Vermont Army National Guard
Camp Johnson

Integrated Natural Resource Management Plan for 2002-2006

And

Environmental Assessment

October, 2001

Camp Johnson
Chittenden County, Vermont

Integrated Natural Resources Management Plan

2002-2006

Signature Page

This Integrated Natural Resources Management Plan (INRMP) meets the requirements for INRMP's listed in the Sikes Act (16 U.S.C. § 670a *et seq.*) and the "Executive Summary and Scope" within this plan.

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List of Acronyms

AR	Army Regulation
ARNG	Army National Guard
BMP	Best Management Practice
BP	Before Present
BX	Base Exchange
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CSMS	Combined Support Maintenance Shop
DoD	Department of Defense
EA	Environmental Assessment
EIS	Environmental Impact Statement

ESA	Endangered Species Act
ESMP	Endangered Species Management Plan
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FMO	Facilities Management Officer
FONSI	Finding of No Significant Impact
GIS	Geographic Information System
GMA	Green Mountain Armory
HUD	U.S. Department of Housing and Urban Development
HWM	Hazardous Waste Management
ICRMP	Integrated Cultural Resource Management Plan
INRMP	Integrated Natural Resources Management Plan
ITAM	Integrated Training Area Management
LCTA	Land Condition Trend Analysis
LOD	Large Organic Debris
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MU	Management Unit
NAGPRA	Native American Graves Protection Act
NEPA	National Environmental Policy Act
NGB	National Guard Bureau
NRCS	Natural Resource Conservation Service
OMS	Organizational Maintenance Shop
OSD	Office of the Secretary of Defense
OTR	Ozone Transport Region
POL	Petroleum Oil and Lubricants
POTO	Plans Operations and Training Officer
RCRA	Resource Conservation and Recovery Act
ROI	Region of Influence
RTI	Regional Training Institute
SHPO	State Historic Preservation Officer
SOP	Standard Operating Procedure
TNC	The Nature Conservancy
TRI	Training Requirements Integration
TSCA	Toxic Substances Control Act
TSI	Timber Stand Improvement
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UVM	University of Vermont
VOC	Volatile Organic Compound
VTANR	Vermont Agency of Natural Resources
VTARNG	Vermont Army National Guard
VTFWD	Vermont Fish and Wildlife Department
VTNNHP	Vermont Non-game and Natural Heritage Program

EXECUTIVE SUMMARY

PURPOSE

The purpose of this Integrated Natural Resources Management Plan (INRMP) is to guide the natural resources management program at Camp Johnson from 2002 through 2006, and to provide a solid foundation on which to build the program beyond the year 2006. This INRMP will allow Camp Johnson to achieve its goal to ensure its primary mission of military training readiness while balancing the sustainability of desired military training area conditions and ecosystem viability. In addition, this INRMP will ensure that natural resources conservation measures and Army activities on Camp Johnson land are integrated and are consistent with federal stewardship requirements including the Sikes Act (16 *United States Code* [U.S.C.], 670a *et seq*.) and the Sikes Act Improvement Act

This plan also contains the associated documentation required for compliance with the National Environmental Policy Act (NEPA), which requires Federal agencies to consider environmental consequences of major proposed actions. This NEPA documentation is in the form of an Environmental Assessment (EA), which analyzes the potential consequences of the proposed action to implement the Camp Johnson INRMP. Based on the EA, an EIS will be prepared or a Finding of No Significant Impact (FNSI) will be issued, and a final 30 day public comment period held.

ENVIRONMENTAL COMPLIANCE

Under the Natural Resource Management on Military Lands Act of 1960 (Title 16 of the Section 670a and following), commonly known as the Sikes Act, as amended according to the Sikes Act Improvement Act of 1997,

> The Secretary of Defense shall carry out a program to provide for the conservation and rehabilitation of natural resources on military installations. To facilitate the program, the Secretary of each military department shall prepare and implement an integrated natural resources management plan for each military installation in the United States under the jurisdiction of the Secretary. Consistent with the use of military installations to ensure the preparedness of the Armed Forces, the Secretaries of the military departments shall carry out the program to provide for the conservation and rehabilitation of natural resources on military installations.

Army Regulation (AR) 200-3 (*Natural Resources—Land, Forest, and Wildlife Management*) "sets forth policy, procedures and responsibilities for the conservation, management, and restoration of land and the natural resources thereon consistent with the military mission and in consonance with national policies. The scope includes the conservation, management, and utilization of the soils, vegetation, water resources, croplands, rangelands, forests, and fish and wildlife species."

SCOPE

Maintaining optimal environmental conditions on the training lands is essential for the success of the military mission at Camp Johnson. Therefore, the focus of this INRMP is on the management of the natural resources in the training areas. The management measures have been developed based on the current conditions of the resources, and the military mission and activities as they are anticipated. This INRMP will guide natural resources management at Camp Johnson for the next five years (i.e., FY 2002 through 2006) and provide a solid foundation from which to build the program beyond the year 2006. This INRMP will be revised at least every 5 years from its date of approval.

The EA scope of analysis is based on identifying, documenting, and evaluating potential effects of implementing the INRMP for Camp Johnson. The EA examines the Army's preferred alternative and a no action alternative. Implementation of the preferred alternative (i.e., proposed action) would mean that the selected management measures set forth in the INRMP would be adopted. Implementation of the no action alternative would mean that existing conditions would continue as the status quo, and no new management measures would be implemented. The development of these selected management measures for the INRMP involved an intensive screening analysis of resource-specific management alternatives. The screening analysis involved the use of accepted criteria, standards, and guidelines, when available, coordination with federal and state natural resource management agencies, and the judgment of Camp Johnson professionals and others to identify management practices for achieving Camp Johnson natural resource management objectives. The outcome of the screening analysis led to the development of the proposed action. Application of this screening process in developing the proposed action, i.e., adoption of the management measures contained in the INRMP, eliminated the need to define and evaluate hypothetical alternatives to plan implementation.

RELATIONSHIP TO THE MILITARY MISSION

The primary mission of Camp Johnson is to provide adequate facilities, training areas, and ranges to maintain the readiness of the Army National Guard (ARNG) for its assigned mission. Such readiness results only from receiving high-quality training that incorporates all mission elements and tasks and provides the high-quality, realistic training to the individuals and units that train there.

The Army recognizes that a healthy and viable natural resource base is required to support the military mission. To be effective, the natural conditions of the training areas on Camp Johnson must be maintained to provide realism. This INRMP helps to ensure that environmental considerations are an integral part of planning activities at Camp Johnson and that natural resources are protected in accordance with Army regulations and policies.

PARTNERSHIPS

Camp Johnson has fostered a number of partnerships with various agencies that assist and participate in the natural resources management program. The primary partners involved in the development and implementation of this plan include the U.S. Fish and Wildlife Service (USFWS) and the Vermont Agency of Natural Resources.

PLANNED MAJOR INITIATIVES

The natural resources management program will either implement or continue to conduct a number of significant projects (see section 6.3). Some of the higher priority projects include:

- Update Geographic Information (GIS) layers for all natural resource areas as new data becomes available. (FY 02-06)
- Develop and provide users of training areas with detailed maps indicating sensitive areas. These maps will be developed by compositing GIS coverages of sensitive species; ecological preserves; wetlands; riparian, wetland, and water resource buffer zones; steep slopes and highly erodible soils; rare plants; threatened and endangered species; and locations of cultural and archeological resources. (FY 02-06)

- Establish and maintain protective vegetative buffer zones around streams, lakes, ponds, and wetlands. (FY 02-06)
- Maintain and update wetlands inventory and assessment database by compiling information on wetland characteristics. (FY 02-06)
- Conduct prescribed burns to maintain and enhance pitch pine-sandplains habitat. (FY 02-06)
- Develop signage to be used on the trails in the pitch pine-sandplains area explaining the natural history and instructing users to stay on the trail to protect sensitive plant species.
- Implement pest management measures. (FY 02-06)
- Restrict the use of pesticides. (FY 02-06)
- Protect cultural resources while implementing this INRMP. (FY 02-06)
- Instill natural and cultural resource conservation awareness while training. (FY 02-06)

COSTS AND BENEFITS

The benefits of this INRMP are numerous. For the military mission, the natural resources management program, as described in this INRMP, will ensure that the environmental conditions of the training lands continue to provide the blend of open and forested areas that are necessary for realistic military training. From an environmental perspective, implementation of this plan will maintain, protect, and enhance the ecological integrity of the training lands and the biological communities (particularly sensitive, rare, threatened and endangered species) inhabiting them. In addition, the natural resources management program described in this plan will protect ecosystems and their components from unacceptable damage or degradation, and identify and restore already degraded habitats.

This plan will ensure users of the training lands will have an increased awareness of the potential for impacts to occur as a result of their activities. This heightened awareness will serve to minimize the possibility for undesirable impacts, thereby decreasing the effort and costs that must be expended to mitigate.

NATIONAL ENVIRONMENTAL POLICY ACT

Under NEPA, federal agencies are required to consider the environmental consequences of major proposed actions. The intent of NEPA is to protect, restore, or enhance the environment through well-

informed Federal decisions. This act is premised on the assumption that providing information to the decision-maker, or proponent, and the public will improve the quality of final decisions.

The Council on Environmental Quality (CEQ) was established under NEPA to implement and oversee Federal policy in the decision-making process. To this end, CEQ has issued *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 CFR Parts 1500-1508). CEQ regulations specifically permit NEPA documents to be combined with other agency documents to reduce duplication and paperwork (40 CFR 1506.4). These regulations encourage agencies to focus on the purpose of the NEPA analysis—that is, making better decisions. Army leadership, the U.S. Environmental Protection Agency, and the Council on Environmental Quality support this recommendation.

Integration. Recognizing the efficiencies in cost and time that could be realized from such an approach, Camp Johnson has combined the INRMP and its associated NEPA documentation. This approach embraces the intent and spirit of NEPA, as well as the requirements of AR 200-2 and AR 200-3. The resultant "planning assessment" formalizes existing natural resource practices and can be used as an effective tool for future planning and decision-making purposes.

Purpose of and Need for Proposed Action. The Vermont National Guard is proposing to implement the INRMP for Camp Johnson. The purpose of the proposed action is to enable Camp Johnson to efficiently manage the use and condition of natural resources located on the installation to protect the natural setting for training purposes. Implementation will support the ARNG's primary mission to train in a realistic environmental setting while meeting mission requirements and complying with environmental regulations. The need for this proposed action is to ensure that natural resources conservation measures and Army activities and lands are integrated and are consistent with federal stewardship requirements including the Sikes Act (16 U.S.C. § 670a(b)) and the Sikes Improvement Act of 1997.

Environmental Consequences. The EA evaluates potential environmental consequences of implementing the proposed action and the no action alternative. Implementation of the proposed action, the Army's preferred alternative, would mean that the selected management measures presented in Section 5 would be adopted. Implementation of the no action alternative would mean that existing conditions (as presented in Section 3.0, Affected Environment) would continue as the status quo. Under

the no action alternative, no new management practices would be implemented and an INRMP would not be formalized.

The development of the management measures involved a screening analysis of resource-specific management alternatives based on various screening criteria. This process focused on considering a reasonable range of resource-specific management alternatives and, from those, developing a plan that could be implemented, as a whole, in the foreseeable future. Alternatives deemed infeasible were dropped from the detailed analysis. (See Sections 1.4 and 5.0).

Cumulative effects are also considered as part of this INRMP. Cumulative effects are defined as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of the agency or person who undertakes such action. Cumulative impact analysis captures the effects that result from the action in combination with the effects of other actions taken during the duration of the proposed action in the same geographic area. Our analysis shows that there will be no cumulative effects from implementation of the INRMP.

Potential environmental consequences of the preferred alternative, implementing the selected management measures presented in the INRMP, are summarized in Table ES-1. The VTARNG does not expect adverse environmental impacts resulting from this proposed action.

Table ES-1
Summary of Potential Environmental Consequences

Resource Area/Environmental Condition[1]	Environmental Consequence	
	No Action	Proposed Action
Environmental Setting	None	None
Climate	None	None
Air Quality	None	None
Noise	None	Beneficial
Topography	Minor Adverse	Beneficial
Geology	Minor Adverse	Beneficial
Soils	Minor Adverse	Beneficial
Water Resources	Minor Adverse	Beneficial
Wetlands	Minor Adverse	Beneficial
Riparian Habitat	Minor Adverse	Beneficial
Terrestrial Ecosystems	Moderate Adverse	Beneficial
Flora	Minor Adverse	Beneficial
Special Natural Areas	Minor Adverse	Beneficial
Fauna	Minor Adverse	Beneficial

Endangered, Threatened, and Rare Species	Minor Adverse	Beneficial
Cultural Resources	Minor Adverse	Beneficial
Land Use	None	Beneficial
Facilities	None	Beneficial
Hazardous and Toxic Materials	None	None
Socioeconomic Resources	None	None
Environmental Justice	None	None
Cumulative Effects [2]	None	None

[1] Resource areas presented in this column are the same resource areas presented in Section 3.0, *Affected Environment.*
[2] Cumulative effects (see Section 7.3) have been added to this table for reader convenience.

SUMMARY

This document reflects the commitment set forth by the Army to conserve, protect, and enhance the natural resources necessary to provide realistic military training for the Army National Guard. The primary purpose and objective of this document is to present an implementable INRMP that guides Camp Johnson in meeting military mission requirements, achieving natural resource management goals, and complying with environmental policies and regulations. In addition, the NEPA analysis required for undertaking this major Federal action (i.e., implementation of this plan) is embodied within the INRMP. This document includes a comprehensive description, evaluation, and assessment of environmental conditions and natural resources at Camp Johnson.

This INRMP is the final plan that will direct the natural resources management program at Camp Johnson from 2002 through 2006. This plan will be reviewed as to operation and effect on a regular basis, but no later than five years from its date of approval (per 16 U.S.C 670a(b)). An ecosystem approach was used to develop the management measures for each resource area. Implementation of the management measures will maintain, protect, and enhance the ecological integrity of the training lands and the biological communities inhabiting them. In addition, the natural resources management measures described in this plan will protect Camp Johnson ecosystem and its components from unacceptable damage or degradation and identify and restore previously degraded habitats.

Command support is essential for the implementation of this INRMP and is required for many of the natural resources management projects described herein. This INRMP has the full support of the Post Commander and other personnel in command positions at Camp Johnson. Implementation of this plan will ensure zero net loss in the capability of military lands to sustain the military mission.

NEPA Findings and Conclusions. Findings based on the EA indicate that, under the preferred alternative, potential consequences would result in either no effects or beneficial effects on each resource area. The affected environment would not be significantly affected by proceeding with the preferred alternative. No significant cumulative effects would be expected. Because no significant environmental impacts would result from implementation of the proposed action, preparation of an Environmental Impact Statement is not required and preparation of a Finding of No Significant Impact is appropriate.

SECTION 1.0:
INTRODUCTION

The Army will be a national leader in environmental and natural resource stewardship for present and future generations as an integral part of our mission.

(*U.S. Army Environmental Strategy into the 21st Century*, 1992)

The purpose of this Integrated Natural Resources Management Plan (INRMP) is to guide the natural resources management program in supporting the military training mission at Camp Johnson from 2002 through 2006, and to provide a solid foundation from which to build the program beyond the year 2006. This INRMP will allow Camp Johnson to achieve its goal to ensure the sustainability of desired military training area conditions and maintain ecosystem viability. In addition, this INRMP will ensure natural resources conservation measures and Army activities on Camp Johnson lands are integrated and are consistent with federal stewardship requirements.

Under the Natural Resource Management on Military Lands Act of 1960 (Title 16 of the *United States Code* [U.S.C.] § 670a *et seq*.), commonly known as the Sikes Act, as amended according to the Sikes Act Improvement Act of 1997,

> The Secretary of Defense shall carry out a program to provide for the conservation and rehabilitation of natural resources on military installations. To facilitate the program, the Secretary of each military department shall prepare and implement an integrated natural resources management plan for each military installation in the United States under the jurisdiction of the Secretary. Consistent with the use of military installations to ensure the preparedness of the Armed Forces, the Secretaries of the military departments shall carry out the program to provide for the conservation and rehabilitation of natural resources on military installations.

Per 16 U.S.C. § 670a(b) of the Sikes Act Improvement Act of 1997, to the extent appropriate and applicable, this INRMP provides for the following:

- Fish and wildlife management, land management, forest management, and fish- and wildlife-oriented recreation.

- Fish and wildlife habitat enhancement or modifications.

- Wetland protection, enhancement, and restoration, where necessary for support of fish, 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.

- Sustainable 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 for the use described above, subject to requirements necessary to ensure safety and military security.

- Enforcement of applicable natural resource laws (including regulations).

- No net loss in the capability of military installation lands to support the military mission of the installation.

- Such other activities as the Secretary of the military department determines appropriate.

The *United States Army Environmental Strategy into the 21st Century* provides the framework to ensure that environmental considerations are integral to the Army mission and that an environmental stewardship ethic governs all Army activities. The Army's environmental strategy is depicted in a model of a building with a foundation and four pillars supporting the overall vision of environmental

stewardship. The strategy's goals focus on the four pillars, which represent compliance, restoration, pollution prevention, and conservation.

The general goal of the conservation pillar is to conserve, protect, and enhance environmental and natural and cultural resources, using all practical means consistent with Army missions, so that present and future generations can use and enjoy them. Resource management in the conservation pillar is focused on conservation and preservation. Conservation involves the responsible management of Army lands to ensure long-term natural resource productivity so the Army can achieve its mission. Conservation balances the need for long-term resource use and resource protection. Preservation focuses on resource protection by limiting use by the Army community. Preservation is essential for ensuring the future integrity of valuable national resources, such as wetlands, endangered species habitat, and historic and cultural sites.

The Army's commitment to the conservation of its natural resources is further reflected in Army Regulation (AR) 200-3, *Natural Resources—Land, Forest, and Wildlife Management* and the Headquarters, Department of the Army (HQDA) INRMP Policy Memorandum (21 March 1997), entitled *Army Goals and Implementing Guidance for Natural Resources Planning Level Surveys (PLS) and Integrated Natural Resources Management Plans (INRMP)*. AR 200-3 "sets forth the policy, procedures, and responsibilities for the conservation, management, and restoration of land and the natural resources thereon consistent with the military mission and in consonance with national policies" (HQDA, 1995b). The INRMP Policy Memorandum states that the purpose for completing planning-level surveys and the INRMP is "to ensure that natural resource conservation measures and Army activities on mission land are integrated and are consistent with federal stewardship requirements" (HQDA, 1997).

AR 200-2, *Environmental Effects of Army Actions*, "sets forth policy, responsibilities, and procedures for integrating environmental considerations into Army planning and decision making" (HQDA, 1988). In particular, AR 200-2, paragraph 2-6e, Integration with Army Planning, states that "environmental analyses and documentation required by this regulation will be integrated as much as practicable with other environmental reviews, laws, and executive orders (Title 40 of the *Code of Federal Regulations* [CFR], Section 1502.25) and — ... Installation management plans, particularly those that deal directly with the environment. These include the Natural Resource Management Plans (Fish and Wildlife Management Plan, Forest Management Plan, and Range Improvement or Maintenance Plan)."

This document reflects the commitment set forth by Camp Johnson to conserve, protect, and enhance the natural resources necessary to provide realistic military training for the soldiers who utilize this installation for training. This INRMP is the plan that will direct the natural resources management program at Camp Johnson from 2002 through 2006. In accordance with the aforementioned regulations, the Army National Guard has integrated the installation's INRMP and the associated Environmental Assessment (EA) for implementing the INRMP into this single document. This document has been prepared in cooperation with the Secretary of the Interior, acting through the Director of the U.S. Fish and Wildlife Service, and the Director of Vermont Agency of Natural Resources (16 U.S.C 670a(a)(2)).

1.01 Cultural Resource Guidance Documents

Other Federal Legislation or Regulation may apply when dealing with Cultural or Historic artifacts or buildings found on Camp Johnson. These regulations are discussed in more detail in the Integrated Draft Cultural Resources Management Plan (final copy due November 2001). These policies include, but are not limited to:

Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 – (P.L. 101-601), requires federal agencies to establish Native procedures for identifying Native American groups associated with cultural items on federal lands, to inventory human remains and associated funerary objects in federal possession and to return such items upon request to the affiliated groups. The law also requires that any cultural items covered by this Act shall be reported to the head of the federal entity who shall notify the appropriate Native American tribe or organization and cease activity in the area of the discovery for at least 30 days.

Archeological Resources Protection Act (ARPA) of 1979 – Prohibits the removal, sale, receipt and interstate transportation of archaeological resources obtained illegally (without permits), from federal or Indian lands and authorizes agency permit procedures for investigations of archaeological resources on lands under the agency's control

Executive Order 13007 of 1996 on Indian Sacred Sites – provides additional direction to federal agencies regarding Indian sacred sites. Federal agencies are, "within the constraints of their

missions", required to accommodated Indian tribes' requirements for access to and ceremonial use of sacred sites on public lands; and avoid damaging the physical integrity of such sites.

Executive Order 13175, Consultation and Coordination with Indian Tribal Governments. This executive order was issued on November 6, 2000, expanding on and strengthening E.O. 13084 (Consultation and Coordination with Indian Tribal Governments, 1998). Federal agencies are to recognize the right of self-governance and the sovereignty of Indian tribes. Agencies are directed to consult with tribes in developing and implementing policies that have tribal implications. Each federal agency is to have "an accountable process to ensure meaningful and timely input by tribal officials in development of regulatory policies that have tribal implications." This executive order supplements the 1994 Executive Memorandum "Government-to-Government Relations with Native American Tribal Governments." E.O. 13084 is revoked as of February 5, 2001 under the new executive order.

National Historic Preservation Act of 1966 (NHPA), as amended through 1992 (16 USC 470-470w). The NHPA is the centerpiece of federal legislation protecting cultural resources. In the act, Congress states that the federal government will "provide leadership in the preservation of the prehistoric and historic resources of the United States," including resources that are federally owned, administered, or controlled. For federal agencies, Sections 106 and 110 of the act provide the foundation for how federal agencies are to manage cultural resources, but other section provide further guidance.

Section 106. Similar to NEPA, Section 106 of the National Historic Preservation Act requires the federal government to take into account the effects of its actions or programs, specifically on historic and archaeological properties, prior to implementation. For the VTARNG, this requirement applies to all proposed actions on federal lands and any proposed activities that are federally supported. Consultation with the SHPO and/or the ACHP is a critical step in this process. Although one Federally-recognized Native American tribe has been identified, the Stockbridge Munsee Community of Wisconsin, their ancestral interest is only in the extreme southwest portion of Vermont. Camp Johnson is located in Central Vermont. There are no Federally-recognized Native Americans with ancestral ties to this region of Vermont.

DoD Annotated Policy 27 October 1999 – DoD promulgated its annotated American Indian and Alaska Native Policy, which emphasizes the importance of respecting and consulting with tribal governments on a government to government basis. The policy requires and assessment, through consultation, of the affect of proposed DoD actions that may have the potential to significantly affect protected tribal resources, tribal rights or Indian lands.

1.1 GOALS AND POLICIES

The general goals of this INRMP for Camp Johnson conform to those outlined in the Army Environmental Strategic Action Plan. Those general goals include the following:

To ensure the long-term sustainability of the lands to support the military mission.
To protect the natural resources.
To protect the cultural resources.
To accommodate multiple uses of the land.

