Panic Grass (Native)
Dichanthelium microcarpon	Small-fruited Panic Grass (Native)
Dichanthelium polyanthes	Roundseed Panic Grass (Native)
Dichanthelium sphaerocarpon	Roundseed Panic Grass (Native)
Panicum anceps	Beaked Panic Grass (Native)
Panicum capillare	Witchgrass (Native)
Panicum dichotomiflorum	Smooth Panic Grass (Native)
Panicum gattingeri	Gattinger's Witchgrass (Native)
Panicum rigidulum	Redtop Panic Grass (Native)
Panicum verrucosum	Warty Panic Grass (Native)
Panicum virgatum	Switchgrass (Native)
Eriochloa villosa	Chinese Cupgrass (E. Asia)
Setaria faberi	Giant Foxtail (Asia)
Setaria parviflora	Perennial Foxtail (Native)
Setaria pumila	Yellow Foxtail (Europe)
Setaria viridis	Green Foxtail (Eurasia)
Paspalum leave	Field Beadgrass (Native)
Paspalum setaceum var. *muhlenbergii*	Slender Beadgrass (Native)
Microstegium vimineum	Japanese Stiltgrass (Tropical Asia)
Sorghastrum nutans	Indian-Grass (Native)
Andropogon gerardii	Big Bluestem (Native)
Andropogon virginicus	Broom-Sedge (Native)
Schizachyrium scoparium var. *scoparium*	Little Bluestem (Native)
Arthraxon hispidus	Small Carpgrass (Asia)

Commelinaceae (Spiderwort Family)

Commelina communis	Asiatic Dayflower (Asia)

Pontederiaceae (Water-Hyacinth Family)

Heteranthera reniformis	Mud-Plantain (Native)

Magnoliids

Aristolochiaceae (Birthwort Family)

Asarum canadense var. *canadense*	Wild Ginger (Native)
Aristolochia serpentaria	Virginia Snakeroot (Native)

Lauraceae (Laurel Family)

Lindera benzoin	Spicebush (Native)
Sassafras albidum	Sassafras (Native)

Magnoliaceae (Magnolia Family)

Liriodendron tulipifera	Tuliptree (Native)

Annonaceae (Custard-Apple Family)

Asimina triloba	Pawpaw (Native)

Dicots

Berberidaceae (Barberry Family)

Caulophyllum thalictroides	Blue Cohosh (Native)
Berberis thunbergii	Japanese Barberry (Japan)
Podophyllum peltatum	Mayapple (Native)

Ranunculaceae (Buttercup Family)

Coptis trifolia ssp. *groenlandica*	Goldthread (Native)
Thalictrum pubescens	Tall Meadow-Rue (Native)
Thalictrum revolutum	Purple Meadow-Rue (Native)
Thalictrum thalictroides	Rue Anemone (Native)
Aquilegia canadensis	Wild Columbine (Native)
Caltha palustris	Marsh-Marigold (Native)
Actaea pachypoda	White Baneberry (Native)
Actaea racemosa	Black Cohosh (Native)
Clematis virginiana	Virgin's-Bower (Native)
Anemone acutiloba	Liverleaf (Native)
Anemone quinquefolia	Wood Anemone (Native)
Anemone virginiana	Tall Anemone (Native)
Ranunculus abortivus var. *abortivus*	Small-Flowered Crowfoot (Native)
Ranunculus acris	Common Meadow Buttercup (Europe)
Ranunculus bulbosas	Bulbous Buttercup (Europe)
Ranunculus hispidus	Hairy Buttercup (Native)
Ranunculus hispidus var. *caricetorum*	Marsh Buttercup (Native)
Ranunculus recurvatus	Hooked Crowfoot (Native)
Ranunculus repens	Creeping Buttercup (Europe)

Papaveraceae (Poppy Family)

Chelidonium majus	Greater Celandine (Eurasia)
Sanguinaria canadensis	Bloodroot (Native)
Stylophorum diphyllum	Celandine-Poppy (Western N.A.)
Adlumia fungosa	Allegheny-Vine (Native)
Corydalis sempervirens	Rock Harlequin (Native)

Platanaceae (Planetree Family)

Platanus occidentalis	Sycamore (Native)

Polygonaceae (Smartweed Family)

Rumex acetosella	Sheep Sorrel (Eurasia)
Rumex crispus	Curly Dock (Europe)
Rumex obtusifolius	Bitter Dock (Europe)
Persicaria arifolia	Halberd-Leaf Tearthumb (Native)

Persicaria hydropiper	Water-Pepper (Europe)
Persicaria lapathifolia	Dock-Leaf Smartweed (Europe)
Persicaria longiseta var. *longisetum*	Low Smartweed (Asia)
Persicaria maculosa	Lady's-Thumb (Europe)
Persicaria pensylvanica	Smartweed (Native)
Persicaria perfoliata	Mile-A-Minute (Asia)
Persicaria punctata var. *punctatum*	Water Smartweed (Native)
Persicaria sagittata	Arrow-leaf Tearthumb (Native)
Persicaria virginiana	Jumpseed (Native)
Polygonum aviculare	Knotweed (Europe)
Polygonum erectum	Erect Knotweed (Native)
Polygonum tenue	Slender Knotweed (Native)
Fallopia convolvulus	Black Bindweed (Europe)
Fallopia japonica	Japanese Knotweed (Japan)
Fallopia scandens	Climbing False Buckwheat (Native)

Caryophyllaceae (Pink Family)

Paronychia canadensis	Forked Chickweed (Native)
Paronychia fastigiata var. *fastigiata*	Whitlow-Wort Chickweed (Native)
Scleranthus annuus	Knawel (Eurasia)
Arenaria serpyllifolia	Thyme-Leaved Sandwort (Europe)
Cerastium fontanum ssp. *triviale*	Common Mouse-Ear Chickweed (Eurasia)
Cerastium glomeratum	Mouse-Ear Chickweed (Eurasia)
Cerastium nutans	Nodding Chickweed (Native)
Cerastium pumilum	Small Mouse-Ear Chickweed (Europe)
Holosteum umbellatum	Jagged Chickweed (Eurasia)
Myosoton aquaticum	Giant Chickweed (Europe)
Stellaria alsine	Bog Chickweed (Eurasia)
Stellaria longifolia	Long-Leaved Stitchwort (Native)
Stellaria media	Common Chickweed (Europe)
Silene antirrhina	Sleepy Catchfly (Native)
Silene caroliniana ssp. *pensylvanica*	Wild Pink (Native)
Silene dichotoma	Forked Catchfly (Eurasia)
Silene latifolia	White Campion (Europe)
Silene stellata	Star Campion (Native)
Silene vulgaris	Bladder Campion (Europe)
Saponaria officinalis	Bouncing-Bet (Europe)
Dianthus armeria	Deptford Pink (Europe)

Amaranthaceae (Amaranth Family)

Amaranthus albus,	Tumbleweed (Central N.A.)
Chenopodium album var. *album*,	Lamb's-Quarters (Native)

Phytolaccaceae (Pokeweed Family)

Phytolacca americana,	Pokeweed (Native)

Nyctaginaceae (Four-O'clock Family)	
Mirabilis nyctaginea,	Heart-Leaved Umbrella-Wort (Native)
Portulacaceae (Purslane Family)	
Claytonia virginica	Spring-Beauty (Native)
Portulaca oleracea	Purslane (Native)
Santalaceae (Sandalwood Family)	
Comandra umbellata	Bastard Toadflax (Native)
Hamamelidaceae (Witch-Hazel Family)	
Hamamelis virginiana	Witch-Hazel (Native)
Crassulaceae (Stonecrop Family)	
Sedum acre	Mossy Stonecrop (Eurasia)
Sedum telephium	Garden Orpine (Eurasia)
Penthoraceae (Ditch Stonecrop Family)	
Penthorum sedoides	Ditch Stonecrop (Native)
Haloragaceae (Water-Milfoil Family)	
Myriophyllum spicatum	Eurasian Water-Milfoil (Eurasia)
Proserpinaca palustris var. *crebra*	Common Mermaid-Weed (Native)
Grossulariaceae (Gooseberry Family)	
Ribes americanum	Black Currant (Native)
Ribes hirtellum	Northern Wild Gooseberry (Native)
Ribes rotundifolium	Wild Gooseberry (Native)
Ribes rubrum	Garden Red Currant (Eurasia)
Saxifragaceae (Saxifrage Family)	
Mitella diphylla	Miterwort (Native)
Saxifraga pensylvanica	Swamp Saxifrage (Native)
Saxifraga virginiensis	Early Saxifrage (Native)
Chrysosplenium americanum	Golden Saxifrage (Native)
Vitaceae (Grape Family)	
Parthenocissus quinquefolia	Virginia-Creeper (Native)
Vitis aestivalis	Summer Grape (Native)
Vitis labrusca	Fox Grape (Native)
Vitis riparia	Riverbank Grape (Native)
Vitis vulpina	Frost Grape (Native)
Geraniaceae (Geranium Family)	
Geranium carolinianum	Wild Geranium (Native)
Geranium columbinum	Long-Stalked Cranesbill (Europe)

Geranium maculatum	Wood Geranium (Native)
Geranium robertianum	Herb-Robert (Native)
Erodium cicutarium	Red-Stem Filaree (Europe)
Onagraceae (Evening-Primrose Family)	
Ludwigia alternifolia	Seedbox (Native)
Ludwigia palustris	Marsh-Purslane (Native)
Circaea canadensis	Enchanter's-Nightshade (Native)
Epilobium coloratum	Purple-Leaved Willow-Herb (Native)
Oenothera biennis	Evening-Primrose (Native)
Oenothera fruticosa ssp. *fruticosa*	Sundrops (Native)
Oenothera fruticosa ssp. *glauca*	Sundrops (Native)
Oenothera perennis	Small Sundrops (Native)
Gaura biennis	Gaura (Native)
Lythraceae (Loosestrife Family)	
Lythrum salicaria	Purple Loosestrife (Europe)
Cuphea viscosissima	Blue Waxweed (Native)
Celastraceae (Staff-Tree Family)	
Euonymus alatus	Burning Bush (Japan & China)
Euonymus atropurpureus	Wahoo (Native)
Celastrus orbiculatus	Oriental Bittersweet (Japan & China)
Violaceae (Violet Family)	
Viola blanda	Sweet White Violet (Native)
Viola cucullata	Blue Marsh Violet (Native)
Viola hirsutula	Southern Wood Violet (Native)
Viola labradorica	American Dog Violet (Native)
Viola lanceolata	Lance-Leaved Violet (Native)
Viola macloskeyi ssp. *pallens*	Sweet White Violet (Native)
Viola palmata	Early Blue Violet (Native)
Viola pedata	Birdfoot Violet (Native)
Viola primulifolia	Primrose Violet (Native)
Viola pubescens	Downy Yellow Violet (Native)
Viola pubescens var. *scabriuscula*	Downy Yellow Violet (Native)
Viola rostrata	Long-Spurred Violet (Native)
Viola rotundifolia	Round-Leaved Violet (Native)
Viola sagittata (including varieties)	Arrow-Leaved Violet (Native)
Viola sororia var. *sororia*	Common Blue Violet (Native)
Salicaceae (Willow Family)	
Populus grandidentata	Bigtooth Aspen (Native)
Populus tremuloides	Quaking Aspen (Native)
Salix bebbiana	Gray Willow (Native)
Salix eriocephala	Diamond Willow (Native)

Salix humilis var. *humilis*	Upland Willow (Native)
Salix nigra	Black Willow (Native)
Salix X *rubens*	Willow (Europe)
Salix sericea	Silky Willow (Native)

Linaceae (Flax Family)

Linum medium var. *texanum*	Yellow Flax (Native)
Linum striatum	Ridged Yellow Flax (Native)
Linum virginianum	Slender Yellow Flax (Native)

Hyperiaceae (St. John's-Wort Family)

Hypericum ellipticum	Pale St. John's-Wort (Native)
Hypericum gentianoides	Orange-Grass (Native)
Hypericum mutilum	Dwarf St. John's-Wort (Native)
Hypericum perforatum	Common St. John's-Wort (Europe)
Hypericum punctatum	Spotted St. John's-Wort (Native)

Euphorbiaceae (Spurge Family)

Acalypha rhomboidea	Three-Seeded Mercury (Native)
Acalypha virginica	Three-Seeded Mercury (Native)
Euphorbia cyparissias	Cypress Spurge (Eurasia)
Euphorbia maculata	Spotted Spurge (Native)
Euphorbia marginata	Snow-On-The-Mountain (West N.A.)
Euphorbia nutans	Eyebane (Native)
Euphorbia vermiculata	Hairy Spurge (Native)

Oxalidaceae (Oxalis Family)

Oxalis stricta	Common Yellow Wood-Sorrel (Native)
Oxalis dillenii ssp. *filipes*	Slender Yellow Wood –Sorrel (Native)
Oxalis violacea	Violet Wood-Sorrel (Native)

Polygalaceae (Milkwort Family)

Polygala paucifolia	Fringed Milkwort (Native)
Polygala sanguinea	Field Milkwort (Native)
Polygala verticillata	Whorled Milkwort (Native)

Fabaceae (Legume Family)

Cercis canadensis	Redbud (Native)
Gleditsia triacanthos	Honey-Locust (Native)
Chamaecrista nictitans	Wild Sensitive-Plant (Native)
Senna hebecarpa	Northern Wild Senna (Native)
Albizia julibrissin	Mimosa (Asia)
Baptisia tinctoria	Wild Indigo (Native)
Crotalaria sagittalis	Rattlebox (Native)
Tephrosia virginiana	Goat's-Rue (Native)
Apios americana	Ground-Nut (Native)

Desmodium marilandicum	Maryland Tick-Clover (Native)
Desmodium nudiflorum	Naked-Flowered Tick-Trefoil (Native)
Desmodium paniculatum	Panicled Tick-Trefoil (Native)
Desmodium perplexum	Perplexed Tick-Trefoil (Native)
Lespedeza cuneata	Chinese Bush-Clover (E. Asia)
Lespedeza hirta	Hairy Bush-Clover (Native)
Lespedeza intermedia	Wand-Like Bush-Clover (Native)
Lespedeza procumbens	Trailing Bush-Clover (Native)
Lespedeza repens	Creeping Bush-Clover (Native)
Kummerowia stipulacea	Korean Lespedeza (Asia)
Kummerowia striata	Japanese Clover (Asia)
Amphicarpaea bracteata	Hog-Peanut (Native)
Coronilla varia	Crown-Vetch (S. Europe)
Lotus corniculata	Bird's-Foot Trefoil (Europe)
Robinia hispida	Bristly Locust (S.E. Us)
Robinia pseudoacacia	Black Locust (Native)
Wisteria sp.	Wisteria (Non-Native)
Medicago lupulina	Black Medic (Eurasia)
Medicago sativa	Alfalfa (Eurasia)
Melilotus alba	White Sweet-Clover (Eurasia)
Melilotus officinalis	Yellow Sweet-Clover (Eurasia)
Dalea leporina	Foxtail Prarie Clover
Trifolium aureum	Large Yellow Hop-Clover (Eurasia)
Trifolium campestre	Low Hop-Clover (Europe)
Trifolium dubium	Little Hop Clover (Europe)
Trifolium hybridum	Alsike Clover (Eurasia)
Trifolium incarnatum	Crimson Clover (Europe)
Trifolium pratense	Red Clover (Europe)
Trifolium repens	White Clover (Europe)

Fagaceae (Beech Family)

Castanea dentata	American Chestnut (Native)
Fagus grandifolia	American Beech (Native)
Quercus alba	White Oak (Native)
Quercus bicolor	Swamp White Oak (Native)
Quercus coccinea	Scarlet Oak (Native)
Quercus ilicifolia	Scrub Oak (Native)
Quercus macrocarpa	Bur Oak (Native)
Quercus montana	Chestnut Oak (Native)
Quercus palustris	Pin Oak (Native)
Quercus prinoides	Dwarf Chestnut Oak (Native)
Quercus rubra	Northern Red Oak (Native)
Quercus velutina	Black Oak (Native)

Myricaceae (Bayberry Family)

Comptonia peregrina	Sweet-Fern (Native)

Juglandaceae (Walnut Family)

Carya cordiformis	Bitternut Hickory (Native)
Carya glabra	Pignut Hickory (Native)
Carya ovata	Shagbark Hickory (Native)
Carya tomentosa	Mockernut Hickory (Native)
Juglans cinerea	Butternut (Native)
Juglans nigra	Black Walnut (Native)

Betulaceae (Birch Family)

Alnus glutinosa	European Alder (Eurasia)
Alnus incana spp. rugosa	Speckled Alder (Native)
Alnus serrulata	Smooth Alder (Native)
Betula alleghaniensis	Yellow Birch (Native)
Betula lenta	Black Birch (Native)
Betula nigra	River Birch (Native)
Betula populifolia	Gray Birch (Native)
Carpinus caroliniana	Hornbeam (Native)
Ostrya virginiana	Hop-Hornbeam (Native)
Corylus americana	American Hazelnut (Native)
Corylus cornuta	Beaked Hazelnut (Native)

Rosaceae (Rose Family)

Waldsteinia fragarioides	Barren-Strawberry (Native)
Geum canadense var. *canadense*	White Avens (Native)
Geum laciniatum	Rough Avens (Native)
Rubus alleghaniensis	Common Blackberry (Native)
Rubus flagellaris	Northern Dewberry (Native)
Rubus hispidus	Swamp Dewberry (Native)
Rubus occidentalis	Black Raspberry (Native)
Rubus odoratus	Purple-Flowering Raspberry (Native)
Rubus pensylvanicus	Blackberry (Native)
Rubus phoenicolasius	Wineberry (Asia)
Agrimonia gryposepala	Agrimony (Native)
Agrimonia microcarpa	Small-Fruited Agrimony (Native)
Agrimonia parviflora	Small-flowered Agrimony (Native)
Agrimonia pubescens	Downy Agrimony (Native)
Rosa carolina	Pasture Rose (Native)
Rosa multiflora	Multiflora Rose (Asia)
Rosa palustris	Swamp Rose (Native)
Rosa wichuraiana	Memorial Rose (Asia)
Potentilla argentea	Silvery Cinquefoil (Eurasia)
Potentilla canadensis	Dwarf Cinquefoil (Native)
Potentilla norvegica ssp. *monspeliensis*	Strawberry-Weed (Native)
Potentilla recta	Sulfur Cinquefoil (Europe)
Potentilla simplex	Old-Field Cinquefoil (Native)

Fragaria virginiana	Wild Strawberry (Native)
Duchesnea indica	Indian-Strawberry (Asia)
Spiraea alba	Narrow-Leaved Meadow-Sweet (Native)
Spiraea latifolia	Meadow-Sweet (Native)
Spiraea tomentosa	Steeplebush (Native)
Prunus americana	Wild Plum (Native)
Prunus avium	Sweet Cherry (Eurasia)
Prunus pensylvanica	Pin Cherry (Native)
Prunus persica	Peach (Asia)
Prunus serotina	Black Cherry (Native)
Prunus virginiana	Choke Cherry (Native)
Physocarpus opulifolius	Ninebark (Native)
Photinia melanocarpa	Red Chokeberry(Asia)
Photinia floribunda	Purple Chokeberry (Native)
Crataegus sp.	Hawthorn
Amelanchier arborea	Serviceberry (Native)
Pyrus communis	Pear (Eurasia)
Malus coronaria	Sweet Crabapple (Native)
Malus pumila	Apple (Eurasia)

Rhamnaceae (Buckthorn Family)

Ceanothus americanus	New Jersey Tea (Native)

Elaeagnaceae (Oleaster Family)

Elaeagnus umbellata	Autumn-Olive (Asia)

Ulmaceae (Elm Family)

Ulmus americana	American Elm (Native)
Ulmus pumila	Siberian Elm (Asia)
Ulmus rubra	Slippery Elm (Native)

Cannabaceae (Hemp Family)

Celtis occidentalis	Hackberry (Native)

Moraceae (Mulberry Family)

Morus alba	White Mulberry (Asia)
Maclura pomifera	Osage-Orange (SW N.A.)

Urticaceae (Nettle Family)

Parietaria pensylvanica	Pellitory (Native)
Pilea pumila	Clearweed (Native)
Boehmeria cylindrica var. *cylindrica*	False Nettle (Native)

Limnanthaceae (Meadow-Foam Family)

Floerkea proserpinacoides	False Mermaid (Native)

Brassicaceae (Mustard Family)	
Hesperis matronalis	Dame's-Rocket (Europe)
Conringia orientalis	Hare's-Ear Mustard (Eurasia)
Draba verna	Whitlow-Grass (Europe)
Arabis canadensis	Sicklepod (Native)
Arabis laevigata var. *laevigata*	Smooth Rockcress (Native)
Alliaria petiolata	Garlic-Mustard (Europe)
Thlaspi perfoliatum	Pennycress (Eurasia)
Brassica rapa	Field Mustard (Europe)
Sinapis arvensis	Charlock (Mediterranean Region)
Lepidium campestre	Fieldcress (Eurasia)
Lepidium virginicum	Wild Pepper-Grass (Native)
Lepidium densiflorum	Wild Pepper-Grass (Native)
Cardamine angustata	Toothwort (Native)
Cardamine bulbosa	Springcress (Native)
Cardamine concatenata	Toothwort (Native)
Cardamine hirsuta	Hairy Bittercress (Europe)
Cardamine parviflora var. *arenicola*	Small-Flowered Bittercress (Native)
Cardamine pensylvanica	Pennsylvania Bitter-Cress (Native)
Cardamine. rotundifolia	Mountain Watercress (Native)
Rorippa islandica	Northern Marsh Yellowcress (Native)
Barbarea verna	Early Wintercress (Eurasia)
Barbarea vulgaris	Common Wintercress (Eurasia)
Alyssum alyssoides	Alyssum (Europe)
Capsella bursa-pastoris	Shepherd's-Purse (Eurasia)
Arabidopsis thaliana	Mouse-Ear Cress (Eurasia)
Cistaceae (Rockrose Family)	
Lechea sp.	Pinweed (Identification Pending)
Lechea racemulosa	Illinois Pinweed (Native)
Malvaceae (Mallow Family)	
Tilia americana var. *americana*	Basswood (Native)
Hibiscus trionum	Flower-Of-The-Hour (Europe)
Malva moschata	Musk Mallow (Europe)
Simaroubaceae (Quassia Family)	
Ailanthus altissima	Tree-Of-Heaven (Asia)
Anacardiaceae (Cashew Family)	
Toxicodendron radicans	Poison-Ivy (Native)
Toxicodendron vernix	Poison-Sumac (Native)
Rhus copallina var. *latifolia*	Winged Sumac (Native)
Rhus glabra	Smooth Sumac (Native)
Rhus typhina	Staghorn Sumac (Native)

Sapindaceae (Soapberry Family)	
Acer negundo	Box-Elder (Native)
Acer pensylvanicum	Striped Maple (Native)
Acer platanoides	Norway Maple (Europe)
Acer rubrum	Red Maple (Native)
Acer saccharinum	Silver Maple (Native)
Acer saccharum	Sugar Maple (Native)
Aesculus sp.	Buckeye (Identification Pending)
Cornaceae (Dogwood Family)	
Cornus alternifolia	Alternate-Leaved Dogwood (Native)
Cornus amomum ssp. *amomum*	Silky Dogwood (Native)
Cornus florida	Flowering Dogwood (Native)
Cornus racemosa	Gray Dogwood (Native)
Cornus sericea	Red-Osier Dogwood (Native)
Nyssaceae (Tupelo Family)	
Nyssa sylvatica	Blackgum (Native)
Hydrangeaceae (Hydrangea Family)	
Hydrangea arborescens	Wild Hydrangea (Native)
Balsaminaceae (Balsam Family)	
Impatiens capensis	Jewelweed (Native)
Polemoniaceae (Phlox Family)	
Phlox maculata	Meadow Phlox (Native)
Ebenaceae (Ebony Family)	
Diospyros virginiana	Persimmon (Native)
Myrsinaceae (Myrsine Family)	
Trientalis borealis	Starflower (Native)
Lysimachia ciliata	Fringed Loosestrife (Native)
Lysimachia nummularia	Moneywort (Europe)
Lysimachia quadrifolia	Whorled Loosestrife (Native)
Lysimachia terrestris	Swamp-Candles (Native)
Anagallis arvensis	Scarlet Pimpernel (Eurasia)
Ericaceae (Heath Family)	
Chimaphila maculata	Spotted Wintergreen (Native)
Pyrola americana	Wild Lily-Of-The-Valley (Native)
Monotropa hypopithys	Pinesap (Native)
Monotropa uniflora	Indian-Pipe (Native)
Kalmia latifolia	Mountain Laurel (Native)
Epigaea repens	Trailing-Arbutus (Native)

Rhododendron maximum	Rosebay (Native)
Rhododendron periclymenoides	Pinxter-Flower (Native)
Lyonia ligustrina	Maleberry (Native)
Vaccinium angustifolium	Sweet Low Blueberry (Native)
Vaccinium corymbosum	Highbush Blueberry (Native)
Vaccinium pallidum	Lowbush Blueberry (Native)
Vaccinium stamineum	Deerberry (Native)
Gaylussacia baccata	Black Huckleberry (Native)
Gaylussacia frondosa	Dangleberry (Native)
Gaultheria procumbens	Teaberry (Native)

Boraginaceae (Borage Family)

Mertensia virginica	Virginia Bluebell (Native)
Hackelia virginiana	Beggar's-Lice (Native)
Myosotis laxa	Wild Forget-Me-Not (Native)
Cynoglossum virginianum	Wild Comfrey (Native)
Buglossoides arvense	Corn Gromwell (Eurasia)
Echium vulgare	Viper's Bugloss (Europe)

Rubiaceae (Madder Family)

Cephalanthus occidentalis	Buttonbush (Native)
Mitchella repens	Partridge-Berry (Native)
Diodia teres	Rough Buttonweed (Native)
Houstonia caerulea	Bluets (Native)
Houstonia longifolia	Long-Leaved Bluets (Native)
Galium aparine	Cleavers (Native)
Galium asprellum	Rough Bedstraw (Native)
Galium circaezans var. *circaezans*	Wild-Licorice (Native)
Galium mollugo	White Bedstraw (Eurasia)
Galium obtusum	Marsh Bedstraw (SW N.A.)
Galium pilosum	Hairy Bedstraw (Native)
Galium tinctorium	Stiff Marsh Bedstraw (Native)
Galium triflorum	Sweet-Scented Bedstraw (Native)

Gentianaceae (Gentian Family)

Sabatia angularis	Rose-Pink (Native)
Gentiana clausa	Closed Gentian (Native)
Gentiana villosa	Striped Gentian (Native)
Bartonia virginica	Bartonia (Native)

Apocynaceae (Dogbane Family)

Vinca minor	Periwinkle (Europe)
Apocynum androsaemifolium	Spreading Dogbane (Native)
Apocynum cannabinum	Indian-Hemp (Native)
Vincetoxicum nigrum	Black Swallow-Wort (Europe)
Asclepias amplexicaulis	Blunt-Leaved Milkweed (Native)

Asclepias exaltata	Poke Milkweed (Native)
Asclepias incarnata ssp. *incarnata*	Swamp Milkweed (Native)
Asclepias purpurascens	Purple Milkweed (Native)
Asclepias quadrifoliata	Four-Leaved Milkweed (Native)
Asclepias syriaca	Common Milkweed (Native)
Asclepias tuberosa	Butterfly-Weed (Native)
Asclepias viridiflora	Green Milkweed (Native)

Oleaceae (Olive Family)

Ligustrum obtusifolium	Obtuse-Leaved Privet (Japan)
Syringa vulgaris	Lilac (Europe)
Fraxinus americana var. *americana*	White Ash (Native)
Fraxinus nigra	Black Ash (Native)

Plantaginaceae (Plantain Family)

Gratiola neglecta	Hedge-Hyssop (Native)
Lindernia dubia	False Pimpernel (Native)
Chaenorrhinum minus	Dwarf Snapdragon (Europe)
Linaria vulgaris	Butter-And-Eggs (Eurasia)
Callitriche heterophylla	Water-Starwort (Native)
Veronica americana	American Brooklime (Native)
Veronica anagallis-aquatica	Water Speedwell (Native)
Veronica arvensis	Corn Speedwell (Eurasia)
Veronica hederifolia	Ivy-Leaved Speedwell (Eurasia)
Veronica officinalis	Common Speedwell (Europe)
Veronica peregrina ssp. *peregrina*	Purslane Speedwell (Native)
Veronica persica	Bird's-Eye Speedwell (Eurasia)
Veronica serpyllifolia	Thyme-Leaved Speedwell (Europe)
Plantago aristata	Bristly Plantain (West N.A.)
Plantago lanceolata	English Plantain (Europe)
Plantago major	Broad-Leaved Plantain (Europe)
Plantago rugelii	Rugel's Plantain (Native)
Plantago virginica	Dwarf Plantain (Native)
Penstemon digitalis	Foxglove Beardtongue (Native)
Penstemon hirsutus	Northeastern Beardtongue (Native)
Chelone glabra	Turtlehead (Native)

Bignoniaceae (Trumpet-Creeper Family)

Catalpa sp.	Catalpa (Non-native, Identification Pending)
Catalpa bignonioides	Catalpa (South N.A.)
Campsis radicans	Trumpet-Vine (Native)

Verbenaceae (Vervain Family)

Verbena hastata	Blue Vervain (Native)
Verbena simplex	Narrow-Leaved Vervain (Native)

Verbena urticifolia (including var. *leiophylla*)	White Vervain (Native)
Lamiaceae (Mint Family)	
Perilla frutescens	Perilla (India)
Collinsonia canadensis	Stoneroot (Native)
Salvia lyrata	Lyre-Leaved Sage (Native)
Prunella vulgaris ssp. *lanceolata*	Heal-All (Native)
Nepeta cataria	Catnip (Eurasia)
Glechoma hederacea	Ground-Ivy (Eurasia)
Lycopus americanus	Water-Horehound (Native)
Lycopus uniflorus	Northern Bugleweed (Native)
Lycopus virginicus	Bugleweed (Native)
Cunila origanoides	Common Dittany (Native)
Pycnanthemum sp.	Mountain-Mint (Identification Pending)
Pycnanthemum incanum	Hoary Mountain-Mint (Native)
Pycnanthemum muticum	Short-Toothed Mountain-Mint (Native)
Pycnanthemum tenuifolium	Narrow-Leaved Mountain-Mint (Native)
Pycnanthemum verticillatum var. *pilosum*	Hairy Mountain Mint (Native)
Pycnanthemum virginianum	Virginia Mountain Mint (Native)
Mentha X *piperata*	Peppermint (Eurasia)
Mentha spicata	Spearmint (Europe)
Mentha X *villosa*	Wooly Mint (Europe)
Clinopodium vulgare	Wild Basil (Europe)
Monarda clinopodia	Bee-Balm (Native)
Monarda didyma	Oswego-Tea (Native)
Monarda fistulosa	Wild Bergamot (Native)
Hedeoma pulegioides	American Pennyroyal (Native)
Scutellaria elliptica var. *elliptica*	Hairy Skullcap (Native)
Scutellaria integrifolia	Hyssop Skullcap (Native)
Scutellaria lateriflora	Mad-Dog Skullcap (Native)
Lamium purpureum	Dead-Nettle (Eurasia)
Leonurus cardiaca	Motherwort (Asia)
Teucrium canadense var. *virginicum*	Wild Germander (Native)
Trichostema dichotomum	Blue-Curls (Native)
Phrymaceae (Lopseed Family)	
Mimulus alatus	Winged Monkeyflower (Native)
Mimulus ringens	Allegheny Monkeyflower (Native)
Phryma leptostachya	Lopseed (Native)
Scrophulariaceae (Figwort Family)	
Buddleja davidii	Butterfly-Bush (China)
Verbascum blattaria	Moth Mullein (Eurasia)
Verbascum thapsus	Common Mullein (Europe)
Scrophularia lanceolata	Lanceleaf Figwort (Native)
Aureolaria virginica	Downy Yellow False Foxglove (Native)