The goals of the natural resources management program, as established by the VTARNG, and provided in detail in Section 5.1, are to maintain ecosystem viability and ensure the sustainability of desired military training area conditions; to maintain, protect and improve ecological integrity; to protect and enhance biological communities, particularly sensitive, rare, threatened and endangered species; to protect the ecosystems and their components from unacceptable damage or degradation, and to identify and restore degraded habitats.

The ability to achieve these goals depends directly on the health and condition of the natural resources. The success of the military mission at Camp Johnson is dependent on the condition of the natural resources, as well. Protecting the ecological and biological integrity of the training lands ensures that the environmental conditions of the training lands continue to provide the vegetation, soil and water resources necessary for realistic military training.

The natural resources management program must remain flexible if it is to achieve long-term success. The natural resources management program will achieve and maintain this flexibility by incorporating adaptive management techniques into the program. Adaptive management is a process by which new information, from either monitoring data or scientific literature, is used to evaluate the success of the management measures currently in place. This information is then used to determine the necessary changes in the management approach to ensure the continued success of the program. The natural resources program may also be required to adapt to unforeseen changes in military mission and legal requirements.

Maintaining optimal environmental conditions on the training lands is essential for the success of the military mission at Camp Johnson. Therefore, the focus of this INRMP is on the management of the natural resources in the training areas. The management measures were developed and based on the current and anticipated future military mission and activities and known natural resource conditions. This INRMP will guide natural resources management at Camp Johnson for the next five years (i.e., 2002 through 2006) and provide a solid foundation from which to build the program beyond the year 2006.

1.2 NEPA COMPLIANCE AND INTEGRATION

1.2.1 National Environmental Policy Act of 1969 (NEPA)

Under NEPA, Federal agencies take into consideration the environmental consequences of proposed major actions. The intent of NEPA is to protect, restore, or enhance the environment through well-informed federal decisions. This act is premised on the assumption that providing timely information to the decision-maker and the public concerning the potential environmental consequences of proposed actions will improve the quality of federal decisions. Thus, the NEPA process includes the systematic, interdisciplinary evaluation of potential environmental consequences expected to result from implementation of a proposed action.

The Council on Environmental Quality (CEQ) was established under NEPA to implement and oversee federal policy in this decision-making process. To this end, CEQ has issued *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 CFR Parts 1500-1508). The CEQ regulations specify that an EA must be prepared to:

- Briefly provide evidence and analysis for determining whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FNSI).

- Aid in an agency's compliance with NEPA when an EIS is unnecessary.

- Facilitate preparation of an EIS when one is necessary.

In addition, according to CEQ regulations (40 CFR Part 1500.2(c)), NEPA's requirements should be integrated "with other planning and environmental review procedures required by law or by agency practice so that all such procedures run concurrently rather than consecutively".

The NEPA process includes various levels of environmental analysis and documentation. The type of ARNG action proposed, the environmental issues involved, and other considerations associated with the action determine the level of analysis and documentation required. Categorically excluded action is an action that has been determine not to have a significant effect on the human environment, either individually or cumulatively, and does not normally require formal environmental analysis.
An EA is described in the CEQ regulations as a concise public document that provides sufficient analysis of an action to determine whether the action has no significant environmental effects or whether a more detailed analysis (an Environmental Impact Statement (EIS)). The EIS process is a detailed study that analyzes the effects of a proposed action and its alternatives and includes an extensive public involvement process.

1.2.2 INRMP and NEPA Integration

Historically, the Army and other DoD agencies have prepared NEPA analysis and documentation for proposed actions to implement plans, such as INRMPs, *after* these plans have been developed. Although this approach complies generally with NEPA regulations and policies, it is cumbersome and often results in the inefficient repetition and redundancy associated with developing completely separate documents.

CEQ regulations encourage NEPA documents to be combined with other agency documents to reduce duplication and paperwork (40 CFR §1506.4) so that agencies can focus on the real purpose of the NEPA analysis—that is making better decisions. Although this recommendation is not routinely or regularly

followed for a variety of reasons, it is supported by Army leadership, the U.S. Environmental Protection Agency (USEPA), and CEQ.

Recognizing the efficiencies in cost and time that could be realized from a fully integrated approach to the planning development process, the United States Army Corps of Engineers (USACE) has, for several years, regularly and successfully combined its civil works project plans and their required NEPA documents, generally at the project Feasibility Study phase. In addition, the *Habitat Conservation Planning Handbook*, developed in a joint effort between USFWS and the National Marine Fisheries Service, strongly recommends combining Habitat Conservation Plans and their NEPA analyses to streamline the planning process. This handbook suggests "the process should be streamlined by integrating the analyses in the same document, to the extent possible, by running the process concurrently, not consecutively, and by conducting joint processes with other agencies as applicable."

Army guidelines recommend that the INRMP and its associated NEPA analysis and documentation be prepared concurrently. In an effort to alleviate the drawbacks of preparing sequential documents and to streamline the overall process, Camp Johnson has fully integrated the INRMP and its associated NEPA analysis and documentation into a single plan. This document has been prepared using the concurrent and fully integrated NEPA analysis approach. This approach embraces the intent and spirit of NEPA, as well as the requirements of AR 200-2 and AR 200-3. Additionally, it formalizes existing natural resource practices and can be used as an effective tool for future planning and decision-making purposes.

The INRMP portion of the document provides management measures that have been developed by considering various alternatives for meeting resource-specific goals and objectives at Camp Johnson. The INRMP also provides the rationale for why certain management measures have been selected for implementation and others have not, based on analysis of resource-specific screening criteria. The EA portion of the document "carries forward" the INRMP's selected management measures as the proposed action. Since other management alternatives are considered and, for various reasons, dropped from further consideration in developing the INRMP, and since no alternative plans have been offered, the EA addresses only the proposed action and a no action alternative. This approach is further described in Section 1.4.4, below.

To readily identify elements of the NEPA analysis, Table 1-1 presents a "road map" indicating corresponding EA sections embodied within this document. All remaining sections pertain primarily to the INRMP.

1.2.3 Interagency Coordination and Review

Interagency participation is invited throughout the process for developing the INRMP. Once the INRMP has been drafted, the EA may be used as a tool to inform decision-makers and the public of the likely environmental and socioeconomic consequences of implementing the proposed action and alternatives. In addition, Camp Johnson provides for public participation in the NEPA process to promote open communication and better decision-making. Public participation is invited throughout the NEPA process for developing the EA portion of the document. The following discussion describes agency and public involvement for this project.

Interagency Coordination. Draft versions of the Integrated Natural Resources Management Plan have been in circulation since 1993. Consultations have occurred with the USFWS and the VTANR. None of the earlier drafts were ever approved at the National Guard Bureau Level and were therefore never considered an official INRMP The current INRMP has taken much of those earlier drafts and incorporated them into this document. Thus, the earlier consultations are still valid for this document. The current document contains more detail of the level of natural resource activities planned for Camp Johnson than did earlier documents. Current drafts have been sent to USFWS, VTANR, US Army Corps of Engineers (USACE), Vermont State Division for Historic Preservation, USDA Vermont SCS State Office, and the Vermont Fish and Wildlife Department. Comments and discussions from these agencies are included in this draft of the INRMP. Comments are available for review in Appendix J.

Project Review and Comment. The primary responsible agencies were provided an opportunity to review and comment on the draft versions of the document (see comments in above paragraph). Relevant and applicable comments have been incorporated into the document. Consultation letters can be found in Appendix J.

1.2.4 Public Participation.

Public input will be obtained during two 15-day comment periods. The initial public comment period will be held following completion of the Draft INRMP/EA. During this time any comments submitted by agencies, organizations, or members of the public on the document will be considered. If the EA concludes that there are no significant impacts, a FNSI will be issued. The draft FNSI and final INRMP/EA will then be made available during another 15-day public comment period. Notices of public comment periods and availability of the documents will be advertised through the local media. Appendix G will include copies of public notices and public comments and responses. The INRMP/EA will be made available for public review at the following libraries:

Burnam Memorial Library
Colchester, VT

Vermont State Library
109 State St.
Montpelier, VT

Bailey Howe Library
Special Collections
University of Vermont
Burlington, VT

Vermont National Guard
State Public Affairs Office
Green Mountain Armory
Camp Johnson
Colchester, VT

1.2.5 Purpose of and Need for the Proposed Action

Camp Johnson is proposing to implement the INRMP. The purpose of the proposed action is to carry out the resource-specific management measures that will enable Camp Johnson to effectively manage the use and condition of natural resources located on the installation to protect the natural setting primarily for military training purposes. Implementation of the proposed action will support the Army's continuing need to train soldiers in a realistic natural setting while meeting other mission and community support requirements and complying with environmental regulations and policies. Implementation of this plan will ensure zero net loss in the capability of military lands to sustain the military mission. The need for this proposed action ensures that natural resources conservation measures and Army activities and lands are integrated and are consistent with federal stewardship requirements including the Sikes Act (16 U.S.C. § 670a(b)) and the Sikes Improvement Act of 1997.

1.2.6 Description of the Proposed Action and Alternatives

Proposed Action. The proposed action is to implement the INRMP for Camp Johnson, Vermont. This proposal would meet the Army's underlying need to train soldiers in a realistic setting that is in compliance with environmental regulations and policies. The proposal includes natural resource management measures that reflect the geographical areas associated with the contiguous properties of the

Table 1-1

Roadmap Indicating NEPA Analysis and Corresponding INRMP Sections

Required NEPA Analysis	Corresponding INRMP Section
The **Executive Summary** briefly describes the proposed action, environmental consequences, and mitigation measures.	Provided immediately following the **Preface**.
The **Purpose of and Need for the Proposed Action** summarizes the proposed action's purpose and need and describes the scope of the environmental impact analysis process.	**Section 1.4.4**
Description of the Proposed Action and Alternatives describes the proposed action of implementing the INRMP (i.e., the selected management measures) and an alternative to implement the proposed action (i.e., the no action alternative).	**Section 1.4.5**
Scope of Analysis describes the scope of the environmental impact analysis process.	**Section 1.4.6**
Affected Environment describes the existing environmental setting.	**Section 3.0**
Environmental Consequences identifies potential environmental effects of implementing the proposed action and the no action alternative.	**Section 7.0**
Conclusions identifies potential impacts associated with the alternatives and draws a conclusion as to which alternative should be implemented.	**Section 8.0**
References provides bibliographical information for cited sources.	Provided in Appendix I**.**
List of Preparers identifies persons who prepared the document and their areas of expertise.	Provided in Appendix M.
Persons Consulted provides a listing of persons and agencies consulted during preparation of the EA.	Provided in Appendix J
The **Appendices** include agency consultation letters and supplemental information used to develop the NEPA analysis.	Provided immediately following **Section 8**.

installation. In addition, because the INRMP is a "living" document, it will be modified (adaptively managed) over time. The proposed action focuses on a 5-year period, which is consistent with the time frame for the management measures described in the INRMP. Implementation of the INRMP means that the proposed action involves putting in place the management measures presented in Section 5.14,

Integration and Summary of Management Measures. Additional environmental analyses may be required as new management measures are developed over the long term (i.e., beyond 5 years). Implementation of some INRMP-related projects could also require additional/supplemental NEPA analysis should project-specific activities or effects fall outside those analyzed and described in this document.

Alternatives. Alternatives considered for the management of Camp Johnson's natural resources are described and evaluated within those sections of this document that address the ecosystem-based management of each specific resource (see Section 5.0). The development of selected management measures for the INRMP involved a screening analysis of resource-specific management alternatives. The screening analysis involved the use of accepted criteria, standards, and guidelines (e.g., USDA/NRCS *National Soils Handbook*; USEPA *Protecting Natural Wetlands: A Guide to Stormwater Best Management Practices*), when available, coordination with federal and state natural resource management agencies, and the judgment of VTARNG professionals and others to identify management practices for achieving Camp Johnson's natural resource management objectives. The outcome of the screening analysis led to the development of the proposed action. Obviously, an infinite number of permutations of specific management alternatives are possible. Consistent with the intent of NEPA, this process focused on considering a reasonable range of resource-specific management alternatives and, from those, developing a plan that could be implemented, as a whole, in the foreseeable future. It then dropped from detailed analysis management alternatives that would not satisfy Camp Johnson's natural resource management objectives or that were otherwise infeasible. Management alternatives that were considered during the screening process but not analyzed in detail are discussed in Section 5.0, as is the rationale for not selecting them. Application of this screening process in developing the proposed action (i.e., adoption of the management measures contained in the INRMP) eliminated the need to define and evaluate hypothetical alternative plans. As a result, the EA, made an integral part of this document, formally addresses only two alternatives, the proposed action and the "no action" alternative described below. Should another plan be offered for natural resources management at Camp Johnson, it would be evaluated as an additional alternative.

No Action. Inclusion of a no action alternative is prescribed by CEQ regulations. The no action alternative serves as a benchmark against which proposed federal actions can be evaluated. Implementation of the no action alternative means that the management measures set forth in the INRMP would not be executed. Current management measures for natural resources would remain in effect, and existing conditions would continue as the status quo. This document refers to the continuation of

existing (i.e., baseline) conditions of the affected environment, without implementation of the proposed action, as the no action alternative. Existing conditions are not static, and characterizations of these conditions are only a "snapshot" that would continually change with no action.

1.2.7 Scope of Analysis

The potential environmental effects associated with the proposed action require assessment to comply with NEPA, regulations of the CEQ, and AR 200-2. This EA identifies, documents, and evaluates the effects of implementing the INRMP for Camp Johnson. The INRMP addresses the geographical area associated with the contiguous properties of Camp Johnson with particular emphasis on the training area. As discussed, this EA examines the Army's preferred alternative (i.e., the proposed action as described in Sections 1.4.4 and 5.0) and a no action alternative (see Sections 1.4.4 and 7.1).

The purpose of this analysis is to provide an objective evaluation of the environmental consequences of an implementable INRMP for Camp Johnson that can guide the installation in the following activities:

- Meeting training needs and military mission requirements.
- Achieving natural resource management goals.
- Meeting legal and policy requirements, including those associated with NEPA, that are consistent with current national natural resources management philosophies.

To meet this objective, an interdisciplinary team of environmental scientists, biologists, planners, economists, engineers, archeologists, historians, and military technicians developed the INRMP and EA. The team identified the affected environment, analyzed the proposed action against existing conditions, and determined the potential beneficial and adverse effects associated with the proposal.

1.3 BACKGROUND

1.3.1 Location

Camp Johnson is located in the northwest region of the State of Vermont, on the eastern fringe of the Champlain Valley. It is located entirely within the town of Colchester, Chittenden County. Nearby cities

include: Burlington, Vermont's largest city, 3 miles to the west; Essex Junction, 3 miles to the east; Montpelier, the state capital, 35 miles to the southeast; and St. Albans, 20 miles to the north. Main roads nearby include Interstate 89, located 2 miles to the west, which runs northeast and southwest, and State Highway 15, which passes along the front entrance to Camp Johnson and crosses the State east to west. Camp Johnson is located 12 miles to the west of Vermont National Guards' Ethan Allen Firing Range. Railway service closest to Camp Johnson is in Essex Junction, where the Central Vermont Railway provides both freight and AMTRAK passenger service. Lake Champlain lies 4 miles to the west of Camp Johnson. (Figure 1-1).

Camp Johnson is surrounded by land serving multiple purposes. Some of the surrounding businesses include the Fanny Allen Hospital and Saint Michael's College, both private institutions. There is also some light industry in the area, some of which occupy the former Fort Ethan Allen. On the northern and eastern boundaries there is a considerable number of private homes.

1.3.2 Installation History

"Camp Johnson" refers collectively to both State and Federal land. The state owned portion of Camp Johnson is approximately 35 acres in size. It contains the Vermont National Guard State Headquarters as well as all the necessary facilities required to support military training at the adjacent federally owned facility, *formerly* known as Ethan Allen Air Force Base.

The former Air Force Base is a Federally owned 625 acre training area located in Colchester, Vermont. It was purchased by the US Government in 1895 and designated Fort Ethan Allen. After being transferred to the Department of the Air Force during the Korean Conflict, it was redesignated Ethan Allen AFB. The installation was deactivated in 1964 and most of the buildings were removed. The land is currently licensed to the VTARNG for training and no longer used by the Air Force. Together, the two parcels are commonly referred to as Camp Johnson and total 660 acres.

For more than half a century after its consolidation, Camp Johnson and Ethan Allen AFB were largely undeveloped. The base was divided roughly in two by Sunderland Brook and bounded to the north by small farms, to the west by the steep slope down to route 7, to the east by farmland along Susie Wilson Road and to the south by Route 15. During this time the base encompassed approximately 1600 acres. Beginning in the mid-1950's, parcels of land adjacent to the reservation were sold to development

interests, Camp Johnson itself parting with some of the land on its periphery. Presently, non-profit institutions, industrial and residential development corporations and private homeowners, own the lands surrounding Camp Johnson.

1.3.3 Neighbors

The lands surrounding Camp Johnson are owned by a variety of non-profit institutions, industrial and residential development corporations and private homeowners. The plateau immediately north of the main drainage of Sunderland Brook is an extension of a large terrace now occupied by the Westbury Mobile Home Park and the newer housing developments along Blakely Road. The mobile home park sits between Kellogg Road and Sunderland Brook, northeast of the reservation. Fort Ethan Allen and Winchester Place (apartments) lie along the eastern boundary of the reservation. St. Michaels College retains ownership of Winchester Place land although the town houses are in private ownership. This small wedge of land abuts Fort Ethan Allen to the northeast. Fort Ethan Allen is a mix of industrial, commercial, institutional and residential properties and was once part of the military reservation of which Camp Johnson is a part.

The Hercules Drive industrial park development sits along the western boundary of the reservation and abuts the Sunny Hollow Property to the north. Ownership is divided among the several dozen companies and corporations operating on the site. Once part of Camp Johnson, these properties totaling 200 to 225 acres were part of the main terrace that the majority of the base sits upon.

1.4 RESPONSIBLE AND INTERESTED PARTIES

The success of the management of the natural resources located at Camp Johnson and the implementation of this INRMP requires a cooperative effort among the parties directly responsible. The level of success can be enhanced by developing partnerships among other parties that have a vested interest in the responsible management of the natural resources at Camp Johnson. A brief description of the parties directly responsible for the implementation of this INRMP, as well as other interested parties is provided below.

1.4.1 Camp Johnson

The role of the organizations at Camp Johnson that are either directly responsible for, or are providing assistance in, the implementation of this INRMP are provided below.

Facilities Management Officer (FMO). The FMO plays a pivotal role in VTARNG planning and maintenance of range facilities. The environmental office, which is very important in the implementation of this plan, falls under the auspices of the FMO.

Post Commander. The Post Commander is directly responsible for operating and maintaining Camp Johnson, including the implementation and enforcement of this INRMP. There is no designated "Post Commander" for Camp Johnson due to its small size. Currently, the FMO acts in the capacity of Post Commander.

POTO (Plans, Operations and Training Office, a.k.a., DCSOPS – Deputy Chief of Staff, Operations). The POTO identifies training requirements to include numbers and types of small arms ranges to support using units. The POTO is a member of the Environmental Quality Control Council (EQCC), the ITAM Steering Committee, and provides direct input to the INRMP development. Per Army regulations 350-4, the POTO is the proponent for the ITAM program at the State ARNG level. Per AR 210-21, the POTO is also a proponent for the Range and Training Land Program (RTLP).

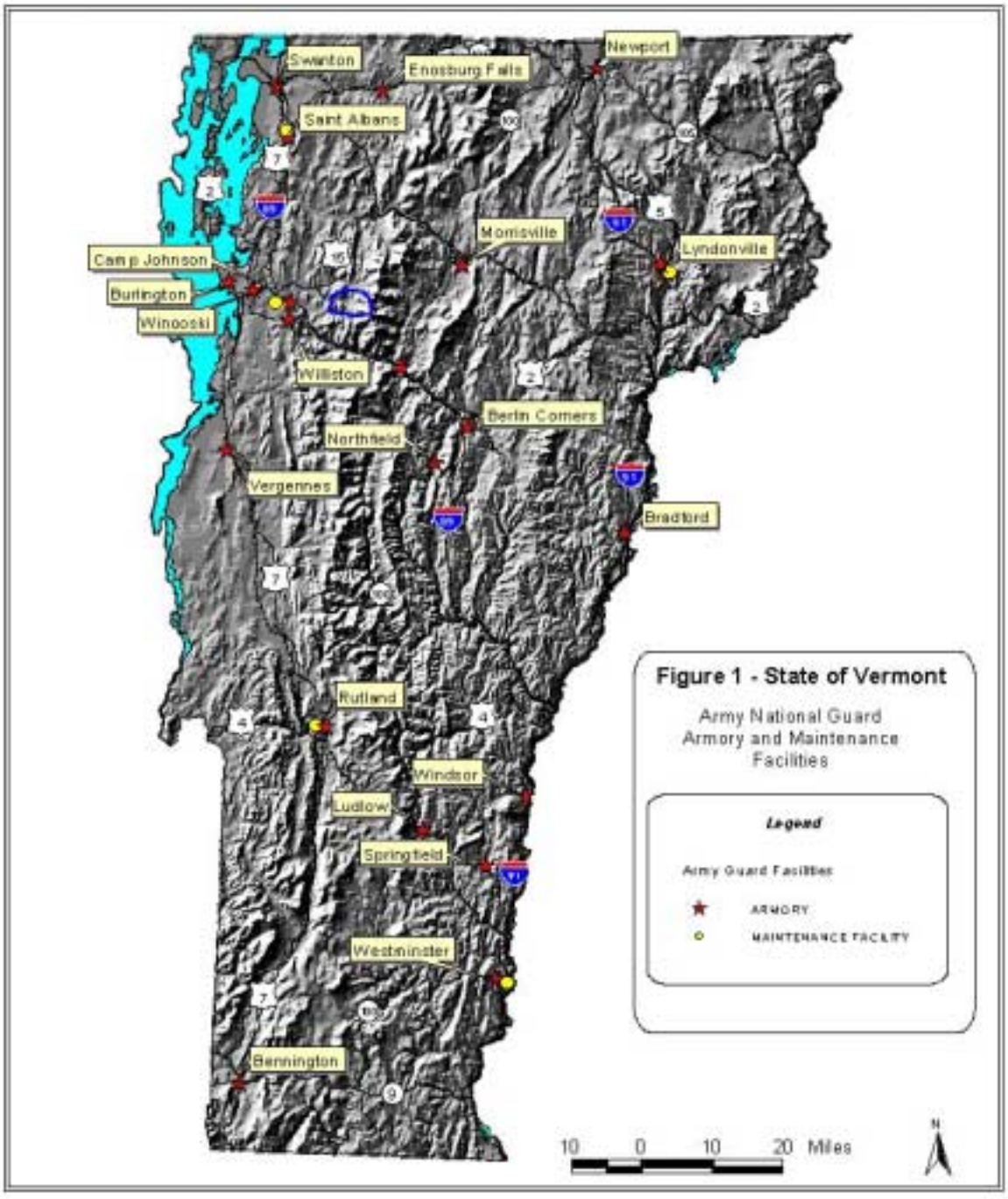
1.4.2 Other Defense Organizations

U.S. Army National Guard Bureau (NGB). The National Guard Bureau (NGB) provides administrative and financial support, and policy guidance to Camp Johnson. NGB reviews, provides comments, and approves Camp Johnson's INRMP.

Vermont State Military Department. The Military Department of Vermont provides administrative, financial, and professional support to Camp Johnson. These include Environmental Engineers, Architectural Engineers, Natural Resource Professionals, maintenance workers and others.