Orobanchaceae (Broom-Rape Family)

Pedicularis canadensis	Wood-Betony (Native)
Melampyrum lineare var. *americanum*	Cow-Wheat (Native)
Conopholis americana	Squawroot (Native)
Epifagus virginiana	Beechdrops (Native)

Paulowniaceae (Empress-Tree Famly)

Paulownia tomentosa	Princess Tree (China)

Convolvulaceae (Morning-Glory Family)

Cuscuta sp.	Dodder
Cuscuta gronovii var. *gronovii*	Common Dodder (Native)
Calystegia hederacea	Japanese Bindweed (Japan)
Calystegia sepium	Hedge Bindweed (Native)
Calystegia spithamaea ssp. *spithamaea*	Low Bindweed (Native)
Ipomoea hederacea	Ivy-Leaved Morning-Glory (South N.A.)
Ipomoea pandurata	Man-Of-The-Earth (Native)

Solanaceae (Nightshade Family)

Solanum carolinense	Horse-Nettle (Native)
Solanum dulcamara	Trailing Bittersweet (Eurasia)
Solanum nigrum	Black Nightshade (Europe)
Physalis heterophylla	Clammy Ground-Cherry (Native)
Physalis subglabrata	Ground-Cherry (Native)

Aquifoliaceae (Holly Family)

Ilex beadlei	Mountain Holly (Native)
Ilex opaca	American Holly (Native)
Ilex verticillata	Winterberry (Native)

Araliaceae (Ginseng Family)

Hydrocotyle americana	Marsh Pennywort (Native)
Aralia hispida	Bristly Sarsaparilla (Native)
Aralia nudicaulis	Wild Sarsaparilla (Native)
Aralia racemosa	Spikenard (Native)
Panax trifolius	Dwarf Ginseng (Native)
Hedera helix	English Ivy (Europe)

Apiaceae (Parsley Family)

Sanicula canadensis	Snakeroot (Native)
Cryptotaenia canadensis	Honewort (Native)
Cicuta bulbifera	Water-Hemlock (Native)
Cicuta maculata var. *maculata*	Beaver-Poison (Native)
Osmorhiza longistylis	Aniseroot (Native)
Daucus carota	Queen Anne's-Lace (Eurasia)

Pimpinella saxifraga	Burnet-Saxifrage (Eurasia)
Pastinaca sativa	Wild Parsnip (Eurasia)

Campanulaceae (Bellflower Family)

Campanula aparinoides	Marsh Bellflower (Native)
Triodanis perfoliata var. *perfoliata*	Venus' Looking-Glass (Native)
Lobelia cardinalis	Cardinal Flower (Native)
Lobelia inflata	Indian-Tobacco (Native)
Lobelia siphilitica	Great Lobelia (Native)
Lobelia spicata	Spiked Lobelia (Native)

Asteraceae (Aster Family)

Carduus nutans	Nodding Thistle (Europe)
Cirsium arvense	Canada Thistle (Eurasia)
Cirsium discolor	Field Thistle (Native)
Cirsium muticum	Swamp Thistle (Native)
Cirsium pumilum	Pasture Thistle (Native)
Cirsium vulgare	Bull Thistle (Eurasia)
Arctium minus	Common Burdock (Eurasia)
Centaurea jacea	Brown Knapweed (Europe)
Centaurea stoebe	Spotted Knapweed (Europe)
Vernonia noveboracensis	New York Ironweed (Native)
Cichorium intybus	Blue Chicory (Europe)
Taraxacum officinale	Dandelion (Eurasia)
Lactuca biennis	Blue Letuce (Native)
Lactuca saligna	Willow-Leaf Lettuce (Europe)
Lactuca serriola	Prickly Lettuce (Europe)
Prenanthes sp.	Rattlesnake-Root (Identification Pending)
Prenanthes alba	Rattlesnake-Root (Native)
Sonchus asper	Spiny-Leaved Sow-Thistle (Europe)
Hieracium sp.	Hawkweed (Identification Pending)
Hieracium caespitosum	King-Devil (Europe)
Hieracium gronovii	Meadow Hawkweed (Native)
Hieracium paniculatum	Panicled Hawkweed (Native)
Hieracium pilosella	Mouse-Ear Hawkweed (Europe)
Hieracium piloselloides	King-Devil (Europe)
Hieracium scabrum	Rough Hawkweed (Native)
Hieracium venosum	Rattlesnake-Weed (Native)
Hypochoeris radicata	Cat's-Ear (Eurasia)
Tragopogon dubius	Yellow Goat's-Beard (Europe)
Krigia virginica	Dwarf Dandelion (Native)
Antennaria howellii ssp. *neodioica*	Howell's Pussytoes (Native)
Antennaria neglecta	Overlooked Pussytoes (Native)
Antennaria parlinii (incl. ssp. *parlinii* and *fallax*)	Parlin's Pussytoes (Native)
Antennaria plantaginifolia	Plantain-Leaved Pussytoes (Native)
Pseudognaphalium obtusifolium	Fragrant Cudweed (Native)

Anaphalis margaritacea	Pearly Everlasting (Native)
Achillea millefolium	Common Yarrow (Europe)
Artemisia vulgaris	Mugwort (Eurasia)
Matricaria discoidea	Pineapple-Weed (West N.A.)
Leucanthemum vulgare	Ox-Eye Daisy (Europe)
Euthamia graminifolia var. *graminifolia*	Grass-Leaved Goldenrod (Native)
Sericocarpus asteroides	White-Topped Aster (Native)
Solidago bicolor	Silver-Rod (Native)
Solidago caesia var. *caesia*	Wreath Goldenrod (Native)
Solidago canadensis (including varieties)	Canada Goldenrod (Native)
Solidago gigantea var. *gigantea*	Smooth Goldenrod (Native)
Solidago hispida	Hairy Goldenrod (Native)
Solidago juncea	Early Goldenrod (Native)
Solidago nemoralis	Gray Goldenrod (Native)
Solidago puberula	Downy Goldenrod (Native)
Solidago rugosa (including varieties)	Wrinkle-Leaf Goldenrod (Native)
Erigeron annuus	Daisy Fleabane (Native)
Erigeron philadelphicus	Philadelphia Daisy Fleabane (Native)
Erigeron strigosus var. *strigosus*	Lesser Daisy Fleabane (Native)
Conyza canadensis var. *canadensis*	Horseweed (Native)
Eurybia divaricatus	White Wood Aster (Native)
Eurybia macrophylla	Bigleaf Aster (Native)
Symphyotrichum laeve var. *laevis*	Smooth Blue Aster (Native)
Symphyotrichum lanceolatum ssp. *lanceolatum*	Panicled Aster (Native)
Symphyotrichum lateriflorum	Calico Aster (Native)
Symphyotrichum novae-angliae	New England Aster (Native)
Symphyotrichum novii-belgii	New York Aster (Native)
Symphyotrichum pilosum var. *pilosum*	Heath Aster (Native)
Symphyotrichum puniceum ssp. *puniceum*	Purple-Stemmed Aster (Native)
Senecio vulgaris	Common Groundsel (Eurasia)
Packera aurea	Golden Ragwort (Native)
Packera paupercula	Balsam Ragwort (Native)
Erechtites hieraciifolia	Fireweed (Native)
Tussilago farfara	Coltsfoot (Eurasia)
Ambrosia artemisiifolia	Common Ragweed (Native)
Ambrosia trifida	Giant Ragweed (Native)
Xanthium strumarium var. *glabratum*	Common Cocklebur (Europe)
Rudbeckia hirta var. *pulcherrima*	Black-Eyed-Susan (Native)
Rudbeckia laciniata	Cutleaf Coneflower (Native)
Rudbeckia triloba	Three-Lobed Coneflower (Native)
Heliopsis helianthoides	Ox-Eye (Native)
Eclipta prostrata	Yerba-De-Tajo (Native)
Helianthus decapetalus	Thin-Leaved Sunflower (Native)
Helianthus hirsutus	Sunflower (Native)
Helianthus laetiflorus	Showy Sunflower (West N.A.)
Helianthus tuberosus	Jerusalem Artichoke (West N.A.)

Galinsoga quadriradiata	Quickweed (Central & S. America)
Bidens frondosa	Beggar-Ticks (Native)
Bidens polylepis	Tickseed-Sunflower (West N.A.)
Bidens tripartite	Three-Lobed Beggar-Ticks (Native)
Helenium autumnale	Common Sneezeweed (Native)
Eupatorium godfreyanum	Vasey's Eupatorium (Native)
Eupatorium perfoliatum	Boneset (Native)
Eupatorium rotundifolium nr. var. ovatum	Round-Leafed Throughwort (Native)
Eupatorium serotinum	Late Boneset (Native)
Eupatorium sessilifolium	Upland Boneset (Native)
Eutrochium fistulosum	Hollow Joe-Pye-Weed (Native)
Eutrochium maculatum	Spotted Joe-Pye-Weed (Native)
Eutrochium purpureum	Sweet Joe-Pye-Weed (Native)
Ageratina altissima	White-Snakeroot (Native)

Adoxaceae (Muskroot Family)

Viburnum acerifolium	Maple-Leaved Viburnum (Native)
Viburnum cassinoides	Witherod (Native)
Viburnum dentatum	Southern Arrow-Wood (Native)
Viburnum lantana	Wayfaring-Tree (China)
Viburnum lentago	Nannyberry (Native)
Viburnum prunifolium	Black-Haw (Native)
Viburnum recognitum	Northern Arrow-Wood (Native)
Sambucus canadensis	Common Elderberry (Native)
Sambucus racemosa var. *pubens*	Red Elderberry (Native)

Caprifoliaceae (Honeysuckle Family)

Symphoricarpos orbiculatus	Coralberry (Native)
Triosteum angustifolium	Horse-Gentian (Native)
Lonicera japonica var. *japonica*	Japanese Honeysuckle (Asia)
Lonicera maackii	Amur Honeysuckle (Asia)
Lonicera morrowii	Morrow's Honeysuckle (Japan)
Lonicera morrowii x *tatarica*	Honeysuckle (Non-Native)
Lonicera xylosteum	Dwarf Honeysuckle, European Fly Honeysuckle (Europe)
Diervilla lonicera	Bush-Honeysuckle (Native)

Dipsacaceae (Teasel Family)

Dipsacus sylvestris	Common Teasel (Native)

ANIMALIA

Herpetofauna (Amphibians and Reptiles)

Amphibia

Bufonidae

Anaxyrus americanus americanus	American Toad
Anaxyrus fowleri	Fowler's Toad
Anaxyrus americanus x fowleri	American/Fowler's Toad Hybrid
Hylidae	
Hyla versicolor	Northern Gray Treefrog
Pseudacris crucifer	Northern Spring Peeper Frog
Ranidae	
Lithobates catesbeianus	American Bullfrog
Lithobates clamitans melanota	Northern Green Frog
Lithobates palustris	Pickerel Frog
Lithobates sylvaticus	Wood Frog
Ambystomatidae	
Ambystoma maculatum	Spotted Salamander
Plethodontidae	
Desmognathus fuscus	Northern Dusky Salamander
Eurycea bislineata	Northern Two-lined Salamander
Eurycea longicauda longicauda	Long-tailed Salamander
Gyrinophilus porphyriticus porphyriticus	Northern Spring Salamander
Hemidactylium scutatum	Four-toed Salamander
Plethodon cinereus	Red-backed, Lead-backed Salamander
Plethodon glutinosus	Northern Slimy Salamander
Pseudotriton ruber ruber	Northern Red Salamander
Salamandridae	
Notophthalmus viridescens viridescens	Red Spotted Newt, Red Eft

Reptilia

Chelydridae	
Chelydra serpentina serpentina	Common Snapping Turtle
Emydidae	
Chrysemys picta marginata	Midland Painted Turtle
Chrysemys picta picta	Eastern Painted Turtle
Clemmys guttata	Spotted Turtle
Glyptemys insculpta	Wood Turtle
Pseudemys rubriventris	Northern Red-bellied Cooter Turtle
Terrapene carolina carolina	Eastern Box Turtle
Trachemys scripta elegans	Red-eared Slider Turtle
Trachemys scripta scripta	Yellow-bellied Slider Turtle
Kinosternidae	
Sternotherus odoratus	Common Musk Turtle, Stinkpot
Scincidae	
Eumeces fasciatus	Common Five-lined Skink
Colubridae	
Coluber constrictor constrictor	Northern Black Racer Snake
Diadophis punctatus edwardsii	Northern Ringneck Snake
Heterodon platirhinos	Eastern Hog-nosed Snake
Lampropeltis triangulum triangulum	Eastern Milksnake

Nerodia sipedon sipedon	Northern Watersnake, Common Watersnake
Opheodrys aestivus	Northern Rough Greensnake
Opheodrys vernalis	Smooth Greensnake
Pantherophis alleghaniensis	Eastern Ratsnake, Black Ratsnake
Regina septemvittata	Queen Snake
Storeria occipitomaculata occipitomaculata	Northern Red-bellied Snake
Thamnophis sauritus sauritus	Eastern Ribbon Snake
Thamnophis sirtalis sirtalis	Eastern Garter Snake
Viperidae	
Agkistrodon contortrix mokasen	Northern Copperhead Snake
Crotalus horridus	Timber Rattlesnake
Phrynosomatidae	
Sceloporus undulatus	Eastern Fence Lizard

Aves (Birds)

Anseriformes

Anatidae (Geese, Ducks, Swans, and Mergansers)	
Anser albifrons	Greater White-fronted Goose
Anser caerulescens	Snow Goose
Anser rossii	Ross's Goose
Branta bernicla	Brant
Branta hutchinsii	Cackling Goose
Branta canadensis	Canada Goose
Cygnus olor	Mute Swan
Cygnus buccinator	Trumpeter Swan
Cygnus columbianus	Tundra Swan
Aix sponsa	Wood Duck
Mareca strepera	Gadwall
Mareca penelope	Eurasian Wigeon
Mareca americana	American Wigeon
Anas rubripes	American Black Duck
Anas platyrhyncos	Mallard
Anas discors	Blue-winged Teal
Anas clypeata	Northern Shoveler
Anas acuta	Northern Pintail
Anas crecca	Green-winged Teal
Aythya valisineria	Canvasback
Aythya americana	Redhead
Aythya collaris	Ring-necked Duck
Aythya marila	Greater Scaup
Aythya affinis	Lesser Scaup
Melanitta perspicillata	Surf Scoter
Melanitta fusca	White-winged Scoter
Melanitta americana	Black Scoter
Clangula hyemalis	Long-tailed Duck

Bucephala albeola	Bufflehead
Bucephala clangula	Common Goldeneye
Lophodytes cucullatus	Hooded Merganser
Mergus merganser	Common Merganser
Mergus serrator	Red-breasted Merganser
Oxyura jamaicensis	Ruddy Duck

Galliformes

Odontophoridae (Quails)

Colinus virginianus	Northern Bobwhite Quail

Phasianidae (Pheasants and Partridges)

Phasianus colchicus	Ring-necked Pheasant
Bonasa umbellus	Ruffed Grouse
Meleagris gallopavo	Wild Turkey

Gaviiformes

Gaviidae (Loons)

Gavia stellata	Red-throated Loon
Gavia immer	Common Loon

Podicipediformes

Podicipedidae (Grebes)

Podilymbus podiceps	Pied-billed Grebe
Podiceps auritus	Horned Grebe
Podiceps grisegena	Red-necked Grebe
Podiceps nigricollis	Eared Grebe
Aechmophorus occidentalis	Western Grebe

Suliformes

Phalacrocoracidae (Cormorants)

Phalacrocorax auritus	Double-crested Cormorant

Anhingidae (Anhingas)

Anhinga anhinga	Anhinga

Procellariiformes

Hydrobatidae

Oceanodroma leucorhoa	Leach's Storm-petrel

Ciconiiformes

Ardeidae (Bitterns, Egrets, and Herons)

Botaurus lentiginosus	American Bittern
Ixobryclus exilis	Least Bittern
Ardea herodias	Great Blue Heron
Ardea alba	Great Egret
Egretta caerulea	Little Blue Heron

Egretta tricolor	Tricolor Heron
Butorides virescens	Green Heron
Nycticorax nycticorax	Black-crowned Night-heron
Nyctanassa violacea	Yellow-crowned Night-heron
Threskiornithidae (Ibises)	
Plegadis falcinellus	Glossy Ibis

Falconiformes

Cathartidae (Vultures)	
Coragyps atratus	Black Vulture
Cathartes aura	Turkey Vulture
Pandionidae (Ospreys)	
Pandion haliaetus	Osprey
Accipitridae (Raptors)	
Ictinia mississippiensis	Mississippi Kite
Haliaeetus leucocephalus	Bald Eagle
Circus cyaneus	Northern Harrier
Accipiter striatus	Sharp-shinned Hawk
Accipiter cooperii	Cooper's Hawk
Accipiter gentilis	Northern Goshawk
Buteo lineatus	Red-shouldered Hawk
Buteo platypterus	Broad-winged Hawk
Buteo swainsoni	Swainson's Hawk
Buteo jamaicensis	Red-tailed Hawk
Buteo regalis	Ferruginous Hawk
Buteo lagopus	Rough-legged Hawk
Aquila chrysaetos	Golden Eagle

Falconiformes

Falconidae (Falcons)	
Falco sparverius	American Kestrel
Falco columbarius	Merlin
Falco rusticolus	Gyrfalcon
Falco peregrinus	Peregrine Falcon

Gruiformes

Rallidae (Rails)	
Rallus limicola	Virginia Rail
Porzana carolina	Sora
Gallinula galeata	Common Gallinule
Fulica americana	American Coot
Gruidae (Cranes)	
Antigone canadensis	Sandhill Crane

Charadriiformes

Charadriidae (Plovers)

Pluvialis dominica	American Golden-plover
Charadrius semipalmatus	Semipalmated Plover
Charadrius vociferus	Killdeer
Scolopacidae (Sandpipers and Shorebirds)	
Actitis macularius	Spotted Sandpiper
Tringa solitaria	Solitary Sandpiper
Tringa melanoleuca	Greater Yellowlegs
Tringa semipalmata	Lesser Yellowlegs
Bartramia longicauda	Upland Sandpiper
Numenius phaeopus	Whimbrel
Calidris pusilla	Semi-palmated Sandpiper
Calidris minutilla	Least Sandpiper
Calidris fuscicollis	White-rumped Sandpiper
Calidris bairdii	Baird's Sandpiper
Calidris melanotos	Pectoral Sandpiper
Calidris alpina	Dunlin
Calidris himantopus	Stilt Sandpiper
Limnodromus scolopaceus	Long-billed Dowitcher
Gallinago delicata	Wilson's Snipe
Scolopax minor	American Woodcock
Phalaropus lobatus	Red-necked Phalarope
Phalaropus fulicarius	Red Phalarope
Laridae (Gulls and Terns)	
Chroicocephalus philadelphia	Bonaparte's Gull
Hydrocoloeus minutus	Little Gull
Leucophaeus atricilla	Laughing Gull
Larus canus	Mew Gull
Larus delawarensis	Ring-billed Gull
Larus californicus	California Gull
Larus argentatus	Herring Gull
Larus glaucoides thayeri	Thayer's Gull
Larus glaucoides	Iceland Gull
Larus fuscus	Lesser Black-backed Gull
Larus hyperboreus	Glaucous Gull
Larus marinus	Great Black-backed Gull
Hydroprogne caspia	Caspian Tern
Chlidonias niger	Black Tern
Sterna hirundo	Common Tern
Sterna forsteri	Forester's Tern
Thalasseus maximus	Royal Tern

Columbiformes

Columbidae (Doves)	
Columba livia	Rock Pigeon
Streptopelia decaocto	Eurasian Collared-Dove
Zenaida macroura	Mourning Dove

Cuculiformes

Cuculidae (Cuckoos)

Coccyzus americanus	Yellow-billed Cuckoo
Coccyzus erythropthalmus	Black-billed Cuckoo

Strigiformes

Tytonidae (Barn Owls)

Tyto alba	Barn Owl

Strigidae (True Owls)

Megascops asio	Eastern Screech-Owl
Bubo virginianus	Great Horned Owl
Strix varia	Barred Owl
Asio flammeus	Short-eared Owl
Aegolius acadicus	Northern Saw-whet Owl

Caprimulgiformes

Caprimulgidae (Nightjars)

Chordeiles minor	Common Nighthawk
Antrostomus carolinensis	Chuck-wills-widow
Antrotsomus vociferus	Eastern Whip-poor-will

Apodiformes

Apodidae (Swifts)

Chaetura pelagica	Chimney Swift

Trochilidae (Hummingbirds)

Archilochus colubris	Ruby-throated Hummingbird

Coraciiformes

Alcedinidae (Kingfishers)

Megaceryle alcyon	Belted Kingfisher

Piciformes

Picidae (Woodpeckers)

Melanerpus erythrocephalus	Red-headed Woodpecker
Melanerpes carolinus	Red-bellied Woodpecker
Sphyrapicus varius	Yellow-bellied Sapsucker
Dryobates pubescens	Downy Woodpecker
Dryobates villosus	Hairy Woodpecker
Colaptes auratus	Northern Flicker
Dryocopus pileatus	Pileated Woodpecker

Passeriformes

Tyrannidae (New World Flycatchers)

Contopus cooperi	Olive-sided Flycatcher
Contopus virens	Eastern Wood-Pewee

Empidonax flaviventris	Yellow-bellied Flycatcher
Empidonax virescens	Acadian Flycatcher
Empidonax alnorum	Alder Flycatcher
Empidonax traillii	Willow Flycatcher
Empidonax minimus	Least Flycatcher
Sayornis phoebe	Eastern Phoebe
Myiarchus crinitus	Great Crested Flycatcher
Tyrannus tyrranus	Eastern Kingbird
Laniidae (Shrikes)	
Lanius ludovicianus	Loggerhead Shrike
Lanius borealis	Northern Shrike
Vireonidae (Vireos)	
Vireo griseus	White-eyed Vireo
Vireo flavifrons	Yellow-throated Vireo
Vireo solitarius	Blue-headed Vireo
Vireo gilvus	Warbling Vireo
Vireo olivaceus	Red-eyed Vireo
Corvidae (Crows)	
Cyanocitta cristata	Blue Jay
Corvus brachyrhynchos	American Crow
Corvus ossifragus	Fish Crow
Corvus corax	Common Raven
Alaudidae (Larks)	
Eremophila alpestris	Horned Lark
Hirundinidae (Swallows and Martins)	
Progne subis	Purple Martin
Tachycineta bicolor	Tree Swallow
Stelgidopteryx serripennis	Northern Rough-winged Swallow
Riparia riparia	Bank Swallow
Petrochelidon pyrrhonota	Cliff Swallow
Hirundo rustica	Barn Swallow
Paridae (Chickadees and Titmice)	
Poecile carolinensis	Carolina Chickadee
Poecile atricapillus	Black-capped Chickadee
Baeolophus bicolor	Tufted Titmouse
Sittidae (Nuthatches)	
Sitta canadensis	Red-breasted Nuthatch
Sitta carolinensis	White-breasted Nuthatch
Certhiidae (Creepers)	
Certhia americana	Brown Creeper
Troglodytidae (Wrens)	
Thryothorus ludovicianus	Carolina Wren
Troglodytes aedon	House Wren
Troglodytes hiemalis	Eastern Winter Wren
Cistothorus palustris	Marsh Wren
Cistothorus platensis	Sedge Wren

Polioptilidae (Gnatcatchers)	
Polioptila caerulea	Blue-gray Gnatcatcher
Regulidae (Kinglets)	
Regulus satrapa	Golden-crowned Kinglet
Regulus calendula	Ruby-crowned Kinglet
Turdidae (Thrushes)	
Oenanthe oenanthe	Northern Wheatear
Sialia sialis	Eastern Bluebird
Catharus fuscescens	Veery
Catharus ustulatus	Swainson's Thrush
Catharus guttatus	Hermit Thrush
Hylocichla mustelina	Wood Thrush
Turdus migratorius	American Robin
Mimidae (Mimids)	
Dumetella carolinensis	Gray Catbird
Mimus polyglottos	Northern Mockingbird
Toxostoma rufum	Brown Thrasher
Sturnidae (Starlings)	
Sturnus vulgaris	European Starling
Motacillidae (Wagtails, Longclaws, and Pipits)	
Anthus rubescens	American Pipit
Bombycillidae (Waxwings)	
Bombycilla cedrorum	Cedar Waxwing
Calcariidae (Longspurs and Snow Buntings)	
Calcarius lapponicus	Lapland Longspur
Plectrophenax nivalis	Snow Bunting
Parulidae (New World Warblers)	
Seiurus aurocapilla	Ovenbird
Helmitheros vermivorum	Worm-eating Warbler
Parkesia motacilla	Louisiana Waterthrush
Parkesia noveboracensis	Northern Waterthrush
Vermivora chrysoptera	Golden-winged Warbler
Vermivora cyanoptera	Blue-winged Warbler
Vermivora cyanoptera x chrysoptera	Lawrence's Warbler (hybrid)
Vermivora cyanoptera x chrysoptera	Brewster's Warbler (hybrid)
Mniotilta varia	Black-and-white Warbler
Oreothlypis peregrina	Tennessee Warbler
Oreothlypis celata	Orange-crowned Warbler
Oreothlypis ruficapilla	Nashville Warbler
Oporornis agilis	Connecticut Warbler
Geothlypis philadelphia	Mourning Warbler
Geothlypis formosus	Kentucky Warbler
Geothlypis trichas	Common Yellowthroat
Setophaga citrina	Hooded Warbler
Setophaga ruticilla	American Redstart
Setophaga tigrina	Cape May Warbler

Setophaga cerulea	Cerulean Warbler
Setophaga americana	Northern Parula
Setophaga magnolia	Magnolia Warbler
Setophaga castanea	Bay-breasted Warbler
Setophaga fusca	Blackburnian Warbler
Setophaga petechia	Yellow Warbler
Setophaga pensylvanica	Chestnut-sided Warbler
Setophaga striata	Blackpoll Warbler
Setophaga caerulescens	Black-throated Blue Warbler
Setophaga palmarum	Palm Warbler
Setophaga pinus	Pine Warbler
Setophaga coronata	Yellow-rumped Warbler
Setophaga dominica	Yellow-throated Warbler
Setophaga discolor	Prairie Warbler
Setophaga virens	Black-throated Green Warbler
Cardellina canadensis	Canada Warbler
Cardellina pusilla	Wilson's Warbler
Icteria virens	Yellow-breasted Chat
Emberizidae (New World Sparrows)	
Pipilo erythrophthalmus	Eastern Towhee
Spizella passerina	Chipping Sparrow
Spizella pallida	Clay-colored Sparrow
Spizella pusilla	Field Sparrow
Spizelloides arborea	American Tree Sparrow
Pooecetes gramineus	Vesper Sparrow
Passerculus sandwichensis	Savannah Sparrow
Ammodramus savannarum	Grasshopper Sparrow
Ammospiza nelsoni	Nelson’s Sparrow
Passerella iliaca	Fox Sparrow
Melospiza melodia	Song Sparrow
Melospiza lincolnii	Lincoln's Sparrow
Melospiza georgiana	Swamp Sparrow
Zonotrichia albicollis	White-throated Sparrow
Zonotrichia leucophrys	White-crowned Sparrow
Junco hyemalis	Dark-eyed Junco
Cardinalidae (Cardinals)	
Piranga rubra	Summer Tanager
Piranga olivacea	Scarlet Tanager
Piranga ludoviciana	Western Tanager
Cardinalis cardinalis	Northern Cardinal
Pheucticus ludovicianus	Rose-breasted Grosbeak
Passerina caerulea	Blue Grosbeak
Passerina cyanea	Indigo Bunting
Spiza americana	Dickcissel
Icteridae (Blackbirds and Orioles)	
Dolichonyx oryzivorus	Bobolink

Agelaius phoeniceus	Red-winged Blackbird
Sturnella magna	Eastern Meadowlark
Euphagus carolinus	Rusty Blackbird
Quiscalus quiscula	Common Grackle
Molothrus ater	Brown-headed Cowbird
Icterus spurius	Orchard Oriole
Icterus galbula	Baltimore Oriole
Fringillidae (True Finches)	
Pinicola enucleator	Pine Grosbeak
Haemorphous purpureus	Purple Finch
Haemorphous mexicanus	House Finch
Loxia curvirostra	Red Crossbill
Loxia leucoptera	White-winged Crossbill
Acanthis flammea	Common Redpoll
Spinus pinus	Pine Siskin
Spinus tristis	American Goldfinch
Coccothraustes vespertinus	Evening Grosbeak
Passeridae (Old World Sparrows)	
Passer domesticus	House Sparrow

Mammalia (Mammals)

Marsupalia

Didelphidae	
Didelphis virginiana	Virginia Opossum

Eutheria

Leporidae	
Sylvilagus floridanus	Eastern Cottontail
Muridae	
Clethrionomys gapperi	Southern Red-backed Vole
Microtus pennsylvanicus	Meadow Vole
Microtus pinetorum	Woodland Vole
Mus musculus	House Mouse
Neotoma magister	Allegheny Woodrat
Ondatra zibethicus	Muskrat
Peromyscus leucopus	White-footed Mouse
Peromyscus maniculatus	Deer Mouse
Rattus norvegicus	Norway Rat
Dipodidae	
Napaeozapus insignis	Woodland Jumping Mouse
Zapus hudsonius	Meadow Jumping Mouse
Castoridae	
Castor canadensis	Beaver
Sciuridae	
Glaucomys volans	Southern Flying Squirrel
Marmota monax	Groundhog

Sciurus carolinensis	Eastern Grey Squirrel
Tamias striatus	Eastern Chipmunk
Tamiasciurus hudsonicus	Red Squirrel
Erethizontidae	
Erethizon dorsatum	Porcupine
Vespertilionidae	
Eptesicus fuscus	Big Brown Bat
Lasionycteris noctivagans	Silver-haired Bat
Lasiurus borealis	Eastern Red Bat
Lasiurus cinereus	Hoary Bat
Myotis leibii	Eastern Small-footed Bat
Myotis lucifugus	Little Brown Bat
Myotis septentrionalis	Northern Long-eared Bat
Nycticeis humeralis	Evening Bat
Perimyotis subflavus	Tri-colored Bat
Soricidae	
Blarina brevicauda	Northern Short-tailed Shrew
Sorex cinereus cinereus	Masked Shrew
Sorex cinereus fontinalis	Maryland Shrew
Sorex fumeus	Smoky Shrew
Talpidae	
Condylura cristata	Eastern Mole
Scalopus aquaticus	Star-nosed Mole
Felidae	
Felis catus	Domestic Cat
Felis rufus	Bobcat
Canidae	
Canis familiaris	Domestic Dog
Canis latrans	Coyote
Ursidae	
Ursus americanus	Black Bear
Mephitidae	
Mephitis mephitis	Striped Skunk
Mustelidae	
Lontra canadensis	River Otter
Martes pennanti	Fisher
Mustela frenata	Long-tailed Weasel
Neovison vison	Mink
Procyonidae	
Procyon lotor	Racoon
Urocyon cinereoargenteus	Grey Fox
Vulpes vulpes	Red Fox
Cervidae	
Odocoileus virginianus	White-tailed Deer
Equidae	
Equus caballus	Domestic Horse

Osteichthyes (Fish)

Cypriniformes

Cyprinidae (Carps and Minnows)

Campostoma anomalum	Central Stoneroller
Cyprinella spiloptera	Spotfin Shiner
Exoglossum maxillingua	Cutlips Minnow
Luxilus cornutus	Common Shiner
Margariscus margarita	Pearl Dace
Nocomis micropogon	River Chub
Notemigonus crysoleucas	Golden Shiner
Notropis hudsonius	Spottail Shiner
Notropis procne	Swallowtail Shiner
Notropis rubellus	Rosyface Shiner
Rhinichthys atratulus	Eastern Blacknose Dace
Rhinichthys cataractae	Longnose Dace
Pimephales notatus	Bluntnose Minnow
Semotilus atromaculatus	Creek Chub
Semotilus corporalis	Fallfish

Catostomidae (Suckers)

Catostomus commersonii	White Sucker
Hypentelium nigricans	Northern Hog Sucker

Siluriformes

Ictaluridae (North American Freshwater Catfishes)

Ameiurus natalis	Yellow Bullhead
Ameiurus nebulosus	Brown Bullhead
Noturus insignis	Margined Madtom

Salmoniformes

Salmonidae (Trouts)

Oncorhynchus mykiss	Rainbow Trout
Salmo trutta	Brown Trout
Salvelinus fontinalis	Brook Trout

Esociformes

Esocidae (Pikes, Pickerels, and Muskellunges)

Esox niger	Chain Pickerel

Scorpaeniformes

Cottidae (Sculpins)

Cottus bairdii	Mottled Sculpin

Perciformes

Centrarchidae (Sunfishes, Basses, and Crappies)

Ambloplites rupestris	Rock Bass, Redeye
Lepomis auritus	Redbreast Sunfish
Lepomis cyanellus	Green Sunfish
Lepomis gibbosus	Pumpkinseed
Lepomis macrochirus	Bluegill
Micropterus dolomieu	Smallmouth Bass
Micropterus salmoides	Largemouth Bass

Percidae (Darts, Walleyes, and Perches)

Etheostoma olmstedi	Tesselated Darter
Percina peltata	Shield Darter

Insecta (Insects)

Lepidoptera-Butterflies

Hesperiidae

Achalarus lyciades	Hoary Edge
Amblyscirtes vialis	Common Roadside Skipper
Ancyloxypha numitor	Least Skipper
Atrytone logan	Delaware Skipper
Epargyreus clarus	Silver-spotted Skipper
Erynnis icelus	Dreamy Duskywing
Erynnis brizo	Sleepy Duskywing
Erynnis juvenalis	Juvenal's Duskywing
Erynnis horatius	Horace's Duskywing
Erynnis baptisiae	Wild Indigo Duskywing
Euphyes bimacula	Two-spotted Skipper
Euphyes conspicuus	Black Dash
Euphyes vestris	Dun Skipper
Hesperia leonardus	Leonard's Skipper
Hesperia sassacus	Indian Skipper
Hylephila phyleus	Fiery Skipper
Nastra iherminier	Swarthy Skipper
Pholisora catullus	Common Sootywing
Poanes hobomok	Hobomok Skipper
Poanes zabulon	Zabulon Skipper
Polites origenes	Crossline Skipper
Polites peckius	Peck's Skipper
Polites themistocles	Tawny-edged Skipper
Pompeius verna	Little Glassywing
Pyrgus communis	Common Checkered-skipper
Thorybes bathyllus	Southern Cloudywing
Thorybes pylades	Northern Cloudywing
Thymelicus lineola	European Skipper
Wallengrenia egeremet	Northern Broken-dash

Papilionidae

Battus philenor	Pipevine Swallowtail
Eurytides marcellus	Zebra Swallowtail
Papilio polyxenes	Black Swallowtail
Papilio glaucus	Eastern Tiger Swallowtail
Papilio troilus	Spicebush Swallowtail

Pieridae

Pieris rapae	Cabbage White
Colias eurytheme	Orange Sulphur
Colias philodice	Clouded Sulphur
Phoebis sennae	Cloudless Sulphur
Pyrisitia lisa	Little Yellow

Lycaenidae

Callophrys augustinus	Brown Elfin
Callophrys gryneus	Juniper Hairstreak
Callophrys irus	Frosted Elfin
Callophrys niphon	Eastern Pine Elfin
Calycopis cecrops	Red-banded Hairstreak
Celastrina ladon	Spring Azure
Celastrina neglectamajor	Applachian Azure
Everes comyntas	Eastern Tailed Blue butterfly
Lycaena phlaeas	American Copper
Parrhasius m-album	White-M Hairstreak
Satyrium calanus	Banded Hairstreak
Satyrium caryaevorum	Hickory Hairstreak
Satyrium edwardsii	Edwards' Hairstreak
Satyrium liparops	Striped Hairstreak
Satyrium titus	Coral Hairstreak
Strymon melinus	Gray Hairstreak

Nymphalidae

Anartia jatrophae	White Peacock
Asterocampa celtis	Hackberry Emperor
Boloria bellona	Meadow Fritillary
Cercyonis pegala	Common Wood-nymph
Chlosyne nycteis	Silvery Checkerspot
Coenonympha tullia	Common Ringlet
Danaus gilippus	Queen
Danaus plexippus	Monarch
Enodia anthedon	Northern Pearly-eye
Euphydryas phaeton	Baltimore Checkerspot
Euptoieta claudia	Variegated Fritillary
Junonia coenia	Common buckeye
Libytheana carinenta	American Snout
Limenitis archippus	Viceroy

Limenitis arthemis arthemis	White Admiral
Limenitis arthemis astyanax	Red-spotted purple
Megisto cymela	Little Wood Satyr
Nymphalis antiopa	Mourning Cloak
Nymphalis vau-album	Compton Tortoiseshell
Phyciodes tharos	Pearl Crescent
Polygonia comma	Eastern Comma
Polygonia interrogationis	Question Mark
Polygonia progne	Gray Comma
Satyrodes appalachia	Appalachian Brown
Satyrodes eurydice	Eyed Brown
Speyeria aphrodite	Aphrodite Fritillary
Speyeria cybele	Great Spangled Fritillary
Speyeria idalia	Regal Fritillary
Vanessa atalanta	Red Admiral
Vanessa cardui	Painted Lady
Vanessa virginiensis	American Lady

Lepidoptera-Moths

Tineidae

Acrolophus sp.	A Clothes Moth

Psychidae

Thyridepteryx ephemeraeformis	Evergreen Bagworm Moth

Gracillariidae

Caloptilia blandella	Caloptilia moth
Caloptilia superbifrontella	Witch-hazel Caloptilia
Cameraria castaneaeella	Leafminer moth
Phyllonorycter celtifoliella	Leafminer Moth

Oecophoridae

Machimia tentoriferrella	Gold-striped Leaftier

Blastobasidae

Valentinia glandulella	Acorn Moth

Sesiidae

Carmenta bassiformis	Eupatorium Borer Moth

Tortricidae

Argyrotaenia quercifoliana	Oak Leafroller
Argyrotaenia velutinana	Red-banded Leafroller Moth
Conchylis oenotherana	Conchylis moth
Cydia latiferreana	Filbertworm Moth

Ecdytolopha punctidiscana	Dotted Ecdytolopha Moth
Olethreutes inornatana	Inornate Olethreutes
Pandemis limitata	Three-lined Leafroller Moth
Phaneta raracana	Reddish Phaneta
Platynota idaeusalis	Tufted Apple Bud Moth
Sparganothis reticulatana	Reticulated Fruitworm Moth
Tortricida sp.	A Tortricid Moth

Apatelodidae

Apatelodes torrefacta	Spotted Apatelodes
Olceclostera angelica	The Angel

Cosmopterigidae

Limnaecia phragmitella	Shy Cosmet

Dolichopodidae

Asyndetus syntormoides	A Diaphorid

Drepanidae

Drepana arcuata	Arched Hooktip
Habrosyne scripta	Lettered Habrosyne
Oreta rosea	Rose Hooktip
Pseudothyatira cymatophoroides	Tufted Thiatirid

Elachistidae

Psilocorsis quercicella	Oak Leaftier Moth

Epipyropidae

Fulgoraecia exigua	An Epipyropid

Erebidae

Apantesis nais	Nais Tiger Moth
Apantesis phalerata	Harnessed Moth
Bomolacha baltimoralis	Baltimore Bomolochia Moth
Caenurgina crassiuscula	Clover Looper Moth
Cisseps fulvicollis	Yellow-Collared Scape Moth
Clemensia albata	Little White Lichen Moth
Ctenucha virginica	Virginia Ctenucha
Cycnia inopinatus	Unexpected Cycnia
Cycnia oregonensis	Oregon Cycnia
Cycnia tenera	Delicate Cycnia
Dasychira plagiata	Northern Pine Tussock moth
Dasychira vagans	Variable Tussock
Drasteria grandirena	Figure-seven Moth
Ecpantheria scribonia	Giant Leopard Moth
Eilema bicolor	Bicolor Moth

Estigmene acrea	Salt Marsh Moth
Euchaetes egle	Milkweed Tussock
Grammia arge	Arge Moth
Grammia parthenice intermedia	Parthenice Tiger Moth
Grammia sp. 1	A Tiger Moth
Grammia sp. 2	A Tiger Moth
Grammia virgo	Virgin Tiger Moth
Halysidota tessellaris	Banded Tussock Moth
Hyphantria cunea	Fall Webworm Moth
Hypoprepia fucosa	Painted Lichen Moth
Lophocampa caryaevorum	Hickory Tussock Moth
Lycomorpha pholus	Black-and-Yellow Lichen Moth
Lymantria dispar	Gypsy Moth
Mocis texana	Texas Mocis
Orgyia leucostigma	White-marked Tussock Moth
Pangrapta decoralis	Decorated Owlet
Panopoda rufimargo	Red-lined Panopoda
Phalaenostola metonalis	Pale Epidelta Moth
Phragmatobia fuliginosa	Ruby Tiger Moth
Pyrrharctia isabella	Isabella Tiger Moth
Scolecocampa liburna	Dead-wood Borer Moth
Spilosoma congrua	Agreeable Tiger Moth
Spilosoma latipennis	Pink-legged Tiger Moth
Spilosoma virginica	Virginian Tiger Moth
Virbia aurantiaca	Orange Holomelina
Virbia ferruginosa	Rusty Holomelina
Virbia immaculata	Immaculate Holomelina

Euteliidae

Marathyssa inficita	Dark Marathyssa Moth

Gelechiidae

Arogalea cristifasciella	White Stripe-backed Moth

Geometridae

Anavitrinella pampinaria	Common Gray
Antepione thisoaria	Variable Antepione
Besma quercivoraria	Oak Besma
Biston betularia cognataria	Pepper-and-Salt Geometer
Cabera erythemaria	Yellow-Dusted Cream Moth
Campaea perlata	Pale Beauty
Caripeta divisata	Gray Spruce Looper Moth
Caripeta piniata	Northern Pine Looper Moth
Cepphis decoloraria	Dark Scallop Moth
Chlorochlamys chloroleucaria	Blackberry Looper Moth
Cyclophora pendulinaria	Sweetfern Geometer

Diagrammis ocellinata	Faint-spotted Angle
Ectropis crepuscularia	The Small Engrailed
Ennomos subsignaria	Elm Spanworm Moth
Epimecis hortaria	Tulip-tree Beauty
Eubaphe mendica	The Beggar
Euchlaena irraria	Least-Marked Euchlaena
Euchlaena serrata	The Saw-Wing
Eulithis diversilineata	Lesser Grapevine Looper Moth
Eulithis gracilineata	Greater Grapevine Looper Moth
Eumacaria madopata	Brown-bordered Geometer
Eupithecia miserulata	Common Pug
Eutrapela clemataria	Curve-Toothed Geometer
Heliomata cycladata	Common Spring Moth
Heliomata infulata	Rare Spring Moth
Hethemia pistasciaria	Pistachio Emerald
Horisme intestinata	Brown Bark Carpet
Hydria prunivorata	Ferguson's Scallop Shell
Hydria sp.	A Geometrid
Hypagyrtis unipunctata	One-spotted Variant
Idaea demissaria	Red-bordered Wave
Iridopsis larvaria	Bent-line Gray
Itame coortaria	Four Spotted Itame moth
Itame pustularia	Lesser Maple Spanworm moth
Lambdina pellucidaria	Yellow-Headed Looper
Lomographa semiclarata	Bluish Spring Moth
Lomographa vestaliata	White Spring Moth
Lytrosis unitaria	Common Lytrosis
Macaria aemulataria	Common Angle
Macaria bicolorata	Bicolored Angle
Macaria coortaria	Four-spotted Itame
Macaria granitata	Granite Moth
Macaria pinistrobata	White Pine Angle
Macaria promiscuata	Promiscuous Angle
Macaria pustularia	Lesser Maple Spanworm
Melanolophia canadaria	Canadian melanolophia moth
Melanolophia signataria	Signate Melanolophia
Mesoleuca ruficillata	White-ribboned Carpet
Metarranthis homuraria	Purplish Metarranthis
Metarranthis hypochraria	Common Metarranthis
Metarranthis obfirmaria	Yellow-Washed Metarranthis
Nemoria bistriaria	Red-fringed Emerald Moth
Orthonama obstipata	The Gem
Pero honestaria	Honest Pero
Pero hubneraria	Hubner's Pero
Pero morrisonaria	Morrison's Pero
Plagodis alcoolaria	Hollow-spotted Plagodis

Plagodis phlogosaria	Straight-lined Plagodis
Plagodis serinaria	Lemon Plagodis
Prochoerodes transversata	Large Maple Spanworm Moth
Protoboarmia porcelaria	Porcelain Gray
Rheumaptera hastata	Spear-Marked Black
Scopula inductata	Soft-Lined Wave
Scopula limboundata	Large Lace-Boarder
Semiothisa aemulataria	Common Angle Moth
Semiothisa granitata	Granite Moth
Semiothisa ocellinata	Faint Spotted Angle Moth
Semiothisa promiscuata	Promicuous Angle Moth
Speranza pustularia	Lesser Maple Spanworm Moth
Synchlora aerata	Wavy-lined Emerald
Tetracis cachexiata	White Slant-lined Moth
Trichodezia albovittata	White-striped Black
Xanthorhoe lacustrata	Toothed Brown Carpet
Xanthotype urticaria	False Crocus Geometer

Lasiocampidae

Malacosoma americanum	Eastern Tent Caterpillar Moth
Malacosoma disstria	Forest Tent Caterpillar Moth
Tolype laricis	Larch Tolype
Tolype notialis	Small Tolype

Limacodidae

Apoda biguttata	Shagreened Slug Moth
Euclea delphinii	Spiny Oak Slug Moth
Lithacodes fasciola	Yellow Shouldered Slug Moth
Parasa chloris	Smaller Parasa
Phobetron pithecium	Hag Moth
Prolimacodes badia	Skiff Moth

Megalopygidae

Megalopyge (Lagoa) crispata	Black Waved Flannel moth

Noctuidae

Abagrotis alternata	Greater Red Dart
Acronicta afflicta	Afflicted Dagger Moth
Acronicta fragilis	Fragile Dagger Moth
Acronicta impleta	Yellow-Haired Dagger Moth
Acronicta increta	Raspberry Bud Dagger Moth
Acronicta innotata	Unmarked Dagger Moth
Acronicta interrupta	Interrupted Dagger Moth
Acronicta longa	Long-winged Dagger Moth
Acronicta ovata	Ovate Dagger Moth
Agnorisma badinodis	Pale-Banded Dart

Agriopodes fallax	Green Marvel
Agrotis ipsilon	Ipsilon Dart
Allotria elonympha	False Underwing
Alypia octomaculata	Eight-spotted forester moth
Amphipoea americana	American Ear Moth
Amphipyra pyramidoides	Copper Underwing
Anagrapha falcifera	Celery Looper Moth
Argyrogramma basigera	Pink-washed Looper Moth
Azenia obtuse	Obtuse Yellow
Baileya australis	Small Baileya
Caenurgina crassiuscula	Clover Looper Moth
Caenurgina erechtea	Forage Looper Moth
Callopistria cordata	Silver-spotted Fern Moth
Callopistria mollissima	Pink-shaded Fern Moth
Catocala amica	Girlfriend Underwing
Catocala antinympha	Sweetfern Underwing
Catocala blandula	Charming Underwing
Catocala coccinata	Scarlet Underwing
Catocala ilia	Ilia Underwing
Catocala lineella	Little Lined Underwing
Catocala palaeogama	Oldwife Underwing
Catocala relicta	White Underwing
Catocala retecta	Yellow-gray Underwing
Catocala ultronia	Ultronia Underwing
Cerma cerintha	Tufted Bird-dropping Moth
Chaetaglaea sericea	Silky Sallow
Charadra deridens	The Laugher
Chrysanympha formosa	Formosa Looper Moth
Chytonix palliatricula	Cloaked Marvel
Colocasia flavicornis	Yellowhorn
Colocasia propinquilinea	Closebanded Yellowhorn Moth
Cosmia calami	American Dun-bar Moth
Cucullia convexipennis	Brown-Hooded Owlet
Dargida diffusa	Wheat Head Armyworm Moth
Diarsia jucunda	Smaller Pinkish Dart
Dyspyralis puncticosta	A Noctuid
Elaphria grata	Grateful Midget
Elaphria versicolor	Variegated Midget
Epiglaea decliva	Sloping Sallow
Eudryas grata	Beautiful Wood-Nymph
Eudryas unio	Pearly Wood-Nymph
Euparthenos nubilis	Locust Underwing
Euplexia benesimilis	American Angle Shades
Euxoa messoria	Reaper Dart
Euxoa velleripennis	Fleece-winged Dart
Faronta (Dargida) rubripennis	The Pink Streak

Feltia herilis	Master's Dart
Feltia jaculifera	Dingy Cutworm Moth
Helicoverpa zea	Corn Earworm Moth
Homorthodes lindseyi	A Noctuid Moth
Hypena baltimoralis	Baltimore Bomolocha
Hypena manalis	Flowing-line Bomolocha Moth
Hyperstrotia flaviguttata	Yellow-spotted Graylet
Idia aemula	Common Idia Moth
Idia forbesi	Idia moth
Idia rotundalis	Rotund Idia Moth
Lacinipolia anguina	Snaky Arches
Lacinipolia renigera	Bristly Cutworm Moth
Lacinipolia vicina	Neighborly Arches
Leucania multilinea	Many-lined Wainscot
Leucania ursula	Ursula Wainscot
Leuconycta diphteroides	Green Leuconycta
Lithacodia carneola	An Owlet Moth
Lithacodia synochitis	An Owlet Moth
Macrochilo absorptalis	Slant-lined Owlet
Marimatha nigrofimbria	Black-bordered Lemon Moth
Metaxaglaea semitaria	Footpath Sallow Moth
Mythimna unipuncta	Armyworm Moth
Nephelodes minians	Bronzed Cutworm Moth
Noctua pronuba	Large Yellow Underwing
Ogdoconta cinereola	Common Pinkband
Oligia fractilinea	Broken-lined Brocade
Orthodes cynica	Cynical Quaker
Palthis angulalis	Dark-spotted Palthis
Palthis asopialis	Faint-spotted Palthis
Panopoda rufimargo	Red-Lined Panopoda
Panthea furcilla	Eastern Panthea
Papaipema baptisiae	Wild Indigo Borer Moth
Parallelia bistriaris	Maple Looper Moth
Peridroma saucia	Variegated Cutworm Moth
Perigea xanthioides	Red Groundling
Phlogophora iris	Olive Angle Shades
Phosphila miselioides	Spotted Phosphila
Phytometra rhodarialis	Pink-Boardered Yellow
Plathypena scabra	Green Cloverworm Moth
Polygrammate hebraeicum	The Hebrew
Ponometia erastrioides	Small Bird-dropping Moth
Protodeltote muscosula	Large Mossy Lithacodia
Protolampra brunneicollis	Brown-Collared Dart
Protorthodes oviduca	Ruddy Quaker
Pseudaletia unipuncta	Armyworm Moth
Pseudeustrotia carneola	Pink-Boardered Pseudeustrotia

Psychomorpha epimenis	Grapevine Epimenis
Raphia frater	The Brother
Renia discoloralis	Discolored Renia
Renia factiosalis	A Renia Moth
Renia flavipunctalis	A Renia Moth
Schinia arcigera	Arcigera Flower Moth
Schinia nundina	Goldenrod Flower Moth
Schinia rivulosa	Ragweed Flower Moth
Spargaloma sexpunctata	Six Spotted Gray Moth
Spragueia leo	Common Spragueia
Sunira bicolorago	Bicolored Sallow
Synedoida grandirena	Figure-seven
Tarachidia erastriodies	Small Bird-dropping Moth
Tetanolita nigrofimbria	Florida Tetanolita
Thioptera nigrofimbria	Black-bordered Lemon Moth
Tricholita signata	Signate Quaker
Trichoplusia ni	Cabbage Looper Moth
Xestia bicarnea	Pink-Spotted Dart
Xestia dilucida	A Dart Moth
Xestia dolosa	Greater Black-letter Dart
Xestia normaniana	Norman's Dart
Xestia smithii	Smith's Dart
Xestia youngii	A Dart Moth
Zale horrida	Horrid Zale
Zale lunifera	Pine Barrens Zale
Zale undularis	Black Zale
Zanclognatha jacchusalis	Yellowish Zanclognatha
Zanclognatha laevigata	Variable Zanclognatha
Zanclognatha lituralis	Lettered Zanclognatha
Zanclognatha pedipilalis	Grayish Zanclognatha
Zanclognatha sp.	A Noctuid Moth

Nolidae

Meganola miniscula	Confused Meganola
Meganola phylla	A Meganola Moth

Notodontidae

Clostera albosigma	Sigmoid Prominent
Dasylophia anguina	Black-spotted Prominent
Datana angusii	Anguss Datana moth
Datana drexelii	Drexel's Datana
Datana integerrima	Walnut Caterpillar Moth
Datana ministra	Yellow-necked Caterpillar Moth
Datana perspicua	Spotted Datana
Datana ranaeceps	Post-burn Datana Moth
Datana sp.	Datana Moth

Gluphisia septentrionis	Common Gluphisia
Heterocampa biundata	Wavy-lined Heterocampa
Heterocampa guttivita	Saddled or Maple Prominent
Heterocampa umbrata	White-blotched Heterocampa
Lochmaeus manteo	Variable Oakleaf Caterpillar Moth
Macrurocampa marthesia	Mottled Prominent
Nadata gibbosa	White-dotted Prominent
Nadata sp.	A Prominent Moth
Nerice bidentata	Double-toothed Prominent
Odontosia elegans	Elegant Prominent
Oligocentria lignicolor	White-streaked Prominent
Peridea angulosa	Angulose Prominent
Pheosia rimosa	Black-rimmed Prominent
Schizura badia	Chestnut Schizura
Schizura unicornis	Unicorn Caterpillar Moth
Symmerista sp.	A Prominent Moth

Oecophoridae

Epicallima argenticinctella	Orange-headed Epicallima

Pterophoridae

Platyptilia carduidactyla	Artichoke Plume Moth

Pyralidae

Anageshna primordialis	A Pyralid Moth
Anania funebris glomeralis	A Pyralid Moth
Blepharomastix ranalis	A Pyralid Moth
Chrysoteuchia topiaria	Topiary Grass-veneer
Crambus agitatellus	Double-banded Grass-veneer
Crambus albellus	Small White Grass-veneer
Crambus laqueatellus	A Pyralid Moth
Desmia funeralis	Grape Leaffolder Moth
Dioryctria zimmermani	Zimmerman Pine Moth
Elophila icciusalis	Pondside Crambid
Elophila obliteralis	Waterlily Leafcutter Moth
Eudonia strigalis	Striped Eudonia
Herculia infimbrialis	A Pyralid Moth
Herpetogramma theseusalis	Herpetogramma Moth
Herpetogramma thestealis	A Pyralid Moth
Hypsopygia olinalis	Yellow-fringed Dolichomia
Lygropia rivulalis	A Pyralid Moth
Microcrambus elegans	Elegant Grass-veneer
Nomophila nearctica	Lucerne Moth
Oneida lunulalis	Orange-tufted Oneida Moth
Ostrinia nubilalis	European Corn Borer
Palpita magniferalis	Splendid Palpita

Pantographa limata	Basswood Leafroller Moth
Perispasta caeculalis	Titian Peale's Crambid
Pococera asperatella	Maple Webworm Moth
Pococera expandens	Double-humped Pococera Moth
Pyrausta acrionalis	Mint-loving Pyrausta
Pyrausta bicoloralis	Bicolored Pyrausta Moth
Pyrausta niveicilialis	A Pyralid Moth
Sciota vetustella	Belted Leafroller
Sitochroa palealis	Carrot Seed Moth
Udea rubigalis	Celery Leaftier Moth
Urola nivalis	Snowy Urola Moth
Vaxi auratella	Curve-lined Vax
Herpetogramma thestialis	A Pyralid Moth

Saturniidae

Actias luna	Luna Moth
Anatheraea polyphemus	Polyphemus Moth
Anisota senatoria	Orange-Tipped Oak Moth
Anisota sp.	A Royal Moth
Anisota stigma	Spiny Oakworm Moth
Anisota virginiensis	Pink-striped Oakworm Moth
Automeris io	Io Moth
Callosamia promethea	Spicebush Silkmoth
Dryocampa rubicunda	Rosy maple Moth
Eacles imperialis	Imperial Moth
Hemileuca maia	Buckmoth
Hyalophora cecropia	Cecropia Moth

Sphingidae

Amphion floridensis	Nessus Sphinx
Ceratomia undulosa	Waved Sphinx
Darapsa choerilus (pholus)	Azalea Sphinx
Darapsa myron	Virginia Creeper Sphinx
Dolba hyloeus	Pawpaw Sphinx
Eumorpha achemon	Achemon Sphinx
Eumorpha pandorus	Pandorus Sphinx
Hemaris diffinis	Snowberry Clearwing
Hemaris thysbe	Hummingbird Clearwing
Lapara bombycoides	Northern Pine Sphinx
Paonias excaecatus	Blinded Sphinx
Paonias myops	Small-eyed Sphinx
Pachysphinx modesta	Big Poplar Sphinx
Sphecodina abbottii	Abbot's Sphinx
Sphinx drupiferarum	Wild Cherry Sphinx

Thyrididae

Thyris maculata	Spotted Thyris
Thyris sepulchralis	Mournful Thyris

Uraniidae

Calledapteryx dryopterata	Brown Scoopwing

Yponomeutidae

Atteva aurea	Ailanthus Webworm Moth

Zygaenidae

Pyromorpha dimidiata	Orange-patched Smoky

Odonata- Dragonflies and Damselflies

Caloptyrigidae

Calopteryx maculata	Ebony Jewelwing

Lestidae

Lestes eurinus	Amber-winged Spreadwing
Lestes vigilax	Swamp Spreadwing

Coenagrionidae

Argia moesta	Powdered Dancer
Argia fumipennis	Varible Dancer
Chromagrion conditum	Aurora Damsel
Enallagma traviatum	Slender Bluet
Enallagma doubledayi	Atlantic Bluet
Enallagama hegani	Hagen's Bluet
Ischnura hastate	Citrine Forktail
Ischnura posita	Fragile Forktail
Ischnura verticalis	Eastern Forktail

Aeshnidae

Aeshna canadensis	Canada Darner
Aeshna umbrosa	Shadow Darner
Aeshna verticallis	Green-striped Darner
Anax junius	Green Darner
Anax longipes	Comet Darner
Boyeria grafiana	Ocellated Darner
Gomphaeschna furcillata	Harlequin Darner

Gomphidae

Arigomphus villosipes	Unicorn Clubtail
Dromogomphus spinosus	Black-shouldered Spinylegs
Gomphus exilis	Lancet Clubtail
Gomphus rogersi	Sable Clubtail
Lanthus parvulus	Northern Pygmy Clubtail

Lanthus vernalis	Southern Pygmy Clubtail
Stylogomphus albistylus	Least Clubtail
Macromiidae	
Didymops transversa	Stream Cuiser
Corduliidae	
Cordulia shurtleffii	American Emerald
Epitheca princeps	Prince Baskettail
Epitheca cynosura	Common Baskettail
Somatochlora tenebrosa	Clamp-tipped Emerald
Libellulidae	
Celithemis elisa	Calico Pennant
Celithemis eponina	Halloween Pennant
Celithemis verna	Double-ringed Pennant
Erythemis simplicicollis	Eastern Pondhawk
Leucorrhinia frigid	Frosted Whiteface
Leucorrhinia intact	Dot-tailed Whiteface
Libellula auripennis	Gold-winged Skimmer
Libellula cyanea	Spangled Skimmer
Libellula incest	Slaty Skimmer
Libellula luctuosa	Widow Skimmer
Libellula pulchella	Twelve-spotted Skimmer
Libellula vibrans	Great Blue Skimmer
Pachydiplax longipennis	Blue Dasher
Pantala flavescens	Wandering Glider
Pantala hymenaea	Spot-winged Glider
Perithemis tenera	Eastern Amberwing
Plathemis lydia	Common Whitetail
Sympetrum rubicundulum	Ruby Meadowhawk
Sympetrum semicinctum	Band-wing Meadowhawk
Sympetrum vicinum	Autumn Meadowhawk
Tramea carolina	Carolina Saddlebags
Tramea lacerate	Black Saddlebags

Appendix D. Research Requirements

Research requirements are projects that would be nice to do by an installation but there is no legal obligation to support them. The concept behind this appendix is that it will allow the installation and other entities (e.g. SERDP and ESTCP) to quickly assess if there are any projects available for funding if it becomes available.

D.1. Fauna

D.1.a. NLEB

Basic population status post-WNS has yet to be determined at FIG. Whereas the species was widespread and numerous in breeding attempts as late as 2004 (Chenger 2004), only the rare individual will end up in a net capture or on an audio recording. The population has dropped to the point where detection rate is extremely low. Further capture and study are necessary to determine species occupation on the installation and habitat preferences now that numbers are so much lower than maximum availability.