1.4.3 Other Federal Agencies

There are a number of Federal agencies, in addition to the Department of Defense (DoD) and Camp Johnson, that have an interest or a role in the management of the natural resources at Camp Johnson.


Swanton
Enosburg Falls
Newport
Saint Albans
Morrisville
Lyndonville
Camp Johnson
Burlington
Winooski
Williston
Berlin Corners
Northfield
Vergennes
Bradford
Rutland
Windsor
Ludlow
Springfield
Westminster
Bennington
Figure 1 - State of Vermont
Army National Guard
Armory and Maintenance
Facilities
Legend
Army Guard Facilities
ARMORY
MAINTENANCE FACILITY
10 0 10 20 Miles
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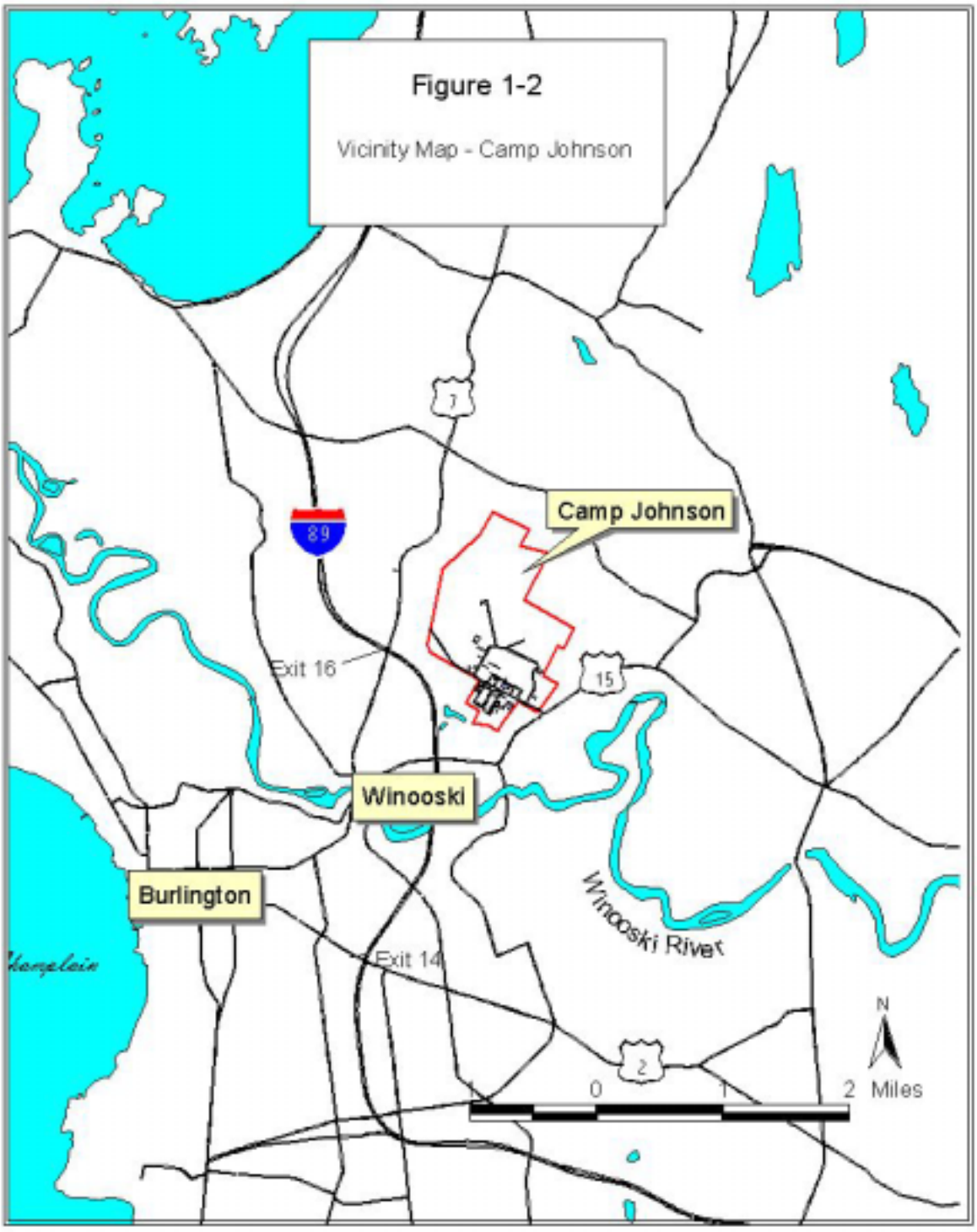
Figure 1-2
Vicinity Map - Camp Johnson
Camp Johnson
89
7
Exit 16
15
Winooski
Burlington
Winooski River
Exit 14
2
N
0
1
2 Miles

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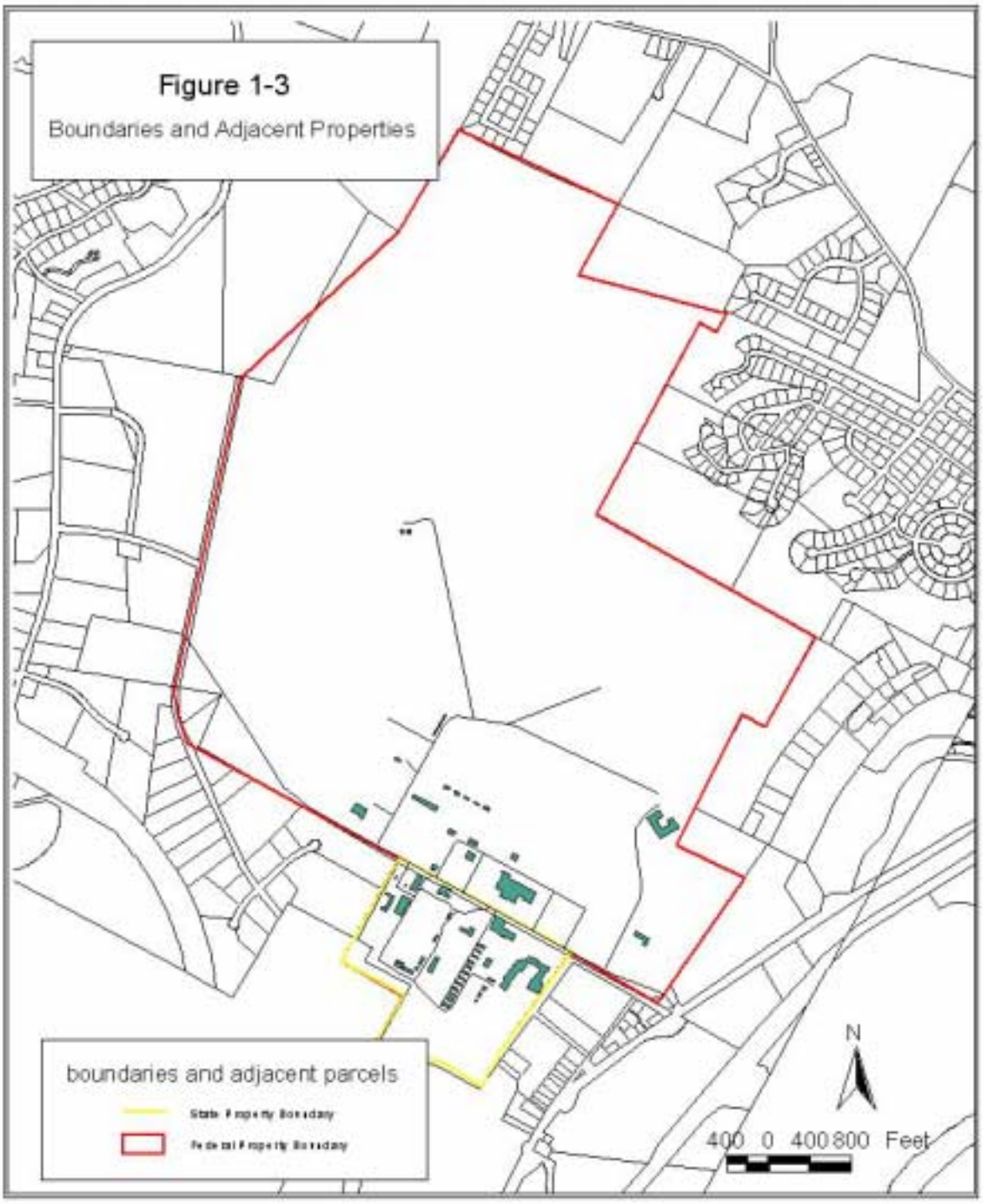
Figure 1-3
Boundaries and Adjacent Properties
boundaries and adjacent parcels
N
400 0 400 800 Feet

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The involvement of these agencies is based on signatory responsibilities, cooperative agreements, regulatory authority, and technical assistance as required by Federal laws and regulations. The agencies and their roles and responsibilities are described below.

U.S. Fish and Wildlife Service (USFWS). USFWS provides guidance concerning the conservation, protection, and management of the fish and wildlife resources presented in the INRMP. USFWS is the primary Federal agency for issues regarding fish and wildlife management, as well as the regulatory authority for the Endangered Species Act of 1973 and the Migratory Bird Treaty Act (16 U.S.C. 703-711).

U.S. Army Corps of Engineers (USACE). USACE maintains jurisdiction over wetlands on Federal Lands.

1.4.4 State Agencies

Vermont Agency of Natural Resources (VTANR). The VTANR play a consulting role concerning the conservation, protection, and management of the fish, wildlife, and other environmental resources presented in this INRMP. The VTANR is the primary state agency for issues regarding fish and wildlife management, as well as the regulatory authority behind the rules and regulations for hunting, fishing, trapping, surface waters, and wetlands. Within VTANR is the Non-Game and Natural Heritage Program (VTNNHP), a division of the Fish and Wildlife Department. The VTNNHP is the lead agency in the pitch pine restoration project, which is discussed in further detail in Sections 3 and 5.

1.4.5 Universities

When compatible with training activities, Camp Johnson voluntarily participates in, and provides assistance with various educational natural resource research projects. There are a number of studies that have recently taken place or that are ongoing projects at Camp Johnson. The University of Vermont is involved in a number of these projects. In addition, St. Michaels College has had representatives from their staff participate in the natural resource planning level surveys completed on Camp Johnson.

Figure 1-1 State of Vermont Facilities and location ***1.4.6 Contractors***

Contractors provide Camp Johnson with technical support for natural resources and environmental management projects. This technical support includes preparation of INRMPs, National Environmental Policy Act (NEPA) analyses and documentation, cultural and biological resource surveys, and wetland delineations.

We are currently administering one contract for natural resource services. Upland Forestry, of Bristol Vermont, holds the contract for Wildlife Management and Forest Management at Camp Johnson.

1.4.7 Other Interested Parties

The Nature Conservancy (TNC). The Department of Defense and TNC have a Cooperative Agreement to provide effective and efficient protection and management of biodiversity within the context of the DoD's environmental security and military missions. Based on the contents of this Cooperative Agreement, VTNNHP and the TNC have a mutual interest in conservation and management of the pitch pine restoration area within Camp Johnson.

Other interested parties may include neighbors, other environmental organizations, citizen organizations, non-federally recognized Native American tribes, and the general public.

SECTION 2.0:
MILITARY MISSION

2.1 OVERVIEW

The primary mission of The Vermont Army National Guard (VTARNG) is to provide adequate facilities, training areas, and ranges to maintain readiness for the assigned mission of being prepared to protect the United States in the event of mobilization. Such readiness results only from receiving high-quality training that incorporates all mission elements and tasks and provides the high-quality, realistic training to the individuals and units who train there.

Peacetime Missions. In peacetime, Camp Johnson operates under the National Guard Bureau and the Military Department of Vermont as a Company level training site, an armored platoon maneuver area, and as the State Headquarters for the Vermont National Guard. Facilities exist to house, sustain and train 100 people year round during weekend or multiple unit training assemblies (MUTA). Activities conducted include weapons firing (on a baffled or indoor range), tactics (both infantry and armor), field bivouacs, engineer equipment training, and land navigation. The VTARNG Aviation units also utilize Camp Johnson for specific helicopter training. An Air Ambulance Medical Evacuation utilizes the area with Black Hawk (UH-60) and two OH-58 helicopters. Pilots train for landing in all weather condition, slope landings and low-level hovering. (See Appendix N for more specific information) The site is also utilized daily as a test-driving area for vehicles undergoing maintenance and as a test flight area for overhauled or repaired helicopters.

2.2 THE RELATIONSHIP BETWEEN THE MILITARY MISSION AND NATURAL RESOURCES

The Army recognizes that a healthy and viable natural resource base is required to support the military mission. To be effective, the natural conditions of the training areas on Camp Johnson must be maintained to provide realism. Areas that are obviously degraded by previous training activity detract from the realism of the current training activity. Vegetation is necessary for cover and concealment, therefore, areas that are stripped of their vegetation are no longer representative of the undisturbed lands that might be encountered during real conflicts. The relationship between soils and vegetation is very

important in supporting the mission. In addition to providing cover and concealment, vegetation protects the soils from erosion. Eroded soils are unable to support the vegetation, which results in a loss of realism and eroded areas also represent a safety hazard to the soldiers. This INRMP helps to ensure that environmental considerations are an integral part of planning activities at Camp Johnson and that natural resources are protected in accordance with Army regulations and policies.

Ongoing military operations performed in support of the mission at Camp Johnson may alter the environmental setting and condition of the natural resources. For example, construction of ditches, defensive fighting positions (foxholes), and roads result in vegetation loss and soil effects such as disturbance, compaction, and erosion. While short-term changes in the environmental setting may still provide for relatively realistic training opportunities, the absence of long-term management measures to properly conserve and restore natural resources may impede Camp Johnson's ability to continue to adequately train soldiers. In addition to the impacts mentioned above, environmental damage can also place other constraints on training such as:

- loss of training acreage;
- decreased tactical maneuverability;
- increased land and natural resource maintenance costs; and
- increased safety hazards.

Implementing appropriate management measures, and considering alternatives to these measures as they are developed, limits the potential for negative impacts to natural resources that are critical to providing a realistic training environment. In addition, such measures likely result in a more effective, long-term approach to natural resource protection and conservation. Table 2-1 provides examples of mission activities and their potential effects on the natural resources and future training/mission capabilities. Presented below are examples of practices that are used to avoid permanent and serious environmental degradation at Camp Johnson (Some management measures employed to reduce or prevent environmental degradation of resources at Camp Johnson are discussed in further sections).

Vehicle Movement. Damage to roads and trails by heavy vehicle maneuvers is costly in terms of money and training time.

Off-road movement can destroy vegetation and ground cover, which results in accelerated soil erosion and the gully formation. Large gullies represent a safety hazard and reduce the availability of quality training land.

Table 2-1

Mission Activities and Their Potential Effects

Activity/Use	Potential Effects on	
	Natural Resources	Training/Combat Readiness
Vehicles operated off-road	Degradation of soil, water, and vegetation Erosion gullies Soil compaction Soil and water contamination from field maintenance	Loss of training realism Loss of camouflaging for vehicles and troop locations Safety hazards in eroded areas Contamination of soils could limit availability of training areas Increased maintenance costs
Defensive fighting positions (foxholes) and defilades	Soil displacement Erosion; eroded soils unable to support vegetation	Loss of training realism Safety hazards in eroded areas
Bivouac Areas	Soil compaction and/or erosion Loss of vegetation/forest understory Litter from meals-ready to eat (MREs), glass bottles, aluminum cans, plastic bags, cigarette butts	Loss of training realism Loss of camouflaging for vehicles and troop locations Limit usable training areas Litter provides Essential Elements of Information (EEI), such as presence and duration at a location, length of supply lines, etc.
Cutting of Vegetation for Camouflage/Field Fortifications	Cut vegetation wilts and discolors to contrast with natural background Eventual loss of vegetation	Loss of training realism Exposed fighting position Dead vegetation is easy target for infrared radar
Amphibious Training	Accidental spills could contaminate drinking water supply and threaten human health	Could limit usable training areas
Field Maneuvers/Range Firing	Wildfires from pyrotechnics, blanks, ammunition or shell detonation. Litter from ammunition brass, plastic paint ball containers, communication wire, concertina wire Soil and water contamination from field maintenance on weapons	Accidental fires result in loss of usable training areas Loss of training realism Immobilized vehicles Potential administrative restrictions as a result of disturbance (*this particularly applies to threatened and endangered species*)

Procedures to reduce damage from vehicle activity and to maintain or enhance training lands are listed below:

On-Road Movement:

- Stay on established roads whenever possible when traveling to or from training areas. Ruts should be filled as soon as possible.

- Avoid driving on the edges of the roads and do not cut corners on the roads. Driving on the shoulder and cutting corners will break down the road's edge, create erosion and lead to the destruction of the road.

- Use only marked roads and trails.

Off-Road Movement:

- Remain on marked trails and designated routes unless otherwise directed.

- Avoid neutral steer turns unless absolutely necessary.

- Avoid crushing trees and shrubs. Do not drive directly up steep slopes.

- Avoid OFF LIMITS areas.

- Reduce vehicle speed.

- Avoid wet areas especially creek bottoms and streams.

Field Activities. Procedures to reduce damage as a result of field activities are provided below.

Camouflage

- Do not cut or damage live trees and shrubs during training. Field fortifications should generally be constructed with rocks (except those from existing stone walls or historical foundations) and fallen dead wood.

- Do not use vegetation as camouflage, use camouflage nets.

- Conduct training with a concern for conservation and future use of range areas.

Waste Disposal

- Police all training areas before and after use. Dispose of all waste in an authorized location and manner.

- Only use the concrete vault latrines or port-o-lets for human waste.

Fire

- When fire danger is high, the use of pyrotechnics, smoke grenades, and simulators may be restricted and regulated by CFMO. Smoke grenades and star-cluster flares will be used only for emergency operations in high fire danger times.

- If a fire occurs, immediately report its location, nature, and size to the CFMO and the Colchester Fire Department @ 655-1412. Attempt to extinguish or at least contain the fire.

Petroleum, Oil and Lubricants (POL) Spills

- Immediately report all POL spills to Environmental Office. Know the size, location, and type. Take immediate action to control, contain, and clean up the spill. Units must clean up the spill or at least initiate spill response until additional resources arrive or as needed.

- Insure that all personnel are trained in spill prevention and response, and all units have adequate spill response materials available.

- Improper handling of POL products constitutes gross negligence and may be punishable by a fine or imprisonment.

Digging

- Permission must be granted by the Environmental Office prior to any digging. Trenches, defilades, tank traps and fighting positions must be filled at the conclusion of training.

- Digging in a State or Federal protected area is prohibited.

- Digging must cease immediately if historical artifacts, such as burial sites, ruins or ceremonial materials are discovered. Federal law (Native Americans Graves Protection and Repatriation Act of 1990 (NAGPRA), PL 100-601) requires reporting any burial sites.

- All dirt mounds constructed during training must be knocked down, regardless of cause.

Existing natural resources on Camp Johnson lands may influence the manner in which the Camp Johnson mission is executed. While natural resources provide a realistic training environment for meeting mission requirements, their existence also has the potential to limit certain military activities. For example, topographic features of the land or the presence of wetlands or threatened and endangered species may prevent military activities, such as construction, from occurring due to the potential for adverse impacts to those sensitive resources. In addition, any permanent degradation of natural resources as a result of ongoing military use would, in turn, ultimately lead to further mission impairment should realistic training conditions no longer be available. Therefore, not only is the proper management of natural resources and their use by the military a sound environmental practice, but it also directly supports the Camp Johnson mission to provide realistic training. This INRMP considers the effects of such natural resources on the mission and the implementation of this INRMP will result in no net loss of military training capacity.

Because the primary mission of Camp Johnson is to provide adequate facilities, training areas, and ranges to maintain the readiness of the National Guard, any environmental initiatives and plans are considered secondary and should be managed so as not to inhibit meeting military requirements. It is important to consider limitations due to the presence of naturally occurring resources that cannot be altered, as well as those limitations resulting from natural resources that have already been impacted.

2.3 FUTURE MILITARY MISSION IMPACTS ON NATURAL RESOURCES

The INRMP is considered a "living" document that is based on several short-, medium-, and long-range planning goals. Short-range goals include activities that are planned to occur in zero to five years, while medium-range goals include activities in a six- to 10-year period. Long-range goals are usually scheduled beyond 10 years. Because an INRMP is a "living" document, goals may be revised over time to reflect evolving environmental conditions. In addition, medium- and long-range planning goals eventually become short-range activities that also require implementation INRMP's are scheduled to be revised at least every 5 years.

An EA, is a document that captures the most current baseline environmental conditions as a "snapshot" in time. This EA has been prepared using baseline conditions as of October, 2000, for short-range management activities and assesses potential environmental impacts resulting from these proposed activities.

The primary long-range planning goal at Camp Johnson is to continue to provide training facilities while supporting environmental strategies and goals consistent with Army regulations and policies. With long-range planning goals in mind, Camp Johnson has developed several short-range goals for the installation to support the current mission and meet future needs. To that end, this INRMP includes management recommendations that meet three short-range planning goals: (1) to implement a comprehensive environmental strategy that represents compliance, restoration, prevention, and conservation; (2) to improve the existing management approach to protecting natural resources on the installation; and (3) to meet legal and policy requirements consistent with national natural resources management philosophies. Details of proposed management measures are discussed in Section 5.0.

SECTION 3.0:
AFFECTED ENVIRONMENT

This section presents a general description of the natural and human environment associated with Camp Johnson.

3.1 ENVIRONMENTAL SETTING

Camp Johnson sits on a plateau at an elevation of 300 ft above sea level. This plateau extends north from the Winooski River to Sunderland Brook, which, along with several of its drainages, forms boundaries to the east and west. The main channel of Sunderland Brook cuts northwest through the northern half of the base, isolating a small terrace of land to the north from the bulk of the camp. The western drainage separates Camp Johnson from Sunny Hollow Park. The eastern drainage extends south about halfway through the eastern arm of the reservation and completes the semicircular "cap" of sloped land around the base with those of Fort Ethan Allen.

3.2 CLIMATE

Situated at the eastern edge of North America, the New England region enjoys an invigorating climate with four well-defined seasons.

The Appalachian Mountains cross the region; most of the major summits vary between 3,500-4,300 feet. Mount Mansfield, the highest point in Vermont at 4,393 feet, lies approximately 20 miles east of Camp Johnson. The Adirondack Mountains to the west rise to between 4,000 and 5,000 feet. Major valleys include the Champlain Valley, the St Lawrence to the north, and the Connecticut to the east.

Camp Johnson is located about 3.5 miles east of Lake Champlain, and about a mile north of the Burlington Airport. At the airport the average occurrence of the last freeze in spring is around May 10th and that of the first in fall is early October, giving a growing season of 145 days. On average, there are a few days a year with the maximum temperature of 90 degrees or higher. This moderate summer heat gives way to a cooler, but nonetheless pleasant fall period, usually extending well into October. High pressure systems moving down rapidly from central Canada or Hudson Bay produce the coldest temperatures during the winter months, but extended periods of very cold weather are rare.

Precipitation, although generally plentiful and well distributed throughout the year, is less in the Champlain Valley than in other areas of Vermont due to the shielding effect of the mountain barriers to the east and west. The heaviest rainfall usually occurs during the summer thunderstorms, but excessively heavy rainfall is quite uncommon. Droughts are infrequent.