Further study is also necessary to determine the availability of hibernacula within the installation boundary. While no known open mines or other cavities occur on the installation, there is a past history of open shaft mining and open fissures in the bedrock on the installation. Animals like the Allegheny woodrat and most of the installation's snakes find winter dens below the frost line, and, due to the NLEB's behavior of crawling into the tops of narrow fissures in caves, perhaps there is more opportunity for winter roosting than is currently believed.

D.1.b. Regal Fritillary

With the exception of adults, there are still wide gaps of knowledge in the regal's life history. One key aspect is the larval diapauses between the first and second instar. While research has shown that the caterpillars will eat their chorizon and then go inert, there is no data available on materials they choose for cover, the depth of that material, whether they go subsurface or remain near the top of the ground litter, and so forth. This knowledge has direct impact on management decisions and would appreciably help survivorship in lab rearing.

Another important avenue of research is that of disease. Wolbachia and nucleo-polyhedral virus (NPV) are widely studied in monarchs, but very little work has been published on these mechanisms and their effects on *Speyeria*. Lab rearing has illuminated the variance in productivity among females and may indicate the presence of a pathogen that affects fertility. Field studies and lab rearing attempts have shown the devastating presence of an unknown disease that affects late instar caterpillars. Mold and fungus seem also to be a prevalent mortality factor in the laboratory.

The existence of two subspecies has been theorized and weakly supported. FIG research has shown some behavior and population modifications that FIG (and possibly all historical Eastern populations) displays compared to the literature on Western populations. Further comparison is necessary to determine whether FIG findings should be applied back to the national metapopulation and to settle some disputes amongst PADMVA and TNC findings with their Western counterparts.

D.1.c. Allegheny Woodrat

Being so often subterranean, woodrats still have substantial holes in their life history information and their known activities at FIG. Camera studies, such as tunnel crawlers and nest cameras would be beneficial to show the level of use, preferred habitat/food sources, and breeding success on the installation. Telemetry would substantiate activity centers and interaction levels among them. Further research on occupied versus acceptable but unoccupied habitat on the installation could yield new knowledge on desired conditions and management techniques. Also, means of monitoring when those management techniques become successful are in demand as active locations get covered in fruit-bearing shrubs. Remote techniques including audio would be very useful for rocky portions of the impact area, where researchers cannot access in person. Much still needs to be known about the woodrat's range extent on the installation. A possible sighting on Blue Mountain in 2004 (McNaughton and Kern field notes) has never been explained, and habitat found in D2 and D4 with possible old sign has never been fully surveyed due to priorities during the prime research season.

D.1.d. Eastern Small-Footed Bat

The Eastern small-footed bat is the most recent listed species to be found on the installation (Chenger 2014). The bat frequents piles of large rock exposed to direct sunlight for its maternity roosts, and plenty of habitat was opened during range construction from 2005-2007. These bats seemed to have moved in after that time period. More research is necessary to determine distinct temperature and microclimate preferences in order to better assess the distribution and population size of these bats on the installation.

D.1.e. Telemetry, Geolocational Data, and Home Range/Habitat Use

A variety of telemetry projects for various species of concern would be helpful to predict management effects, describe population health and adaptability, and define priority locations. Species of interest include various turtles (box, spotted, and wood especially), Allegheny woodrats, timber rattlesnakes, smooth greensnakes, golden winged-warblers, black bear, fishers, various raptors, and Eastern coyotes. Seasonality varies from species to species, some requiring breeding range, others requiring dispersal, and still others requiring wintering data. A generalized set of equipment and protocol to do these studies would be very beneficial. Radio methods have been difficult or produced poor results in the past due to the topography on the installation and the amount of signals, both high and low frequency, in use around the installation by the military, regional users (like cell towers and state agency radios), and the public. A GPS method with automated collection would be ideal.

D.2. Flora

D.2.a. Violets

Scientific study into propagation methods continues informally at FIG. Collected seed has a very low germination rate, but there is circumstantial evidence that much higher seedling success can be obtained. More research is needed into the means of boosting this success including methods to remove the eliasome, the optimal stratification time and conditions, and UV light requirements.

Besides germination, trichomes on the leaves are barriers for caterpillar feeding. More research into the cause of variation and possible environmental factors that contribute to trichome development are very much a critical part of the regal fritillary rearing program. Initial research indicates that available nitrogen in the soil may play some part (Cromp 2007).

Seed dispersal in violets has long been linked to explosively dehiscing seedpods or ants. At FIG, the key species do not disperse all that far from seedpods alone, and subpopulations organically creep out across open landscapes (Hovis et al. 2006). This suggests that ants may be a major factor, but the species of the seed carriers are unknown. Positively identifying ants willing and able to carry V. sagittata seed in particular would benefit site selection and pre-release factors for the regal fritillary reintroduction program.

D.2.b. Vasey's Eupatorium

Scientific literature suggests that Vasey's thoroughwort (*Eupatorium godfreyanum*) and round-leaved thoroughwort (*E. rotundifolium*) may not be genetically pure species. Variation and intergrades have been found between sites at FIG, and the species seem to fare extraordinarily well despite their statewide distribution and status. Intense genetic analysis may indicate that the species are actually hybrids of the common upland boneset (*E. sessilifolium*).

D.2.c. Yellow-Fringed Orchis

Yellow-fringed orchis populations appear in very different and very distinct habitats on the installation: mesic oak forest, upland warm-season grassland slopes, and emergent herbaceous wetlands. More research in reproductive success is necessary to determine which habitat is best for the species and habitat objectives to further the populations. For now, it seems that the woodland population produces the most flowers in productive years, while the grassland slope population has seen the least browse. While the full-sun emergent wetland population has produced the most blooms in a single season, it has not had a repeat of that season in the near decade since that mast. Deer browse, fire regime, and vegetative competition may all be serious factors in the success or decline of the species, but the research has remained low and obscure. Access to the wild populations is very difficult during the height of the blooming season due to the military training schedule, so off-post or laboratory research would be a requirement.

D.2.d. Vegetation Community Classification

The state's vegetation communities fail to capture much diversity or distinction amongst herbaceous, barrens, and scrub communities. When trying to describe the ideal habitat for many rare species and for the state's best functioning warm-season grasslands, the possible community guidelines introduced in Fike (1999) leave much to be desired. A better understanding of these communities and how they differ from location to location can be found in Latham and Thorne (2007), but a full description of these subcategories needs to go through scientific peer review and register with the National Vegetation Classification Standard (McKerrow 2014).

Appendix E. Migratory Bird Conservation

FIG is part of Pennsylvania Audubon's Second Mountain Important Bird Area (IBA) and the Kittatinny Ridge global IBA. The installation is home to a diverse wealth of breeding and migratory birds including many state and regional rarities, state responsibility species, and a migration counting point (Second Mountain Hawkwatch). A Memorandum of Understanding between DoD and USFWS was updated in 2014 and includes pertinent information for military installations to include FIG.

E.1. 2014 MIGRATORY BIRDS MOU (BETWEEN DOD AND USFWS)

The MOU resulted from the legal requirements set forth in EO 13186 (17 January 2001). The agreement has been refreshed three times since its original signing (2006, 2011, 2014).

This MOU specifically pertains to the following categories of DoD activities:

I) Natural resource management activities, including, but not limited to, habitat management, erosion control, forestry activities, hunting, fishing, agricultural out-leasing, conservation law enforcement, invasive-weed management, and prescribed burning.

2) Installation support activities, including, but not limited to, administration, retail sales, food service, health care, water and sewage treatment, supply and storage, education, housing, equipment maintenance, base transportation, laundry and dry cleaning, recreation, and religious activities.

3) Operation of industrial activities.

4) Construction, maintenance, renovation, or demolition of facilities that support the activities described in items 1 through 3.

5) Prevention or abatement of pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable.

The following FWS programs have responsibilities with regards to bird conservation activities:

1) The Division of Migratory Bird Management and the Migratory Bird Programs in FWS Regional Offices serve as focal points for policy development and strategic planning. These offices develop and implement monitoring and management initiatives that help maintain healthy populations of migratory birds and their habitats and provide continued opportunities for citizens to enjoy bird-related recreation.

2) The Division of Bird Habitat Conservation is instrumental in supporting habitat conservation partnerships through the administration of bird conservation grant programs and development of joint ventures that serve as major vehicles for implementing the various bird conservation plans across the country.

3) Ecological Services Field Offices across the country serve as the primary contacts for technical assistance and environmental reviews involving migratory bird issues. The Field Offices coordinate with the Regional Migratory Bird Offices, as necessary, regarding permits and overall migratory bird conservation coordination.

4) The Office of Law Enforcement is the principal FWS program that enforces the legal provisions of the MBTA, BGEPA, ESA, and other laws pertaining to migratory birds.

5) The National Wildlife Refuge (NWR) System manages NWR and Waterfowl Production Areas across the country, many of which were established to protect and conserve migratory birds. NWR not only protects important bird habitat, but also focuses on monitoring migratory bird populations, restoring and maintaining native habitats, and educating the public on recreational and economic benefits of migratory birds.

6) The Science Applications program works with other FWS programs and partners to ensure that the necessary science, tools, and capacity are available for planning and implementing the most efficient and effective conservation actions to protect fish and wildlife, including migratory birds. The office facilitates regional self-directed science management partnerships called Landscape Conservation Cooperatives to develop and apply shared science capacity to conservation.

Responsibilities of Both Parties

The Parties agree that this MOU shall be implemented to the extent permitted by law and in harmony with evolving requirements of agency missions, subject to the availability of appropriations and budgetary limits. Both Parties shall:

1) Support the conservation intent of Executive Order 13186, and the migratory bird conventions by:

    a) Integrating bird conservation principles, measures, and practices into agency planning and actions; and

    b) Avoiding or minimizing, to the extent practicable, the exposure of birds and their resources to avian stressors that result in take.

2) Emphasize an interdisciplinary, collaborative approach to migratory bird conservation in cooperation with other governments, state and federal agencies, and

non-federal partners within the geographic framework of the North American Bird Conservation Initiative (NABCI) Bird Conservation Regions (BCR.)

3) Work to protect, restore, and enhance migratory bird habitats, as practicable, on DoD-managed lands, in ways that do not conflict with or impede military training and testing, by:

   a) Designing and executing actions to minimize, to the extent practicable and consistent with the military mission, avian stressors on migratory bird populations, including impacts to breeding, migration, or wintering habitats; and by developing and implementing, as appropriate, conservation measures that could reduce the take of migratory birds or enhance the quality of the habitats they use.

   b) Working to identify, conserve, and manage significant bird conservation sites that occur on DoD-managed lands.

   c) Preventing or abating pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable; and

   d) Preventing the introduction and establishment of, and controlling and reducing the spread of existing, non-native invasive species that may be harmful to native flora and fauna, including migratory bird populations, as required by Executive Order 13112 on Invasive Species.

4) Work with willing landowners to prevent or minimize the loss or degradation of migratory bird habitats on lands adjacent or near military installation boundaries. This cooperative conservation may include:

   a) Participating in efforts to identify, protect, and conserve important migratory bird habitats or other significant bird conservation sites and ecological conditions that occur in landscapes or watersheds that may be of conservation value to migratory birds found on DoD lands, and that also buffer one or more installations from adverse impacts to DoD mission or resource-management activities;

   b) Providing information on migratory bird resources found on DoD lands for partners to include and integrate into their outreach and education materials and activities; and

   c) Using available authorities to enter into agreements with federal, state, tribal, or other governmental entities, or nongovernmental organizations to conserve and enhance habitats in a manner compatible with military operations.

5) Promote collaborative projects such as:

   a) Developing or using existing inventory and monitoring programs, at appropriate scales, with national or regional standardized protocols, to assess the status and trends of bird populations and habitats, including migrating, breeding, and wintering birds.

   b) Designing management studies and research/monitoring projects using national or regional standardized protocols and programs to identify the habitat conditions needed by applicable species of concern, to understand interrelationships of co-existing species, and to evaluate the effects of management activities on habitats and populations of migratory birds;

   c) Sharing inventory, monitoring, research, and study data for breeding, migrating, and wintering bird populations and habitats in a timely fashion with national data repositories such as the Avian Knowledge Network, National Point Count Database, and Monitoring Avian Productivity and Survivorship (MAPS).

   d) Working in conjunction with each other and federal and state agencies to develop reasonable and effective conservation measures for actions that reduce the exposure of birds and their habitats to avian stressors.

   e) Participating in or promoting the implementation of existing regional or national inventory and monitoring programs such as Breeding Bird Survey (BBS), Christmas Bird Counts, bird atlas projects, or game-bird surveys (e.g., mid-winter waterfowl surveys) on DoD lands where practicable and feasible.

   f) Using existing partnerships and exploring opportunities for expanding and creating new partnerships to facilitate combined funding for inventory, monitoring, management studies, and research; and

   g) Improving habitat on lands adjacent to DoD-managed lands through programs such as the DoD Readiness and Environmental Protection Integration and Land and Water Conservation Fund programs.

6) Work cooperatively to identify and utilize existing conservation measures to avoid or minimize the effects of avian stressors and develop new conservation measures as needed.

7) Per Executive Order 13186 (Sec. 3(12)), provide training opportunities to appropriate personnel on responsibilities under the MBTA, GBEPA, and other regulations protecting birds, current processes for coordination on bird conservation issues, strategies for properly assessing how actions effect bird populations, and

recommended approaches on how to avoid or minimize the exposure of birds and their habitats to avian stressors.

8) Participate annually in the interagency Council for the Conservation of Migratory Birds.
The duties of the Council include the following:

   a) Sharing resource information to help conserve and manage migratory birds.

   b) Fostering partnerships to further the goals of Executive Order 13186.

   c) Reporting annually on Executive Order accomplishments and recommendations; and

   d) Selecting an annual recipient of a Presidential Migratory Bird Federal Stewardship Award.

9) Promote migratory bird conservation nationally and internationally through activities such as National Public Lands Day and International Migratory Bird Day.

Department of Defense Responsibilities:

1) Follow all migratory bird permitting requirements for intentional take under 50 CFR 21.22 (banding or marking), 21.23 (scientific collecting), 21.26 (special Canada Goose permit), 21.27 (special purposes), or 21.41 (depredation). Though no permit is required to take birds in accordance with 50 CFR 21.43-21.47 (depredation orders), follow all regulatory requirements set forth in those sections when applicable.

2) Consistent with military mission requirements, encourage incorporation of comprehensive migratory bird management objectives into relevant DoD planning documents, including INRMPs, Integrated Pest Management Plans (IPMPs), Installation Master Plans, NEPA analyses, and other relevant documents. Comprehensive planning efforts for migratory birds include PIF Bird Conservation Plans, the North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, North American Waterbird Conservation Plan, and associated regional plans where available.

3) Consistent with current and emerging mission requirements, manage military lands and non-military readiness activities in a manner that supports migratory bird conservation, habitat protection, restoration, and enhancement.

4) Inventory and monitor bird populations on DoD lands to the extent feasible to facilitate decisions about the need for, and effectiveness of, conservation efforts.

5) In accordance with DoD *INRMP Implementation Manual* (DoDM 4715.03, 2013), work cooperatively with FWS and state and fish and wildlife agencies to promote timely development, effective review, and revisions of INRMPs, including any potential revisions to promote the conservation of migratory birds.

6) Incorporate conservation measures addressed in regional or state bird conservation plans in the INRMP development process.

7) Consistent with safety and security requirements, allow the FWS and other partners reasonable access to military lands for conducting sampling or survey programs, including but not limited to MAPS, BBS, International Shorebird Survey, game-bird surveys, and breeding bird atlases.

8) Consistent with safety and security requirements and bird conservation responsibilities, support the economic and recreational benefits of bird-related activities by allowing public access to military lands for recreational uses, such as bird watching and other non-consumptive activities.

9) Develop policies and procedures for facilities design that will promote the conservation of migratory bird populations and habitat, including:

   a) Mitigating the negative impacts of reflective glass in building design by considering building location and orientation with respect to migratory bird areas, and use of other mitigation techniques, such as reducing the amount of reflective glass on buildings.

   b) Maximizing the use of native landscaping to promote migratory bird habitat, except in areas subject to BASH hazards.

   c) Turning off interior building lighting at night, especially lighting in offices with exterior windows that face outward to exterior building surfaces that may be visible to migratory or resident birds.

10) Prior to implementing any activity that has, or is likely to have, a measurable negative effect on migratory bird populations:

   a) Identify the migratory bird species likely to occur in the area of the proposed action, and determine if any species of concern could be affected by the activity.

   b) Assess and document, through the project planning process (e.g., NEPA), the potential effects of the proposed action on species of concern. Use best available demographic, population, or habitat-association data in the assessment of effects upon species of concern.

c) Engage in early planning and scoping with the FWS to proactively address migratory bird conservation, and to initiate appropriate actions to avoid or minimize the exposure of birds and their habitats to avian stressors that may result in the take of migratory birds.

11) Continue to promote the conservation of migratory birds on military lands, to the extent permitted by law, subject to the availability of appropriations, within administrative budgetary limits, and where in harmony with DoD missions.

a) Fire and fuels-management practices. Fire plays an important role in shaping plant and animal communities and is a valuable tool in restoring habitats altered by decades of fire suppression. Fire management may include fire suppression, fire prevention, fuels treatment, and prescribed burning. Prescribed burning is one of the most effective tools in managing grassland and longleaf pine/wiregrass ecosystems. Fire-management planning efforts will consider the effects of fire management strategies on the conservation of migratory bird populations and should be combined with monitoring to properly assess fire management on relevant habitats and species.

b) Management practices for invasive and aquatic nuisance species. Invasive and aquatic nuisance species are a threat to native plants and wildlife throughout the United States, including on military lands. Efforts to prevent, control, and contain these species must consider both the impacts from invasive species and the effects of the control efforts on migratory bird populations. Invasive species that can threaten migratory birds and their habitats include, but are not limited to, exotic grasses, trees and weeds, terrestrial and aquatic insects and organisms, non- native birds, and stray and feral cats.

c) Communications towers, utilities, and energy development. Increased communications demand, changes in technology, and the development of alternative energy sources have resulted in additional exposure of migratory birds and their resources to avian stressors. DoD will review best practices outlined in FWS Guidance and consult with FWS as needed when considering the development of these technologies on military lands. Construction of new utility and energy systems and associated infrastructure should avoid or minimize the exposure of birds and their resources to avian stressors. Consideration also may be given to retrofitting existing utilities to reduce impacts. Available guidance includes (but is not limited to):

i. Avian Power Line Interaction Committee -*Suggested Practices for Avian Protection on Power Lines* (2006)
ii. Avian Power Line Interaction Committee- *Reducing Avian Collisions with Power Lines* (2012)
iii. U.S. Fish and Wildlife Service Land-*based Wind Energy Guidelines* (2012)

iv. U.S. Fish and Wildlife Service *Guidance on the Siting, Construction, Operation, and Decommissioning of Communication Towers* (2000) and FWS comments to the FCC on towers and lighting (2007)

12) To the extent reasonable and practicable, use a best-practices approach for routine maintenance, retrofitting, and management actions to the extent they do not diminish military readiness, including:

a) Turning out lights in buildings, especially multiple-story buildings, at night, except where needed for safety or security reasons.

b) Reducing or eliminating activities that can attract invasive species, including feeding or managing outdoor or feral cats.

c) Minimizing or eliminating the use of pesticides (e.g., insecticides, herbicides, rodenticides).

d) Covering open pipes in which birds may be able to enter but not escape (e.g., in-ground pipes, outhouses, roofs).

e) Minimizing exposure to hazardous chemicals, including covering or removing open pits containing oil or other chemicals.

f) Minimizing vegetation removal and manipulation during the breeding season, as practicable and when not in conflict with airfield BASH management.

Responsibilities of the Fish and Wildlife Service

1) Work with DoD by providing recommendations to minimize the effects of avian stressors on migratory birds from DoD actions.

2) Through the Division of Migratory Bird Management, maintain a web page of permits that provides links to all offices responsible for issuing migratory bird take permits and permit applications.

3) Provide essential background information to DoD, when requested, to ensure sound management decisions. This may include information on migratory bird distributions, status, key habitats, conservation guidelines, and risk factors within each BCR. FWS will regularly update its *Birds of Conservation Concern* publication so it can be reliably referenced.

4) Work to identify special migratory bird habitats (e.g., nesting, stopover, migration corridors), and the ecological conditions important in those habitats.

5) Using the Points of Contact list, the FWS will continue to provide general guidance and information regarding migratory birds and their habitats to DoD, upon request. This guidance includes technical assistance for avoiding or minimizing project-related impacts on migratory birds.

6) The Migratory Bird Program will develop and provide FWS guidance to the Ecological Services Field Offices to ensure consistency in the interpretation and implementation of the MBTA as it applies to all federal actions.

7) In accordance with FWS Guidelines for Coordination with DoD and Implementation of the 1997 Sikes Act, promote timely and effective review of INRMPs, including any potential recommendations and revisions related to the conservation of migratory birds.

8) Review and comment on NEPA and other planning documents forwarded by military installations.

9) Notify installations of any proposed or current actions that may result in a significant take of migratory birds.

E.2. INVENTORY AND MONITORING

The installation depends on the staff of the PADMVA Wildlife Office and the public to provide data on breeding and migrating birds. The standard monitoring mechanisms include point counts, breeding bird atlas projects, migration counts, and annual counts. Point counts generally monitor habitat change and land management activities. The breeding bird atlas project (run 4 out of every 20 years) cover breeding activities for the entire state, but also provide local data through local participants. Migration counts are held annually at Hawkwatch during the fall by volunteers. Annual counts, such as the Christmas Bird Count (CBC) are held by national and state conservation organizations and have local organizers who compile public and PADMVA staff data. PADMVA staff carries observation notebooks to record species encountered in the field and quantity (if applicable) which adds considerably to all data pools.

Full inventorying was completed in 1989 and 1992 for the installation baselines. PADMVA Wildlife has added other record media including eBird and public reports, Hawkwatch data, contracted research data, staff data, and monitoring results. Currently, the list stands at 278 total species reported on the installation and 142 of those species showing some evidence of possible breeding. All but 9 species are listed as applicable under the Migratory Bird Treaty Act (MBTA).

E.3. HABITAT CONSERVATION

Grasslands and shrublands contain the most regional rarities and species of conservation concern, as well as being among the most important habitats in the state's wildlife action plan. These habitats receive the most attention for both conservation and management, since they hold the majority of the land-based training hosted on the installation. Efforts at enhancing these

habitats are focused and ongoing because of the diversity and importance they host. Species such as the regal fritillary bring emphasis and attention to spreading these habitats and protecting them from exotics and succession.

Forests and woodlots are also valuable to the avian species on the installation, and they similarly receive attention for their ecological value. Species such as oak, chestnut, and hemlock are valuable both to the birds and to the military mission as strong and resistant tree cover that can survive some damage from fire and training while providing key food and shelter to wildlife and root stabilization to the soil. These habitats are also important for minimizing noise impacts and ricochet near our borders and inholdings.

PADMVA and PAARNG are committed to enhancing these habitats for ecological value while providing realistic environments for our nation's military trainers. The terrain effects soldiers consider on the battlefield are best represented through diversity of habitat and condition here at home. Striving to preserve the health of these environments makes sense for both natural resource managers and mission sustainment.

E.4. COLLABORATION AND COOPERATION

FIG bird life benefits from close working ties amongst PADMVA Wildlife, DCNR BOSP, volunteer organizations, local Audubon compilers, and the PGC. Surveys are run using standardized methods easily comparable with other data from across the nation. This includes possible collaboration with online data collection projects like eBird, the Avian Knowledge Network (AKN), the Hawk Migration Association of North America (HMANA), the National Point Count Database, Breeding Bird Research and Monitoring Database (BBIRD), and the Pennsylvania Breeding Bird Survey. Other collaborations include Audubon CBC participation (in the Lebanon circle), the Pennsylvania Ornithological Review Committee (PORC), and several local tours, surveys, and projects.

PADMVA Wildlife regularly coordinates volunteer support from local birding organizations for these projects and surveys. Local clubs, schools, groups, organizations, and individuals have contributed nest boxes, expert opinion, count staffing, and identification help for the birds on the installation. Additionally, these resources have also spread public awareness through word of mouth, public programs, and county data.

E.5. OUTREACH AND PUBLIC ACCESS

The public has limited access to some of the more active regional rarity locations such as Shuey Lake, Memorial Lake, Marquette Lake, and Second Mountain Hawkwatch. Township roads like Cold Springs Road and Tomstown Road have additionally made birding possible on other interesting portions of the installation.

PADMVA Wildlife provides migratory bird tours and grassland tours annually in May and July. These tours allow the public special access to otherwise restricted portions of the installation. Many birders from local audubon chapters and elsewhere participate in these tours each year.

Some employees of the Wildlife office also post rarities to the statewide Audubon Listserv when those rarities occur in publicly accessible locations. The network of volunteers and Hawkwatch Association members also spread word of mouth knowledge readily through the birding community. The Wildlife office maintains lists of installation observation records and produces publications such as the "Bird Checklist of Fort Indiantown Gap" for those interested. Second Mountain Hawkwatch has a few older publications and publishes daily through the fall migration season on http://www.hawkwatch.org/, which is a clearinghouse of hawk watch data from around the world.

E.6. INTEGRATION

The Wildlife office strives to integrate with all national, state, and regional conservation plans including the SWAP, the Partners in Flight (PIF) Bird Conservation Plan for the Northern Ridge and Valley, the DoD PIF Strategic Plan, the NABCI, and so forth. Monitoring is integrated whenever possible with national monitoring data collections and national, state, and regional coordinated monitoring handbooks and projects. Data is also coordinated with county PA Society of Ornithology (PSO) compilers whenever appropriate.

Data is regularly stored in eBird as well as onsite project-specific databases. The eBird tool is a widely used method for coordinating national and state efforts. Additional tools from statewide collaborations include the PSU Breeding Bird Atlas site for the Second PBBA, the data sheets and portals for the Christmas Bird Count (Lebanon County CBC is the only CBC that includes the installation). While possible through some of the residences on the installation, no known FIG users participate in the Great Backyard Bird Count other than through regular observation submissions on eBird.

E.7. REGULATIONS

Any study involving the actual capture or handling of birds for FIG require the appropriate permits and licenses which may or may not include banding licenses, depredation permits, scientific collection permits, and hunting licenses. Work shall not be performed in lieu of the appropriate certification.

The MBTA requires strict limitations on individual take of all but exotic and localized game birds. Even exotic birds must have an open season declared by the PGC as determined by multiple court decisions in the last ten years. The ESA requires strict limitations on take for individuals of all listed animal species within the Act (unless there is a 4(d) rule). These takes may be intentional or non-intentional but still follow the same enforcement with the same penalties. Installation actions that may affect species and individuals covered by these regulations must apply for and obtain the proper permits and permissions from the USFWS. Some actions may be covered within the INRMP, but these actions must be specifically listed and documented in means consistent for the approval of the USFWS.

Hunting of game birds is covered within the state by the PGC, but the hunts themselves are authorized, enforced, and enacted by the USFWS except where MBTA exceptions exist. For these reasons, PADMVA Wildlife is unable to establish its own hunting seasons for any of these species without first seeking the proper approval of the enacting agency. PADMVA can and has implemented regulations above and beyond those of the state and USFWS. As examples, PADMVA has added regulations banning quail collection despite PGC and PFBC having available seasons and harvest limits for these animals.

Appendix F. INRMP Benefits for Endangered Species and Critical Habitat

Table F.1. Species Listed/Proposed for Listing Under ESA with Critical Habitat Potential at Fort Indiantown Gap.

Scientific Name	Common Name	Petition/Date	Current Determination/Status	Activity at FIG
Myotis septentrionalis	Northern Long-eared Bat	Matteson (CBD) 2010	Federally Threatened with 4(d) rule, species status assessment being conducted to help inform federal listing status changes, PA Endangered	Maternity colonies, breeding and migration; hollow trees and cavities and trees with loose bark (often fire-scarred), Lebanon and Dauphin Counties.
Danaus plexippus plexippus	Monarch	Center for Biological Diversity et al., 14 Aug 2014	On 15 Dec 2020, USFWS ruled that threatened listing was warranted but precluded by higher priorities. No rules or regulations have been made at this time.	Breeding and migration; widespread in warm-season grasslands, Lebanon and Dauphin Counties.
Speyeria idalia idalia	Regal Fritillary – eastern subspecies	Federal Register 49 FR 21664 21675 (1984); Petitioned to list on April 19, 2013 by WildEarth Guardians,	Removed from list as a Category II Candidate Species by judicial decision in 1995. USFWS positive 90-day finding – 18 Sep 2015. Listing decision expected in 2022. PA endangered.	Breeding; widespread in warm-season grasslands, Lebanon and Dauphin Counties.
Callophrys irus irus	Frosted Elfin	Not in federal register. Is being proactively assessed by USFWS	Not listed. Listing decision will be made in 2023. PA endangered.	Final year of surveys, previously found as a breeding colony; Impact area section (Range 24) with host plant, wild indigo.

Neotoma magister	Allegheny Woodrat	None	Removed from list as a Category II Candidate Species due to uncertain status in south at last time of review (1995), PA Threatened	Breeding; Second Mountain, Lebanon and Dauphin Counties.
Vermivora chrysoptera	Golden-winged Warbler	Sewell (PSU) 2010	Currently undergoing a 12-month finding on 2010 petition, listing determination expected in 2024.	Breeding and migration; shrubland edges and islands in native warm-season grassland habitat Lebanon and Dauphin Counties
Myotis lucifugus	Little Brown Bat		Currently undergoing a discretionary status review, listing determination expected in 2022.	Breeding and migration; riparian forests and wetlands, rarely detected onsite due to WNS-induced declines, Lebanon and Dauphin Counties
Perimyotis subflavus	Tri-colored Bat	Center for Biological Diversity and Defenders of Wildlife 2016	Currently undergoing a 12-month finding on 2016 petition, listing determination expected in 2022.	Breeding and migration; riparian forests, rarely detected onsite due to WNS-induced declines, Lebanon and Dauphin Counties
Clemmys guttata	Spotted Turtle	Adkins Giese et al. (CBD) 2012	"May be warranted" for listing as of 1 July 2015. Listing determination expected in 2023.	Breeding, confined mainly to wet meadows and wetlands, Lebanon and Dauphin Counties.
Glyptemys insculpta	Wood Turtle	Adkins Giese et al. (CBD) 2012	"May be warranted" for listing as of 18 Sep 2015. Listing determination expected in 2023.	Breeding, streams and adjacent fields and woodlands. Lebanon and Dauphin Counties.
Pseudemys rubriventris	Northern Red-bellied Cooter	Fish and Wildlife Service (FWS) 2011	Listing determination expected in 2023. PA threatened.	A couple individuals found living in single waterbody adjacent to post.

		Citation: 76 FR 59835		Research needs to be conducted to determine actual population.
Haliaeetus leucocephalus	Bald Eagle	N/A	Federally delisted in August 2007. PA status change in 2014 to protected. Three federal Acts still protect this species: the Bald and Golden Eagle Protection Act, the Migratory Bird Treaty Act, and the Lacey Act.	Breeding and migration; first nesting attempt at Marquette Lake in 2014-15.
Scirpus ancistrochaetus	Northeastern Bulrush	N/A	Listed Endangered.	Never found on installation but found in region.
Glyptemys muhlenbergii	Bog Turtle	N/A	Listed Threatened w/4(d) rule.	Never found on installation but found in region. Surveyed extensively.
Myotis sodalis	Indiana Bat	N/A	Federally Endangered	Never found on installation but found in region. Surveyed extensively. Habitat requirements similar to NLEB. Motus Tower on installation recorded this species flying over (migrating through) the installation.
Bombus pensylvanicus	American Bumblebee	N/A	Petition submitted on 1 February 2021. On 29 September 2021, USFWS ruled a 90-day finding was substantial and that listing “may be warranted”	Found in 2016 and 2017. Requires grassland habitats and other open spaces with nectar plants.

F.1. Northern Long-eared Bat

Status

In January 2010, the Center for Biological Diversity (CBD) petitioned the USFWS to list the northern long-eared bat as endangered or threatened under section 4(a)(1) of the Endangered Species Act. In a 12-month petition finding, the USFWS found that listing of the species was warranted (U.S. Department of Interior 2011). On 2 April 2015, the northern long-eared bat was federally listed as threatened (U.S. Department of Interior 2016), making it the first federally listed species known to occur on Fort Indiantown Gap. The USFWS is currently reviewing the status of the northern long-eared bat following a lawsuit put forth by the CBD in 2020, and a new proposed rule and final listing determination are due within 18 months of the completion of the species' status assessment (likely fall FY2022, R. Niver, pers. comm.). The northern long-eared bat was listed as endangered in Pennsylvania in January 2019, has a state conservation ranking of S1 (critically imperiled) (PNHP 2021), and is designated as a Species of Greatest Conservation Need (PGC-PFBC 2015).

White-nose syndrome (WNS) is the most severe and immediate threat to the northern long-eared bat and was the basis of the species' listing. Other threats to the species include habitat loss and fragmentation, disturbance and loss of hibernacula, wind energy development, and climate change. Currently, 30 state or federally owned ARNG installations across 19 states have occurrence records of the northern long-eared bat.

Monitoring

Bat surveys were conducted on Fort Indiantown Gap beginning in 1999, with initial pre-construction surveys used to determine presence/absence of the federally endangered Indiana bat. Beginning in 2016, more extensive bat surveys were conducted on the installation in collaboration with researchers from Temple University. Eight of the 9 Pennsylvania resident bat species, as well as the evening bat (*Nycticeius humeralis*), have been documented on Fort Indiantown Gap. There is suitable roosting and foraging habitat for all bat species that occur on the installation, however, there are currently no known hibernacula onsite.

Cave-hibernating bat species are experiencing severe population declines throughout eastern North America (Ingersoll et al. 2013), largely as the result of a fungal disease known as white-nose syndrome (WNS). White-nose syndrome, caused by the cold-loving fungal pathogen *Pseudogymnoascus destructans* (Minnis and Lindner 2013), was first documented near Albany, NY during the winter of 2006 and has since spread to 35 U.S. states and 7 Canadian provinces (www.whitenosesyndrome.org). WNS was first confirmed at 10 hibernacula in 4 Pennsylvania counties during the winter of 2008-2009, and by 2011-2012 WNS had spread throughout much of the state (Heffernan and Turner 2016). All 6 cave-hibernating bat species found in Pennsylvania are known to be infected with WNS (Turner et al. 2011).

The results of capture and acoustic surveys in 2016-2020 have documented drastic declines in populations of several bat species on Fort Indiantown Gap, presumably as the result of WNS (Hauer et al. 2019, Hauer et al. 2020). Prior to WNS, the northern long-eared bat was the most common bat species on the installation, comprising 47% (n = 111) of total mist-net captures and

this species was captured at >50% of sites surveyed (TNC 2000a, TNC 2001, Bat Conservation and Management, Inc., 2004). Sampling efforts pre-SBCT in 2004 showed extensive use of the training corridor by northern long-eared bats, as 98 individuals (most of which were reproductive females) were captured in forests on or near proposed ranges (Bat Conservation and Management, Inc., 2004). Since 2016, only 3 (0.2% of total captures) northern long-eared bats have been captured at 3 of 96 (3.1%) of sites surveyed (Hauer et al. 2017, Hauer et al. 2018, Hauer et al. 2019). Declines in summer captures of northern long-eared bats at FIG are consistent with post-WNS capture trends across Pennsylvania. Northern long-eared bats declined from 24.8% of total captures in years prior to WNS to 12.6% of captures after WNS (Butchkoski and Bearer 2016). Declines in captures of *Myotis* bats and tri-colored bats have largely been offset by big brown bats (*Eptesicus fuscus*) and eastern red bats (*Lasiurus borealis*), whose populations appear to be stable or increasing at Fort Indiantown Gap (Hauer et al. 2019). Total capture rates have increased steadily over time, with 8.1 bats captured per survey in 2004 and 17.8 bats captured per survey in 2019.
Long-term, stationary acoustic monitoring at 8 sites in 2018-2020 revealed peaks in nightly activity of northern long-eared bats in spring (mid-April - May) and late summer (mid-August – early September) (Hauer et al. 2020). Our data suggests that northern long-eared bats return to the installation by April and remain active on the installation until October. Northern long-eared bats are infrequently detected onsite, comprising only 0.6% of total identified passes, 90.4% of which were recorded at 1 site along Indiantown Run in TA B-06A (Hauer et al. 2020).

PADMVA Wildlife staff have confirmed the use of 6 known, occupied maternity roosts for 3 northern long-eared bats (2 juvenile males, 1 lactating, adult female) captured in 2017-2019. All 6 roosts are in recently burned forests where there are no proposed construction actions, 3 in TA A-32 north of Ranges 12 and 13A and 3 in TA D-02 east of Range 37 proper. Species of roost trees included red maple (n = 3), black birch (n = 1), black gum (n = 1) and northern red oak (n = 1). Roost trees were small (4.8-24 cm DBH) and most had exfoliating bark, cat faces (partially healed or grown-over wound on a tree stem usually resulting from fire), and/or hollow boles in the main stem.

The results of recent mist-netting surveys, acoustic monitoring, and radio-telemetry day-roost searches indicate that the distribution of northern long-eared bats on Fort Indiantown Gap may largely be restricted to the western end of the training corridor and the south-facing slope of Blue Mountain (TA B-06A, A-32, A-33, A-34) in Cantonment, and these areas provide particularly important foraging and roosting habitat for this species.

Management

Given regional-scale declines in populations of several cave hibernating bat species due to WNS, and the lack of known bat hibernacula onsite, land managers at Fort Indiantown Gap aim to provide and enhance summer foraging and roosting habitat for all bat species following forest management best practices (U.S. Army Environmental Command 2015, Silvis et al. 2016, Johnson and King 2018) and conservation measures listed in the final 4(d) rule (U.S. Department of Interior 2016).

Silviculture

Silviculture practices including even-aged and uneven-aged harvest methods are used to manage forests in support of military training, improve forest stand condition and health, and provide and/or enhance wildlife habitat (U.S. Army Environmental Command 2015). Changes in the structure and composition of forests can alter foraging and roosting habitat use by bats, including the northern long-eared bat.

Northern long-eared bats are roost "generalists", having been found roosting in live trees and snags, as well as anthropogenic structures including buildings and bat boxes (Silvis et al. 2016). However, they typically form summer maternity colonies within cavities of snags or senescing live trees, under loose bark, or in tree cavities (Silvis et al. 2016). Northern long-eared bats roost in numerous tree species within forest stands of various types and conditions, however, roosts are generally in overstory trees in later stages of decay than surrounding trees and are in canopy gaps (Perry and Thill 2007, Lacki et al. 2009).

Results vary widely among studies on foraging habitat use by northern long-eared bats in response to silviculture. Despite being adapted to foraging in cluttered, structurally complex forested habitats, Loeb and O'Keefe (2005) documented greater northern long-eared bat activity in open rather than cluttered conditions. In Ohio, northern long-eared bat activity did not differ between shelterwood and control stands (Titchenell et al. 2011). Similarly, Caldwell et al. (2019) and Dodd et al. (2012) found no difference in northern long-eared bat activity between stands with varying degrees of overstory tree removal.

Removal of trees has the potential to negatively impact northern long-eared bats either directly through injury or mortality or indirectly through the loss of roosting habitat. The following conservation measures will be taken for all silviculture activities to minimize adverse impacts to northern long-eared bats:

- Removal of trees >3 inches DBH during the pup season (1 June – 31 July) will be restricted
- Removal of known, occupied northern long-eared bat maternity roost trees or any trees within 150 feet of a known, occupied maternity roost tree will be restricted. Known, occupied maternity roosts are defined as "trees that have had female or juvenile northern long-eared bats tracked to them or the presence of female or juvenile bats is known as the result of other methods." A tree will remain a known, occupied maternity roost "as long as the tree and surrounding habitat remains suitable for northern long-eared bats."
- Retain snags in silvicultural treatments unless there is a safety concern for the contractor or military personnel, or unless the treatment is a salvage cut or clearcut.

Exceptions to the removal of unoccupied trees >3 inches DBH during the 1 June – 31 July restricted period include:

1. Small-scale Military Training Needs
   Tree removal required for line-of-sight on training ranges and other training projects (e.g., chainsaw classes, disaster preparedness) may remove up to 5 acres during the restricted period. Preceding the cut, PADMVA Wildlife staff will determine presence/probable absence of northern long-eared bats following USFWS survey

guidelines (USFWS 2020). If northern long-eared bats are determined to be present, tree removal operations will not occur until after the restricted period.

2. Hazard Trees and Storm Damage
   Hazard trees can be defined as trees that pose an immediate danger to human life or property. A hazard tree >3 inches DBH with suitable roosting characteristics (e.g., exfoliating bark, crevices, cavities) that needs to be removed during the restricted period, must be assessed by natural resources personnel prior to removal. If appropriate, an emergence survey will be conducted to determine if bats are present. If no bats are present, the hazard tree must be promptly removed.

   Downed trees that block roads, trails, and other points of access may be removed if they become a barrier. Several hurricanes and other storms have produced substantial damage in recent years, and under emergency conditions such as these, the installation will do what is necessary for force protection, training access, and safety purposes.

Prescribed Fire

Land managers on military installations use prescribed fire to achieve many forest management objectives, including hazardous fuel removal for wildfire mitigation, ecosystem restoration, maintenance of grasslands and open forests for military training, and wildlife habitat enhancement (U.S. Army Env Command 2015). Fire may affect bats directly through exposure to heat, smoke, and carbon monoxide, and indirectly through habitat modification and changes in insect prey abundance, diversity, and availability (Dickinson et al. 2009, Johnson and King 2018). The effects of fire likely vary by bat species, season of burn, burn frequency, and intensity (Harper et al. 2016).

Low-intensity prescribed fire may provide favorable roosting and foraging habitat for bats by reducing structural complexity or "clutter" in the midstory and understory, reducing tree densities, creating canopy gaps and snags (Perry 2012). Several recent studies have found that bats generally benefit from fire, largely in response to the increased availability and/or suitability of roosts (Boyles and Aubrey 2006). Specifically, northern long-eared bats may preferentially roost in burned forests (Loeb and O'Keefe 2014). In Kentucky, Lacki et al. (2009) located 74% of northern long-eared bat maternity roosts in previously burned habitats. Similarly, Perry and Thill (2007) found 54% of male day roosts within areas that had been burned 1-5 years prior. Johnson et al. (2009) also located 38% of maternity roosts for this species within burned areas while documenting no differences in roost switching behavior or distances between successive roosts between burned and unburned treatments.

The results of day-roost telemetry searches onsite in 2017-2019 support these findings as all 6 northern long-eared bat roosts were in recently burned (<5 years prior) forests (Hauer et al. 2017, Hauer et al. 2018, Hauer et al. 2019). Most of these roosts were small diameter snags with hollow boles and numerous catfaces and crevices likely created by fire. Similarly, Johnson et al. (2012) found northern long-eared bat roosts in cavities of small diameter trees post-fire.

However, prescribed fire has the potential to negatively impacts bats. Adults bats are slow to arouse from torpor when air temperatures are less than 50°F, and thus may not be able to escape smoke and heat from fires. Non-volant pups are likely the most vulnerable to death or injury from fire. The following conservation measures will be taken for prescribed burning to minimize adverse impacts to northern long-eared bats:

- Avoid conducting prescribed burns in suitable forested northern long-eared bat habitat from 1 June – 31 July
- Use low intensity burns during the active season (1 April – 31 October) when ambient temperatures are <50°F
- Where practical, remove hazard trees and construct fire breaks during winter to reduce the chance of removing or disturbing occupied roosts
- Where practical, protect known maternity roost trees from fire

Bat Boxes

Roost availability is an important factor for bat survival and population persistence. Artificial roosts, such as bat boxes, can be used to supplement existing roosting habitat or to mitigate the loss of natural roosts (Taylor et al. 2020). Several bat species have been found to use bat boxes as day or maternity roosts, including big brown bats, little brown bats, Indiana bats, and to a lesser extent northern long-eared bats. In 2006, PADMVA Wildlife staff installed 21 bat boxes near several bodies of water throughout the training corridor and Cantonment, many of which are no longer in suitable condition to be used by bats. Over the next few years, bat boxes in poor condition will either be repaired or replaced with new boxes. In summer 2021, PADMVA Wildlife staff installed 5 new bat boxes, and these boxes (along with any newly repaired or replaced boxes) will be monitored annually to determine use by bats.

Motus Towers

In 2017, 6 automated radiotelemetry towers were installed on the installation as part of the Motus Wildlife Tracking System (Bird Studies Canada). Each tower consists of 4 9-element Yagi antennas positioned in each of the cardinal directions. Three Indiana bats originally captured and radio tagged by PGC biologists at a bat box in Berks Co., PA in fall of 2018 and 2019 were later detected by several of the Motus towers onsite. The fact that these detections occurred during the fall swarm period (mid-October - early November) in both years, suggests that an undocumented Indiana hibernaculum may exist near the northern boundary of FIG, adjacent to State Game Lands (SGL) 211. Several historic northern long-eared bat hibernacula are also located in SGL 211 north of FIG (G. Turner, PGC, pers. comm.). The continued operation of the Motus towers at FIG will enable PADMVA Wildlife staff to document seasonal movements of Indiana bats and other bat species of conservation concern and may aid in the search for new winter populations of these species.

Land Use Buffering

The Fort Indiantown Gap ACUB program is used to preserve public lands and conservation-compatible use for air corridors used in flight training. The program has several enlisted and interested partners looking to purchase or create easements on land around the DeHart Reservoir

north of Fort Indiantown Gap. This land contains high-quality northern long-eared bat habitat along Clark's Creek and its tributaries and preserves a contiguous stretch of wooded stream valleys from State Route 325 south to Fort Indiantown Gap property. For these reasons, the ACUB program should be considered for conservation measures or potential conservation crediting programs as land is purchased and/or eased should other listings occur.

Providing a Conservation Benefit to the Species

Populations of northern long-eared bats have undergone precipitous declines throughout the northeastern United States since 2006-2007 as the result of white-nose syndrome. As such, the maintenance of high-quality, forested habitat for roosting and foraging will be particularly important for the conservation and recovery of this species. This will be accomplished onsite through the use of forest management best practices. Northern long-eared bats have benefitted from current forest management practices (e.g., prescribed fire, mechanical thinning) onsite, as evidenced by the selection of recently burned stands for roosting.

Providing Certainty that the Management Plan will be Implemented

The management plan follows simple, easily followed polices that were already in use and were proven to be effective on the installation prior to listing of the northern long-eared bat. For example, the management plan follows the annual Prescribed Fire Project Plan, which is submitted to several state agencies for approval prior to implementation. In addition, there will be a moratorium on prescribed fire and tree removal within suitable forested northern long-eared bat habitat during the pup season (1 June to 31 July). PADMVA Wildlife staff will coordinate with the USFWS to ensure that management actions remain in compliance with the Endangered Species Act and the final 4(d) rule (U.S. Department of Interior 2016).

Providing Certainty that the Conservation Effort will be Effective

Since 2018, a long-term bat monitoring plan has been implemented to determine the current distribution and relative abundance of northern long-eared bats onsite, and to determine the potential effects of land management practices and military training activities on habitat use of this species (Powers 2018). This plan incorporates multiple field methodologies (e.g., mist-netting, acoustic monitoring, radiotelemetry, emergence counts) following guidance provided by the PGC, USFWS (USFWS 2020) and NABat (Loeb et al. 2015). This plan will enable the collection of extensive, long-term data to track changes in Fort Indiantown Gap's bat populations over time and will also contribute to national and international initiatives (e.g., Motus, NABat). The plan will be updated and refined by PADMVA Wildlife staff on an annual basis.

F.2. Eastern Regal Fritillary (eastern subspecies)

Status

The regal fritillary was petitioned to the USFWS by WildEarth Guardians in 2013 followed by a 18 Sep 2015 90-day substantial finding. A "Substantial Finding" means that the petition provides enough information to substantiate that listing this species may be warranted. USFWS recognizes the regal as two distinct subspecies, eastern and western, in its species status

assessment. FIG has the only known population of the eastern subspecies in the world (Gates, 2021). It ranks as both globally (T1) and nationally imperiled (N1) (NatureServe 2021). Currently, the regal is considered endangered by PA state conservation organizations (DCNR, PFBC, PGC, PNHP) with a state ranking of S1 (critically imperiled) and a Global Rank of G3 (vulnerable). No state regulatory agency claims legal responsibility for this species.

At one time, the regal's geographic range spanned across North America from New Brunswick to New England, south to northern Georgia, west to Colorado, and north to Manitoba (NatureServe 2021, Swengel 1993). Similarly, in Pennsylvania it once ranged across most of the state. It was listed as a category II species under the United States Endangered Species Act until the category was eliminated in 1996 (USFWS 1996). The regal fritillary is a grassland endemic that until recently (Chazal 2014) persisted at two locations in the eastern United States (Schweitzer 1984, 1993, 2000; Swengel 1993).

Historically at FIG, repeated disturbance from military activities had maintained open habitats (Ferster and Vulinec 2010, Latham et al. 2007, Warren et al. 2007) but more recently, management using prescribed fire and manual stewardship has maintained habitat. By delaying succession of woody shrubs and trees, disturbance promotes the growth of essential habitat component and other herbaceous plants essential to the survival of the eastern regal fritillary (Latham et al. 2007). Fields are characterized as native grassland habitat that supports the 3 main habitat components essential for survival: host plants for caterpillars, nectar plants for adults (Kelly and Debinski 1998) and native warm season bunch grasses which provide protective sites for all life stages (Ferster and Vulinec 2010.) Host plants include violets for larvae and perennial forbs such as *Asclepias spp.*, *Cirsium spp.*, and *Monarda fistulosa* for adults. Warm season grass thatch and tussocks are also considered essential as they provide refuge for all life stages. This type of grassland habitat is common at FIG and supports the training mission as well as sensitive wildlife species.

For the past 20+ years, FIG has been monitoring and managing for the regal as the result of a lawsuit brought about by The North American Butterfly Association (NABA) in the late 1990's. As a compromise, FIG signed an MOU with TNC which delineated and preserved more than 219 acres of prime training fields harboring the largest population centers of regals. In 1998, three regal research areas (RRA) were established and considered off-limits to mechanized and other forms of high impact training exercises. An additional RRA was added in 2002 after dense pockets of regal fritillaries were discovered by researchers. While not legally designated as critical habitat and no current MOU with any conservation entities exists to protect these areas, FIG still treats them as critical habitat and thus, they function as such.

Currently, there are 4 protected RRAs hosting 3 subpopulations. The largest subpopulation is located on the west end of the installation and occupies portions of R36, D3C, and D2. This subpopulation is further divided into 2 adjacent monitoring zones referred to RRA-D1 and RRA-D3. Each is monitored separately but is considered one subpopulation (Ferster and Vulinec 2010, Keyghobadi et al. 2007). The delineated habitats are 82 acres and 50 acres, respectively. The second subpopulation is located directly adjacent to the eastern side of the impact area on R23AE. RRA-R23 is delineated at 42 acres and also has its own monitoring system. The third subpopulation, RRA-B12, is located on the east end of the installation and is split into a northern

section in B12A and an adjacent southern section in R30. It is 35 acres and is the smallest subpopulation. It is also isolated from other RRAs by a public road, tree lines, and various other types of unsuitable habitat. Like the other RRAs, it also has a fixed population monitoring scheme. A fifth monitored area located in C4 (RRA-C4) also harbors a population of regal fritillaries but is not part of the original area delineated by the former MOU with TNC. It has been part of the monitoring scheme since 1999.

Monitoring

S. idalia population monitoring relies on estimates of relative and total population size as well as density estimates of host plants and other habitat variables. RRAs are monitored annually using the Pollard-walk method (Pollard and Yates 1993). From these data, a population index can be calculated and compared over time. To calculate parameter estimates such as survival, recapture, and population size, mark-release-recapture (MRR) surveys are performed every 4-5 years. Performing and MRR requires: 1) nets to capture butterflies 2) datasheets to record data 3) extra fine Sharpie markers to mark butterflies with a unique ID and 4) calipers to record morphometrics (body length, wing length, and head capsule size). Surveyors begin by searching the landscape for butterflies. When one is encountered an attempt to capture is made. If successful, the animal is carefully removed from the net by gently squeezing the forewings together to secure the butterfly. Once out of the net, a unique ID is written on the inside and outside of at least one wing but more if possible. The mark is alpha numeric with a single letter that identifies the surveyor and a number to the hundreds place that indicates the number of the individual captured (ex. M001). Not all letters of the alphabet can be used since some are easily confused with others. Once the mark is applied, the data is recorded on a datasheet. This includes the unique ID, time of capture, RRA, field #, and morphometrics. Wing condition is also recorded. This is a qualitative measure scored on scale of 1 to 5 where 1 represents a freshly eclosed individual and 5 represents an older, tattered individual. Once all data has been collected, the butterfly released back to its initial location.

Habitat surveys include estimating violet density and vegetative cover using a set of randomized, semi-permanent $2m^2$ plots. The first survey was performed in 2000 and a survey(s) has been conducted every 4-6 years since. Nectar plant surveys have been conducted using 3 different methods: randomized plots, total nectar plant counts, and transect counts. These surveys are conducted every 4-5 years. Occupancy surveys are conducted and used to identify metapopulation satellites and dispersal events. These are performed annually but are more limited by access issues and lack of staffing.

Five standardized regal fritillary MRR surveys have been conducted since 2001, the most recent event occurring in 2017. In 2001, the population was estimated to be about 1,000-1,200 individuals. More than a decade later, this estimate has increased nearly five-fold (Swartz 2014a) (table A7.2, table A7.3) only to decline 3 years later, leaving the population at its lowest levels ever recorded (Tilden and Swartz 2017). In 2020, there was a notable rebound which demonstrated the cyclic nature of this butterfly species. Transect data corroborate these findings (table A7.4). The increase was almost certainly related to the creation of large, contiguous tracts of grassland habitat via range construction and other land clearing events between 2008-2012. Key habitat factors include clump-forming warm season grass cover (generally little bluestem,

Schizachyrium scoparium, but occasionally broom sedge, *Andropogon virginicus*, and/or Indiangrass, *Sorghastrum nutans*), native nectar species (including but not limited to favored species such as *Asclepias incarnata, A. syriaca, A. tuberosa, Cirsium discolor, C. pumilum* and *Monarda fistulosa*), and larval host violets (primarily arrow-leaf violets, *Viola sagittata*). The extreme drop-off after 2014 cannot be explained but may include: poor weather related to climate change, over-exposure to wildland fire, disease, and natural population cycling. We currently do not have enough information to draw any clear conclusions, hence the importance of establishing independent and viable populations off the installation.

Table F.2. Population estimates from *Speyeria idalia* MRR surveys in 2001, 2005, 2014, 2017-MRR at FIG. **Values in parenthesis represent the standard error.**

RRA	Males					Females				
	2001*	**2005**	**2009**	**2014**	**2017**	**2001***	**2005**	**2009**	**2014**	**2017**
B12	NA	109.26 (8.78)	55.33 (3.43)	76.13 (27.26)	13.31 (1.27)	NA	132.41 (19.49)	55.01 (6.86)	16.94 (8.47)	15.67 (12.18)
C4	NA	0.00 (NA)	6.00 (3.46)	280.69 (33.67)	15.96 (4.81)	NA	2.00 (NA)	6.00 (1.73)	132.98 (33.14)	7.80 (5.04)
R23	NA	189.47 (13.09)	328.61 (92.38)	531.34 (69.31)	185.77 (42.77)	NA	135.37 (20.99)	319.94 (92.38)	258.11 (113.05)	94.57 (36.77)
Delta[1]	NA	202.33 (16.20)	641.96[a] (21.95)	2764.86[a] (243.05)	349.77 (32.07)	NA	250.09 (33.11)	421.60[a] (51.12)	1373.66[a] (NA)	130.00 (27.55)
Total	**600.00**	**501.06**	**1031.90**	**3653.02**	**564.81**	**300.00**	**519.87**	**802.55**	**1781.69**	**248.04**

***** only a single super-population number is presented here due to issues with MRR methodology and data collection during this sampling year.

[a] Additional acreage surveyed

[1] RRAs D3 and D1were lumped as one subpopulation named "Delta"

Table F.3. Grand total for MRR population estimates for RRAs by survey year and site.

RRA	Year				
	2001*	**2005**	**2009**	**2014**	**2017**
B12	NA	241.67	110.34	93.07	28.98
C4	NA	2.00	12.00	413.67	23.76
R23	NA	324.84	648.55	789.45	280.34
Delta[1]	NA	452.42	1063.56 [a]	4138.52 [a]	479.77
Total	**900.00**	**1020.93**	**1834.45**	**5434.71**	**812.85**

***** only a single super-population number is presented here due to issues with MRR methodology and data collection during this sampling year.

[a] Additional acreage surveyed

[1] RRAs D3 and D1were lumped as one subpopulation named "Delta"

Table F.4. RRA and corresponding standardized density values (*S. idalia*/route-acre) for route data at FIG from 2011-2019. Q=Quartile.

RRA	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
B12	2.18	1.72	3.38	4.08	5.56	2.80	1.69	0.82	1.69	2.39
C4	0.75	1.00	2.42	5.97	4.73	0.92	0.43	0.14	0.53	2.27
D1	11.74	9.03	28.26	31.81	38.28	5.77	4.66	4.66	4.22	4.43
D3	3.74	4.24	15.46	11.24	17.99	1.98	1.53	1.99	1.40	2.15
R23	2.44	9.91	9.02	13.63	8.35	2.44	4.82	3.66	3.90	10.98
Median	**2.44**	**4.24**	**9.02**	**11.24**	**8.35**	**2.44**	**1.69**	**1.99**	**1.69**	**2.39**
Average	**4.17**	**5.18**	**11.71**	**13.35**	**14.98**	**2.78**	**2.62**	**2.25**	**2.35**	**4.44**
Q1-Q3	**1.83-5.74**	**1.54-9.25**	**3.14-18.66**	**5.52-18.18**	**5.35-23.06**	**1.45-4.28**	**1.00-4.59**	**0.50-4.25**	**0.97-4.06**	**2.21-7.70**
SD	**4.36**	**4.11**	**10.62**	**11.02**	**14.05**	**1.81**	**1.99**	**1.90**	**1.62**	**3.77**

Management

The native warm-season grasslands that regals utilize require frequent low-intensity disturbance. Most of this disturbance is provided by dormant season fires, either set by prescribed fire techniques or initiated by training activities. Fire serves to remove duff, initiating germination of and providing space for violet and nectar-plant seeds. Fire also serves to invigorate and favor clump-forming grasses over mat-forming cool-season grasses. In addition to fire, grasslands are also maintained with dormant season mowing and spot treatments of herbicide. While herbicide is not the preferred alternative, minimal doses applied directly to problem species are necessary when other management techniques fail to remove a hazard species. The aerial application of herbicide is assessed in the Aerial Spray Statement of Need; this document discusses the importance of maintaining buffer zones and prohibiting spraying within 25 meters of sensitive areas (to include water features/wetlands as well as designated regal research areas).

Pasture thistle (*Cirsium pumilum*) is crucial for mid-season nectar availability. Originally in the RRAs, this species was almost the only available nutrition source for ovipositing females during their transition from the mid-season diapauses and therefore critical to population dynamics. Insecticide has been used in a targeted manner to remove invasive weevils from pasture thistle. Thistle heads are directly injected at the base of the involucres (where the weevils enter and lay

eggs), either post-flowering or with the assistance of an exclosure to keep rare pollinators from ingesting any chemical-tainted nectar. The weevils have been devouring seed heads at an unsustainable rate, reducing this key mid-season/transitional nectar source to a local rarity status. FIG has been introducing native-to-post wild bergamot as a surrogate for the mid-July purple blooms of the pasture thistle.

Rearing

FIG researchers and Hershey ZooAmerica employees have refined and enhanced existing lab rearing protocols. Adult females are collected in mid-August and held in paper bags with shredded, unbleached paper towels as an ovipositional substrate, along with a violet leaf intended to induce oviposition, and a moist cotton ball to provide humidity. Females are highly fecund, laying thousands of eggs in a laboratory setting (Becker 2013, Wagner et al. 1997). Mortality is most common during the overwintering phase, where delicate first instar larvae easily succumb to changes in microclimate resulting in mold or desiccation. Survival of overwintering larvae significantly increased after adapting a protocol being tested by a butterfly rearing lab in the Midwest. Small groups of first instar caterpillars are placed in sealed, vented cups filled with paper towel squares on which they can settle. These cups are placed in larger plastic storage containers, alongside open cups filled with hydration salts designed to maintain humidity and, in turn, reduce caterpillar desiccation. The containers are housed in an incubation chamber programmed to stay at an optimal temperature from October to April. The increased larval survivorship achieved with this method should allow for continued success in producing healthy regals for reintroduction. In April, larvae are "woken up", assessed for survivorship, and prepared for release directly to reintroduction sites or to FIG to supplement the existing population. Some larvae are retained in the lab for further rearing studies at ZooAmerica. Once pupation occurs, they are placed into a holding cage until metamorphosis is completed. After emergence, adults are measured and marked with a unique character, and released to reintroduction sites or FIG.