Because of the trend of the Champlain Valley between the Adirondack and Green Mountain ranges, most winds have a northerly or southerly component. The prevailing direction most of the year is from the south. Winds of damaging force are very uncommon.

Most storms approach from the west, but the heaviest episodes of rain or snow are often associated with the relatively infrequent, but intense "nor'easters"—storms that originate in the northern Gulf of Mexico or along the southeast United states coast, and track northeastward along or just off the New England coast. The flow around these systems pulls inland vast amounts of moist air from the Atlantic Ocean. Heavy precipitation is the result.

Table 3-1 Temperature and Precipitation Averages for Burlington Vermont*

MONTH	MAX (°F)	MIN (°F)	AVE. (°F)	PRECIP (in.)
January	25.1	7.5	16.3	1.82
February	27.5	8.9	18.2	1.63
March	39.3	22.0	30.7	2.23
April	53.6	34.2	43.9	2.76
May	67.2	45.4	56.3	3.12
June	75.8	54.6	65.2	3.47
July	81.2	59.7	70.5	3.65
August	77.9	57.9	67.9	4.06
September	69.0	48.8	58.9	3.30
October	57.0	38.6.	47.8	2.88
November	44.0	29.6	36.8	3.13
December	30.4	15.5	23.0	2.42
ANNUAL	54.0	35.2	44.6	34.47

*(National Weather Service)

3.3 AIR QUALITY

Air quality is regulated at the federal level through regulations promulgated under the Clean Air Act of 1970 and its subsequent amendments. The act directed the USEPA to establish and enforce national ambient air quality standards (NAAQS) for air pollutants that endanger public health. EPA consequently adopted air quality standards for six criteria pollutants—ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter (total suspended particulates), and lead particles (Table 3-2). The Clean Air Act requires state or local governments to monitor ambient levels of these pollutants and to develop air quality management plans to ensure compliance with the standards.

3.3.1 Air Pollutant Emissions at Camp Johnson

Camp Johnson has a variety of air pollution sources related to training and training related activities. The facility is used as a training site for both military and civilian use.

Camp Johnson is located within the Champlain Valley Air Management Area (Air Quality Control Region 159), which is designated as attainment or unclassifiable for all criteria pollutants with the exception of PM_{10}, for which the secondary standard is not met, and for ozone. Vermont is within the Northeast ozone transport region (OTR), and is therefore, designated as a non-attainment for ozone. Within the OTR tropospheric ozone levels are influenced by sources of ozone precursors within the region as well as those upwind of the region (i.e., mid-western states).

An air emissions study was completed at Camp Johnson in 1996. The purpose of the study was to determine if the facility is considered a major source of air pollutants and subject to the Title V Operating Permit Program under the Clean Air Act Amendments of 1990. The inventory included an assessment of both actual and potential air emissions, using 1996 as the baseline year. Air pollutant sources at the facility, including stationary, fugitive, and mobile sources were considered.

The emission study determined that the actual emissions from the stationary sources at Camp Johnson were: 1.18 tons of nitrogen oxide ($NO_{x)}$, 0.7 tons of sulfur dioxide ($S0_2$), 0.23 tons of carbon monoxide (CO), 0.33 tons of respirable particulate matter smaller than 10 microns in diameter (PM_{10}), and 1.81 tons

of volatile organic compounds (VOCs) in the baseline year of 1995. *Potential* emissions from the stationary sources at the facility are: 14.35 tons of No_x, 14.5 tons of S02, 5.74 tons of CO, 2.79 tons for PM_{10}, and 14.98 tons of VOCs.

3.3.2 Air Pollutant Emissions in the Surrounding Area

Table 3-2

National Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standards g/m^3(grams/meter^3)	Secondary Standards g/m^3	parts per million
Particulate Matter	24 Hour Maximum[a]	150	150	
	Annual Arithmetic Mean	50	50	
Sulfur Dioxide	24 Hour Maximum[b]	365	None	0.14
	Annual Arithmetic Mean	80	None	0.03
Carbon Monoxide	8 Hour Maximum[b]	10	None	9.00
	1 Hour Maximum[a]	40	None	35.00
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	0.053
Lead	Quarterly Arithmetic Mean[b]	1.5	1.5	
Ozone	1 Hour Maximum[a]	235	235	0.12

[a] National Primary Standards express the level of air quality necessary to protect the public health from any known or anticipated adverse effects of a pollutant, allowing for a margin of safety to protect sensitive members of the population. National Secondary Standards express the level of air quality necessary to protect the public welfare by preventing injury to agricultural crops and livestock, deterioration of materials and property, and adverse impacts on the environment.
[b] National standards, other than those based on annual geometric means, are not to be exceeded more than once per year.

Table 3-3
Actual Air Emissions, Camp Johnson

Actual Emissions, tons/year - 1995					
Source	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**VOC**
Boilers	0.60	0.70	0.15	0.05	0.01
Tanks	0.00	0.00	0.00	0.00	0.01
Degreasing	0.00	0.00	0.00	0.00	0.17
Gasoline dispensing	0.00	0.00	0.00	0.00	0.02
Steam Cleaners	0.09	0.01	0.06	0.01	0.01
Paint booth	0.00	0.00	0.00	0.26	1.58
Total	0.69	0.71	0.21	0.32	1.80
All Emissions **3.73**					

Actual Emissions, tons/year - 2000					
Source	**NO_X**	**SO_2**	**CO**	**PM_{10}**	**VOC**
Boilers	1.34	0.51	1.12	0.41	0.04
Tanks	0.00	0.00	0.00	0.00	0.01
Degreasing	0.00	0.00	0.00	0.00	0.12
Gasoline dispensing	0.00	0.00	0.00	0.00	0.01
Steam Cleaners	0.09	0.01	0.06	0.01	0.01
Paint booth	0.00	0.00	0.00	0.00	0.00
Paint Gun Cleaner	0.00	0.00	0.00	0.00	0.16
Total	1.43	0.52	1.18	0.42	0.35
All Emissions **3.88**					

Steam cleaner calculations are constant. See App C-2, 1996 Air Emission Inventory.
Binks paint booth was dismantled Fall 1998.
Paint gun cleaner calculations are based on 100% volatization of the paint thinner.
See Appendix G, 2001 CSMS Air Permit Application.

Due to the size of Camp Johnson, the number of active buildings with heating systems,, and the operation of a new paint booth, the VTARNG has completed a non-major stationary source permit application to the State of Vermont. The permit is currently under review and an issuance date of 01 Oct 2001 is anticipated pending the State's approval.

3.4 NOISE

The Noise Control Act of 1972 (Public Law 92-574) directs federal agencies to comply with applicable federal, state, interstate, and local noise control regulations. In 1974, the USEPA provided information on negative effects of noise, identifying indoor and outdoor noise limits that protect public health and welfare (e.g., prevent hearing damage, sleep disturbance, and communication disruption). In addition, sound quality criteria promulgated by the USEPA, the U.S. Department of Housing and Urban Development (HUD), and DoD have identified noise levels to protect public health and welfare with an adequate margin of safety. These levels are considered acceptable guidelines for assessing noise conditions in an environmental setting. Noise levels below 65 decibels (dB) are generally considered to be normally acceptable in suitable living environments. For purposes of this INRMP and EA, noise is described in the context of sound levels that result directly from Camp Johnson military operations and the compatibility of land use resources with these levels.

3.4.1 Noise Levels at Camp Johnson

Noise levels at Camp Johnson are usually fairly low. There is one small arms baffled range located on the facility. Other noise producing activities are minimal. There are occasional helicopter flights into the area. Landing zones are designated and are located in the interior of the installation to avoid civilian areas. Flight paths are also designated and are designed to avoid civilian areas as much as possible.

3.5 TOPOGRAPHY

Camp Johnson sits on a plateau of land at an elevation of 300 ft above sea level. This plateau extends north from the Winooski River to Sunderland Brook, which, along with several of its drainages, forms boundaries to the east and west. The main channel of Sunderland Brook cuts northwest through the northern half of the base, isolating a small terrace of land to the north from the main portion of Camp Johnson. The western drainage extends south about halfway through the eastern arm of the reservation and completes the semicircular "cap" of sloped land around the base. The southern section of this eastern arm unites the upland areas of the base with those of Fort Ethan Allen.

The land that is part of the main plateau slopes very gently upward from southeast to northwest, the highest ground being just to the west of the large sandblow. This terrace extends in finger like projections perpendicular to Sunderland brook, forming a series of small ridges or terraces ranging from 20 to 50 meters long. The draws between these fingers of land are, in places, moderately sloped and rolling and in other places, quite steeply sloped (25-30%) and deep. All of these draws eventually drain into the central lowland or valley in which Sunderland Brook is located.

3.6 GEOLOGY

3.6.1 General Geology

The geologic history of the region known as the Western Chittenden County Sandplain is intimately connected with that of Lake Champlain. Before the last glacial period a northward flowing river occupied the present valley of the lake. The retreat of the Wisconsin glaciation 13,000 years ago formed a lake (Lake Vermont) in the former river valley. As the glaciers receded, the region was invaded by the

opening of the St. Lawrence Sea way, which deposited an extensive bed of clay. As the sea was draining to the north and the land was rebounding, ice blocked rivers once again flowed into the still waters of what was to become Lake Champlain. Lake Champlain occupied three well-marked water levels. As water levels continued to recede, successive deltas formed further and further downstream occupying progressively lower elevations, finally reaching the present lake level. From the erosion deposits of the Winooski River, three sand deltas were formed to mark each lake level. This region became known as the Western Chittenden County Sandplain. Set at 300 feet above sea level (200 feet above present lake level), the Winooski delta is the largest of the three and is now where Camp Johnson is located.

3.7 SOILS

There are two types of soils that dominate this sandplain; the Adams-Windsor and Hartland soils. Underline with limestone bedrock and clay parent material, both surface layers are sandy and highly permeable, varying from pure sand to sandy loam. According to the Chittenden County Soils Survey, the Adams-Windsor is considered loamy sand and the Hartland is classified to be fine sandy loam. The texture of these sands is uniform throughout the forest community with a depth ranging from a few centimeters to seven meters. As a result from the high percolation rate of the fine sands, both substrates are acidic ranging from 5-6 in pH. The Natural Resource Conservation Services (NRCS) will conduct a new soil survey during the summer and fall of 2001, with the final report released in the summer of 2002. This survey will provide new and updated soils information for Camp Johnson. The current soils database is from data that were collected in the 1950's and 60's and are considered outdated and unreliable. The new soils layer will be digital and will be integrated into the Geographic Information System for VTARNG, and will help make more informed decisions concerning the management of natural resources. (See Figure 3-1)

The *Soil Survey of Chittenden County, Vermont* (1967) states that the majority of soils in western Chittenden county were formed by now extinct lakes. The soils are made-up of water deposited material, primarily sand and clay. The four major soil series represented on Camp Johnson are as follows:

Adams-Windsor: Most of these soils formed deep sandy material within now extinct lakes. The soils are composed of a quartz or schist sandy material, occurring to a depth of 40 inches. The Type II can be underlain by a loam silt, lake deposited clays or bedrock. The soil type is most often located along the

Lake Champlain Valley and occasionally in upper valleys in the surrounding foothills. The soils are generally excessively well drained, given the depth of sand and generally low water table of four feet or more. This soil is rated as having good to excellent potential for timber production.

Hartland: This soil type occurs much like the Hartland soils found in gullies and along banks. The soils are either formed in water or by wind. The general composition is of quartz, schist, or phyllite.

There are numerous other soil series represented, but individually they are scattered and small in area. These to be sandy or gravelly loam soils. While the soils are not too disposed towards erosion, the slopes dictate that care be used in locating potential logging roads, and placing water bars at frequent enough intervals to prevent serious erosion. Overall the soils represented on the reservation are moderately good for timber production, with few areas of poor productivity.

Soils are a vital resource. They are complex systems that take centuries to develop. They can be altered drastically by erosion, compaction, or topsoil removal. Sediment from erosion in streams and ponds affect water quality and aquatic organisms. Plants draw their life from the soil and all animals, including humans, depend directly or indirectly on plants for food. Healthy soils form the foundations for healthy ecosystems.

3.8 WATER RESOURCES

Sunderland Brook is the major drainage system on Camp Johnson (figure 3-6). This brook runs generally from southeast to northwest through the northern quarter of the reservation boundary. Lily Pad Pond is the only pond of any measurable size at Camp Johnson.

Groundwater

Groundwater hydrology in Chittenden County is largely defined by topography and the distribution and saturated thickness of high conductivity glacial outwash deposits and low conductivity glacial till deposits. The distribution of unconsolidated sediments results in steep hydraulic gradients in the upland areas, with a general flattening of the water table within the regions of glacial outwash. Groundwater flows from hills toward valleys and discharges into streams, rivers, wetlands, and ponds. In the higher

elevations, where soils are often shallow and bedrock close to the surface, the source of sufficient quantities of potable groundwater is deep within the bedrock.

3.8.2 Surface Water

Sunderland brook and some minor tributaries are the major surface water resources on Camp Johnson and run through the northern quarter of the Installation. The main channel of Sunderland Brook cuts northwest though the northern half of the base, isolating a small terrace of land to the north from main portion of Camp Johnson. The western drainage separates Camp Johnson from Sunny Hollow Park. The eastern drainage extends south about halfway through the eastern arm of the reservation and completes the semicircular "cap" of sloped land around the base. The southern section of this eastern arm unites the upland areas of the base with those of Fort Ethan Allen.

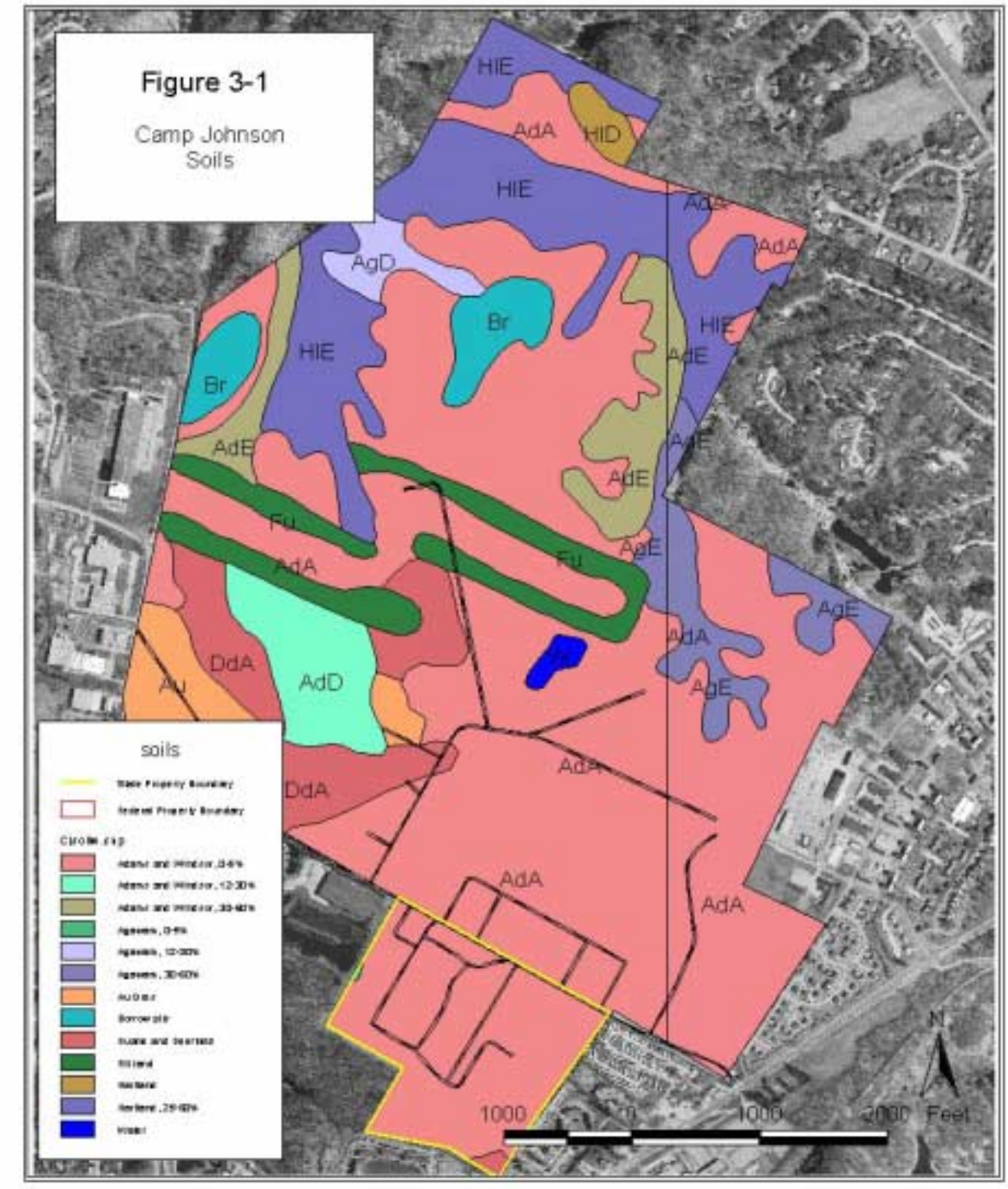
Figure 3-1
Camp Johnson
Soils
HIE
AdA
HID
HIE
AdE
AdA
AgD
Br
HIE
HIE
AdE
Br
AdE
AdE
AdE
Fu
AdE
AdA
Fu
AdE
AdA
DdA
AdD
Au
AdA
DdA
AdA
AdA
soils
1000
0
1000
2000 Feet
N

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3.8.3 Wetlands

Wetland delineations were done during the fall of 1998 and the spring/summer of 1999. As required by provisions of the Vermont Wetland Rules, delineations were done using the methodology contained in the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands. This methodology uses three criteria – plants, soils, and hydrology – to identify wetlands. Documentation of wetlands boundaries is provided through data recorded on USACE data forms for transects established at selected points along the delineated boundary. These forms contain information on plant species composition and abundance, descriptions of soil horizons, and evidence of hydrology at wetland and upland points of either side of the boundary. Transects were completed for representative boundary type and at sites where there was a marked change in boundary characteristics. The actual delineations were conducted by a wetlands consultant who flagged all wetlands at Camp Johnson. VTARNG Environmental staff then located all flags using a GPS receiver and mapped using Pathfinder Software and ARCVIEW GIS software.

All wetlands in Vermont are classified as Class One, Two or Three. Class One wetlands are those wetlands that, in and of themselves, are exceptional or irreplaceable in their contribution to Vermont's natural heritage and are therefore so significant that they merit the highest level of protection. There are no identified Class One wetlands on Camp Johnson. Class Two wetlands are those other than Class One that are found to be so significant, either taken alone or in conjunction with other wetlands, that they merit protection under the Vermont wetland rules. Class Three wetlands are those that are not significant enough to merit protection under the Wetland Rules.

Seventy-five acres of wetlands have been identified at Camp Johnson and can be located in Figure 3-2. Approximately 60 acres of those were identified on the National Wetlands Inventory Map and are considered Class Two Wetlands. The remaining acres are Class 3 wetlands.

3.8.4 Riparian Habitat

Riparian areas are equally beneficial to lentic (ponds and lakes) and lotic (streams and rivers) water bodies. The essential component of these riparian areas is vegetation. Riparian areas typically have high levels of species productivity and greater species diversity than upland sites. Broader riparian zones have

greater species diversity than narrow, steep-sided riparian areas. The diversity of species is critical in providing protection from extreme changes in environmental conditions such as those created by floods or forest fires. Rich riparian diversity is partially due to the presence of many species adapted to two adjacent habitat types; this is known as the "edge effect." (See Section 5.5.4.1 for a more detailed description of the edge effect.)

Riparian habitats provide water and food requirements for many wildlife species. Riparian areas provide habitat for many wildlife species (e.g., amphibians, beaver, muskrat, waterfowl) for breeding and rearing young, as well as providing areas for escape, hiding, and resting cover. Riparian areas also form natural travel corridors for wildlife species. Vegetation in the riparian area protects the water quality by reducing sediment, nutrient, and contaminant loading from activities occurring in the surrounding watershed. Overland water flow approaching surface water bodies from the surrounding watershed is intercepted and filtered by riparian vegetation before it enters the water body. Pollutant and sediment transported may be partially removed as a result of a combination of processes including reduction in flow pattern and transport capacity, settling and deposition of particulates, and eventually nutrient uptake by plants. In addition, the vegetation provides stream bank/shoreline stabilization to the water body. The roots of the riparian vegetation anchor shoreline sediments and protect the shoreline from the erosive forces of water movement (USEPA, 1993).

For lotic stream systems, riparian areas serve several additional functions. The riparian areas act as a temperature regulator by shading the water surface and maintaining necessary temperatures for cold-water aquatic species. The riparian areas also supply large organic debris (LOD) to the stream system, which influence the in stream channel structure, such as the occurrence of pools and riffles. As a result of this pattern of pools and falls, streams with LOD typically have less erosion, slower routing of organic detritus (the main food source for aquatic invertebrates), and greater habitat diversity than straight, even-gradient streams. LOD also provides habitat cover for aquatic species and characteristics ideally suited for fish spawning.

Riparian areas provide valuable flood control during storms. The vegetated riparian area attenuates flood waters and reduces the erosive nature of the water before reaching upland areas. Most riparian areas provide flood conveyance through controlled movement of floodwaters from upstream to downstream areas. Some riparian areas may store water during floods and slowly release it to downstream areas, lowering flood peaks (USEPA, 1993).