Regals are released as caterpillars in mid-late spring, or as adults in the summer, primarily to reintroduction sites. While a variety of sites and partnerships are being explored for future potential, PGC state game lands represent the only current release sites. A small number of larvae released in the previous fall (old protocol) or the current spring successfully become adult butterflies that have been readily observed in summer, but year-to-year success has been elusive. Thus far, our program has not been able to maintain self-sustaining satellite populations. Additional years of release and monitoring will be necessary to determine survivability of these experimental populations. We suspect that condition of habitat is a key factor in determining site quality for the Regal. Most reintroduction sites taken into consideration in the past have been too small and over-run with undesirable vegetation. Sites like these require extensive management efforts to reproduce conditions like those of FIG RRA's. Because of these observations, efforts have shifted to one reintroduction site in western Pennsylvania, a reclaimed historical strip mine, which has shown great potential to mimic the conditions at FIG. To facilitate this reintroduction work, a formal agreement has been made with PGC allowing FIG staff to devote more time and resources to working with this site. Partnerships with universities and other organizations are also being developed, to increase the ability to address the many demands of a successful reintroduction. Reestablishment of satellite populations elsewhere

would begin the road to recovery for this butterfly and would also satisfy a main goal of USFWS and DoD.

Habitat Expansion

The Wildlife office, in conjunction with Forestry and the ITAM office, work to improve native warm-season grassland conditions throughout the installation. Isolation was cited as a key stressor on population dynamics according to a study by the Natural Academy of Science (Keyghobadi et al. 2006, 2013). Since the first publication, a timber sale in training areas C-5A and C-4 has created a potential corridor between the 3 subpopulations east of the impact area. Success of this was verified during the last MRR (Swartz 2014a) but was limited to RRAs C4, R23, and the Deltas. Native grasses, violets, and forbs quickly filled in gaps out to R23, allowing the smaller subpopulation in C4 to expand with the habitat. The population has increased so much that it is no longer considered marginal.

Additional land clearing efforts and construction have also occurred throughout the east end training areas (B9-12 and R30) but have not produced the same positive effect on population size as other areas on FIG. Here, grassland habitat has been slower to develop, leaving large patches of marginal habitat dominated by invasive vegetation and trees which do not support the different resources required for all life stages of regals. This combined with RRA-B12's already isolated position, appear to hinder population growth as well as dispersal. Regal populations, as well as other disturbance dependent species, exist within a metapopulation structure. This consists of a matrix of various sized habitat pockets that support each other through dispersal. The metapopulation fluctuates over time as satellites populations die off and get re-colonized. Little, if any, movement has been observed between this subpopulation and any other. In fact, comparing mark-recapture datasets over time (Swartz 2010, 2014a) demonstrates a decrease in movement between RRA-B12 and any other RRA.

The increase in fire tempo on Ranges 35 and 36, along with timber clearing and construction of ranges has led to new colonization events and the most significant population increases on the installation. The Range 36 subpopulation (RRAs D1 and D3) has the largest and fastest growing subpopulation on the installation. One area in particular, located in the central part of the range, has driven this trend which can be verified by MRR and transect data . It is situated between the firing line and several targets and burns at least once a year, whether under prescribed fire conditions or fires ignited by training rounds.

In addition, Wildlife staff grow nectar plants and larval host plants from seed or divisions (often through contracted nurseries but also in-house). In the spring and fall, plants are installed in deficient areas on the landscape. Successes include introducing and growing available *Monarda fistulosa* where *Cirsium pumilum* declines and moving *Asclepias incarnata* into areas of the corridor where it hasn't dispersed itself.

Providing a Conservation Benefit to the Species

FIG has set aside 219 acres of core grassland habitat for conservation purposes. It has been divided into separate management units that are part of a long-standing monitoring system that

tracks eastern regal fritillary populations levels at FIG as well as all of the resources it needs for survival. We also have a land management plan that is fully integrated into our own conservation programs as well as the military mission, and a growing reintroduction project that brings together multiple agencies and partners for common conservation purpose.

Providing Certainty that the Management Plan will be Implemented

The management plan does not interfere with training and has been fully integrated into our program for over a decade.

Providing Certainty that the Conservation Effort will be Effective

The regal fritillary conservation project has been operating in its current formulation since the early 2000's and, because of this long-standing monitoring and management project, FIG has been able to successfully maintain the last population of eastern regal fritillaries in the world.

F.3. Golden-winged Warbler

Status

In February 2010, the GWWA was petitioned to be listed under the Endangered Species Act (ESA). In June 2011, the USFWS released its 90 day finding that based on substantial scientific information, listing of the GWWA may be warranted. The GWWA is currently undergoing a 12-month finding based on the petition and if warranted could be listed in FY2024 (USFWS 2021). The GWWA is a rarely observed breeder at FIG. The GWWA requires a mosaic of early successional forest and open (grassland) areas for breeding and foraging and mature forest post-fledging. Challenges facing the GWWA are loss of habitat and the expansion of, and hybridization with the blue-winged warbler (BWWA) (Bakermans et al. 2011). Suitable habitat can be found throughout many training areas at FIG. This habitat also supports an abundant BWWA population resulting in increased opportunities for hybridization.

Advanced stages of replacement have been observed, as described in Dunn and Garrett (1997) wherein backcrossed Brewster's and Lawrence's warblers have become increasingly common. GWWA likely breed on the installation every year, but their presence has only occasionally been detected. Evidence of their presence can be found in the many backcrossed hybrid individuals, Brewster's warblers and Lawrence's warblers, that have been detected over the years. This fits Dunn and Garrett's (1997) description of the late stages of BWWA invasion. GWWA presence on the installation will likely diminish if their prediction is correct.

Studies such as Confer and Knapp (1981), Bulluck (2007), and Larkin and Grata (2009) show that some isolation of the GWWA from the BWWA occurs at higher altitudes, but elevations at FIG only range from 350 feet above mean sea level (msl) to just under 1,400 feet msl. Isolating for GWWA on the ridges is not expected to occur until over 1,900 feet msl (Bulluck 2007). Patton et al. (2010) suggest grass cover and canopy cover play important roles.

FIG is one of only two known breeding locations in Dauphin or Lebanon Counties (Wilson et al. 2012). The area has experienced steep declines since the first breeding bird atlas project in 1984-1989, and GWWA numbers continued to decline through the second breeding bird atlas project in 2004-2009.

Monitoring

There has been limited success in breeding detections through various bird survey techniques including annual installation-wide point count surveys and annual census counts (Derr and Gardner 2020). These surveys can be augmented with audio call surveys (using audio lures to invoke a breeding male response) at known locations to determine occupancy, but GWWA cannot be distinguished from BWWA by song alone. Visual confirmation of species identity is needed since both species and hybrid can sing each other's song.

Once identified, territories may be marked during return visits to the field (Larkin et al. 2011). These locations can be revisited annually, but often male GWWA are displaced by BWWA males and hybrids.

Management

Abundant high-quality GWWA habitat is present at FIG. This habitat is kept open using dormant-season prescribed fire, mechanical treatments, and limited herbicide to reduce invasive species like mile-a-minute that remove understory or limit regeneration. FIG has been identified as a leader in the state for this type of habitat and for our management expertise (Senser 2008, WMI 2014, Latham pers. comm.).

Care to avoid harm to the population and to individual birds is already covered under proper management for compliance with MBTA, but in general, species-specific nesting locations should be marked and avoided when found. Mechanical, combustible, and chemical treatments should maintain a 20 m buffer from a known nesting location.

A focus on restoring habitat with native shrubs and herbaceous plants increases the abundance and diversity of insects feeding on the plants in the GWWA breeding area. This in turn produces better nutrition for developing hatchlings and adults. FIG has a strict policy of using only native plantings within installation boundaries, and the invasive pest management policies target against non-native dominance in the training corridor. This also benefits local insect abundance immediately upon seeding or planting.

Providing a Conservation Benefit to the Species

GWWA habitat is created and maintained through the use of several land management techniques including, but not limited to, prescription and wildland fire, chemical applications including herbicide, and mechanical treatments including invasive species removal and periodic mowing or brush cutting. As succession naturally progresses, these areas become prime breeding habitat and nesting locations. Prime habitat is very difficult to create directly but is also very easy to derive naturally following a proper land-management rotation.

Providing Certainty that the Management Plan will be Implemented

The management plan does not interfere with military training and land use coincides with GWWA habitat and therefore is a good fit for cooperation and funding even without additional effort. If ESA listing occurs, legal status will add to the gravitas of implementation. Coordination with USFWS on both ESA listing and MBTA will ensure compliance with the plan.

Providing Certainty that the Conservation Effort will be Effective

Currently, breeding GWWA are rarely observed on the installation. Breeding males, the easiest individuals to detect, rarely return to the same locations in successive years. Due to the nature of the habitat, documentation of successful nesting efforts and species identification of females is difficult to obtain without disrupting breeding behavior. A limited number of migrating individuals continue to pass through the installation each year, although they are difficult to detect. Monitoring schemes include point-count surveys in early successional habitat (see Becker and Brittingham 2005, McNaughton, Swartz, and Hovis 2011), annual installation-wide point count surveys since 2016 (Derr and Gardner 2020), opportunistic calling surveys, and public data collected in eBird. Declines have followed the pattern of BWWA transition outlined in Peterson's Field Guide to Warblers (Dunn and Garrett 1997), so BWWA and intergrades are also carefully noted.

Ephemeral habitat is difficult to quantify with long-term trends since the habitat is constantly changing. Installation-wide survey efforts will bring some regulation to the data, but with 17,000 acres and a small population, many birds may never be detected. The best course of action is to continue rotating the habitat so that some portion of the installation is able to host the species in any given year. Annual habitat monitoring should continue to produce observations and documentation of breeding males.

F.4. Monarch

Status

On 15 December 2020, USFWS ruled the monarch butterfly (*Danaus plexippus plexippus*) warranted a threatened listing but was precluded at this time due to higher priorities. No rules or regulations exist for this species but its status will be reviewed each year and the Service intends to propose listing the monarch in FY24. NatureServe (2015) ranks the eastern population (Mexican overwintering population) of monarchs as G4/T1 (critically imperiled) but has no national rank status (NNRB) as of yet. It currently has no state ranking (SNRB) either and, like the eastern regal fritillary, is considered orphaned taxa.

The monarch exists in North America as two migratory populations. The main population is in the Mid-Western and Eastern states while the smaller, second one is located on the West Coast into coastal California and adjacent states. Both populations migrate between winter roosting sites in the southern US and Mexico and non-winter foraging/breeding sites further north, extending as far as northern Quebec and British Columbia. Over the past 15 years, the main population has experienced an 80-90% collapse probably due to pesticide use and habitat

conversion, resulting in the massive loss of their host plant, milkweeds (*Asclepias spp*). The spread of disease via monarch rearing programs has also been cited as a source of mortality.

At FIG, during the spring and fall migration periods, monarch butterflies can be seen migrating throughout the installation. The majority are observed in the fall as the population travels from Canada and the northern US to Mexico and the southern US. They occur throughout the installation in open spaces that support its host plant, milkweeds. Habitats such as forest interiors and later successional or overgrown habitats typically do not support milkweeds and thus, do not support reproducing individuals. Their strong flying ability allows them to exploit various habitats and can provide them access to remote areas across the landscape. The full life cycle (from egg to adult) takes about 30 days so each life stage occurs on the installation.

Data collected from annual butterfly monitoring transects corroborate the declining national trend. Declines are not related to military training but to host plant loss in the mid-Western US, illegal logging of roosting habitat in Mexico, and the spread of disease from amateur monarch rearing efforts. Regardless, the ramifications of listing the monarch will directly affect the military mission.

Monitoring

Monarchs were incorporated into the regal fritillary monitoring scheme in 2007 and uses the same methodology. Guidelines for monitoring at FIG can be found in the previous INRMP (2002a) as well as from in-house protocols (Swartz and Tilden 2015a). The Wildlife staff use a modified version of the transect-based system created by Pollard and Yates (1993). With these data, Wildlife staff has started to establish trends in adult abundance over time just as with the regal fritillary. Additional surveys that account for survival of immature stages (egg, larvae, and pupae) are being developed for future inclusion. The effect of herbicide application on host plants (i.e. milkweeds) also needs to be monitored as overuse is likely a leading cause of monarch decline (USDA 2015).

Habitat Management

Essentially, open habitats that support larval (milkweeds) and adult host plants (milkweeds and other wildflowers) are required. Creating this habitat requires disturbance to set back succession; either by military training events or coordinated management activities led by FIG Conservation Staff.

Multiple land management methods are used but typically rely on dormant season prescribed fire to maintain open space throughout most of the training corridor. These areas are actively managed as grassland habitat and meadows dominated by native vegetation such as warm season grasses, milkweeds, and wildflowers. Some of this land is currently managed specifically for the regal fritillary and operates under a 3-5 year fire rotation to maintain grasslands vegetation. Other management methods that maintain or create open habitats involve timber harvesting, mechanical brush removal, and backpack herbicide application. In some cases, aerial herbicide application is used to manage thickets and forest stands. These habitats do not support host plants and, therefore, do not support monarch butterfly.

Providing a Conservation Benefit to the Species

Already established management and monitoring schemes created for regal fritillary conservation (see G.2.) will benefit monarch conservation in a similar fashion. The monitoring scheme allows conservation staff to track population indicators annually while the management plan creates and maintains open, grassland habitats that support host plants as well as training for soldiers.

Providing Certainty that the Management Plan will be Implemented

The management plan is the same used for the regal fritillary since the use very habitats and have similar needs. That plan has been successfully implemented and integrated into FIG's conservation and training programs for over a decade.

Providing Certainty that the Conservation Effort will be Effective

FIG conservation staff have been monitoring and managing for the monarch butterfly for last 10+ years as it has been imbedded into the same scheme used for the eastern regal fritillary project.

F.5. Allegheny Woodrat

Status

The Allegheny woodrat (*Neotoma magister*) is a medium-sized rodent closely associated with rocky habitats (e.g., rock outcrops, cliffs, boulder fields, talus) of the Appalachian Mountains in the eastern United States (Castleberry et al. 2006). Since the late 1970s, this species has experienced population declines throughout much of its historic range, particularly in northern portions including Connecticut and New York where it has been completely extirpated (Balcom and Yahner 1996, Castleberry et al. 2006). A combination of factors have likely contributed to population declines (LoGiudice 2006, Smyser et al. 2012) including habitat loss and fragmentation (Balcom and Yahner 1996, Ford et al. 2006), competition from game species (Balcom and Yahner 1996), increased prevalence of raccoon roundworm (*Baylisascaris procyonis*) (Kazacos 2001, LoGuidice 2003, Page et al. 2012), and reduced hard mast availability following the loss of the American chestnut (*Castanea dentata*) from chestnut blight (Wright and Kirkland 2000), and repeated gypsy moth (*Lymantria dispar*) defoliation of oaks (*Quercus* spp.) (Hall 1988). The Allegheny woodrat has disappeared from many formerly occupied rock islands and corridors in eastern and northwestern Pennsylvania, and currently occupies only roughly half of its historically occupied range within the state (Balcom and Yahner 1996, Butchkoski 2006). As a result, the Allegheny woodrat is currently state-listed as threatened with a state conservation ranking of S2 (imperiled) (PNHP 2020), and it has been designated as a Species of Greatest Conservation Need (PGC-PFBC 2015).

Monitoring

The majority of suitable Allegheny woodrat habitat on Fort Indiantown Gap is located along the ridgeline of Second Mountain, which forms the installation's northern boundary immediately

adjacent to Pennsylvania State Game Lands 211. Most historic habitat sites are located between Cold Springs Road and Trail 35, directly north of the installation's main dudded impact area. More recently, rock outcrops have been located to the west and east in TAs Range 37, D-02, and B-10B. Potential Allegheny woodrat habitat has also been found on Blue Mountain in TA D-04; however, these sites have yet to be surveyed. To date, 23 habitat sites have been located onsite (Hauer et al. 2020).

Live trapping surveys for Allegheny woodrats were conducted in 1999 and 2002 (TNC 2000a, Hart 2002). Due to low capture success in both years, surveys in subsequent years involved searching suitable Allegheny woodrat habitat to locate fresh caches and toilet areas (latrines). In 2010, PADMVA Wildlife staff began using remote game cameras to confirm Allegheny woodrat presence at habitat sites, and game cameras have since been incorporated into annual monitoring efforts following a protocol developed by the PGC (Turner et al 2020). While the number of habitat sites surveyed varies slightly from year to year due to logistical constraints, the proportion of occupied sites has remained relatively stable over the last 5 years, ranging from 50% in 2019 to 71.4% in 2018 (Hauer et al. 2020). Additional live trapping at 6 sites in fall 2019 resulted in the capture of 1 Allegheny woodrat (Britzke 2019).

Management

Management actions that increase the quantity and quality of food resources, particularly hard and soft mast, in forest stands containing and adjacent to active Allegheny woodrat habitat sites will benefit the species (Butchkoski 2006, Hassinger et al. 2008). Prescribed fire may be used to promote the regeneration of hard mast producing tree species (e.g., *Quercus*, *Carya*) (Brose and Van Lear 1998, Brose et al. 2001, Holzmueller et al. 2011, Thomas-Van Gundy et al. 2015) and increase the abundance and diversity of herbaceous understory vegetation (Hutchinson et al. 2005, Holzmueller et al. 2009, Burton et al. 2011, Kinkead et al. 2013), thereby increasing the availability of food and cover for Allegheny woodrats. A recent study conducted by PADMVA Wildlife staff found no effect of repeated prescribed fire on Allegheny woodrat occupancy, however, all occupied sites were in burned areas (Hauer et al. *in press*). PADMVA Wildlife staff are currently managing these stands using low-intensity, dormant season burns on a 3-5 year burn rotation. Removal or selective thinning of non-mast trees may further stimulate oak regeneration by allowing more sunlight to reach the understory. Downed trees should also be retained as they provide protective cover and a substrate for fungi, an important food source for Allegheny woodrats during spring and summer (Butchkoski 2006, Hassinger et al. 2008).

Providing a Conservation Benefit to the Species

Allegheny woodrats have experienced population declines throughout much of their historical range since the 1970s, likely due to a combination of factors. However, the Allegheny woodrat population at Fort Indiantown Gap appears to be relatively stable, and its persistence may be attributed to the installation's fire history. Recent evidence suggests that Allegheny woodrats occupy sites within burned areas as they may provide a greater abundance and diversity of food resources (Hauer et al. *in press*).

Providing Certainty that the Management Plan will be Implemented

FIG has over 20 years of experience monitoring and managing for this species. Future monitoring efforts will be conducted in coordination with the PGC. Data gathered through annual camera-trapping and subsequent habitat surveys will be disseminated to the PGC and other state agency personnel and working groups to aid in the development of regional conservation strategies for this species.

Providing Certainty that the Conservation Effort will be Effective

Future monitoring efforts for Allegheny woodrats on Fort Indiantown Gap will involve annual visual searches and camera-trapping of known habitat sites in late summer – early fall to confirm presence and activity levels. Vegetation sampling may be conducted periodically to assess the effects of habitat management practices (i.e., prescribed fire) on the habitat surrounding occupied sites. PADMVA staff will also continue to search for additional suitable Allegheny woodrat habitat on Second Mountain, as well as Blue Mountain using a combination of aerial imagery, GIS, and field reconnaissance. If suitable rock habitat is found, those sites will be incorporated in annual monitoring efforts.

F.6. Little Brown Bat

Status

The USFWS is currently conducting a discretionary status review of the little brown bat and a listing determination is scheduled for FY2022 (USFWS 2021). The little brown bat was listed as endangered in Pennsylvania in January 2019, has a state conservation ranking of S1 (critically imperiled) (PNHP 2020), and is designated as a Species of Greatest Conservation Need (PGC-PFBC 2016).

The little brown bat was once the most common bat species in Pennsylvania (Merritt 1987). However, the little brown bat has undergone severe population declines due to white-nose syndrome (WNS) and is now threatened with regional extirpation (Frick et al. 2010). Since the initial onset of WNS in Pennsylvania in 2009, statewide captures of little brown bats during summer mist-netting surveys have declined significantly from 3.24 to 1.28 captures/1,000UE (Butchkoski and Bearer 2016). A 99.5% decline in little brown bats has been observed at 93 hibernacula in the state (Scafini and Turner 2019).

Monitoring

Prior to WNS, little brown bats were relatively common on Fort Indiantown Gap, comprising 15% (n = 34) of mist-net captures (TNC 2000a, TNC 2001, Bat Conservation and Management, Inc., 2004). However, only 1 little brown bat has been captured onsite since 2004. To date, no little brown bat maternity roosts have been confirmed onsite, but a roost was found 1.5 km from the installation in 2021.

Little brown bats are infrequently detected onsite, comprising only 0.1% of total identified passes in 2018-2020. Each year, little brown bats were first detected on the installation in late

April – early May, and they remained active on the installation until late September – early October. The probability of detecting little brown bats was highest during the fall season (16 August – 31 October) in 2019 and 2020, which may be indicative of fall migratory movements through the installation. It must be noted that the echolocation calls of Indiana bats and little brown bats are nearly indistinguishable, therefore we conservatively group these species together into a single species group for reporting purposes. Recorded calls of these two species are presumed to be little brown bats, and until an Indiana bat is physically captured and identified in-hand, the species is not considered to occur on the installation.

Management

Habitat management as described in the northern long-eared bat section will also benefit little brown bats. Little brown bats are known to roost and form maternity colonies in human-made structures during the summer. Several buildings in Cantonment (Quarters 15, Quarters 38, Bldg. 8-72) are currently in use by big brown bats during the summer and are monitored annually. If any bats are discovered during the demolition or repair of buildings, all work must cease, and Fort Indiantown Gap's Wildlife or Integrated Pest Management Office must be immediately contacted to have them humanely captured and removed. If colonies of bats are found in structures and there is a requirement to evict/exclude them, any actions should only be done after prior coordination with Fort Indiantown Gap's Wildlife or Integrated Pest Management office. Bat evictions/exclusions may not be performed during the summer maternity season (1 April – 31 August) (WNS Conservation and Recovery Working Group 2015). While unlikely for little brown bats, big brown bats will regularly hibernate in man-made structures. Thus, evictions/exclusions should also be avoided during the winter months if there is evidence of winter bat use in a structure (WNS Conservation and Recovery Working Group 2015). No lethal control methods are permitted for bats unless there is a suspected human health risk for exposure to rabies or other diseases.

Providing a Conservation Benefit to the Species

Populations of little brown bats have undergone precipitous declines throughout the northeastern United States since 2006-2007 as the result of white-nose syndrome. As such, the maintenance of high-quality, forested habitat for roosting and foraging will be particularly important for the conservation and recovery of this species. This will be accomplished through forest management best practices including prescribed fire and mechanical thinning. The installation of bat boxes in known use areas will also provide artificial roosting habitat for this species.

Providing Certainty that the Management Plan will be Implemented

PADMVA Wildlife staff will coordinate directly with the USFWS on possible, upcoming species listings and will conduct Section 7 consultation when needed. Additionally, PADMVA Wildlife staff will also coordinate with the PGC regarding current monitoring efforts. This document sets forth a regulatory requirement to meet the management plan recommendations outlined within several sections of this INRMP.

Providing Certainty that the Conservation Effort will be Effective

Since 2018, a long-term bat monitoring plan has been implemented to determine the current distribution and seasonal activity patterns of little brown bats onsite, and to determine the potential effects of land management practices and military training activities on habitat use of this species (Powers 2018). This plan incorporates multiple field methodologies (e.g., mist-netting, acoustic monitoring, radiotelemetry, emergence counts) following guidance provided by the PGC, USFWS (2020) and NABat (Loeb et al. 2015). This plan will enable the collection of extensive, long-term data to track changes in Fort Indiantown Gap's bat populations over time and will also contribute to national and international initiatives (e.g., Motus, NABat). The plan will be updated and refined by PADMVA Wildlife staff on an annual basis.

F.7 Tri-colored Bat

Status

In June 2016, the Center for Biological Diversity (CBD) and Defenders of Wildlife (DOW) petitioned the USFWS to list the tri-colored bat as endangered or threatened based on Factors A, C, and E in section 4(a)(1) of the Endangered Species Act (CBD/DOW 2016). The USFWS is conducting a 12-month finding on the petition and a listing determination is scheduled for FY2022 (USFWS 2021). The tri-colored bat was listed as endangered in Pennsylvania in January 2019, has a state conservation ranking of S1 (critically imperiled) (PNHP 2020), and is designated as a Species of Greatest Conservation Need (PGC-PFBC 2015).

The tri-colored bat has undergone severe population declines throughout the eastern U.S. due to white-nose syndrome (WNS) (Ingersoll et al. 2013). Since the initial onset of WNS in Pennsylvania in 2009, statewide captures of tri-colored bats during summer mist-netting surveys have declined significantly from 0.11 to 0.05 captures/1,000UE (Butchkoski and Bearer 2016). A 92.5% decline in tri-colored bats has been observed at 93 hibernacula in the state (Turner and Scafini 2019).

Monitoring

Only six tri-colored bats have been captured onsite since 1999, suggesting that this species was probably never common onsite even before WNS (TNC 2000a, Bat Conservation and Management, Inc., 2004, Hauer et al. 2019).

Tri-colored bats are infrequently detected onsite, comprising only 0.4% of total identified passes in 2018-2020, with 96.3% of identified passes recorded at one site along Indiantown Run in TA B-06A. Each year, tri-colored bats were first detected on the installation in mid-April – early May, and they remained active on the installation through much of October (Hauer et al. 2020).

PADMVA Wildlife staff have identified the approximate locations (via triangulation) of eight day-roost trees, four of which were used by a juvenile female tri-colored bat captured in August 2019, and four for an adult female tri-colored bat captured at the same site in June 2021. All eight roosts were located near the capture site within mature, mixed-hardwood forests along

Indiantown Run in TA B-08, B-06A, and A-34 (Hauer et al. 2019, Hauer et al. 2021, unpublished data).

The results of recent mist-netting surveys, acoustic monitoring, and radio-telemetry day-roost searches indicate that the distribution of tri-colored bats on Fort Indiantown Gap may largely be restricted to riparian forested habitats in Cantonment, particularly along Indiantown Run where it feeds into Marquette Lake and Memorial Lake.

Management

Habitat management as described in the northern long-eared bat section will also benefit tri-colored bats.

Providing a Conservation Benefit to the Species

Populations of tri-colored bats have undergone precipitous declines throughout the northeastern United States since 2006-2007 as the result of white-nose syndrome. As such, the maintenance of high-quality, forested habitat for roosting and foraging will be particularly important for the conservation and recovery of this species. This will be accomplished through forest management best practices including prescribed fire and mechanical thinning.

Providing Certainty that the Management Plan will be Implemented

PADMVA Wildlife staff will coordinate directly with the USFWS on possible, upcoming species listings and will conduct Section 7 consultation when needed. Additionally, PADMVA Wildlife staff will also coordinate with the PGC regarding current monitoring efforts. This document sets forth a regulatory requirement to meet the management plan recommendations outlined within several sections of this INRMP.

Providing Certainty that the Conservation Effort will be Effective

Since 2018, a long-term bat monitoring plan has been implemented to determine the current distribution and relative abundance of tri-colored bats onsite, and to determine the potential effects of land management practices and military training activities on habitat use of this species (Powers 2018). This plan incorporates multiple field methodologies (e.g., mist-netting, acoustic monitoring, radiotelemetry, emergence counts) following guidance provided by the PGC, USFWS (USFWS 2020) and NABat (Loeb et al. 2015). This plan will enable the collection of extensive, long-term data to track changes in Fort Indiantown Gap's bat populations over time and will also contribute to national and international initiatives (e.g., Motus, NABat). The plan will be updated and refined by PADMVA Wildlife staff on an annual basis.

F.8 Eastern Small-Footed Bat

Status

In 2010, the Center for Biological Diversity (CBD) petitioned the USFWS to list the eastern small-footed bat as endangered or threatened (Matteson 2010). In a 12-month petition finding, the USFWS found that listing of the species was not warranted. The eastern small-footed bat is listed as threatened in Pennsylvania with a state conservation ranking of S2 (imperiled) (PNHP 2020), and it has been designated as a Species of Greatest Conservation Need (PGC-PFBC 2015).

The eastern small-footed bat has been historically rare throughout eastern North America (Best and Jennings 1997), and little is currently known about its foraging and roosting habits during summer (Gannon and Bovard 2016). Current threats to the eastern small-footed bat include disturbance and destruction of hibernacula, loss of foraging habitat (i.e., forested areas with abundant rock outcrops), and white-nose syndrome (WNS). While susceptible to WNS, eastern small-footed bats have not exhibited mass mortality like other *Myotis* species, possibly due to its propensity to roost solitarily in colder, drier areas near the entrances of hibernacula, and its relatively short hibernation period (Whidden 2010).

Monitoring

There were no occurrence records of eastern small-footed bats on Fort Indiantown Gap until 2014, when 1 individual was captured over a boulder field in TA D-03D (BCM 2014, unpublished data). A pregnant female eastern small-footed bat was also captured in May 2017 (also in D-03D) (Hauer et al. 2017). Long-term, stationary acoustic monitoring in 2018-2020 revealed peaks in nightly activity of eastern small-footed bats in late spring (mid-May – early June) and early fall (mid-September – mid-October). Eastern small-footed bats were first detected between 6-8 April and appeared to remain active on the installation until mid- to late October each year. Eastern small-footed bats are infrequently detected onsite, comprising only 1.3% of total identified passes, 99% of which were recorded at 1 site in TA D-03D (Hauer et al. 2020). Thus, the distribution of eastern small-footed bats appears to be restricted to the western end of the training corridor, where rock habitat is more prevalent. To date, no eastern small-footed bat roosts have been confirmed onsite.

Management

Habitat management as described in the northern long-eared bat section will also benefit eastern small-footed bats. A particular focus should be placed on the management of forest stands containing or near rock outcrops and boulder fields, as these areas may serve as summer roosting habitat for this species.

Providing a Conservation Benefit to the Species

Populations of eastern small-footed bats have undergone declines throughout the northeastern United States since 2006-2007 as the result of white-nose syndrome. As such, the maintenance of high-quality, forested habitat for roosting and foraging will be particularly important for the conservation and recovery of this species. Eastern small-footed bats have largely benefitted from current forest management practices (e.g., prescribed fire, mechanical thinning) as well as the

construction of training ranges which exposed rock habitat preferred by this species. Nightly activity of eastern small-footed bats was higher at sites following a shelterwood preparatory cut performed in 2019 when compared to pre-harvest (2017-2018) activity levels at the same sites (Hauer et al. 2019).

Providing Certainty that the Management Plan will be Implemented

Little information exists on foraging and roosting habitat use by eastern small-footed bats onsite and statewide. Data gathered through acoustic and/or mist-netting surveys will be disseminated to the PGC and will help to inform future conservation and management efforts for this species.

Providing Certainty that the Conservation Effort will be Effective

Since 2018, a long-term bat monitoring plan has been implemented to determine the current distribution and relative abundance of eastern small-footed bats onsite, and to determine the potential effects of land management practices and military training activities on habitat use of this species (Powers 2018). This plan incorporates multiple field methodologies (e.g., mist-netting, acoustic monitoring, radiotelemetry, emergence counts) following guidance provided by the PGC, USFWS (USFWS 2020) and NABat (Loeb et al. 2015). This plan will enable the collection of extensive, long-term data to track changes in Fort Indiantown Gap's bat populations over time and will also contribute to national and international initiatives (e.g., Motus, NABat). The plan will be updated and refined by PADMVA Wildlife staff on an annual basis.

F.9. Spotted Turtle

Status

In July 2012, the Center for Biological Diversity (CBD) petitioned the USFWS to list 53 species of amphibians and reptiles, including the spotted turtle, as endangered or threatened based on Factors A, B, D, and E in section 4(a)(1) of the Endangered Species Act (Adkins Giese 2012). In a 90-day petition finding, the USFWS determined that listing of the species may be warranted, and a listing determination is scheduled for FY2023 (USFWS 2021). NatureServe ranks the spotted turtle as globally secure (G5) and nationally secure (N5). The spotted turtle has a state conservation ranking of S3S4 (vulnerable/apparently secure) and is designated as a Species of Greatest Conservation Need (PGC-PFBC 2015). Similar to wood turtles, spotted turtle populations have undergone significant declines throughout much of their geographic range, largely due to habitat loss and destruction, overexploitation for the pet trade, nest predation, and road mortality (Adkins Giese 2012).

The spotted turtle has been confirmed present on 40 military installations throughout its geographic range (DoD PARC 2019).

Monitoring

Since 2003, PADMVA Wildlife staff have conducted annual, installation-wide mark-recapture surveys of all turtle species, including spotted turtles. Spotted turtles encountered in the field are marked using carapace notches (Cagle 1939), and other pertinent morphometric data is collected. Approximately 75 unique spotted turtles have been encountered and marked onsite since 2003 (PADMVA Wildlife, unpublished data).

PADMVA Wildlife staff conducted a radio-telemetry study from 2015-2017 to determine home ranges, movements, and seasonal activity patterns of spotted turtles onsite. A total of 12 individuals were captured, marked, and radio-tagged in 4 training areas (Area 14, Range 23, Range 30, C-04) with known spotted turtle subpopulations. Radio-tagged turtles were relocated once per week during the active season each year. Preliminary analyses revealed that spotted turtles had relatively small home ranges and largely remained within 50 m wetland and stream buffers (PADMVA Wildlife, unpublished data).

In 2019, PADMVA Wildlife staff participated in and contributed data to a regional spotted turtle status assessment developed by the Northeast Spotted Turtle Working Group (Spotted Turtle Working Group 2019). This assessment uses a standardized, trap-based protocol for sampling for spotted turtles within potential habitat (Spotted Turtle Working Group 2019). PADMVA Wildlife staff conducted 3 4-night trapping periods during the active season in 2 training areas (B-12A and C-04). A total of 16 spotted turtles were captured during this survey (Picone 2019). In spring 2021, PADMVA Wildlife staff will conduct additional trapping (including several new sites) as part of a population assessment of spotted turtles on military installations led by the Smithsonian Conservation Biology Institute.

Management

Spotted turtles inhabit slow moving, shallow bodies of water with soft bottoms and aquatic vegetation including wet meadows, woodland streams, swamps, ephemeral pools, and small ponds. They also utilize open upland habitats when traveling between wetland areas, when migrating from hibernacula to spring-summer habitats, and for aestivation and nesting. Radio-telemetry data collected 2015-2018 will be analyzed in FY22 to determine distances traveled. Spotted turtles are active from March – October/November, with activity peaking in May when ambient temperatures are 13-18°C (Ernst and Lovich 2009).

The following best management practices will be implemented to minimize adverse impacts to spotted turtle populations on FIG, following guidelines developed by DoD PARC (2019):

- Protect upland, terrestrial habitats surrounding wetlands and ensure connectivity between adjacent wetlands.
- Maintain a 300-foot buffer around wetlands known to be occupied by spotted turtles.
- If possible, avoid use of military and other vehicles in wetland areas.
- Forest management (e.g., mechanical thinning, prescribed fire) can enhance spotted turtle habitat and may be required to slow habitat succession. However, these practices should be restricted within 300 ft of wetlands known to be occupied by spotted turtles during the active season (March – October). Instead, management should occur over the winter when spotted turtles are inactive and overwintering in wetland areas.

- If possible, manage fields via mowing during the winter months. Avoid mowing fields from late May through July when spotted turtles are nesting.

Providing a Conservation Benefit to the Species

The spotted turtle population on Fort Indiantown Gap will benefit from proactive, adaptive management of wetlands and wet meadow habitats. PADMVA Wildlife staff will consider various nest protection strategies if active nests are found onsite. Possible strategies include predator exclusion, head-starting, and temporary training restrictions surrounding nests. These strategies will not be enacted without prior consultation with the PFBC and USFWS. PADMVA Wildlife staff will coordinate directly with the USFWS on possible, upcoming species listings and will conduct Section 7 consultation/engage in a Section 7 conference if the spotted turtle is proposed for listing. Additionally, PADMVA Wildlife staff will also coordinate with the PFBC regarding current monitoring efforts.

Providing Certainty that the Management Plan will be Implemented

The management plan is a commitment under the Sikes Act, the Endangered Species Act, and Pennsylvania Code. Multiple organizations have oversight and regulatory responsibilities to hold FIG to its commitments. Further, if critical habitat is designated for this species, protection/conservation of such habitat would likely be covered by several wetlands' regulations. As the PAARNG has a federal mission, FIG/PADMVA are held to the standard of the Executive Orders for wetland conservation above and beyond the standard codes.

Providing Certainty that the Conservation Effort will be Effective

PADMVA Wildlife staff commit to the continuation of installation-wide mark-recapture surveys for all turtle species, including spotted turtles. Mark-recapture data will be analyzed periodically to determine population estimates and track long-term population trends. PADMVA Wildlife staff will also complete analyses of radio-telemetry data collected in 2015-2017 to inform future conservation efforts and potential training restrictions. PADMVA Wildlife staff will continue to contribute data to regional monitoring and conservation efforts for this species as well.

F.10. Wood Turtle

Status

In July 2012, the Center for Biological Diversity (CBD) petitioned the USFWS to list 53 species of amphibians and reptiles, including the wood turtle, as endangered or threatened based on Factors A, B, C, D, and E in section 4(a)(1) of the Endangered Species Act (Adkins Giese 2012). In a 90-day petition finding, the USFWS determined that listing of the species may be warranted, and a listing determination is scheduled for FY2023 (USFWS 2021). NatureServe ranks the wood turtle as globally vulnerable (G3) and nationally vulnerable (N3). The wood turtle has a state conservation ranking of S3S4 (vulnerable/apparently secure) and is designated as a Species of Greatest Conservation Need (PGC-PFBC 2015). Wood turtle populations have undergone

significant declines throughout much of their geographic range, largely due to habitat loss and destruction, overexploitation for the pet trade, and predation (Adkins Giese 2012).

The wood turtle has been confirmed present on 13 military installations throughout its geographic range, and it may be present on an additional 26 installations (DoD PARC 2019).

Monitoring

Since 2003, PADMVA Wildlife staff have conducted annual, installation-wide mark-recapture surveys of all turtle species, including wood turtles. Wood turtles encountered in the field are marked using carapace notches (Cagle 1939), and other pertinent morphometric data is collected. Approximately 225 unique wood turtles have been encountered and marked onsite since 2003, with an average of 23 individuals encountered per year over the last 6 years (PADMVA Wildlife, unpublished data).

PADMVA Wildlife staff have participated in and contributed data to a regional status assessment that was first developed by the Northeast Wood Turtle Working Group in 2012. This assessment uses a standardized monitoring protocol to survey 1-km stream segments of suitable wood turtle habitat (Jones et al. 2018). PADMVA Wildlife staff have conducted 87 visual encounter surveys of 10 1-km stream segments of 6 streams in 2013-2020 (except for 2017), resulting in 42 wood turtle encounters (Shinskie et al. 2020).

Management

Wood turtles overwinter and mate in slow moving, cold water streams, but they utilize a variety of terrestrial landscapes ranging from early successional habitats (e.g., open fields, shrublands) to mature forests for both foraging and nesting throughout the remainder of the year (Jones et al. 2018). For much of the active season (March – October), wood turtles typically remain close to overwintering streams, with most activity occurring within 300 ft of streams (Jones 2009, Parren 2013). During the nesting period (mid-May – mid-July), however, females may travel far (up to 600 m) from overwintering streams in search of suitable nesting habitat (Steen et al. 2012). Thus, wood turtles (particularly females) may be especially vulnerable to human-related activities (e.g., forest management, mowing, military field training exercises and bivouacking) during the summer months if these activities occur near wood turtle streams.

The following best management practices will be implemented to minimize adverse impacts to wood turtle populations on Fort Indiantown Gap, following guidelines in Jones et al. (2018) and DoD PARC (2019):

- Maintain unfragmented, riparian buffers ≥300 ft along wood turtle streams.
- Forest management (e.g., mechanical thinning, prescribed fire) can enhance wood turtle habitat, but should be restricted within 300 ft of wood turtle streams during the active season (March – October). Instead, management should occur over the winter when wood turtles are inactive and largely restricted to streams.
- If possible, manage fields via mowing during the winter months. If mowing occurs during the active season, decks ≥8 inches high should be used and mowing should occur during the hottest times of the day when wood turtles avoid open areas.

- Where practical, limit road construction within 300 ft of wood turtle streams and use existing roads and trails for military training activities.

Providing a Conservation Benefit to the Species

The major benefit to the wood turtle population on FIG is the protection and enhancement of high-quality overwintering and nesting habitats. Through the careful application of management treatments, utilization of best management practices, and conservation from perceived threats, FIG provides the species with necessary habitat requirements to ensure long-term population persistence. PADMVA Wildlife staff will coordinate directly with the USFWS on possible, upcoming species listings and will conduct Section 7 consultation when needed. Additionally, PADMVA Wildlife staff will also coordinate with PFBC regarding current monitoring efforts.

Providing Certainty that the Management Plan will be Implemented

The management plan is a commitment under the Sykes Act, the Endangered Species Act, and Pennsylvania Code. Multiple organizations have oversight and regulatory responsibilities to hold FIG to its commitments. Further, if critical habitat is designated for this species, protection/conservation of such habitat would likely be covered by several wetlands' regulations. As the PAARNG has a federal mission, FIG/PADMVA are held to the standard of the Executive Orders for wetland conservation above and beyond the standard codes.

Providing Certainty that the Conservation Effort will be Effective

PADMVA Wildlife staff commit to the continuation of installation-wide mark-recapture surveys for all turtle species, including wood turtles. Mark-recapture data will be analyzed periodically to determine population estimates and track long-term population trends. PADMVA Wildlife staff will continue to contribute data to regional-scale monitoring and conservation efforts for this species as well.

F.11. Red-Bellied Cooter

Status

In April 2010, the Center for Biological Diversity (CBD) petitioned the USFWS to list 404 species of amphibians and reptiles, including the northern red-bellied cooter, as endangered or threatened based on Factors A, B, C, D, and E in section 4(b)(3)(A) of the Endangered Species Act (Adkins Giese 2012). In a 90-day petition finding, the USFWS determined that listing of the species may be warranted and scheduled a listing determination for FY2023 (USFWS 2021). The northern red-bellied cooter, also known as redbelly turtle, is listed as Near Threatened (NT) on the IUCN Red List (van Dijk 2011). NatureServe ranks the northern red-bellied cooter as globally secure (G5) and nationally secure (N5). The northern red-bellied cooter has a legal status of State Threatened (PT), a state conservation ranking of S2S3 (imperiled/vulnerable) and is designated as a Species of Greatest Conservation Need (PGC-PFBC 2015). Like wood and spotted turtles, northern red-bellied cooter populations are significantly affected by habitat

degradation, loss, and destruction, collection for the pet trade, nest predation, competition with invasive species, and road mortality (Adkins Giese 2012).

The northern red-bellied cooter has been confirmed present on 27 military installations across its geographic range (Petersen et al. 2018).

Monitoring
One individual was confirmed on the installation in April 2017. A few other sightings have occurred in subsequent years. Monitoring surveys will begin in FY22 with the intent to add individuals to the ongoing mark-recapture program. These surveys will also inform our knowledge of the population.

Management

Northern red-bellied cooters inhabit permanent aquatic bodies of water, including large deep ponds and lakes. They occur in tannin-stained (black water) habitats, open-water kettle ponds, and slow-moving river stretches. They tend not to inhabit ephemeral wetlands. They require abundant aquatic vegetation as it provides important cover for hatchlings and subadults.

Northern red-bellied cooters bask frequently throughout the year, which is when they are most often detected. Females can be encountered on land during the nesting season, where they nest in open canopy sites such as agricultural fields and the edges of roads. Nests are constructed in the spring, but nesting can occur from May – August (usually June) (Ernst and Lovich 2009). Northern red-bellied cooters are active from March/April – October.

The following best management practices will be implemented to improve knowledge of population and minimize adverse impacts to northern red-bellied cooters on FIG, following guidelines developed by DoD PARC (2020):

- Conduct visual surveys to document occurrence and identify habitats. Add individuals to the ongoing mark-recapture program and use this data to monitor population trends.
- Protect habitats by identifying and mitigating pollution inputs when possible.
- Protect individuals by identifying and controlling invasive species.
- Protect individuals against poaching activity or harm due to heavy recreational fishing.

Providing a Conservation Benefit to the Species

The northern red-bellied cooter population on Fort Indiantown Gap will benefit from proactive, adaptive management of deep-water habitats. PADMVA Wildlife staff will consider various nest protection strategies if active nests are found onsite. Possible strategies include predator exclusion, head-starting, and temporary training restrictions surrounding nests. These strategies will not be enacted without prior consultation with the PFBC and USFWS. PADMVA Wildlife staff will coordinate directly with the USFWS on possible, upcoming species listings and will conduct Section 7 consultation when needed. Additionally, PADMVA Wildlife staff will also coordinate with the PFBC regarding current monitoring efforts.

Providing Certainty that the Management Plan will be Implemented

The management plan is a commitment under the Sykes Act, the Endangered Species Act, and Pennsylvania Code. Multiple organizations have oversight and regulatory responsibilities to hold FIG to its commitments. Further, critical habitat for this species is likely to be covered by several wetlands' regulations. As the PAARNG has a federal mission, FIG/PADMVA are held to the standard of the Executive Orders for wetland conservation above and beyond the standard codes.

Providing Certainty that the Conservation Effort will be Effective

PADMVA Wildlife staff commit to the continuation of installation-wide mark-recapture surveys for all turtle species. Mark-recapture data will be analyzed periodically to determine population estimates and track long-term population trends. PADMVA Wildlife staff will continue to contribute data to regional monitoring and conservation efforts for this species as well.

F.12. Frosted Elfin

Status

The frosted elfin butterfly (*Callophyrus irus irus*) has been part of an on-going, proactive assessment by USFWS since 2018. NatureServe ranks this species as critically imperiled globally (G2), nationally (N3), and on the state level (S1S2). Habitat loss is the driving force behind the decline throughout its range (NatureServe 2021).
At FIG, the host plant is wild indigo (*Baptisia tinctoria*) which thrives on recently disturbed, low nutrient soils. Adults are in flight during the early Spring (April-May) while larvae can be observed soon after and into June. Neither are found away from host plant patches. Pupae remain in the leaf litter on the soil surface until the following spring.

In the early 1990's, PA Natural Heritage Staff (now Western PA Conservancy) performed Flora and Fauna surveys to assess the biodiversity on the installation. While working at Range 24 in early May, biologists documented a lone frosted elfin adult among a large patch of wild indigo plants down range. Subsequent ad-hoc surveys were unable to relocate this species, and in more recent times (2018 and on), systematic surveys have been conducted; thus far without success. It is unlikely that this species still exists at FIG due to the high fire frequency at the historic site and other locations that support host plants.

Monitoring

Since 2019, FIG staff and contractors have been performing occupancy surveys as access and weather allows. The dangerous nature of the survey location and difficult access makes formal surveys exceptionally hard to do. FIG Conservation staff and contractors will continue to perform surveys into the foreseeable future.

Management
N/A

Providing a Conservation Benefit to the Species

N/A

Providing Certainty that the Management Plan will be Implemented
N/A

Providing Certainty that the Conservation Effort will be Effective
N/A

F. 13 American Bumble Bee

Status

On 1 February 2021, The Center for Biological Diversity submitted a petition to USFWS to list the American bumble bee (Bombus pensylvanicus). On 29 September 2021, USFWS ruled that a 90-day finding was substantial triggering an SSA. It is considered vulnerable globally (G3) with no state ranking (SNR) at this time.

Bombus pensylvanicus was likely the most common bumble bee in North America until the late 1990's (NatureServe 2021). Habitat loss, pesticide use, and Nosema infections are the main contributors to population declines. Preferred habitat includes grasslands and wildflower meadows that support nectar plants as well as areas that support above ground nests.
Recent bee surveys at FIG have found this species in 2016 and 2017. In 2016, the first sighting was made in the summer by a contractor down range on Range 36 in a patch of flowers close to the firing line. In 2017, another contractor made 2 sightings in late summer in regal fritillary habitat in Bravo 12 just south of the Conservation office building.

Monitoring

We do not have regular monitoring system for this species. We conduct periodic surveys on pollinator networks as related to the regal fritillary and monarch butterflies. This allows us to track observations and behaviors of numerous non-target species that includes bees and other potential pollinators of grassland wildflowers.

Management
N/A

Providing a Conservation Benefit to the Species
N/A

Providing Certainty that the Management Plan will be Implemented
N/A

Providing Certainty that the Conservation Effort will be Effective
N/A

Appendix G. Constraints/Restrictions to Military Mission

Please also refer to map (page J-3) in Appendix J.

G.1. Northern Long-Eared Bat

While not prohibited under the final 4(d) rule (U.S. Department of Interior 2016), the USFWS recommends that military smoke and obscurants, particularly M18 colored smoke grenades and white phosphorus, not be used within suitable forested northern long-eared bat habitat during the active season (1 April – 31 October) to reduce adverse impacts to roosting bats.

While there is some evidence to suggest that anthropogenic noise may influence bat foraging behavior (Schaub et al. 2008, Siemers and Schaub 2011), noise resulting from military training activities at firing and maneuver ranges and hovering aircraft is unlikely to adversely affect northern long-eared bats (U.S. Army Environmental Command 2015). Northern long-eared bat roosts located onsite in 2017 and 2018 were found in TA A-32, near the Muir Army Airfield. In addition, results from acoustic and mist-netting surveys from 2016-2020 indicate that Acorn Road and the surrounding forest provides quality bat foraging habitat despite being next to the airfield.

G.2. Eastern Regal Fritillary

Areas identified as being part of the 219 acres of Regal Research Area (RRA) and delineated as such in the field are not available for heavy or wheeled maneuver, bivouacking, helicopter landing, or artillery firing positions. These areas are not removed entirely from training, as they can be used for a variety of purposes including, but not limited to, being downrange as part of the impact area for that range, light maneuver (on foot), drop zones, and simulation use as minefield or other operational impediment. Restrictions have not impacted military training because work arounds have ensured military training is not compromised. In addition, eastern regal fritillary-occupied acreage outside the 219 acres has maintained persistent populations whose range has expanded over the last 20+ years of monitoring.

USFWS is recognizing the regal fritillary as two distinct subspecies: eastern (S. i. idalia) and western (S. i. occidentalis). Both are currently under a Species Status Assessment (SSA) with a decision coming in 2021 (Gates, 2021). FIG has the only remaining population of the eastern subspecies. Should it become listed, there will likely be additional pressure to conserve and manage for this species in additional areas at FIG, likely around areas already occupied with established populations. This may interfere with training activities and future planning around currently established RRA's. An extremely small, highly erratic population located along Range Road behind Ranges 8 and 9 may also create additional restrictions though, we still do not know if this is truly a separate population or if it's just population dispersal from RRA's.

G.3. Golden-winged warbler

To date, no habitat restrictions have been proposed for the GWWA. Current land-management practices in support of the military mission favor the creation and maintenance of GWWA habitat. Slowing the management cycles or containing the extent of the management footprint for any reason would impact not only GWWA habitat use, but also the military training cycle that has direct implications on military readiness.

Unanticipated breaks in the training cycle can also have a negative feedback on habitat response. Maintenance requests, direct impacts from the trainers, and indirect impacts such as fire all help to manage the brush and invasive species in those locations.

G.4. Monarch Butterfly

In December 2020, The monarch butterfly was found to be warranted for a threatened listing but was precluded due to higher priorities at USFWS. . Therefore, there are no restrictions on the military mission. Should USFWS officially list the species and create a legal framework for conservation, it could prove to have the most severe restrictions on training and operations.

Restriction concerns come from both the monarch itself and its host plant, milkweed. Adults begin migrating through south-central PA as early as May and are present until freezing weather arrives in October and November. During this time, they are free-flying adults that nectar from milkweeds, thistles, and other assorted grassland and meadow wildflowers, reaching peak densities at FIG between late summer and early fall. With adults comes reproduction. Eggs are deposited and larvae develop continuously throughout the adult flight season making conflict unavoidable regardless of life stage. FIG hosts 5 species of milkweed which are ubiquitously distributed across the installation on training lands as well as right of ways to reach those training lands. The most wide-spread species on the installation, common milkweed, forms wide spreading clonal colonies that readily spread across disturbed and poor-quality soils, which is a dominant soil type at FIG.

During the flight season, restrictions to training may impair tracked- and wheeled-vehicle maneuvers, helicopter operations, and live-fire events. Furthermore, the use of herbicides and other forms of vegetation management used to control obstacles and open travel lanes may also see some restriction. The monarch butterfly is migratory; none are on site during the winter and early spring (about November-April), therefore no restrictions during that timeframe.

G.5. Allegheny Woodrat

The Allegheny woodrat currently poses no restrictions on the military mission. Should this species be listed, it could prove to have restrictions on military training and operations. However, the majority of suitable Allegheny woodrat habitat and all known habitat sites onsite are located along the ridgeline of Second Mountain, where military training and operations are unlikely to impact woodrats or their habitat.

G.6. Little Brown Bat

The little brown bat currently poses no restrictions on the military mission, as it is covered under management and conservation measures already in place for the northern long-eared bat. Should the species be listed, it could prove to have restrictions on military training and operations. FIG will engage in a Section 7 consultation if listing occurs.

Little brown bats are known to roost and form maternity colonies in human-made structures during the summer months. Military personnel may encounter roosting bats in occupied buildings. All bats found in buildings should be immediately reported to Fort Indiantown Gap's Wildlife or Integrated Pest Management office, so they can be humanely captured and removed.

Field structures such as equipment and ammunition bunkers, magazines, and other similar structures may also be unusable during the pup (1 June – 31 July) or hibernation (1 November – 31 March) seasons, if occupied by bats. However, recent inspections of such structures (e.g., ASP, FO bunker) by PADMVA Wildlife staff have not revealed evidence of recent use by bats.

G.7. Tri-colored Bat

The tri-colored bat currently poses no restrictions on the military mission, as it is covered under management and conservation measures already in place for the northern long-eared bat Should the species be listed, it could prove to have restrictions to military training and operations. FIG will engage in a Section 7 consultation if listing occurs.

G.8. Eastern Small-Footed Bat

The eastern small-footed bat currently poses no restrictions on the military mission.

G.9. Spotted Turtle

To date, no habitat restrictions have been proposed for the spotted turtle. There is the potential for conflict between spotted turtles and military maneuver, bivouac, and field training exercises during the active season. If the species were to be listed, seasonal restrictions on military training in areas immediately adjacent to occupied wetlands may be imposed. However, military training is already restricted in wetland areas under federal law and DoD policy.

PADMVA Wildlife staff initiated a radio-telemetry study in 2015 to determine home range sizes and movement patterns of spotted turtles in order to identify potential areas of conflict. While analysis of these data has not yet been completed, preliminary results suggest that conflict with military training activities would likely be minimal as spotted turtles largely remained within wetland boundaries and stream buffers.

G.10. Wood Turtle

There is potential for conflict between wood turtles and military maneuver, bivouac, and field training exercises during the summer (May – July) nesting period when wood turtles, particularly females, disperse from overwintering streams and are more widely distributed on the landscape. No habitat restrictions have been proposed for the wood turtle to date. If the species were to be listed, formal consultation would address installation missions and proposed actions, and could impose additional seasonal restrictions on military training in areas immediately adjacent to wood turtle streams. Road mortality from vehicle collisions is one of the greatest threats to wood turtles on FIG, as many roads and trails onsite are located immediately adjacent to or intersect wood turtle streams.

G.11 Red-Bellied Cooter

The northern red-bellied cooter is a state-listed species and is to be protected from human conflict, such as poaching, recreational fishing pressures, and road mortalities. If the species were to be listed, formal consultation would address installation missions and proposed actions, and could impose seasonal restrictions on military training in habitat-adjacent areas. Currently there are no training restrictions associated with the northern red-bellied cooter or its habitat.

G.12. Timber Rattlesnake

The timber rattlesnake is a state protected species and is not to be harmed, hunted, or harassed (FIG Outdoor Recreation Regulation 215-2). Attention should be given out of concern for potential rattlesnake/human conflicts. FIG employees and soldiers training at FIG are informed prior to entering the field/training environment that rattlesnakes are present on the installation (FIG REG 350-2). Avoidance is the best means for minimizing risks to personal safety. Notify Range Operations if wildlife is impacting training (FIG REG 350-2). Should that notification be made, trained personnel in the Wildlife Section will be dispatched to properly handle and remove a snake. Currently there are no training restrictions associated with the timber rattlesnake or its habitat.

G.13. Bald Eagle Nest

Region 5 of the USFWS, which includes Pennsylvania, suggests a 300-meter aircraft buffer zone for active bald eagle nests. The suggestions also include a 200-meter buffer on other human activity that can be seen from the nest (to include hunting and fishing, walking, starting engines, and other activities as detailed on their website), and 100 meters for activities with obstructed views. As long as aircraft and personnel leave this relatively minor amount of space alone, activities can proceed as normal. Additionally, it should be noted that nest building, egg laying/incubation, hatching/rearing young, and fledging young typically occurs from November through July in this area. Any disturbances that cannot be avoided or maintain the appropriate buffer distance should occur between August and October. In instances where the space is not

compatible with necessary activities, PADMVA can apply for a depredation permit and follow consultation. As of 31 May 2021, there is one nesting pair on the installation, which has resulted in a minor impact to military training (helicopter fire buckets and travel.) It has been easier to avoid the nests and buffer them than to actively discourage the nesting activity.

G.14. Bog Turtle Habitat

Despite extensive searches and turtle monitoring through 2021, no bog turtles have been found on the installation. However, the USFWS has designated critical habitat for the species, and several areas surveyed at FIG have revealed wetlands associated with potential bog turtle habitat. FIG staff works closely with USFWS personnel to determine the best course of action should a proposed action be located near potential habitat. Recommendations include implementation of avoidance measures and/or conducting a Phase II (presence/absence) study.

G.15. Indiana Bat

Despite extensive searches and targeted surveys (live capture and acoustic) through 2021, no Indiana bats have been found on the installation in any season, but surveys continue as part of an annual monitoring effort. At this point in time, USFWS has not designated critical habitat for this species. For these reasons, the Indiana bat currently poses no restrictions on the military mission.

G.16. Northeastern Bulrush

Even though extensive surveys, dating back to 1989, have been conducted, no northeastern bulrush has been found on the installation. Therefore, the northeastern bulrush currently poses no restrictions on the military mission.

G.17. Frosted Elfin

The Frosted Elfin butterfly is known only from a single observation in Range 24B and 24C by PA Natural Heritage Program staff in the 1990's. It has not been observed since. FIG conservation staff are currently in the third year of a 3-year of survey to relocate this species, though it seems unlikely to still exist on the installation. It is actually 2 subspecies separated by pupation type. The subspecies for our region pupates on the soil surface while the other burrows into the soil and is protected. Continued survival of this species at the historic locations at FIG seems doubtful due to frequent and, at times intense, prescribed and wildfire events that have become more common as training activity has steadily increased.

USFWS is currently working on the SSA, therefore no training restrictions at this time. A listing decision will not be made until 2023. Should we relocate it and it gets listed, restrictions will likely affect ARNG and Bollen Range activities, as critical habitat would likely include Ranges 23 and 24 series. Range 24 is where the historic population was located, and both ranges consist

of grassland habitat with high densities of the host plant wild indigo. If other populations are located on the installation, those may also be included. The Frosted Elfin is not found without its host plant, wild indigo, which is found in high densities on Ranges 36, 38 and throughout the impact area, particularly along the edges of Hotel Road. Those areas may also be subject to training restrictions that limit the causes of fire.

Appendix H. Climate Change

H.1. Anticipated Climate Changes

The National Climate Assessment (Horton et al. 2014) indicates that heat waves, heavy downpours, and sea level rise will affect our region. From 1895 to 2011, the region observed 2°F increases in mean annual temperature (a rise of 0.16°F per decade) and mean annual precipitation increases of 5 inches (>10%, 0.4 inches per decade). Sea level has risen 1 foot since 1900 despite global averages of only 8 inches. Very heavy (heaviest 1% of all daily events) precipitation events have risen more than 70% just between 1958 and 2010.

Warming will continue 4.5°F to 10°F by 2080 at current emissions rates but may only warm 3°F to 6°F if substantial emissions reductions take place. FIG currently faces 5-10 days per year above 90°F but may face anywhere from 30-40 days per year in the next 65 years.

Winter and spring precipitation are expected to increase, with 5 to 20% increases in winter precipitation. Summer and fall precipitation changes are projecting to be very small compared to current normal. Heavy downpours, seasonal drought, and earlier snowmelt are all predicted.

Sea levels will rise 1 to 4 feet globally (even more in the region due to subsidence and ocean current changes) by 2100 with variation based on land-based ice in Greenland and western Antarctica. Vulnerability to major hurricanes and tropical storms will rise along with the seas.

H.2. Impacts

The effects of climate change are far-reaching and seem minor when approached in the short-term. Long-term and large-scale thinking is more difficult, but environmental management is essentially planning for and considering the benefits and costs of the long-term. Climate change affects both the natural world as well as the human world, so the discussion is split between training impacts and natural resources impacts though they do mesh.

H.2.a. Training

The most noticeable and direct impact to military training will be heat casualties as a result of increases in 90°F days during the height of the training season. Already, these casualties are a top priority in risk assessments and preventable accidents for training units. While preventative measures can be taken to avoid heat casualties, some events will continue to occur. At an average of 5-10 days of Heat Category 4 and above for normal training, many of these days are lost to the training units as commanders decide not to run risks. When that number approaches a full month of 90° days, there is no avoidance or work-around for troops stationed here on their two-week Annual Training (AT). High-stress activities such as physical training (PT) and training in body armor will have to be conducted.

In addition to heat casualties, the number of days lost to severe weather incidents is likely to rise. Extreme downpours, floods, and even violent thunderstorms will cause the shutdown of ranges and facilities. Tornados, hurricanes, and other storm events have caused loss of training days, significant damage to infrastructure, and also force the governor to call out units for active duty on domestic emergencies within the state. These activations and delays cause serious financial harm and interference for units within PAARNG.