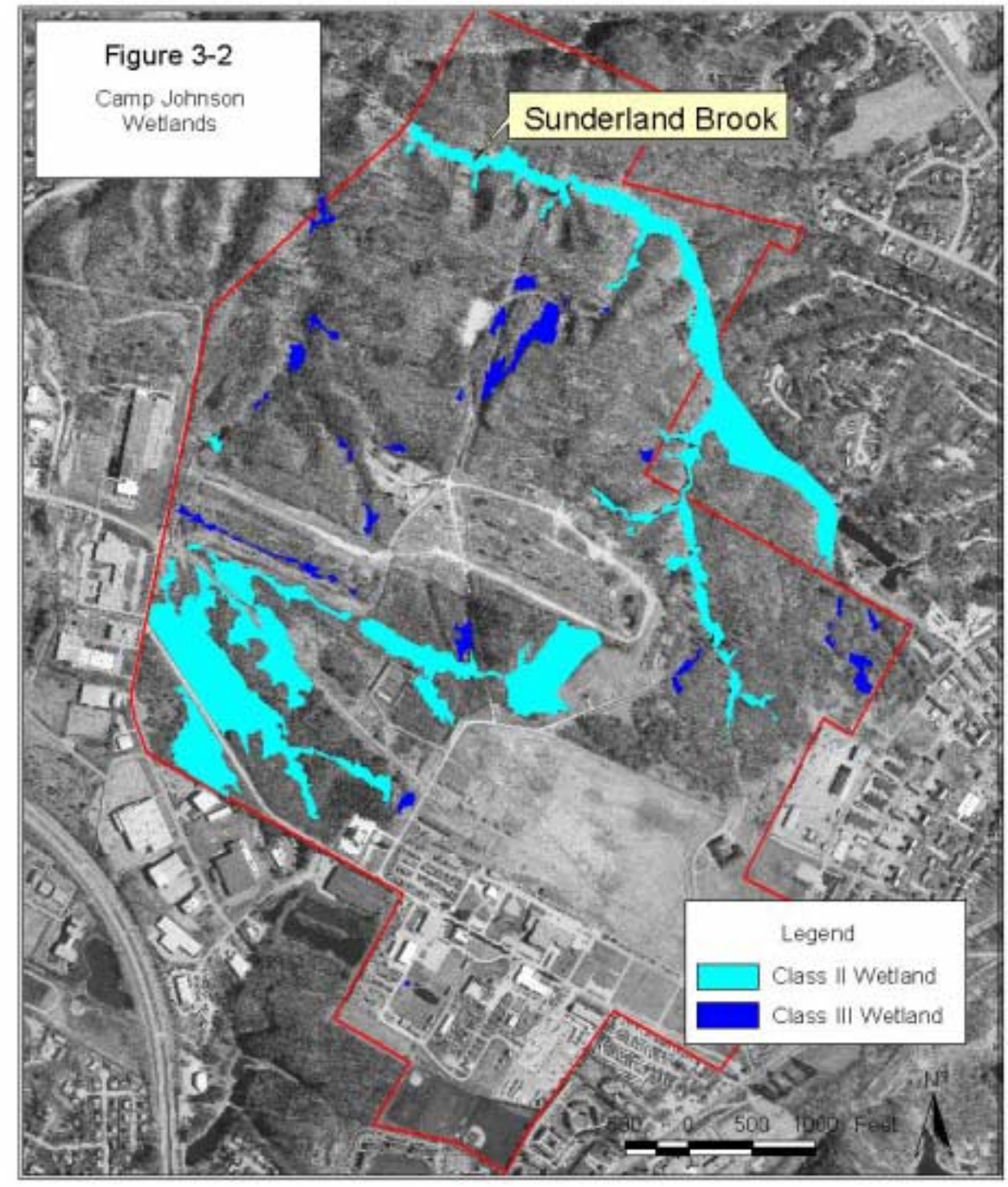
Figure 3-2
Camp Johnson
Wetlands
Sunderland Brook
Legend
Class II Wetland
Class III Wetland
500 0 500 1000 Feet
N

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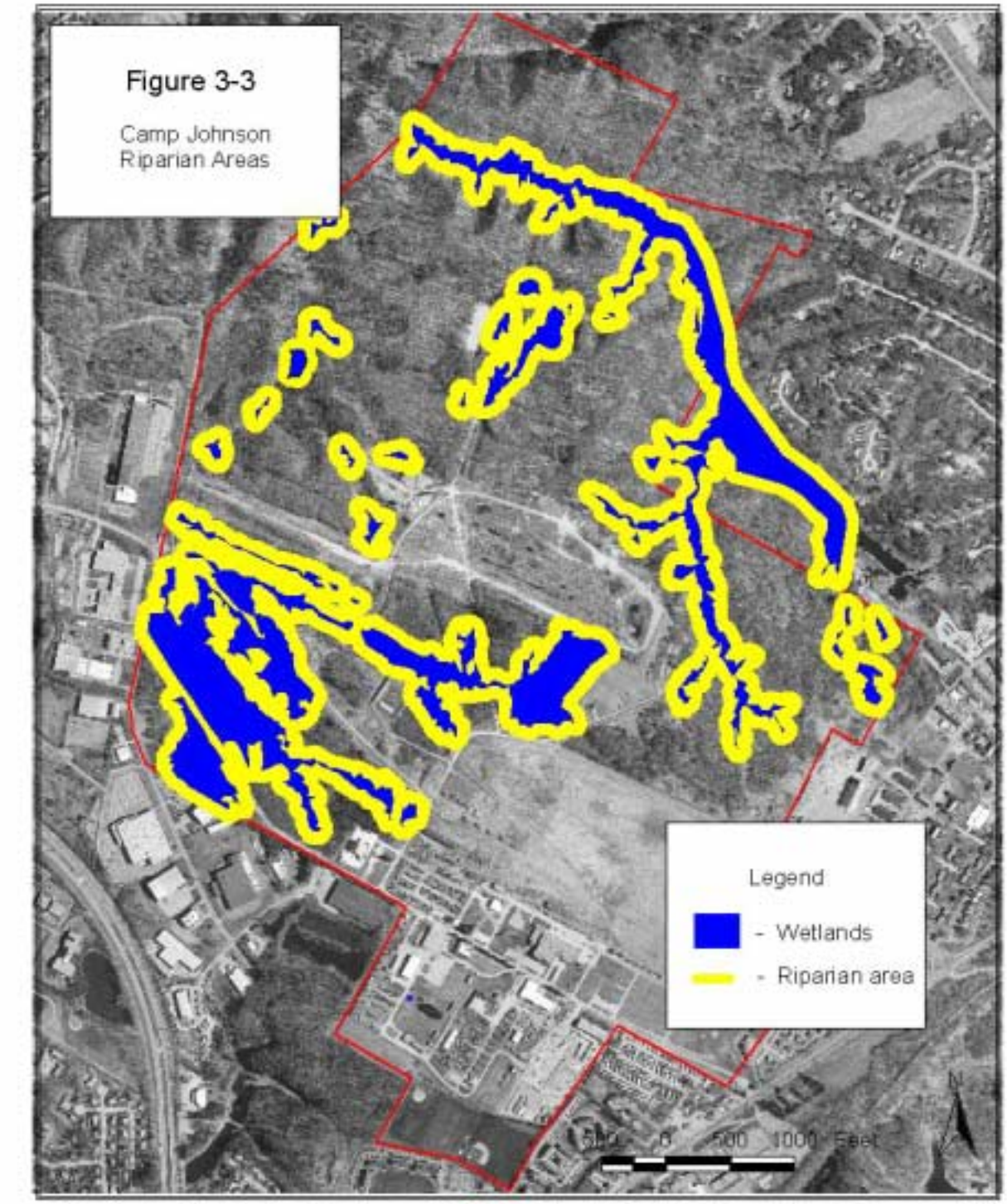
Figure 3-3
Camp Johnson
Riparian Areas
Legend
- Wetlands
- Riparian area
500 0 500 1000 Feet
N

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Most of the water bodies at Camp Johnson are surrounded by grassy areas or forested areas, which can help trap the sediment load transported by storm water before it enters the water system and can help stabilize the stream banks to avoid additional erosion problems. However, descriptive characterizations and quantitative habitat assessments have not been conducted for these areas. Without this information, the ecological integrity of Camp Johnson's riparian areas remains unknown. See Figure 3-3 for location of riparian areas.

3.9 COMMUNITIES AND ECOSYSTEMS

Camp Johnson is part of a larger ecosystem that includes mountain terrain and the lower foothills that form the boundary for the Champlain Valley. The prevalence of native plants and animals demonstrates that much of the biological diversity at Camp Johnson has been preserved and is being improved. The most recent glacial event, the incursion of the Wisconsin ice sheet, caused the majority of plants native to the area at that time to be buried under tons of ice and glacial debris.

Approximately two-thirds of Camp Johnson is forested. There are two major areas which are not forest: the southern "core" section where the base headquarters are situated, and the south-central section which is kept open for tank maneuvering. The former contains landscaped areas and a large field which is periodically used for tank maneuvers and helicopter access, the later is a scrub-successional area.

3.9.1 Flora

An inventory of vascular plants on Camp Johnson was conducted in 1996. The rare and listed plants searched for included those federally listed as threatened or endangered, as well as candidate species for listing; and plants state-listed as threatened or endangered, plus those considered rare or uncommon by the Vermont Nongame and Natural Heritage Program (VNNHP), Vermont Fish and Wildlife Department. A complete plant list developed from those surveys can be found in Appendix A. This plant list is currently in the process of being updated based on surveys from 2000.

The Vermont Military Department and the Vermont Fish and Wildlife Department (VTFWD) entered into a Memorandum of Agreement (MOA) in 1992, for the purpose of developing and implementing a

plan for the restoration and management of pine-oak-heath-sandplain natural community type and its constituent rare, threatened, and endangered plant species at Camp Johnson in Colchester, VT.

Camp Johnson has a large number of plant rarities, though none are Federally listed. Of the 24 species on the list, 7 are state threatened species and one is state endangered, plus one species that prior to 1996 was considered historical, meaning that it had not been recorded in the state for 25 years. The table below represents data from 1999-2000 surveys conducted by Mr. Brett Engstrom on behalf of the VTNNHP.

Table 3-4

STATE LISTED RARE, THREATENED AND ENDANGERED PLANTS AT CAMP JOHNSON

SPECIES	STATE RANK	STATE STATUS	FIRST OBSERVED	LAST OBSERVED
blunt-leaved milkweed (A*scepias amplexicaulis*)	S1	Threatened	1994	1999
poke milkweed (A*sclepias exaltata*)	S3	None	1996	1996
a sedge (C*arex brevior*)	S2S3	None	1995	1996
low bindweed (C*alystegia spithamea*)	S2	Threatened	1990	1999
stout-wood reed-grass (C*inna arundinaceae*)	S3	None	1996	1999
panicled tick-trefoil (*Desmodium paniculatum*)	S3	None	1996	1996
rough avens (*Geum laciniatum*)	S2	None	1999	1999
plains frostweed (*Helianthemum bicknellii*)	S2S3	Threatened	1990	1999
Canada frostweed (*Helianthemum canadense*)	S2S3	None	1993	1999
harsh sunflower (H*elianthus strumosus*)	S2S3	Threatened	1985	1999
large whorled pagonia *(Isotria verticillata*)	S2	Threatened	1993	1999
wood lily *(Lillium philadelophicum*)	S3	None	1993	1999
green adder's mouth (*Malaxis unifolia*)	S2	None	1999	1999
slender mountain-rice (*Oryzopsis pungens*)	S2	Threatened	1990	1999
a panic grass (P*anicum columbianum*)	S3	None	1993	1999
depauperate panic-grass (*Panicum depauperatum*)	S3	None	1985	1999
cypress witchgrass (*Panicum dichotomum*)	S3	None	1996	1999
Tuckerman's panic-grass *(Panicum tuckermanii*)	S2	None	1999	1999
yellow panic-grass (*Panicum xanthophysum*)	S3	None	1985	1999
racemed milkwort (*Polygala polygama*)	S2	None	1985	1999
slender knotweed (*Polygonum tenue*)	S1	Historical	1993	1993

cursed crowfoot (*Ranunculus scleratus*)	S2	None	1999	1999
many-leaved sedge (*Scirpus polyphyllus*)	S2	Endangered	1996	1999
Virginia chain-fern (*Woodwardia virginica*)	S1	Threatened	1829	1958

Table 5-2 Key to State Rank Designations.

S1 (State listed)	Very rare, generally 1 to 5 occurrences. Believed to be extant and/or some factor making it especially vulnerable to extirpation from the state
S2	Rare, generally 6 to 20 occurrences. Believed to be extant and/or some factor making it especially vulnerable to extirpation from the state.
S3	Uncommon, believed to be more than 20 occurrences and/or there is some threat to it in the state.

3.9.2 Special Natural Areas

Camp Johnson contains the largest example in the state of Vermont of a pine-oak-heath sandplain forest. These sandplain communities once covered up to 15,000 acres in Western Chittenden County, most likely occurring on the landscape in large patches of flat terrain incised by small streams.. Today only 4% of this natural community remains. Camp Johnson contains the largest sandplain community left in Vermont. Currently, 126 acres of sandplain community are managed for restoration.

Aside from development, succession without periodic disturbance poses a threat to this complex endangered habitat. Windthrow, ice damage and primarily fires are all critical processes to this natural community. Suppressing fires from this system is detrimental to its integrity. Fire creates forest openings, releases critical nutrients, exposes mineral soil and promotes the growth of several critical species in the State of Vermont.

In 1992 the State Military Department entered into a MOA with the VTFWD to develop and implement a plan for the restoration and management of pine-oak –heath-sandplain habitat and its constituent rare, threatened, and endangered plant species at Camp Johnson. In 1994, a management plan was developed

through the Legacy Resource Management Management Program and titled "Restoration of Pine-Oak-Heath Sandplain Forest at Camp Johnson, Colchester Vermont". The plan includes prescribed burning, planting of pitch pine seedlings, transplanting of sensitive plants, a floristic survey of the area, and vegetation monitoring plots to track the progress of the restoration efforts. (Figure 3-4) A copy of the MOA can be found in Appendix D.

3.9.3 Fauna

Informal surveys have been completed for those animals listed on Federal and State threatened and endangered lists and for those species that are suspected to be rare to the sandplain community type. Currently the Grasshopper Sparrow is the only known listed animal at Camp Johnson. The Grasshopper Sparrow is state-listed threatened. A 50-acre grassland has been extensively surveyed to verify the presence of the grasshopper sparrow in 1999 through 2001. Indications are that there are three territories in the grassland, based on observations of males singing. In 1999, a female was spotted with food, indicating that she was feeding her young.

3.9.4 Fish

Fish surveys were conducted on Camp Johnson during July and August of 1999. Four sites were sampled using a backpack electro shocker (capable of sampling in water up to 1 meter deep), and covered a variety of habitats. The spring and summer of 1999 were unusually dry, and water levels in lakes, ponds, rivers and streams throughout Vermont were lower than normal. Several smaller streambeds were completely dry by the end of June, and beaver ponds appeared lower than usual. This lack of water made it impossible to sample some locations. Nevertheless, given the variety of habitats that were sampled, it is assumed that a representative sample of the fishes of Camp Johnson was obtained. (Appendix B)

A total of 8 species, representing three families were found on Camp Johnson. No unusual or rare species were found. In general, the fish communities of the habitats sampled were quite representative of similar, relatively undisturbed habitats elsewhere in Vermont.

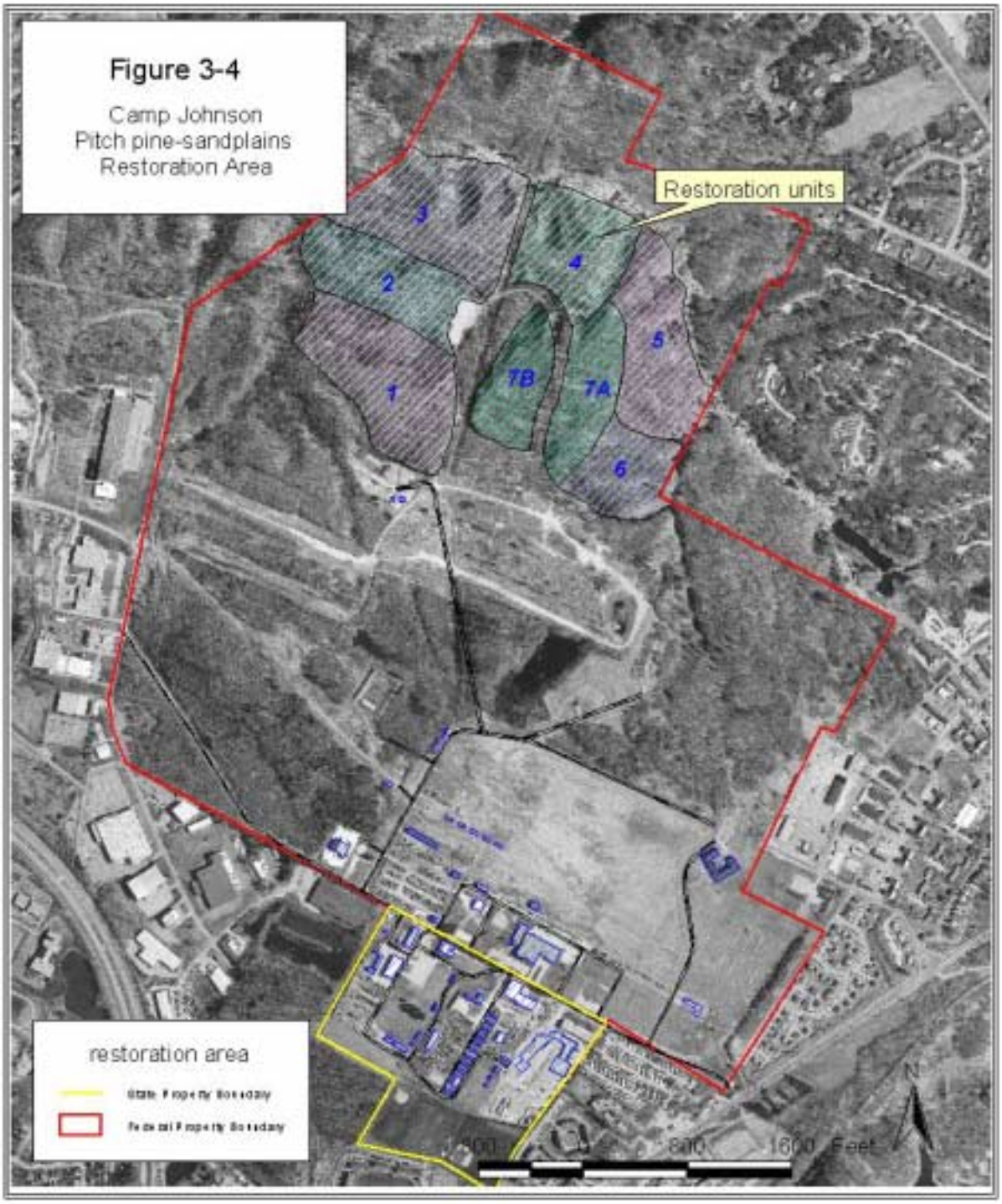
Figure 3-4
Camp Johnson
Pitch pine-sandplains
Restoration Area
Restoration units
3
2
4
5
1
7B
7A
6
restoration area
800
1600 Feet
N

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Table 3-5, Fish of Camp Johnson

Family	Common Name	Scientific Name
Cyprinidae	blacknose dace	*Rhinichthys atratulus*
	fathead minnow	*Pimephales promelas*
	northern red-bellied dace	*Phoxinus eos*
	creek chub	*Semotilus atromaticulatus*
	golden shiner	*Notemigonus crysoleucas*
	common shiner	*Luxilus cornutus*
Cyprinodontidae	Banded killifish	*Fundulus diaphanus*
Centrarchidae	pumpkinseed sunfish	*Lepomis gibbosus*

3.9.5 Invertebrates

Invertebrate surveys were completed during the summer of 1999 on Camp Johnson. Specifically, surveys were conducted on the insect groups of lepidoptera (moths and butterflies), and odonata (dragonflies and damselflies).

A total of 37 species of butterflies were recorded at Camp Johnson. Two of special note were found although they are not State or Federally listed species. A population of the Delaware skipper and the Appalachian brown were located along the Sunderland Brook area of Camp Johnson. Both of these species are relatively rare for Vermont. The Biodiversity of moths at Camp Johnson appears to be relatively high (Miller 1999, Appendix C)

A total of 39 species of dragonflies and damselflies were reported from Camp Johnson. Two species of damselflies are of considerable interest: one is a possible new state record of *Enallagma carunculatum*, and the other is three records of *Lestes eurinus*, which had only been reported once before from the State (Miller, 1999, Appendix C).

3.9.6 Reptiles and Amphibians

No listed species have been identified on Camp Johnson. Future additional surveys will be conducted on Camp Johnson and will concentrate on the pitch pine-sandplains restoration area for state listed species that are suspected to occur in this type of habitat.

3.10 ENDANGERED, THREATENED, AND RARE SPECIES

Fish, and invertebrates were surveyed in 1999, and other faunal surveys have been done to determine the presence of any listed species. No federally listed threatened or endangered species have been found or suspected at Camp Johnson. The VTNNHP Program has been contacted on numerous occasions to determine if any federally listed species would be expected to occur at Camp Johnson. The USFWS has also been consulted regarding the presence of Federally listed species and concurred that none are believed to be present. Several state listed rare species have been found on Camp Johnson. Seven threatened plants (See table 3-3) and one state listed endangered plant exist within the boundaries of Camp Johnson, as well as the grasshopper sparrow, a state threatened species.

As mentioned previously, a MOA exists with the Vermont Fish and Wildlife Department and the VTNNHP for the restoration and maintenance of the unique pine-oak-heath-sandplain community on Camp Johnson. The VTARNG works closely with these agencies in monitoring, conserving and restoring these plant populations.

3.11 CULTURAL RESOURCES

Prehistoric occupation in Vermont is divided into three major periods: the Paleo-Indian Period, dating from ca. 11,000 Before Present (B.P.) to ca. 9,000 B.P., the Archaic Period (ca. 8,000 B.P. to ca. 3,000 B.P.), and the Woodland Period (ca. 3,000 B.P. to European Contact). The Paleo-Indian period began after the glacial retreat from the Champlain Lowland, and with a shift from a low tundra environment to one characterized by a spruce parkland-open spruce woodland which probably supported musk-ox, mastodon, mammoth, moose-elk and caribou. At least twenty sites have been recorded in the Champlain lowland and one is located in the Green Mountain upland. From 9000 B.P. until 6000 B.P. was a period of great climate fluctuation, and many researchers doubt that northern New England – including Vermont, was inhabited during this period of rapid environmental change. However, site data do not support these conclusions. Early Archaic sites identified on the basis of temporally diagnostic bifurcate-base and Swanton corner-notch projectile points, have been recorded in all of the major watersheds that

drain into Lake Champlain. Due to environmental limitations, movements into the uplands may have been somewhat exploratory however, and only the most prolific areas are likely to have attracted aboriginal foraging parties on a consistent basis during the warmer seasons of the year.

Using a sensitivity model developed and tested on other projects in Chittenden County, fifteen sample areas were selected on Camp Johnson for testing. Five prehistoric sites were identified. The small sites were located along Sunderland Brook and near the heads of erosional gullies. The archaeological model identified areas on Camp Johnson that are moderate to high probability areas of encountering cultural remains. This model was based on slope, distance to water, and other factors. (Figure 3-5)

Evaluation at three of the sites provide sufficient data to confirm that sites were small, contained low to very low densities of artifacts, were found at shallow depths, and date from the entire span of Native American prehistory in VermontBased on the recovery of a graver, one site dates to the first period of human settlement in Vermont, the Paleo-Indian Period which began roughly 10,000 – 11,000 years ago. Two other sites represent small camps occupied briefly sometime during the Late Archaic period, roughly 4,000 – 5,000 years ago. Site size ranged from about 14 square meters to about 20 square meters, although most activity was focused in smaller areas. Given the tight spatial clustering of artifacts, they were left behind by one or a few individuals who stayed for only a brief period. Activities included stone toolmaking and/or maintenance, cooking, and processing materials such as hides or bone.

3.11.1 Inadvertent Discovery

Protocol for inadvertent discovery of cultural resources encountered during operations at Camp Johnson can be found in Appendix L.

3.11.2 Historic Structures

A building inventory and evaluation report was conducted in 2000 by Paula Sagerman, a Historic Preservation Consultant. This report states that there are no structures that are individually eligible for the National Register of Historic Places. However, there are many intact historic structures that are significant to Vermont's military history and that appear to be eligible as contributing structures in a National Register Historic District. Camp Johnson is not eligible as a separate historic district because a majority of the historic structures have been removed or altered, the camp's visual landscape is now

dominated by non-historic structures lining the main driveway, and the remaining historic structures do not sufficiently depict the history of Camp Johnson.

Because of Camp Johnson's continuous 100 year history as a military installation and it's historical association with Fort Ethan Allen, it is a very important chapter in the history of Vermont. It appears that the remaining historic structures are eligible as contributing structures in the Fort Ethan Allen Historic District just off the northeast boundary of Camp Johnson. This includes all structures constructed 1940 or earlier, except for six buildings which have lost their historic significance due to alterations. Camp Johnson's period of significance (historically speaking) is 1896-1940. Camp Johnson was prepared for use in 1896 and has at least one structure from this date. Although structures dating to as late as 1949 are potentially eligible for the National Register, no buildings were constructed between 1941 and 1949 and the most recent historic structures date to 1940. Camp Johnson's period of significance overlaps Fort Ethan Allen's (1893-1944). Fort Ethan Allen's and Camp Johnson's association also includes their contiguous parcels and similar opening dates (1894 and 1898), and they also show a successful cooperation between the State and Federal governments because they shared many facilities while Fort Ethan Allen was an active military post.