Hurricanes placed a major toll on the PAARNG, the installation and its resources in the past decade. Hurricane Sandy (2012) wiped out infrastructure, cleared training schedules for weeks at a time, and even reset stream morphology (Cinotto pers. comm.). Hurricane Sandy shut down the electrical grid at FIG for nearly three days and mobilized the PAARNG statewide. Five years later PAARNG personnel were deployed to Puerto Rico to assist with the devastation caused by Hurricane Maria. Overall, floods and winter storms account for 41% of all domestic missions, and weather events as a whole count for 47% (Smith unpublished data).

Droughts on the other hand require extra efforts and materials from the full-time support for FIG and for the soldiers as well. Having few potable water sources and trailers for training units, FIG experiences major shortages of distribution when droughts and high-temperature days overstretch water buffaloes and greywater treatment units. Dust control also becomes an issue for air quality, vision, and sedimentation. In drought, engineering units typically have to run water trucks to wet down heavy-use trails rather than getting to other infrastructure improvements that need to get done.

H.2.b. Natural Resources

The natural resources at FIG are already affected by the past century of climate change. Drought resistance, strongly anchored floodplain species, and species able to withstand greater flexibility in the climate of the region are all thriving in the training environment. Fragile species that are susceptible to these impacts are becoming more and more rare on our landscape. Several southern species such as blue-winged warbler, black vulture, blue grosbeak, spring peeper, and American holly more commonly found southward have been increasing on installation lands and in the region. For some rare edge-of-range species, this has been a tremendous boon. For others, like the golden-winged warbler, the species are getting squeezed out of their former niche.

The Pennsylvania Natural Heritage Program (PNHP) and NatureServe have issued climate change vulnerability indices by species for some of FIG's species of interest (Table I.1. Climate Change Vulnerability Index Assessment for Selected Species at FIG). Of the highest species of concern, only regal fritillary and golden-winged warbler are evaluated.

The regal fritillary is dependent on high-quality warm-season grasslands, which should increase and expand within the state under a warmer climate. Unfortunately, this species is most vulnerable during the spring, when climate shifts and high rainfall may make caterpillars and pupae susceptible to disease, mold, and fungus (Wagner 1997). Longer growing seasons and slight changes in nectar availability may also make the species vulnerable when they are trying to maintain energy for mating and oviposition as adults.

Table H.1. Climate Change Vulnerability Index Assessment for Selected Species at FIG

Common Name	Scientific Name	Vulnerability Score	Confidence
Cerulean warbler	*Dendroica cerulean*	Presumed stable	Very high
Golden-winged warbler	*Vermivora chrysoptera*	Increase likely	Moderate
Blue-winged warbler	*Vermivora pinus*	Increase likely	Very high
Regal fritillary	*Speyeria Idalia idalia*	Presumed stable	Very high
Frosted elfin	*Callophrys irus*	Presumed stable	Very high
Eastern small-footed bat	*Myotis leibii*	Moderately vulnerable	Low
Allegheny woodrat	*Neotoma magister*	Moderately vulnerable	Very high
Goldenthread	*Coptis trifolia*	Highly vulnerable	Very high
Spotted turtle	*Clemmys guttata*	Moderately vulnerable	Moderate
Timber rattlesnake	*Crotalus horridus*	Presumed stable	Very high
Wood turtle	*Glyptemys insculpta*	Presumed stable	Moderate

The golden-winged warbler, too, is given a positive chance against climate change. The warbler's main source of competition and main threat in this region, the blue-winged warbler, is also likely to increase and increase the pressure on GWWAs. The edge has already been granted to the more southerly ranging blue-wings, and it does not look like that pressure will be relieved in the future.

Streams and the organisms that use them have radically changed in the face of major storms on the installation. One example, the historic Saint Joseph's Springs in C-3 and B-8, jumped banks and formed a new permanent channel after Hurricane Ivan (2004), and then jumped again and reset to the original channel following Hurricane Sandy; three stream routes in just 8 years. Adding to the situation, sedimentation from miles of unimproved roads and trails on the installation is reactivated in these storms, sending thousands of tons of stored debris downstream into stream crossings and impoundments like Marquette and Memorial Lakes.

As FIG is made up of many first and second order streams, flooding is usually brief and immediate during and after a high rainfall. Aquifers along the two mountains charge our groundwater in both valleys. Likewise, these seeps and aquifers lessen the impact of major droughts by providing groundwater to the surface systems.

H.3. Solutions and Strategies

Current indicators and predictions bode well for our ecological strength, the native warm-season grassland. Grasslands are a statewide priority habitat community (PGC and PFBC 2016). They also function as excellent habitat for both soldiers and our rare species. In that respect, FIG is poised to continue its natural resource legacy and to help guide the state in creating and managing more of the durable habitat.

Storm management preparedness is an issue of sustainability as well as readiness. Narrow culvert design, outdated impoundment release mechanisms, and impermeable surface area all make disasters more damaging and more costly. Not all impacts can be avoided but allowing for above-average flow and permeable pavements in engineering designs strengthens PAARNG abilities to function as normal during extreme events. Given the predictions of higher

precipitation and more frequent significant precipitation events, plans and infrastructure need to incorporate well above average flow capacity or face restabilization and reconstruction. PADMVA Conservation is committed to helping prepare the PAARNG for weather-related deployments. The training site engineers requested chainsaws and training for PEMA callouts after the extensive tree damage the state faced in Hurricane Sandy. Additionally, vehicle recovery simulations were once conducted only on dry ground, but the FIG ITAM office came up with innovative isolated training ponds that do not impact sedimentation controls or local waterways. The Conservation Office has helped to develop BMPs with the engineers for all E&S work and site design (PADMVA 2009). The mowing plan (Hovis and McNaughton 2005) also provides for flood and drought controls by keeping standing vegetation as long as possible (slowing surface flows and preventing evaporation and erosion with land cover).

Protecting vulnerable species on the installation is a constant daily routine. Luckily, the training corridor remains fairly flexible in terms of improved structures and urban encroachment. These types of situations tend to lock resources in place, not allowing slow migration and creep of breeding and roosting habitats. The best means of preventing bottlenecks is to keep the ridgelines as natural as possible, not avoiding management but avoiding physical structures. The ridgelines provide more than just a wildlife buffer, they also act as a buffer for noise, ricochet, wildland fire, encroachment, and even trespass. Keeping natural cover on these features will allow necessary movements in altitude and connect FIG with the greater Saint Anthony's Wilderness that runs through State Gamelands 211.

Wetlands are possibly the most heavily protected vegetation community in the United States thanks to specialized laws, executive orders, and regulations. The protection of natural wetlands needs to be kept a priority over mitigation, which is a potential solution. Wetland mitigation creates issues with encroachment, as each acre taken is reproduced with a multiplier, stealing training lands and other potentially usable space around the installation. Wetlands and cold-water dependent species seem to be most of what PNHP has deemed climate imperiled. As the installation creates stormwater basins, wetland mitigations, and other water structures, care should be taken to consider habitat as much as hydrology. Small stormwater management ponds and sewage control structures in cantonment are already being used by uncommon birds like Virginia rails and soras, herps such as spotted turtles, and interesting and important insects including odonates. The key is to get them to hold water at the soil surface or low-level standing water through a portion of the basin; vegetative cover including cattail, sedges, and rushes; and keeping a small buffer from human interaction even if it's just a few feet.

The Sustainability Program was initiated at FIG in 2010. The National Guard used FIG as a test facility and issued their Sustainability Policy on 14 January 2011 (NGB 2011). Army launched initial sustainability plans in 2004 and released a new initiative in May 2010. Sustainment makes sense, as supply chains and footprints can be a vulnerability to the force. The push to renewable fuels and self-sufficient machinery will result in lower air emissions and will be the key to slowing global warming. History shows that military technology and spending is a driver for the rest of humanity, and by taking the lead, PAARNG will help others while helping ourselves. FIG can meet these objectives with sustainment planning in building and site design, best management practices, finding efficiencies, and striving for innovation.

Appendix I – ITAM Work Plan FY 2022

Project #	Project Title	Execution FY	Needed to mitigate conditions relating to immediate soldier safety?	Needed to mitigate conditions relating to environmental compliance?	Needed to mitigate conditions relating to a current training stoppage?	Project Description
FIG2022001	ADMIN: SRP GIS Administration	2022	YES	YES	YES	Develop annual SRP GIS workplan and coordinate with the ITAM Coordinator and other Garrison staff to include: identify needed training and travel requirements for SRP GIS Coordinator; identify and purchase software, hardware, supplies (including plotter paper, plotter cartridges and supplies, printer paper and ink cartridges, and computer peripherals), imagery, and other data acquisition needs; map out DA reporting schedules, and major program deliverable schedules; identify draft budgets necessary to support these items and provide to the ITAM Coordinator. Conduct travel and training for: TSS Workshop, 1 week; vendor-led technical training, 1 week (to include RCMPT training, ESRI User Conference and professional development training on GIS techniques and emerging technologies). Coordinator is contracted through Temple University.
FIG2022002	ADMIN: SRP GIS Support to Range Ops	2022	YES	YES	YES	Provide geospatial analysis and cartographic support to Range Operations. • Attend meetings (may specify required meetings: e.g., weekly/bi-weekly range safety meetings) with Range staff to identify geospatial data and mapping requirements in support of Range Operations. • Prepare/provide geospatial data, perform geospatial analysis, and provide ma products to support range operations planning, and range scheduling/planning reviews, including the creation of danger zones, the development of noise contours, and the development of range operations map products using the Range Managers Toolkit (RMTK) suite of applications. • Perform Range Facility Management Support System (RFMSS) enhanced Graphic Fire Desk (eGFD) fielding tasks per the DA, DAMO-TRS SRP RFMSS eGFD Deployment Memorandum. Maintain and configure geospatial data to support automated range scheduling. Perform geospatial data development, formatting, upload, and maintenance of geospatial data and maps necessary to support the RFMSS eGFD. • Facilitate and coordinate basic GIS training for range personnel. Note: Range Operations and Training Support task time frames change frequently

						when range schedules are adjusted to respond to weather events and changes in unit training schedules. Geospatial products required for training events may be required in as little as one hour turn around.
FIG2022003	ADMIN: GIS Support to Range Modification	2022	YES	YES	YES	Gather and create geospatial data and perform geospatial analysis to support Range Modernization planning charrettes and Range Modernization reconfigurations to include range siting. Develop range project maps IAW Department of the Army, Range Complex Master Planning: A User Guide for U.S. Army Installations and Government guidance to support the Range Complex Master Plan (RCMP). Develop maps depicting landscape conditions, constraints, alternatives analysis, restrictions, operational overlay, safety/regulatory/stewardship, airspace, and critical infrastructure. Currently, there are four types of maps required to support Range Modernization in the RCMP: Safety/Regulatory/Stewardship Considerations Map; Airspace Maps; Range Project Maps; and the Operational Overlay.
FIG2022004	ADMIN: GIS Mission Support	2022	YES	YES	YES	Provide training support products in direct assistance to the execution of training strategies and missions, at all echelons, on the installation's ranges and training lands. Develop and maintain geospatial data, perform geospatial analysis, and create training support cartographic products (i.e., maps) in support of unit training. • Develop, maintain, and update Military Installation Maps (MIMs) with the required geospatial data layers in accordance with MIM Production Guidance Documentation (MPGD) to support mission requirements. Maintain, develop, and retain a copy of the geospatial data associated with each MIM to include required geospatial data layers to fill the MIM map extent. Digitally update each MIM annually (in Adobe .pdf or GeoPDF formats) unless changes have not been made to range and training land designations and configurations or to training support infrastructure. • Provide standard and customized maps to support unit training making maximum use of the Military Installation Map (MIM) Inventory available on the SRPWeb Portal (https://srp2.army.mil/gis/MIM/Forms/AllItems.aspx). Specific map outputs include: standard Military Installation Map (MIM), mission planning maps, training plans, live-fire shot sheets ((with surface danger zones (SDZs)), maneuver area/corridor maps, and maps of individual training facilities/areas including, but not limited to, maneuver training areas, landing zones, MEDEVAC, infantry movement corridors, aerial operations, special-use imagery maps, transportation, land navigation, and special use training sites. Standard map scales are 1:25,000 and 1:50,000 scale. Larger scale maps may be required for individual training events or facilities.

						• Develop daily planning maps as an overlay that reflects training footprints and training facilities assist in identifying suitable ranges and maneuver lands required for scheduling, and represents adjustments based on range scheduling or field conditions that impact the scheduled training event(s). Respond to changing training schedules and/or training location changes stemming from weather, safety, or other factors. Updated support maps may be required in as little as one hour to meet training schedule needs. • Maps are provided electronically (e.g., GeoPDF format) via email, at SRP GIS walk in center (paper and DVD copy), through installation portal, via SRP Web Portal, and/or at Kiosk.

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FIG2022005	ADMIN: GIS Data Development	2022	YES	YES	YES	Develop, update, manage, report, and maintain the DAMO-TRS (SRP) proponent SDSFIE Army Adaptation geospatial data layers in accordance with the DAMO-TRS SRP geospatial Data Development Strategy, the SRP geospatial data Quality Assurance Plans (QAPs), and the SDSFIE Army Adaptation. Serve as the installation/site(s) Data Steward for all DAMO-TRS (SRP) proponent geospatial data layers. Coordinate all range-related facility data with the installation real property office to ensure correct real property attributes are included in the geospatial data and real property databases. Staff, review, and validate data by the installation SME for each data layer (i.e. Range Officer, ITAM Coordinator, Range Safety Officer, etc.). Develop, maintain, and update Military Installation Map (MIM) with the required data layers for the MIM to support mission requirements per the MIM Production Guidance Documentation (MPGD) found on SRPWeb (https://srp.army.mil). Maintain, develop, and retain a copy of the existing geospatial data to include the creation of the required geospatial data layers to fill the MIM map extent. Digitally update the MIM annually unless changes have not been made to range and training land designations and configurations or to training support infrastructure. On a quarterly basis: • Develop and validate DAMO-TRS (SRP) proponent geospatial data layers for compliance with the respective QAP. • Complete QA/QC of each geospatial data layer and associated metadata. • Submit the data to the installation functional SME (i.e., Range Officer or equivalent) for review of completeness and accuracy. • Submit geospatial data to the IGI&S Manager for review. • Conduct reviews of QAPs for geospatial data layers under the Data Steward's responsibility. • Submit data to the IGI&S Support Center (OACSIM IGI&S) and the SRP GSC. • Submit map project files, associated data tables, associated map export files, symbology files, metadata, briefings, and all associated documentation collected, developed, and maintained in support of SRP GIS and related SRP functions to the SRP GSC.

FIG2022006	ADMIN: Training Requirements Integration	2022	YES	YES	YES	Facilitate installation training mission goals by including environmental compliance requirements, range facilities requirements, and landscape condition requirements in the development of range and training land management decisions and the coordination of mission needs with garrison facility and environmental plans. These actions are inherently iterative, and require frequent coordination, reviews, and approvals with other Garrison offices. Many TRI actions, particularly those related to integration of mission needs into Garrison plans, are subject to individual installation timelines and processes. Key TRI actions are: Provide decision support to range and training land planning, scheduling, modernization, and maintenance. Obtain information from appropriate offices regarding the conditions of ranges and training lands, and provide recommendations to the installation DPTMS and ITAM offices on potential impacts and permitting requirements of relevant environmental, natural, and cultural resources for the proposed training. Include the use of information from RTLA, LRAM, and SRP GIS in this process. Attend training briefings, land management coordination meetings, and other range and training land planning and scheduling meetings; provide written and verbal input, as appropriate, on potential issues; and recommend changes to range and training land schedules Actively participate in range and training land management planning and execution; ensure mission needs are considered in environmental and facilities planning; and ensure environmental constraints are considered in mission planning. Communicate the installation training mission needs for ranges and training lands for inclusion into the plans and programs of other installation offices involved in the management and oversight of land and related natural, cultural, and environmental resources. Coordinate with the appropriate installation offices to provide mission goals and objectives for inclusion in the planning and resourcing of installation land management programs. Include information from RTLA, LRAM, and SRP GIS in this process. In particular, coordinate the inclusion of RCMP mission goals and objectives into the installation Integrated Natural Resources Management Plan (INRMP) and subordinate plans, and ensure the various land management programs associated with these participate in the development and submittal of workplans necessary to achieve

						mission needs. Provide the approved annual ITAM workplan for inclusion as an INRMP appendix. Coordinate mission needs with analysis of the INRMP required by the National Environmental Policy Act (NEPA) to ensure proposed training land management actions are included in the NEPA approval process.
FIG2022007	ADMIN: Sustainable Range Awareness	2022	YES	YES	YES	Create and distribute educational information to enhance awareness for training land users of environmental and cultural resource issues that affect training activities. Update/develop and distribute information to range and training land users on reducing impacts and minimizing regulatory and compliance issues related to disturbance of natural, cultural, and environmental resources on ranges and training land.
FIG2022008	MAINTAIN: Dust suppression of 12 mi of maneuver trail	2022	YES	NO	NO	Because of the amount of heavy training that occurs concentrated to a few areas at FIG, dust resulting from maneuver poses a significant safety hazard. 12 miles of maneuver trails require dust suppression annually. Work includes repair and maintenance of trails such as grading, adding aggregate and compaction and dust palliative application. Application work will be contracted, and trail work will be done by LRAM crew using ITAM equipment
FIG2022009	MONITOR: Special Training Support Assessments	2022	NO	NO	NO	As per the FTIG RTLA Protocol: monitor ongoing support and maintenance activities in a total of 275 ac in the Landing Zones in Training Areas C-03 and A-31 and Training Area bivouac sites in A-02, C-03 and B-12A. Includes trail and training area maintenance, erosion monitoring, and vegetation management.
FIG2022010	MONITOR: Disturbed Area Assessments	2022	NO	YES	NO	The focus of disturbance surveys is to identify disturbed sites spatially, determine the level of disturbance and track these and other areas over time to assess whether the proportion of the terrain in each disturbance category is decreasing, staying the same or increasing. Disturbance assessed includes degree of de-vegetation, type and severity of maneuver damage, and severity of erosion. Corrective actions will be identified when necessary.

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FIG2022011	MONITOR: Grassland and Non-Forested Area Assessments	2022	NO	YES	YES	Monitor the effectiveness of vegetation management projects (prescribed burns, mowing and herbicide application). While the scope and areas assessed vary from year to year, we typically assess the effectiveness of prescriptions from the previous year. For FY22 we plan on conducting assessments primarily on 350ac in a portion of Alpha areas, Charlie Training Area, and the open areas north of Range road supporting maneuver.
FIG2022012	MONITOR: Trails Condition Assessment Protocol	2022	NO	NO	NO	Survey trail segment conditions, site-specific problems and manage and analyze data for the western third of the training corridor with priority given to new or reported problems, accounting for approximately 44 miles of trails. Trails will be assessed for maneuver damage, erosion, culvert status or new culvert needed, and stone wearing course status needing repair. Add new trails as they are developed.
FIG2022015	ADMIN: ITAM Administration	2022	YES	YES	YES	Develop annual ITAM Plan and Workplans covering all ITAM functions (TRI, SRA, LRAM, RTLA, SRP GIS); oversee and schedule staff; coordinate staff training and TDY's; develop annual reports; coordinate all ITAM equipment requirements; identify needed training and travel requirements for ITAM staff; identify software, hardware, office supplies, field supplies, vehicle and fuel requirements, and other office and field supply acquisition needs (RTLA supplies include PPE, bug repellent, equipment replacement such as range poles and quadrat PVC, white boards and markers, cameras, GPS purchase, maintenance, and repair) track major program deliverable schedules. Oversee task execution, contract requirements, reports including monthly status reports, task execution reports, and ITAM Plan annual execution reports. Conduct travel and training for: ITAM Workshop (1 week per coordinator minus SRP GIS); vendor led technical training (1 week per RTLA and LRAM coordinator), including professional development and job-specific classes such as botany symposium for RTLA and technical equipment and procedural training such as gravel roads and trail maintenance training; as well as 1 week for ITAM Plan training and RCMPT training (ITAM Coordinator). ITAM, RTLA and SRP GIS Coordinators are contracted through Temple University, while the LRAM Coordinator is a state employee.

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FIG2022017	MAINTAIN 33 Acres of Medina Ridge and Tomahawk LZs	2022	NO	NO	NO	Control vegetation on 33 acres of open field in Medina Ridge and Tomahawk LZs for safe aviation training. One herbicide application, one brush grinding, and two mowings are required per year. Work to be done by ITAM and natural resources staff.
FIG2022018	MAINTAIN 57 Acres Of West Field LZ	2022	NO	NO	NO	Mow 21.88 acres of west field and 35 acres of training area A01. Area will be mowed 2 times in order to maintain safe aviation training. Work done by ITAM and natural resources staff.
FIG2022019	MAINTAIN 35 acres of landing zones in the training corridor	2022	NO	NO	NO	Control 35 acres of woody vegetation growth and encroachment including 3 acres of mowing. Controlling woody vegetation includes activities such as herbicide application, and Brown brush monitor mowing of the approach and departure zones as well as at the peripheries. Mowing the landing areas with a pull behind mower is necessary for soldier safety in order to keep the grass at a height where the pilots can see the ground and dismounts to see where they are maneuvering off the LZ. Woody vegetation control is as needed, and mowing should be done twice annually.
FIG2022022	MAINTAIN up to 6 miles of maneuver trails in the training corridor	2022	YES	YES	NO	the LRAM crew is able to maintain an average of six miles of maneuver trails annually, to reduce or avoid repair activities. This intends to keep trails in a condition safe for soldiers using them as well as avoid environmental Notices of Violation, potentially caused by erosion and sedimentation into local streams. Activities will be accomplished by ITAM personnel and the equipment used will be both ITAM equipment and borrowed, Reservation Maintenance equipment (when necessary). Activities include grading, ditching, compacting, and shaping of trails, BMP construction such as ditch lining, and cleaning and replacing existing, damaged culverts if necessary.

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FIG202 2023	REPAIR FARP near Range 38	2022	NO	NO	YES	Repair Range 38 FARP. After several years on non-use, The FARP near Range 38 is being repaired to support aviation gunnery and refueling missions. Work includes hauling, and dumping stone followed by grading and compacting, to a site approximately XX acres in size. Work will be done by ITAM personnel using ITAM equipment and borrowed, DPW equipment if necessary.
FIG202 2024	MAINTAIN 50 acres of Firing Points Annually	2022	NO	NO	NO	The LRAM crew is able to maintain 50 acres of firing points annually. Maintenance activities include mowing, removal of woody vegetation through mechanical and chemical means, grading, and the occasional application of aggregate to harden sites. This will ensure line of site, and maneuverability at the firing point, ensuring enough room for the firing units to occupy the site.
FIG202 2025	MAINTAIN 51 acres of Light Maneuver in TA A-02	2022	NO	NO	YES	Maintain 51 acres of light maneuver that has woody vegetation encroachment. Because of vegetation encroachment, light maneuver is hindered in much of the understory of the wooded areas in A-02. Work includes mechanical forestry mulching and herbicide application. Mechanical removal will be by existing vegetation management contract, and herbicide will be applied by LRAM personnel using ITAM equipment.
FIG202 2026	MAINTAIN 30 Acres of Bivouac Area in TA B-12A	2022	NO	NO	NO	Because of woody vegetation regrowth in the understory, brush grinding and herbicide application needs to be conducted to keep the area available for units bivouacking. Work to be done includes mechanical removal of, and herbicide application to woody vegetation regrowth. Work will be done by ITAM personnel using ITAM equipment and resources.

J-1: Installation Setting Map

Fort Indiantown Gap National Guard Training Center

Mulitple Municipalities, Dauphin and Lebanon Counties, Pennsylvania

0 0.75 1.5 3 4.5 6 Miles

N

Legend

- Installation Boundary
- County Boundary
- Municipal Boundaries
- Federally-Controlled Parcels
- State Game Lands
- State Parks
- Other State-Controlled Parcels
- Static Water Features
- Streams
- Darlington Trail
- Horse-Shoe Trail
- Appalachian Trail
- Urbanized Areas

ELIZABETHVILLE
WASHINGTON
UPPER PAXTON
JACKSON
Jackson Twp
SGL 210
JEFFERSON
Rush Twp
TREMONT
PINE GROVE
Swatara STATE PARK
COLD SPRING
RUSH
SGL 80
BETHEL
WAYNE
Wayne Twp
SGL 211
UNION
Ft Indiantown Gap Pang Training Ctr
Monroe Valley Golf Club
Fredericksburg
Bethel Twp
Swatara Twp
SWATARA
Joseph E. Ibberson CONSERVATION AREA
MIDDLE PAXTON
SGL 211
EAST HANOVER
Memorial Lake STATE PARK
Indiantown Gap National Cemetery
Hanover Twp
JONESTOWN
Manada Golf Club
WEST HANOVER
Boyd Big Tree CONSERVATION AREA
NORTH ANNVILLE
NORTH LEBANON
LOWER PAXTON
NORTH LONDONDERRY
WEST LEBANON
LEBANON
CLEONA
ANNVILLE
NORTH CORNWALL
SOUTH ANNVILLE
SOUTH LEBANON
SUSQUEHANNA
SOUTH HANOVER
DERRY

N

J-2: Installation Area Topographic Map

National Guard Training Center - Fort Indiantown Gap

Multiple Municipalities, Dauphin and Lebanon Counties, Pennsylvania

0 0.5 1 2 3 4 Miles

Legend

Installation Boundary

J-3: Training Constraints Map

National Guard Training Center - Fort Indiantown Gap

Multiple Municipalities, Dauphin and Lebanon Counties, Pennsylvania

N

Legend

- Installation Boundary
- Training Areas
- Lakes and Ponds
- Air Field Surfaces
- UXO/Impact Areas
- Ammunition Supply Point
- Regal Fritillary Research Areas
- Bald Eagle Roosting Sites
- Northern Long-Eared Bat Roosting Sites
- Spotted Turtle Buffer Areas
- Wood Turtle Buffer Areas
- Steep Slopes

0 0.5 1 2 3 4 Miles

J-4: Partnerships and Opportunities Map

National Guard Training Center - Fort Indiantown Gap

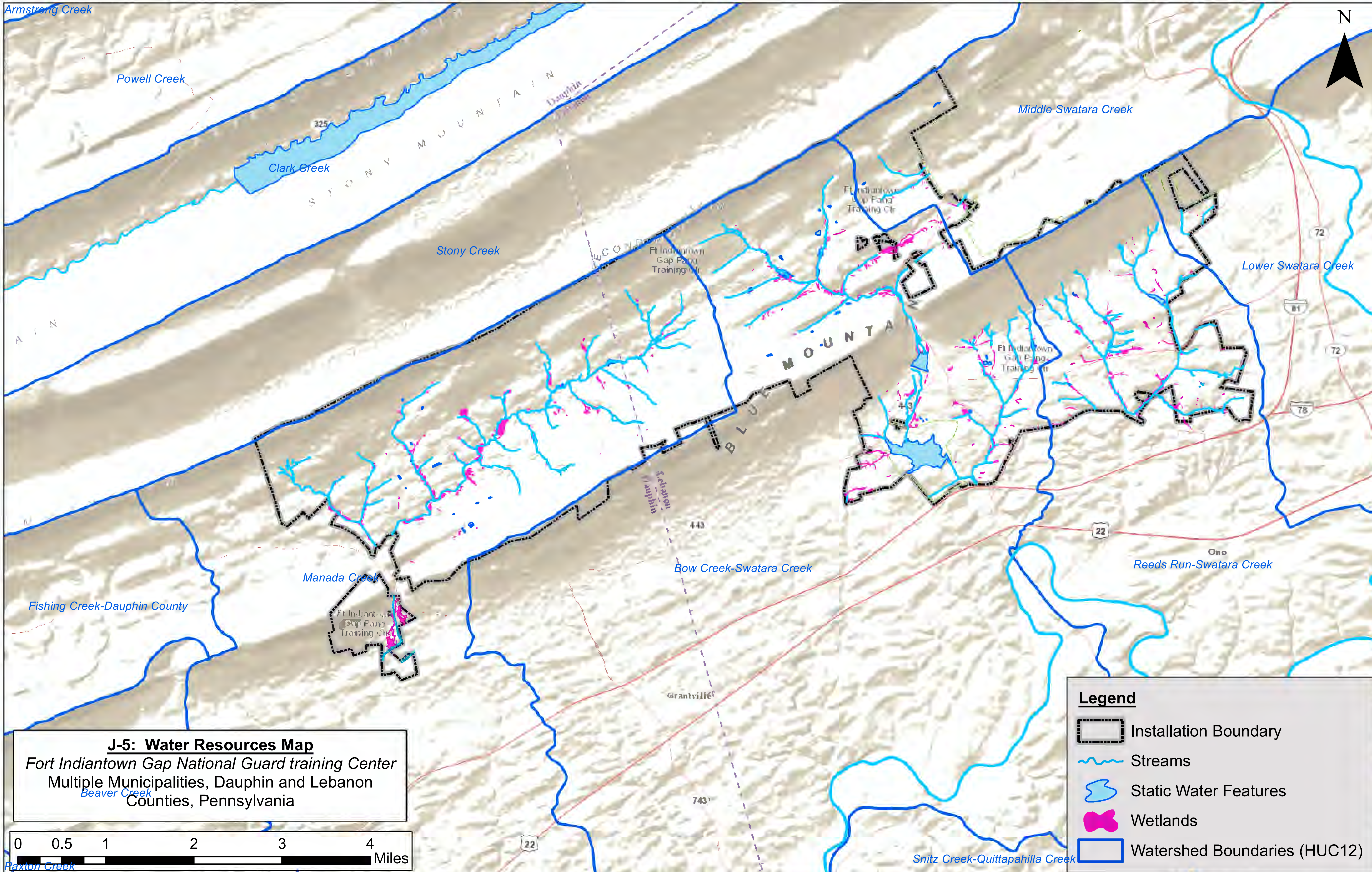
Multiple Municipalities, Dauphin and Lebanon Counties, Pennsylvania

N

0 1.5 3 6 9 12 Miles

Legend

- Installation Footprint
- State Gamelands and Parks
- FTIG Approved ACUB Program Area
- Other State-Controlled Properties
- Federally-Controlled Parcels
- Other Protected Parcels
- Kittatinny Ridge Conservation Landscape Boundary
- TNC Priority Landscape Blocks
- Appalachian Trail
- Other Local Trails


N
Armstrong Creek
Powell Creek
Clark Creek
Stony Creek
STONY MOUNTAIN
BLUE MOUNTAIN
Middle Swatara Creek
Lower Swatara Creek
Ft Indiantown Gap Rang Training Ctr
Manada Creek
Fishing Creek-Dauphin County
Bow Creek-Swatara Creek
Reeds Run-Swatara Creek
Ono
Grantville
Beaver Creek
Paxton Creek
Snitz Creek-Quittapahilla Creek
Dauphin
Lebanon
325
443
743
72
81
78
22
Legend
Installation Boundary
Streams
Static Water Features
Wetlands
Watershed Boundaries (HUC12)
0 0.5 1 2 3 4
Miles

J-5: Water Resources Map

Fort Indiantown Gap National Guard training Center

Multiple Municipalities, Dauphin and Lebanon Counties, Pennsylvania