3.12 LAND USE

Land use on Camp Johnson has been military for the past 100 years in some form or another. Currently there is one baffled small arms range which is the only live fire area on the installation (besides one indoor range in the Green Mountain Armory). Camp Johnson is licensed to the State for National Guard purposes by the Department of the Army. The Camp has various mission for the VTARNG, but the most important one is its tracked vehicle training mission. The flat and lightly wooded terrain is rare on National Guard lands, and hence makes Camp Johnson a unique site that is integral to the present and future training missions of the VTARNG.

3.12.1 Training Areas.

Camp Johnson is 660 acres in size and is divided into four major training areas (from the range regulation manual – see Figure 3-6).

Area A. – This area includes facilities that house the fulltime operation of the VTARNG. Facilities available for use are limited to classroom, equipment maintenance, and/or parade field type activities (non-tactical).

Area B. – This area includes a single, large open area suitable for rotary wing aircraft operations and administrative activities. The area is bounded on the south by area "A", on the west by area "C" and a gravel surface road, on the north by area "D" and a paved road, and on the east by a chain link fence. Area "B" also contains two latrine buildings with running water (operations on request from 1 May through 31 October). This area contains at least three grasshopper sparrow territories (a state listed

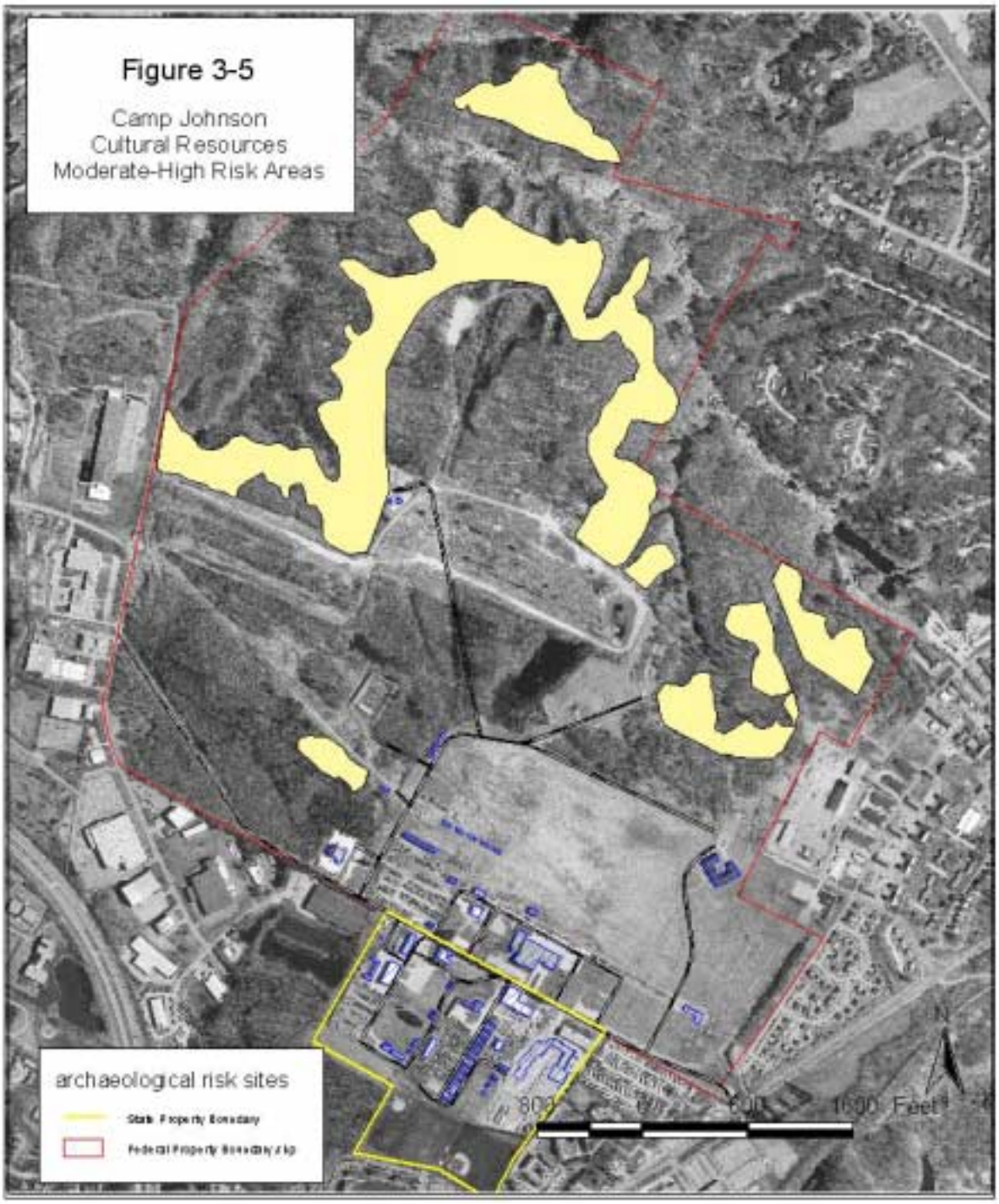
Figure 3-5
Camp Johnson
Cultural Resources
Moderate-High Risk Areas
archaeological risk sites
State Property Boundary
Federal Property Boundary
800
0
1600 Feet

BLANK

threatened species) and may have certain restrictions during the bird breeding season. (See Appendix N for further information concerning training in Area B)

Area C. The southern portion of this area is relatively flat with both open and lightly wooded terrain, ideal for vehicle driver and gunnery training. The northern portion of Area "C" is heavily wooded and broken and is an excellent area for small unit dismounted tactics, bivouac, and winter survival. This area includes the emergency operations center. Area "C" is bounded on south by a sand tank trail, on the west by the Colchester industrial park, on the north by an the range boundary, and on the east by a sand/dirt road and Area "D".

Area D. – This is similar to Area "C" in both topography and capabilities; however, it offers a substantially better bivouac area for up to a battalion-sized unit with both wheels and tracks. Area "D" is bounded on the south by a paved road and Area "B", on the west by a sand/dirt road and Area "C", on the north by the range boundary, and on the east by Fort Ethan Allen and the range boundary.

3.12.2 Ranges.

Range "A" (area C-4, Figure 3-6) – Baffled Range. This is the only outdoor range located at Camp Johnson. Permitted weapons at the range include:

1.) M16 training, practice and qualification (25 meter alternate course).
2.) Pistol training practice and qualification (alternate 25 yard course); NRA conventional pistol course;
3.) Biathlon training on paper and steel targets.
4.) Other firearms or courses of fire require review and approval by the FMO and POTO.

3.12 FACILITIES.

Most facilities on Camp Johnson are located in the cantonment area. In addition, one baffled range and a small tank maneuver area also exist on base. The main buildings consist of Green Mountain Armory and Vermont National Guard State Headquarters; Two Organizational Maintenance Shops, a Combined Support Maintenance Shop, Building #5, a state maintenance building, the Plans, United States Property and Fiscal Official Offices, Base Exchange, a Regional Training Academy, a small Military Museum, and other assorted storage buildings (Figure 3-7).

3.13.1 Transportation System

Roadways. There are approximately 4.5 miles of roads within the borders of Camp Johnson. These are roads that are owned and maintained by the Vermont Military Department and/or the VTARNG. Approximately 2.5 miles are paved road and the remaining 2.0 miles are gravel road.

Surrounding Roadways. The main gate of Camp Johnson exits on to State Highway 15. Interstate 89 is approximately 1.5 miles to the southwest of Camp Johnson. State Highway 2 runs parallel to the western boundary of the camp and can be accessed via the back gate by authorized personnel only.

3.13.2 Utilities

Potable Water. Water is provided to Camp Johnson cantonement area through the City of Colchester public water system.

Fire Protection. Fire protection is provided by the Colchester Fire Department, Colchester, VT

Wastewater Treatment. Colchester municipal sewer system.

Storm Drainage. A Stormwater Pollution Prevention Plan is available for Camp Johnson. This plan is dated December 1999, and describes storm water pollution prevention plans for all major facilities within Camp Johnson. It is available at locations throughout Camp Johnson and at the Environmental Office. It is entitled "Stormwater Pollution Prevention Plans for VTARNG".

Electricity. Electricity is provided to Camp Johnson through Green Mountain Power Company.

Heat. Heat is provided to select buildings on an individual basis. All systems are heating oil type systems. The new CSMS, completed in 2000, has a wood chip fired boiler. Building #5 and OMS #7 also have supplemental heating systems in the maintenance areas of those buildings, consisting of used oil burning systems. They have a capacity of 275 and 250 gallons respectively. An aggregate of 41,000

gallons of potential underground storage of heating fuel exist on Camp Johnson. Above ground storage for heating fuel consists of a 105,000 gallon tank used to heat building 5.

Solid Waste. Solid waste is picked up by the State Military Department and taken to the Burlington Area Transfer Station, operated by Waste Systems International.

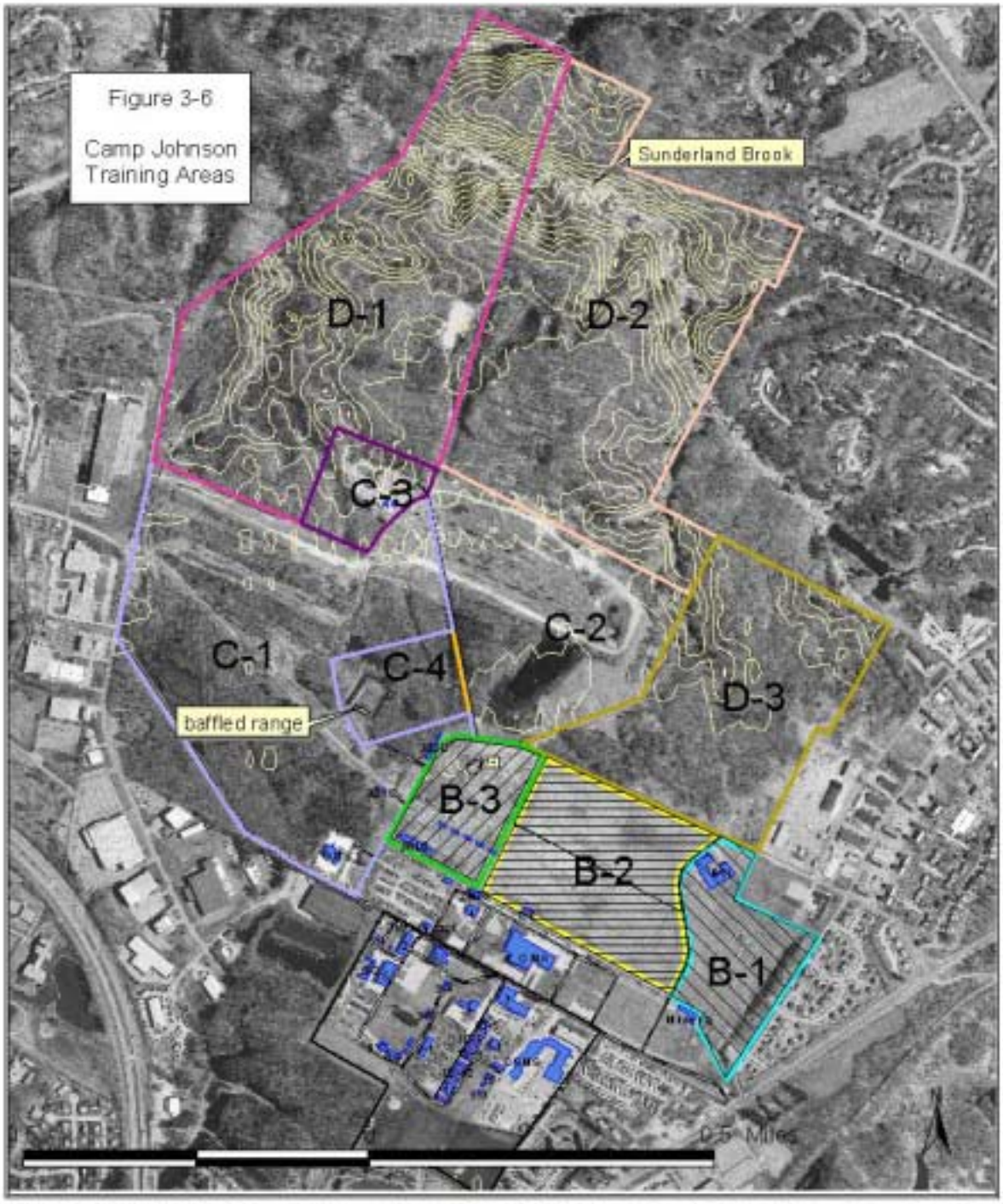
Figure 3-6
Camp Johnson
Training Areas
Sunderland Brook
D-1
D-2
C-3
C-1
C-4
C-2
D-3
baffled range
B-3
B-2
B-1
0.5 Miles

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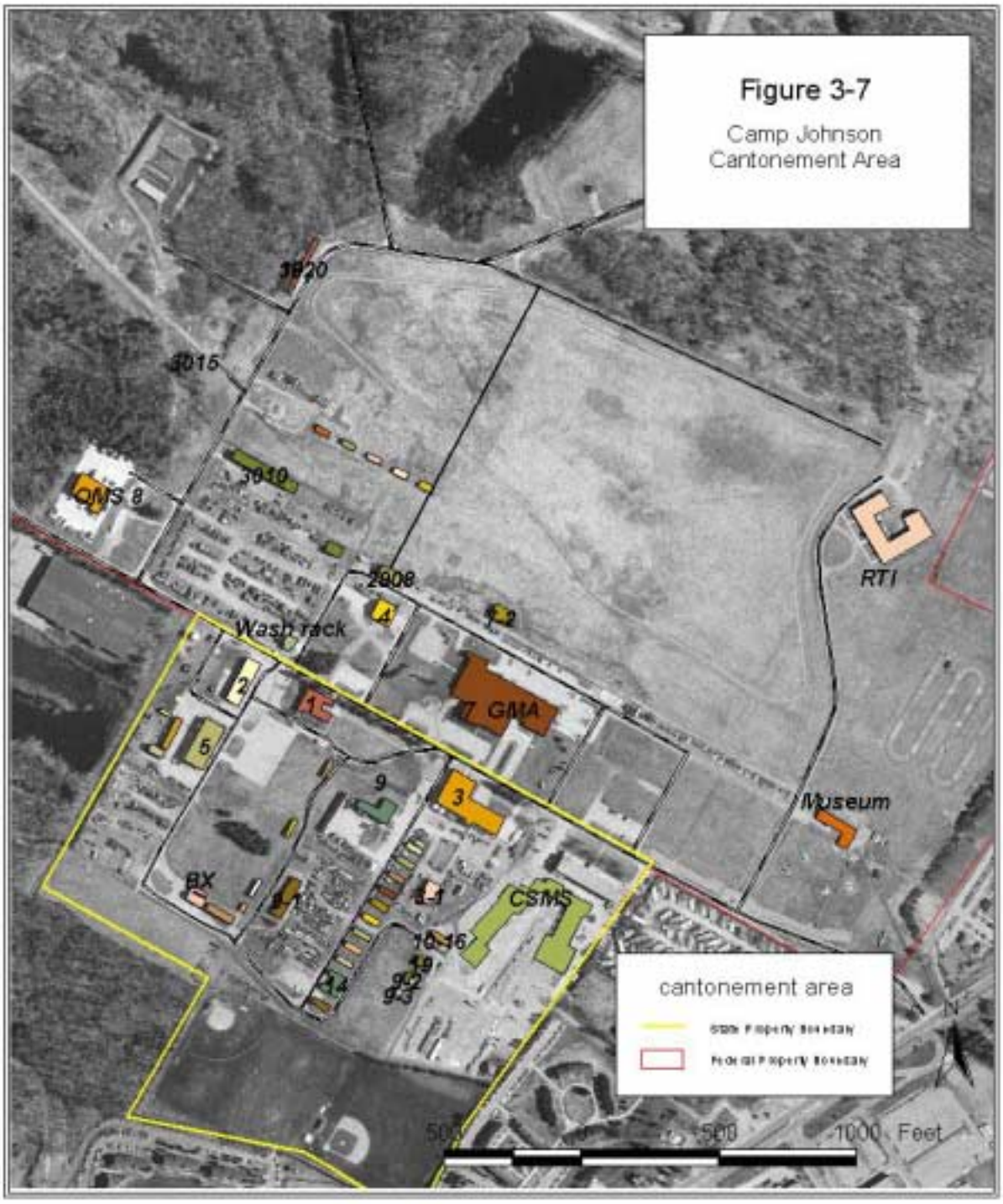
Figure 3-7
Camp Johnson
Cantonement Area
3020
3015
3010
QMS 8
2908
Wash rack
RTI
7 GMA
Museum
BX
CSMS
cantonement area
500
0
500
1000 Feet

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3.14 HAZARDOUS AND TOXIC MATERIALS

Hazardous waste is defined as any material that requires special methods to prevent contamination of the environment from inherent detrimental characteristics of waste. Camp Johnson Hazardous Waste Management Standing Operating Procedure (HWM SOP) specifies the requirements for waste identification, storage, handling, transportation, disposal, emergency response, and waste minimization.

3.15 SOCIOECONOMIC RESOURCES

The socioeconomic resources of a region are typically characterized in terms of population, housing, and employment. These resources are often interrelated in that an increase or decrease in population could change the demand for housing or employment. Socioeconomic conditions are usually expressed in terms of total population and density, housing units and vacancy rates, and industry earnings and employment. These indicators characterize the region of influence (ROI). The region of influence for Camp Johnson is Chittenden County, with a population of about 143,947, and projected to climb to about 165,000 by 2015. (Calandrelli, 1999)

3.15.1 Population

Chittenden County is the heart of the state of Vermont and is the population, employment and cultural center. The population density is nearly three times that of any other county in Vermont (Table 3-6). There are only seven towns in Vermont with a population above 10,000 and Chittenden County claims four of them. According to the Chittenden County Profile, Chittenden County is expected to continue growing at a faster rate than the State over the next decade. The more rural towns such as Bolton, Hinesburg, Huntington, and Underhill are expected to have the highest rate of growth while Burlington and Winooski are expected to lose population by the year 2020. Table 3-7 shows the population estimates for Colchester, Vermont, the town in which Camp Johnson is located.

Table 3-6

Population and Population Density

Geographic Place	Population	Square Miles	Population Density (Pop. per Square Mile)

Vermont	593,740	9,249	64.2
Chittenden County	143,947	539	267.1

The 1996 Chittenden County Regional Plan identified population centers in an urban center, an inner ring, and an outer ring. Population grew in Chittenden County by 9.8% between 1982 and 1992 and developed land increased by 25.3% (U.S. Census, 1990). Forty percent of this development had been on cropland or pasture.

Table 3-7

Colchester, VT - Population Estimates

	Population 1996	**Projection 2005**	**Projection 2010**	**% Change to 2010**
Colchester	16,696	18,948	19,870	16.0

Source: USDOC, estimates from 1990 census.

3.16 ENVIRONMENTAL JUSTICE

On February 11, 1994, President Clinton issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. This order directs agencies to address environmental and human health conditions in minority and low-income communities so as to avoid the disproportionate placement of any adverse effects from federal policies and actions on these populations. The general purposes of this Executive Order are as follows:

►To focus attention of Federal agencies on human health and environmental conditions in minority communities and low-income communities with the goal of achieving environmental justice.

►To foster non-discrimination in Federal programs that substantially affect human health or the environment.

►To give minority communities and low-income communities greater opportunities for public participation in, and access to, public information on matters relating to human health and the environment.

Consideration of environmental justice concerns includes race and ethnicity and the poverty status of populations. Table 3-8 depicts these characteristics for the population in Chittenden County.

The Census Bureau bases the poverty status of families and individuals on 48 threshold variables, including income, family size, number of family members under 18 and over 65 years of age, and amount spent on food. The poverty threshold for the U.S. is $11,921 for a family of three (Grolier, 1995). The 1999 median household income estimate for the Chittenden County is $43,464 (USDOC, estimate for 1999).

3.17 Protection of Children

Executive Order 13045, *Protection of Children from Environmental Health and Safety Risks*, requires federal agencies, to the extent permitted by law and mission, to identify and assess environmental health and safety risks that may disproportionately affect children. The Order, dated April 21, 1997, further requires federal agencies to ensure that their policies, programs, activities, and standards address these disproportionate risks. The Order defines environmental health and safety risks as "risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest (such as the air we breathe, the food we eat, the water we drink and use for recreation, the soil we live on, and the products we use or are exposed to)." There are no identified or suspected environmental health and/or safety risks that will disproportionately affect children because of any actions proposed in this INRMP. All activities that occur on the range are scheduled through range control. Each year, Camp Johnson hosts a variety of youth programs, including Boy Scout camps, Cub Scout day camps, and anti-drug programs. Camp Johnson is also patrolled by security 24 hours a day.

Table 3-8

Race, Ethnicity, and Poverty Status for Vermont, Chittenden County, and the United States

	Chittenden County	Vermont	United States
White	97.2%	98.4%	80.3%
Black	1.0%	0.5%	12.1%
American Indian, Eskimo, Aleut	0.2%	0.3%	0.8%
Asian, Pacific Islander	1.6%	0.8%	2.9%
Hispanic[1]	1.2%	0.9%	9.0%

Living in Poverty	8.1%	11.2%	13.1%

Source: USDOC, Census, 1994b.
[1] Persons of Hispanic origin may be of any race.

SECTION 4.0:
MANAGEMENT PROGRAMS AND INITIATIVES

4.1 NATURAL RESOURCES MANAGEMENT

The overall installation natural resources program, directed by the Natural Resources Branch of the Environmental Section of the FMO, consists primarily of activities, detailed in Section 5.0 of this Plan, and in the management of the natural resource elements discussed in Section 3.0.

Discussed below are programs that are integral to, or otherwise related to, natural resources management at Camp Johnson.

4.2 INTEGRATED TRAINING AREA MANAGEMENT (ITAM)

The Army's ITAM program is a management and decision-making process geared toward integrating Army training and other mission requirements for land use with sound natural resource management of its lands (HQDA, 1995c). The Army's goal in establishing the ITAM program is to achieve optimum, sustainable use of training lands by implementing a standardized methodology to inventory and monitor land condition, integrate training requirements with land capacity, educate land users to minimize adverse impacts, and provide for land rehabilitation and maintenance (HQDA, 1995b; HQDA, 1995c).

The program consists of four components:

Land Condition Trend Analysis (LCTA)
Land Rehabilitation and Maintenance (LRAM)
Training Requirements Integration (TRI)
Environmental Awareness

The Natural Resources Manager acts as the ITAM Coordinator and administers the LCTA and LRAM components. The specific activities for each of these components are detailed in a comprehensive ITAM Annual Work Plan prepared jointly by the installation ITAM steering committee and VTARNG and covering the current year and several out years. Camp Johnson has not yet participated in the ITAM

program. ITAM Funding and manpower are needed to better implement this INRMP at Camp Johnson, especially in areas where tank maneuvers cause land disturbance.

4.3 LAND MANAGEMENT

Army Regulation 200-3 has set forth that "land utilization will be planned with an awareness of the potential environmental effects of proposed actions and the mission requirements will avoid or minimize adverse effects and restore or enhance environmental quality." To that end, Camp Johnson's goal for land management is to maintain soil productivity to ensure sustained vegetative cover to provide adequate military training areas while protecting and enhancing native wildlife and vegetation.

Land management activities that are conducted at Camp Johnson to achieve these goals are described below.

Mowing. Turf and lawn areas are mowed on an as needed basis depending upon availability of personnel and equipment. Growing conditions in Vermont generally require mowing every 1.5 – 2 weeks in the cantonement area. Other areas that are mowed include the obstacle course area near the Regional Training Institute. The large field north of the Green Mountain Armory is mowed annually, but not until after August 1, because of state threatened bird habitat. (See section 5.9.1 for further discussion)

Prescribed Burning. In consultation with the VTNNHP, prescribed burns occur infrequently in accordance with the cooperative agreement concerning the restoration and maintenance of the pitch pine-oak-heath woodland. This area is approximately 126 acres and is being actively managed for pitch pine restoration. In the spring of 1993, 1995 and 1998, small burns were conducted by the Nature Conservancy, the VTNNHP and Vermont Military Department personnel. There are plans for future prescribed burns in the management area. (See section 5.7.1 for further discussion).

4.4 COMMUNITY AWARENESS

The Sikes Act requires that military installations provide public access for natural resource uses to the extent public access is appropriate and consistent with the military mission. Because of the small size of the installation, it has been the policy of the VTNG to limit access to the public for safety reasons. The VTNG uses other means to foster community awareness, including hosting teenage drug awareness

programs, constructing community projects (ball fields) throughout the state for no cost to the town, and other community awareness projects too numerous to mention.

4.5 OUTDOOR RECREATION PROGRAMS

Due to safety considerations, liability issues, and the relatively small size of Camp Johnson, recreation programs are not permitted.

4.6 ENFORCEMENT

Local and/or State law enforcement services are utilized on an as-needed basis when requested or approved by the CFMO, or his duly authorized representative, to investigate accidents and various criminal investigations. Operations on Camp Johnson by officers of the USFWS and the State of Vermont will coordinate all activities with the CFMO.

4.7 CULTURAL RESOURCE PROTECTION

The primary cultural resources objective is to implement this INRMP in a manner consistent with conservation of cultural resources at Camp Johnson.

4.7.1 Cultural and Historic Resources Program

Natural Resource management activities that might have the potential to impact historic or cultural resources will have a cultural resource consultant review the project prior to implementation for potential impacts. For example, if a modification to structures or soil disturbance is to take place, the cultural resources consultant can determine whether potentially eligible resources may be affected, and whether or not a cultural resources survey is required. The purpose of the survey is to determine whether historic or cultural resources would be adversely affected by the proposed action. Because of the research done in developing a predictive model for the presence of archaeological and cultural resources by the University of Vermont's Consulting Archaeology Group, parts of Camp Johnson were identified as having a moderate to high probability of containing significant cultural resource artifacts. Activities that

may impact cultural resources include: New construction, increased range activities, new types of training or use of new equipment. None of these types of activities are planned in this INRMP.

4.7.2 Natural Resources Management Implications

A substantial amount of work concerning the management of the prehistoric and historic cultural resources at Camp Johnson has been completed by the University of Vermont Consulting Archaeology Program, including large-scale surveys, architectural assessments, and maps. Prior to any soil disturbance or modification of structures, these maps and survey results should be consulted to determine the probability of disturbing any archaeological sites or historic structures that may be potentially eligible for listing on the NRHP or may be of significance to federally-listed Native American tribes or groups.

Natural Resources personnel should consult the Integrated Cultural Resources Management Plan as an early step in the natural resources management planning process. Appropriate steps are as follows:

- Identify the area or structure to be affected and coordinate in accordance with the Integrated Cultural Resources Management Plan.

- Using existing maps, examine for the presence of existing or potential archeological sites and standing structures.

To comply with the National Historic Preservation Act (Section 106) and the Archeological Resources Protection Act, the Vermont SHPO will be contacted in accordance with the Integrated Cultural Resources Management Plan (ICRMP). (The ICRMP is being developed concurrently with this document, and should be finalized in November 2001). This action may require the completion of a Phase I archaeological survey, including background research and archaeological excavations. If archaeological sites considered to be potentially NRHP-eligible are found, further excavation work (Phase II and/or Phase III) may be required by the Vermont SHPO. If historic structures are involved, any proposed modifications or demolition must be in accordance with the Integrated Cultural Resources Management Plan or approved by the Vermont SHPO. As per NHPA section 106 process, an application for undertaking may be required and must be approved prior to construction or training. It is important to allocate enough time for this.

In cases of inadvertent discoveries, the Standard Operating Procedures are outlined in detail in the VTARNG ICRMP. These procedures must be followed. An abbreviated one page handout can be found in Appendix L.

Curation of Collections and Records. Any artifacts collected during the course of previous or future archaeological excavations, or recovered within the installation during construction, soil disturbance, or other means, along with associated documentation, must be curated according to 36 CFR Part 79, *Curation of Federally-Owned and Administered Archeological Collections*. Pre-existing collections are not exempt from this rule.

Native American Consultation.

The VTARNG complies with the tribal consultation requirements identified in federal laws, federal regulations, presidential executive orders, and DoD and Army policy. These include, but are not limited to, situations involving NEPA, NHPA, ARPA, AIRFA, NAGPRA, 36CFR 800, 43 CFR 10, EO 13007, EO 13175, the DoD Annotated American Indian and Alaska Native Policy (dated 27 October 1999), and AR 200-4. The only Federally recognized Tribe known to be affiliated with lands used by the VTARNG is the Stockbridge-Munsee Band of Mohican Indians, in Bowler, Wisconsin.

In accordance with the laws, regulations, executive orders, and policies cited above, the VTARNG will consult with the Stockbridge-Munsee Band, on a government-to-government basis, on projects, activities, and actions that have the potential to affect their interests. In regard to descendants of native people that lack Federal recognition, their opinions will be sought in the same manner that VTARNG would seek comments from any member of the public that has special knowledge or concerns.

4.8 ECOSYSTEM MANAGEMENT

This INRMP follows the direction set forth in the memorandum issued by the Deputy Under Secretary of Defense for Environmental Security (8 August 1994) regarding the *Implementation of Ecosystem Management in the DoD*. The memorandum states that ecosystem management will become the basis for future management of DoD lands and waters.

DoD's overall goal regarding ecosystem management is ". . . to preserve, improve, and enhance ecosystem integrity. Over the long term, this approach will maintain and improve the sustainability and

biological diversity of terrestrial and aquatic (including marine) ecosystems while supporting sustainable economies and communities." The specific principles and guidelines that DoD has identified to achieve this goal are listed below:

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

Ecosystem management recognizes that humans are ecosystem components and that sustainable human activity does not mutually exclude the preservation and enhancement of ecological integrity. Therefore, it is ecosystem management that provides Camp Johnson the means to both protect biodiversity and continue to provide high-quality military readiness.

The management measures and strategies that have been proposed for Camp Johnson have been developed with consideration for the interrelationships between the requirements of the military mission, the individual components of the ecosystem, and other land use activities. The focus is on maintaining the structure, diversity, and integrity of the biological communities, while recognizing that the soldiers and military mission are a vital component of the ecosystem. An adaptive management strategy has been incorporated into this INRMP to monitor the temporal and spatial dynamics of the ecosystems and to adjust the management measures and strategies based on improved knowledge and data. The monitoring programs generate the data needed to determine whether the management measures and strategies are effective in achieving their intended goals and objectives. This management approach will preserve and enhance the natural resources, while providing the optimum environmental conditions required to sustain the military mission and realistic training conditions.

SECTION 5.0:
NATURAL RESOURCES MANAGEMENT

This chapter begins with a description of the methods used to develop this INRMP and the management measures for each resource area. Section 5.2 provides an overview of the general goals and objectives established by the Natural Resources Branch at Camp Johnson for the management of the resources. Resource-specific discussions, provided in Sections 5.3 through 5.11, provide detailed explanations of the goals and objectives, management strategies, and other management alternatives considered for each resource area. Resource-specific goals and objectives are provided, as well as the relationship of the resource in supporting the mission. The subsections entitled *Management Measures* describe the management measures selected to be implemented to meet the resource-specific goals and objectives. These subsections provide the rationale for why the management measures have been selected and their potential relationship to or impact on other natural and cultural resources and the military mission. Other management alternatives that have been considered but have been rejected for reasons such as economical or ecological impracticality are discussed as a subheading under each resource area. Section 5.12 provides a summarization of the management measures, including inventorying and monitoring programs, for all resource areas, their relationship to each other and the military mission, and how they serve to achieve the goals and objectives of the natural resources management program at Camp Johnson.

5.1 METHODS

The preparation of this INRMP involved the review and analysis of past natural resource management practices, ongoing programs and the current conditions of the existing resources as detailed in Section 3.0. The review process included interviewing Camp Johnson personnel, representatives of the Plans, Operations and Training Office, Battalion Operations Officers, and Unit Commanders, as well as key individuals from State and Federal agencies (e.g., United States Fish and Wildlife Service, USFWS and Vermont Agency of Natural Resources, VTANR); collecting existing environmental documentation; and conducting field reconnaissance of the installation.

The findings from the interviews, field reconnaissance, and document review process have been synthesized and incorporated into this INRMP using the ecosystem management approach described in Section 4.8. Where data gaps exist, inventorying and monitoring programs and planning level surveys have been proposed. These programs are designed to collect the data necessary to fill those information gaps and to achieve the objectives of the natural resources program.

The approach used to develop the discussion of the management strategies for each resource followed three general steps:

Goals and Objectives. The goal and objectives for the management of the resource, as well as the relationship of the resource to other components of the ecosystem (including the human component) and the military mission, were described.

Management Measures. Past management strategies, current conditions, and an array of management strategies based on a more-informed knowledge of ecosystem management principles were evaluated and considered to develop management strategies that would achieve the goals and objectives for the resource, as well as those of the overall natural resources management program. An inventory of needs and monitoring programs necessary to generate data to ensure continued success of the program and to provide the information needed to facilitate the integration of adaptive management techniques was included.

Adaptive management is a continuing process of action(s) based on planning, monitoring, evaluation, and adjustment. When adequately designed and effectively implemented, the process allows managers to determine how well their actions meet their objectives (whether that is protection of sensitive habitats or maintenance of scenic beauty) and what management steps are needed to increase the chances of achieving the objective.

Other Management Alternatives. Other management alternatives were considered during the screening process, but eliminated because they were economically infeasible, ecologically unsound, or incompatible with the requirements of the military mission. A discussion of these alternatives is included.

5.2 GOALS AND OBJECTIVES OF THE NATURAL RESOURCES PROGRAM

The goal established by Camp Johnson for the natural resources management program is to maintain ecosystem viability and ensure the sustainability of desired military training area conditions. The Natural Resources Branch has identified a number of objectives necessary to achieve this goal:

- ► Manage all resources to support the installation training mission.
- ► Result in zero net loss of military training capacity at Camp Johnson.
- ► Implement a natural resources management program that reflects the principles of ecosystem management.
- ► Use adaptive management techniques to provide the flexibility to revise management strategies based on increased knowledge and data gained from monitoring programs and science literature.
- ► Seek to maintain or increase the level of biodiversity of native species.
- ► Protect forest resources from unacceptable damage and degradation resulting from insects and disease, animal damage, invasive species, and wildfire; and manage the resources in a manner that supports the military mission.
- ► Prevent the degradation of water quality, protect aquatic and riparian habitats, and identify and restore degraded habitats.
- ► Protect soil resources from erosion and destabilization through prevention and restoration efforts.
- ► Protect and preserve cultural resources in accordance with State and Federal laws.

- Provide special protection and management that lead to the recovery of threatened and endangered species if they occur, and protect species of special concern.

- Protect rare and unique plant species identified as state or locally rare, but without legal protection status, to the extent practical without undue restrictions on operations.

- Protect sensitive and ecologically significant habitats located on Camp Johnson.

- Manage wildlife and fisheries resources within the principles and guidelines of ecosystem management to maintain productive habitats and viable populations of native species.

- Provide a positive contribution to the community by offering informative and educational instruction and opportunities.

5.3 SOIL MANAGEMENT

The primary goals of soil conservation and management on Camp Johnson are to identify areas where soil erosion is occurring, protect soil resources, and prevent soil erosion and its potential impacts on water quality, habitat, endangered species, and mission objectives.

Objectives of soil conservation and management on Camp Johnson are to rehabilitate areas where soils have been disturbed or where active soil erosion is occurring, minimize erosion, and when possible to avoid disturbance of soils that are considered to be moderately or severely susceptible to erosion. Where these areas are disturbed, either as a result of anthropogenic activities or due to natural causes, they are to be stabilized and repaired in a timely manner to avoid the development of excessive erosion sites. Installation sources of erosion and sedimentation, runoff, and dust will also be controlled to prevent damage to land, water resources, equipment, and facilities on both the installation and adjacent properties. Camp Johnson is entering into a contract with the Natural Resources Conservation Service to complete a soil survey of Camp Johnson. The current GIS layer is incomplete and the digital data quality is uncertain. Therefore, we will not make predictions of soil erodibility based on the current soils layer. Until the new survey is completed, decisions on soil stabilization will be based principally on observation. The size of the installation and the area of potential soil erosion problems will allow us monitor the soil situation until the newest soil survey is complete – estimated to be spring of 2002.

5.3.1 Management Measures

Camp Johnson will implement the following general and specific soil conservation provisions:

- Maintain existing road ditches, culverts, and turnouts to ensure proper drainage and minimize the potential for the development of ruts and mud holes and other erosion related problems. Where necessary, construct new ditches, culverts, or turnouts to divert water away from roads.

- Stabilize, seed, and mulch eroded roadsides and new road cuts with native vegetation where feasible in a timely manner to minimize impacts to adjacent habitats resulting from the transport and deposition of eroded soils.

- Conduct routine road and trail maintenance in all training areas. Grade, fill ruts, place gravel, and stabilize banks and edges of roads/trails as needed. Conduct inspection and repair on an annual basis.

- Implement Best Management Practices (BMPs) to stabilize and rehabilitate soils in all training areas (annually).

- Monitor bivouac areas for signs of excessive soil compaction, rutting, or erosion. Where possible, periodically close existing bivouac areas. Implement BMPs to reduce excessive soil compaction, rutting, and erosion. Consider some form of site hardening, such as the use of geotextiles, where it would be consistent with site use, environmental conditions, and training objectives. Determine locations for alternate bivouac sites and use these on a rotational basis.

- Implement BMPs such as check dams, bank stabilization, etc., to reduce erosion and sedimentation at gully erosion or wash out areas.

- When exposure of soils is necessary to accomplish mission objectives, whether for military training or for other activities such as timber harvest, use soil conservation measures (e.g., check dams, wind breaks, diversions) to control erosion, sedimentation, and dust. To limit land maintenance expenditures and minimize environmental impacts,

site physically intensive land-disturbing activities, when possible, on the least erodible lands (those requiring the least cover for erosion control).

- Implement erosion and sediment controls where appropriate. Maintain protective vegetative covers over all compatible areas, especially on steep slopes. Where necessary, gravel, fabrics, mulch, riprap, or other materials that are environmentally safe and compatible with the location, may be used, as appropriate, for control of erosion in problem areas.

- Soils from training activities that require excavation such as defensive fighting positions (foxholes) must be saved and when the training is completed the soil must be returned to the excavation and compacted to the approximate undisturbed soil density. Soil layers must be replaced as they were - subsoil in the hole first and cover with topsoil, then the leaf litter and organic material. Overfill holes to allow for settling. Unit Commanders are responsible for ensuring that small excavations are filled properly. Defensive fighting positions will be limited in the high risk cultural resource areas identified in Figure 3-5

- Soil disturbing activities are also restricted from wetlands (Figure 3-2) or identified cultural resource sites. Soil erodibility shall be considered when planning training that will destroy vegetation.

- Natural Resources staff will study the existing mountain bike trail erosion problems and stabilize soil in certain problem areas. In a larger context, the mountain bike issue must be dealt with on a long term basis, and Management must be proactive in developing a plan that will address the concerns of the mountain biking public, military mission and natural resource professionals. Liability issues continue to be a major obstacle in allowing public access to the trail system at Camp Johnson.

5.3.2 Other Management Alternatives Considered

Other soil management alternatives that represented a program consisting of fewer, and less intensive, management measures were considered, but rejected. The other management alternatives considered represented the minimum approach to achieving a soil resource management program that could comply with the guidelines established in Army Regulation

(AR) 200-3. The management alternatives in this approach were aimed at controlling the level of erosion, soil loss, and disturbance that could potentially occur, rather than taking the steps necessary to prevent, to the maximum extent practicable, the likelihood of these events occurring.

Given the nature of the soils on the reservation, this minimal approach to soil management has been rejected. The military mission requires continuous vegetative cover, and the ability to sustain this cover over the long term could be jeopardized by a minimal management approach and unexpected climatological events. The effort and resources necessary to implement this approach is a prudent investment toward ensuring the long-term sustainability of the soil resources.

5.4 WATER RESOURCES MANAGEMENT

The ecological and human health importance of maintaining healthy water bodies at Camp Johnson is reinforced by several federal and state laws/regulations. In addition, AR 200-1 and AR 200-3 promote the importance of maintaining healthy water body systems on the installation.

The primary goal of water resources management at Camp Johnson is to protect the water bodies on the installation. The objectives defined for meeting this goal are:

- ►Identify and restore degraded aquatic habitats.
- ►Protect aquatic and riparian habitats.
- ►Prevent degradation of water quality.

5.4.1 Management Measures

The management measures that will be implemented to protect water quality are as follows:

- Maintain 50-foot vegetative buffers with a sufficient number of canopy species around all water bodies where possible

- Limit the impact on water bodies and riparian buffers caused by training exercises. The direct input of pollutants (e.g., lead, petroleum products), as well as the increased erosion of stream banks/shorelines and disturbance of soils in the nearby riparian areas of the

impact areas can lead to inputs of nutrients and pollutants and transport to downstream water bodies.

- Pesticides and fertilizers will be applied minimally at Camp Johnson, in conformance with appropriate standards, and should not be applied in riparian buffer areas. These applications will be done in accordance with VTARNG Integrated Pest Management Plan and only after review and approval by a certified pesticides applicator on the Environmental Staff.

- Limit vehicle use in the vicinity of the water bodies at Camp Johnson to reduce the introduction of hydrocarbons into aquatic systems.

- Control nuisance species to the extent possible.

5.4.2 Other Management Alternatives Considered

A less intensive approach to water resource management was considered but rejected. The Endangered Species Act and the Clean Water Act have severe regulatory implications for noncompliance that could adversely affect Camp Johnson's ability to support its mission. In addition, potential liability exists from not knowing the quality of the water from which people catch and eat fish, come into contact with, and possibly drink. These conditions warrant implementing the water quality monitoring program described in this INRMP to characterize the water resources.

5.5 HABITAT MANAGEMENT

AR 200-3 requires Army habitat management efforts to be conducted in a manner that conserves and enhances biological diversity, while being consistent with Army goals to accomplish the military mission. The regulation also requires that primary consideration be given to the management of environmentally-sensitive areas and areas of special management concern. To this end, habitat management activities on Camp Johnson are directed toward the maintenance of healthy ecosystems and the restoration of degraded ecosystems.

5.5.1 Riparian Areas

The goal of riparian management at Camp Johnson is to protect water quality and fishery resources. Riparian areas are critical for dissipating stream energy associated with high water flows, filtering sediment and pollutants, improving floodwater retention and ground water recharge, stabilizing stream banks and shorelines, providing habitat for instream and upland species, and supporting biodiversity (USEPA, 1993). The primary objective of riparian management at Camp Johnson is to maintain adequate riparian areas.

5.5.1.1 Management Measures

General riparian management measures have been developed based on the goals and objectives for protecting water quality and fishery resources. These general management measures are primarily aimed at maintaining adequate riparian buffer areas. Specific and general management measures are listed below.

- Conduct riparian habitat assessments to document conditions, assess status and trends, and monitor future conditions through the LCTA program.

- Maintain 50-foot vegetated riparian buffers that can stabilize stream banks and intercept surface runoff containing suspended sediments, nutrients, and pollutants. They also help to moderate water temperatures and provide valuable wildlife habitat. In addition, the buffer should contain a sufficient number of canopy species. No bare soil should occur in this riparian area.

- Plant native vegetation for riparian stabilization. Native hardwood species and native grasses may also provide needed streambank stabilization.

- Restore degraded riparian habitat or mitigate impacts on the habitat when requirements are identified and resources are available.

- Locate bivouac sites at least 300 feet from surface waters. If bivouac sites are located in areas adjacent to a waterbody or its drainage way, implement BMPs for sediment and erosion control.

- Monitor for the presence of exotic species.

- Limit activities within the riparian buffer zones to those which would cause little or no impact on water quality and aquatic habitats.

- Plan recreational development and training exercises to minimize shoreline and stream bank erosion and mitigate unavoidable impacts.

- Limit pesticide and fertilizer use in riparian buffers.

- Stream crossings will be located, designed, constructed, and maintained to provide maximum erosion protection; to have the least adverse effects on wildlife, aquatic life, and their habitats; and to maintain hydrologic processes and water quality. Any crossings will have the necessary state and federal permits prior to construction.

5.5.2.2 Other Management Alternatives Considered

Additional management measures that were considered as techniques for protecting riparian areas, but are no longer being considered, include restricting access. Restricting access to riparian areas at Camp Johnson was considered to protect the integrity of these areas. Restriction of access is no longer being considered as a viable alternative due to the conflict it presents with maintaining the military mission at Camp Johnson.

5.5.3 Wetlands

Wetlands are of critical importance to the protection and maintenance of living resources, since they provide essential breeding, spawning, nesting, and wintering habitats for many fish and wildlife species. Wetlands also enhance the quality of surface waters by impeding erosive forces of moving water and trapping waterborne sediment and associated pollutants, maintaining base flow to surface waters through the gradual release of stored flood waters and groundwater, and providing a natural means of flood control and storm damage protection through the absorption and storage of water during high-runoff periods.

The main goal of Camp Johnson wetland management approach is to continue to implement a program that is consistent with DoD natural resources policy. A wetland management policy with the objective of maintaining no net loss of wetland habitat will be continued. Activities occurring both in or adjacent to wetlands that would result in negative impacts on the habitats will be avoided, when possible, in a manner consistent with mission objectives. Where impacts on wetlands are not avoidable, mitigation of the impacts will be implemented. In a manner consistent with Executive Order 11990, wetland management objectives at Camp Johnson will take a progressive approach toward protecting existing wetlands, rehabilitating degraded wetlands, and (if applicable) restoring former wetlands.

Some of the wetlands on the training site are natural, but others have been created by excavation, impoundment, either manmade or by wildlife, or modifications to the drainage flow. The majority of the wetlands on Camp Johnson have been formed during use of the drainage ways by beavers or muskrats. Most of the wetlands are attributed to tributaries of Sunderland Brook, however, some are associated with changes in drainage patterns over the years since the areas were cleared and/or developed. Camp Johnson contains 75 acres of wetlands. Wetlands are shown in Figure 3-2 and are delineated as Class I or II.

5.5.3.1 Flood Plains

Camp Johnson is not located within any flood plains.

5.5.3.2 Management Measures

Camp Johnson will implement (or continue to implement) the following wetland conservation provisions:

- Continue to develop the GIS database showing the location of wetlands on Camp Johnson. The goal of the management measure is to develop a consistent and accurate inventory of wetland resources. The inventory should be developed in a manner so that it can be modified to more accurately define wetland boundaries as information becomes available or as boundaries change.

- Maintain the wetland inventory and assessment database by monitoring information on wetland characteristics, as new information is collected. This database will be developed to be used with the map database. The goal of these management measures is to use the database to enable management to make decisions in a manner that will minimize potential impacts on wetland habitats on and adjacent to Camp Johnson. The database will also be used to track wetland conditions on Camp Johnson and to assist in the identification of potential problem areas.

- Maintain 50-foot buffers around class II wetlands and 100 ft around class I wetlands as determined in the Vermont Wetland Rules of 1990. Currently there are no class I wetlands identified on Camp Johnson. Where it is determined that a wetland has, or could have, significant habitat value, or where current activities adjacent to a wetland are causing noticeable adverse impacts on the habitat, buffers of greater than 100 feet are considered. Activities within buffer zones are limited to those which would cause little or no impact on, or disturbance to, the wetland. In cases where established activities already occur within buffers and cannot be reasonably changed, monitor wetland conditions to ensure minimization of potential impacts.

- Restore degraded wetlands or mitigate impacts on the habitats when requirements are identified and resources are available.

- Pursue water quality management procedures that protect wetlands from excessive nonpoint source runoff.

- Encourage project managers to coordinate early with the Natural Resources Branch to determine potential adverse impacts to wetlands.

- Plan development and training to avoid wetland impacts to the maximum extent possible and mitigate unavoidable impacts on wetland functions.

- Review operations and maintenance programs that potentially affect wetlands, and develop procedures and guidelines to avoid the loss of wetland functions.

- Evaluate general vegetative characteristics of wetlands to determine where potential future control of invasive species could result in measurable habitat value enhancement.

5.5.3.3 Other Management Alternatives Considered

The comprehensive management measures described above provide the maximum amount of protection for wetlands without impeding the military mission. The other management alternatives that were considered, but rejected, were less comprehensive and, therefore, offered less protection for these sensitive and protected ecosystems. This less intensive management alternative did not include establishing buffer zones, continued development of the wetlands database, updating GIS databases and coverages, or evaluating water quality. This less intensive alternative offered the level of protection necessary to maintain the wetlands at their current status, but did not offer ways to improve and enhance their ecological integrity and protect the biological communities inhabiting them. For example, establishing buffer zones will ensure adequate long-term protection by decreasing the likelihood of future adverse impacts. In addition, increasing the amount of information that is known about the wetlands on Camp Johnson will provide the necessary data to properly monitor the systems. Increasing the database will allow the natural resources managers to track the success of the management practices and to adapt future management practices as needed. The more comprehensive management measures will ensure the long-term ecological viability of these sensitive ecosystems.

A more intensive management alternative was also considered. This alternative restricted all activity in and around wetlands. Given the number of wetlands on the reservation, this alternative was considered to be too restrictive and incompatible with the mission and, therefore, was dismissed.

5.5.4 Terrestrial Habitat

The primary goal of terrestrial habitat management at Camp Johnson is to maintain, enhance, or restore native plant communities, as well as their associations with native fauna. Habitat management on Camp Johnson is conducted using an ecosystem or landscape approach and in a manner that does not interfere with the military mission. The emphasis on ecosystem management serves to enhance biological diversity in general, rather than the prevalence of

particular species of game. The following section describes terrestrial habitat management practices to be implemented at Camp Johnson.

5.5.4.1 Management Measures

Maintain and Improve Unique Trees and Forest Stands. Pine-oak-heath-sandplain natural communities are declining throughout Vermont. Camp Johnson contains the largest block of remaining sandplain community in the state. The official sandplain restoration area encompasses approximately 126 acres, although the pine-oak –heath community extends beyond the restoration area by probably twice that amount. Methods to improve sandplain community are underway per the Memorandum of Agreement of 1992 with the Nongame and Natural Heritage Program. Prescribed burns took place in the spring of 1998 and 1995 and were designed to create a good seedbed for the natural regeneration of pitch pine. The burn of 1995 drastically altered the forest structure and vegetation in unit 7A. Tree mortality was 68% for trees greater than 8 inches diameter. All trees less than this diameter died in the year of the burn. The high overstory mortality has made the management a very sunny area. Pitch pine seedlings were planted in this area and are thriving.

The effects on the 1998 ecological burn on rare plants is difficult to determine. Rare plants in Management Unit (MU) 7B persist in areas where they were documented prior to the burn. This is particularly true for slender mountain-rice (*Oryzopsis pungens*), where known individuals have been followed for many years. Flowering effort in these known plants has decreased over the years for reasons apparently not related to the burn. Low bindweed (*Calystegia spithamneae*) did appear in this unit for the first time, possibly as a result of the burn.

In MU 7A effects of the 1998 fire on rare plants is confounded by the much more dramatic impact that the 1995 burn had on the vegetation. In this management unit, several rare plants have thrived. Low bindweed, slender mountain rice, and yellow panic-grass (*Panicum xanthophysum*) have been particularly successful.

While it is early to tell, there appears to be little, if any, natural pitch pine regeneration from the 1998 burn. The 1995 burn resulted in a few naturally regenerated pitch pine seedlings.

Another prescribed ecological burn is being considered on several one acre patches in the summer of 2001 or the spring of 2002.

5.5.4.2 Erosion Management

As discussed in the previous section, several types of training activities disturb soils and vegetation. This type of disturbance does not mimic any past natural disturbance, although removal of vegetation and exposing bare soil does create some conditions similar to those created by fire. Some of the plants listed in table 3-3 require this type of periodic disturbance to survive, and may be found on Camp Johnson because of certain types of training disturbance. However, care must be taken to minimize soil erosion and the invasion of non-native vegetation.

Disturbed areas will be re-vegetated with native vegetation whenever feasible. Guidance provided by the USDA Natural Resource Conservation Service will be followed. Corrective actions for disturbed soils will vary depending on the size of the site, the soils and the slope of the area where the disturbance occurred.

Areas greater than $15m^2$ will be mulched after seeding. Silt fence will be utilized to minimize the off-site migration of the soil. The perimeter from which runoff could occur should be lined with silt fences. Silt fences will be installed as instructed below.

1. Place the silt fence at the lowest elevation of the area to be repaired.
2. Install silt fence as recommended by the manufacturer.
3. Inspect the silt fence frequently and repair or replace promptly.
4. Remove the silt fence when it has served its usefulness, so storm flow or drainage will not be blocked.
5. Dispose of the sediment trapped by this practice in an area that is not prone to erosion.
6. Remove accumulated silt when it reaches a depth of six inches.
7. At each end of the silt fence, turn fence upslope and extend until the ground surface goes uphill.

5.5.4.3 Other Management Alternatives Considered

A higher-intensity approach to terrestrial habitat management was considered where management techniques similar to those described above were implemented on a larger scale. Under this alternative, a larger total cover of unique tree stands would be protected from harvesting, more forest openings would be created, and more stands would undergo prescribed burning. In the context of Camp Johnson's primary mission, this approach would not be feasible. In addition to the prohibitive cost of some labor-intensive management techniques, it is likely that other techniques would interfere with the objectives of the military mission or other natural resource management programs.

5.6 FOREST MANAGEMENT

Forest management involves exercising influence over the ecological processes of a forest in an effort to provide specific sustainable products and amenities from the forest while maintaining its long term health and vigor. The Army forest management program is required to support and enhance the immediate and long-term military mission and to meet natural resource stewardship requirements set forth in federal laws (AR 200-3). Army policy further stipulates that forest resources must be managed for multiple uses, using an ecosystem management approach to optimize the benefits to the installation's natural resources. Ecosystem management provides a framework for holistic management of the resource rather than focusing emphasis on a single aspect or activity such as timber production or game species management.

Most forest management at Camp Johnson is related to the restoration of the pitch pine habitat area. The last timber sale was in the fall of 1998 and the spring of 1999 and involved the clearing of six one acre patches in an effort to create forest openings required for the successful germination of pitch pine seedlings. In addition to forest openings, pitch pines need a mineral soil seedbed for germination to occur. This can only be accomplished through burning. Additional small logging operations may occur in blocks of 1 acre or less, as the restoration program continues through 2006.

Because of Camp Johnson's size and because of the location of the restoration area, additional forest management options are limited at this time. Other logging operations at Camp Johnson may occur as a salvage operation if large numbers of trees suffer mortality from wind, ice or other

natural disasters. If such a disaster were to occur on a large scale (larger than a few acres) a separate document satisfying NEPA requirements would need to be conducted to analyze the effects of such a salvage operation.

The forest management program at Camp Johnson must also fully comply with all applicable federal laws, policies, and regulations pertaining to forest management. Federal laws, policies, and regulations that have the potential to impact forest management at Camp Johnson include AR 200-3, PL 86-797, Sikes Act, as amended (16 U.S.C. § 670 a through o), 10 U.S.C. § 2665 (Sale of certain interest in land: logs), DoD Inst 7310.5 (Accounting for production and sale of lumber and timber products), Executive Order 11990 (Protection of Wetlands), Endangered Species Act of 1973, as amended (16 U.S.C. §§ 1531 et seq.), and the National Forest Management Act of 1976 (16 U.S.C. §§ 1601 et seq.).

5.6.1 Timber Inventory

Forest inventories are the foundation for the development of management and regulation plans. AR 200-3 requires forest stand inventories be conducted and kept current (at least every ten years) to provide for sustained production of forest products. Camp Johnson is divided onto seven forest management compartments. Compartments were delineated based on similarities in species and sizes present as well as physiography and access. Areas containing predominantly sawtimber were inventoried to obtain estimates of timber volume, stand condition, timber types, size classes, and other general information needed for long-term management planning.

To identify how conditions change in response to management practices, information from the forest stand inventories will continue to be collected and integrated with other inventories, such as timber harvest areas; timber stand improvement (TSI) areas; riparian, wetland, and water resource buffer zones; stream corridors; ecological communities; wetlands; steep slopes; rare plants; threatened and endangered species; locations of cultural and archeological resources; and soil and water resources. A GIS database consisting of these data layers will be maintained and updated with each new inventory. Maps built from these data can be used to track temporal and spatial status and trends of the forest resources relative to other ecologically or geologically sensitive resources.

The last timber stand inventories on Camp Johnson took place in 1991. Forest stands will need to be updated during the period that this management plan covers.

5.6.2 Timber Harvest

Timber Harvesting. Timber harvest activities involve coordination and consultation with a number of state and federal agencies to ensure Camp Johnson's compliance with all state and federal regulations. Since the inception of the Memorandum of Agreement with the Nongame and Natural Heritage Program in 1992 and the creation of the pitch pine-sandplain restoration area, all timber operations have focused on the restoration site. Timber removal has occurred to create small forest openings (~ 1 acre) to improve conditions and create germination sites for pitch pine. Since the loss and fragmentation of pitch pine habitat has created smaller and smaller blocks of habitat, natural disturbance regimes that perpetuate pitch pine cannot occur. Small forest openings will continue to be created through logging and in conjunction with prescribed burns, to mimic past natural disturbances in order to improve habitat for the dwindling pitch pine populations and their associated rare and threatened species. At this time, the pitchpine sandplains restoration management plan is undergoing review as to the extent of the timber stand manipulation that will occur to improve the pitchpine area. Any subsequent decisions on the management of the restoration area in regards to timber harvesting will conform to all guidelines established in this INRMP.

5.6.3 Other Management Alternatives Considered

A higher-intensity approach to terrestrial habitat management was considered where management techniques similar to those described above were implemented on a larger scale. Under this alternative, a larger total cover of unique tree stands would be protected from harvesting, more forest openings would be created, and more stands would undergo prescribed burning. In the context of Camp Johnson's primary mission, this approach would not be feasible. In addition to the prohibitive cost of some labor-intensive management techniques, it is likely that other techniques would interfere with the objectives of the military mission or other natural resource management programs.

5.7 SPECIAL NATURAL AREAS PROTECTION AND MANAGEMENT

DoD Instruction Number 4715.3 (Environmental Conservation Program, May 3, 1996) specifies that "areas on DoD installations that contain natural resources that warrant special conservation efforts . . . may be designated as special natural areas." It further states that "the natural resources management plan for the installation shall address special management provisions necessary for the protection of each area." These special natural areas can include botanical areas, ecological reserve areas, geological areas, natural resource areas, riparian areas, scenic areas, zoological areas, "watchable wildlife" areas, and traditional cultural places having officially-recognized special qualities or attributes.

Camp Johnson has identified the pitch pine–sandplain community as an area of statewide significance. Motorized activities should be limited in this designated area for the protection of pitch pine and associated species.

5.7.1 Natural Communities of Statewide Significance

There is one natural community of statewide significance at Camp Johnson. It is described below:

Pine-oak-heath-sandplain management area.

In Chittenden County, VTNNHP has inventoried sandplains as part of their rare plant, rare animal, and natural community inventory. They focus on the ancient river deltas of the Winooski River in Chittenden County as the best examples of sandplain communities in the sate.

Currently, the number of known sandplain sites in Vermont is less than two dozen, covering in total less than 265 ha (665 acres). Some of these sites represent only a few rare plants scattered along developed margins. Others are chunks of oak-pine sandplain forest ranging from approximately 1.5 to 100 ha.

The most extensive habitat in terms of contiguous, undeveloped land, is the military reservation at Camp Johnson. Camp Johnson has been under government control for

almost a century and in that time, several areas have received relatively little use and have not undergone and extensive natural disturbance.

5.7.2 Management Measures

- To minimize disturbance within these areas, no timber harvest or timber stand improvement activities will occur unless required to maintain or restore suitability for training, such as salvage logging following a severe blowdown or an insect/disease breakout. The natural areas will be maintained as a GIS database layer to facilitate planning and analysis of protection measures. Wildfires will generally be suppressed, and efforts will be made to control the introduction or spread of invasive plant populations.

- Develop signs for soldiers and community members for the pitch pine area that explain the fragile nature of the pitch pine-sandplains habitat, and the efforts to restore this rare habitat in Vermont. Explain that the area contains many rare and sensitive plants that need to be protected. Signs should also instruct hikers/bikers to stay on existing trails to reduce the potential impacts to those rare and threatened plants.

- Conduct periodic prescribed burns in small sections of the restoration area in an attempt to create suitable habitat for pitch pine regeneration. In addition to prescribed burns, some forest openings will be created through timber management, and then burned. This combination is required in order to create the right conditions for seed germination. All management in the pitch pine-sandplain restoration area will be done in conjunction with the VTNNHP and will benefit many of the state listed rare and threatened plant species.

Protection of Endangered, Threatened, and Rare Species

Locations of the rare plants will be maintained on a GIS database and will be made known to potential users of a special natural area, if deemed necessary. Access to particular areas supporting a rare plant population will be restricted to non-motorized traffic only. Fencing or posting signs around plants or populations will be done only when it becomes absolutely necessary to avoid adverse impacts, so as to not invite vandalism.

Invasive Plant Control. Any invasive plant population that poses a threat to a special natural area will be controlled or removed, if feasible. At this time, however, no such threat is imminent.

Monitoring. All special natural areas will be monitored periodically for changes in their unique ecological attributes. Particular attention will be focused on changes to rare plant populations.

5.7.3 Other Management Alternatives Considered

The absolute restriction of all personnel from natural areas was considered as a management option. However, this approach conflicts with the primary goal of Camp Johnson to provide a quality military training experience. The dual goals of protecting these areas and using almost all portions of the installation for training are not mutually exclusive. They both can be accomplished if done so in an adaptive management context. As long as the monitoring of these areas is made to be a priority and ecological conditions are assessed on a periodic basis, then training activities can be modified on an as-needed basis.

5.8 WILDLIFE MANAGEMENT

Because of the small size of Camp Johnson and its close proximity to urban areas, no specific wildlife management program is in place at this time. Wildlife may best be managed by using an ecosystem-oriented rather than species-oriented approach. If we manage to protect habitats native to the area (pitch pine-sandplains) and focus on control of invasive species, erosion, soil stability and other more general problems, no wildlife specific management measures are needed at this time. If any new threatened or endangered species are discovered on Camp Johnson, a review of this policy will be required.

5.9 ENDANGERED, THREATENED, AND RARE SPECIES MANAGEMENT

Species that are candidates for federal listing or are state-listed as threatened, endangered, or of special concern are not protected under the ESA. For state-listed species, installations are encouraged to cooperate with state authorities in efforts to conserve these species.

Rarity designations for plants have been determined by the VTANR based on the number of individuals of a particular species that are estimated to occur inside the state. Since the state

rarity rank itself does not mandate protection and the legal protection under Vermont state law does not prohibit rare plant disturbance by property owners, the protection and management of these species is treated by the Army as a matter of responsible stewardship.

5.9.1 Animal Species

Grasshopper Sparrow

There are no federally listed rare or endangered animal species that will be negatively impacted by any part of the Management Plan. The grasshopper sparrow has been identified on a grassland just north of the cantonement area in the area identified as training area B in Figure 3-6. The grasshopper sparrow is listed as state threatened and was first identified in 1999 and was again sighted in 2000.

After consultation with the VTNNHP personnel, and after consulting the literature on grassland bird management, cooperators involved in preparation of this plan agreed that it would be a prudent measure to prohibit mowing operations on the grassland in question at least until after August 1. The grasshopper sparrow has raised and fledged any young by that period and would not be in danger when the field is mowed. The grassland is approximately 50 acres and is not used extensively as part of military training. One section is used as a helipad for the UH-60 on occasion and may need to be mowed more often. A running track encircles the entire grassland area. The interior of the grassland receives very little foot traffic and almost no vehicular traffic because of the height of the grass. (See Appendix N for an Addendum addressing aviation training and grassland bird management)

Monitoring of the grasshopper sparrow will continue on an annual basis to check for any changes that may be taking place.

Plant Species

Recent (summer 1999) field surveys for rare and listed plants were conducted by Mr. Brett Engstrom (Appendix E). Fifteen rare plants of statewide significance and 9 uncommon state plants exist on Camp Johnson. Of the 15 rare species, one is state listed endangered and 7 are

state threatened. In addition, one species was considered historical (SH), meaning that it had not been recorded in the state for 25 years. It was first located on Camp Johnson in 1993.

Highlights of the findings are outlined below in table 5-1:

Table 5-1

STATE LISTED RARE, THREATENED AND ENDANGERED PLANTS AT CAMP JOHNSON

SPECIES	STATE RANK	STATE STATUS	FIRST OBSERVED	LAST OBSERVED
blunt-leaved milkweed (A*scepias amplexicaulis*)	S1	Threatened	1994	1999
poke milkweed (A*sclepias exaltata*)	S3	None	1996	1996
a sedge (C*arex brevior*)	S2S3	None	1995	1996
low bindweed (C*alystegia spithamea*)	S2	Threatened	1990	1999
stout-wood reed-grass (C*inna arundinaceae*)	S3	None	1996	1999
panicled tick-trefoil (*Desmodium paniculatum*)	S3	None	1996	1996
rough avens (*Geum laciniatum*)	S2	None	1999	1999
plains frostweed (*Helianthemum bicknellii*)	S2S3	Threatened	1990	1999
Canada frostweed (*Helianthemum canadense*)	S2S3	None	1993	1999
harsh sunflower (H*elianthus strumosus*)	S2S3	Threatened	1985	1999
large whorled pagonia *(Isotria verticillata*)	S2	Threatened	1993	1999
wood lily *(Lillium philadelophicum*)	S3	None	1993	1999
green adder's mouth (*Malaxis unifolia*)	S2	None	1999	1999
slender mountain-rice (*Oryzopsis pungens*)	S2	Threatened	1990	1999
a panic grass (P*anicum columbianum*)	S3	None	1993	1999
depauperate panic-grass (*Panicum depauperatum*)	S3	None	1985	1999
cypress witchgrass (*Panicum dichotomum*)	S3	None	1996	1999
Tuckerman's panic-grass *(Panicum tuckermanii*)	S2	None	1999	1999
yellow panic-grass (*Panicum xanthophysum*)	S3	None	1985	1999
racemed milkwort (*Polygala polygama*)	S2	None	1985	1999
slender knotweed (*Polygonum tenue*)	S1	Historical	1993	1993
cursed crowfoot (*Ranunculus scleratus*)	S2	None	1999	1999
many-leaved sedge (*Scirpus polyphyllus*)	S2	Endangered	1996	1999
Virginia chain-fern (*Woodwardia virginica*)	S1	Threatened	1829	1958

blunt-leaved milkweed (*Ascepias amplexicaulis*)	S1	Threatened	1994	1999
poke milkweed (*Asclepias exaltata*)	S3	None	1996	1996
a sedge (*Carex brevior*)	S2S3	None	1995	1996
low bindweed (*Calystegia spithamea*)	S2	Threatened	1990	1999
stout-wood reed-grass (*Cinna arundinaceae*)	S3	None	1996	1999
panicled tick-trefoil (*Desmodium paniculatum*)	S3	None	1996	1996
Rough avens (*Geum laciniatum*)	S2	None	1999	1999
Plains frostweed (*Helianthemum bicknellii*)	S2S3	Threatened	1990	1999
Canada frostweed *(Helianthemum canadense*)	S2S3	None	1993	1999
harsh sunflower (*Helianthus strumosus*)	S2S3	Threatened	1985	1999
large whirled pagonia *(Isotria verticillata*)	S1	Threatened	1993	1999
wood lily (*Lillium philadelophicum*)	S3	None	1993	1999
green adder's mouth (*Malaxis unifolia*)	S3	One	1999	1999
slender mountain-rice (*Oryzopsis pungens*)	S2	Threatened	1990	1999
a panic grass (*Panicum columbianum*)	S3	None	1993	1999
depauperate panic-grass (*Panicum depauperatum*)	S3	None	1985	1999
cypress witchgrass (*Panicum dichotomum*)	S3	None	1996	1999
Tuckerman's panic-grass (*Panicum tuckermanii*)	S1	None	1999	1999
Yellow panic-grass (*Panicum xanthophysum*)	S3	None	1985	1999
racemed milkwort (*Polygala polygama*)	S2	None	1985	1999
slender knotweed (*Polygonum tenue*)	SH	Historical	1993	1993
cursed crowfoot (*Ranunculus scleratus*)	S2	None	1999	1999
many-leaved sedge (*Scirpus polyphyllus*)	S1	Endangered	1996	1999
Virginia chain-fern (*Woodwardia virginica*)	S1	Threatened	1829	1958

Table 5-2 Key to State Rank Designations.

S1 (State listed)	Very rare, generally 1 to 5 occurrences . Believed to be extant and/or some factor making it especially vulnerable to extirpation from the state
S2	Rare, generally 6 to 20 occurrences. Believed to be extant and/or some factor making it especially vulnerable to extirpation from the state.
S3	Uncommon, believed to be more than 20 occurrences and/or there is some threat to it in the state.
SH	Not found in the state for at least 25 years. (designation has yet to be changed since the Camp Johnson sightings.

5.9.2 Other Management Alternatives Considered

Since the protection of federally listed species is mandated by federal law and protection of state-listed and rare species is required by Army regulation, other management alternatives that would have afforded less protection to these species were not considered. Also, the absolute restriction of training operations in all areas supporting a rare or state-listed species was disregarded as a viable management option since support of the military mission is the primary function of Camp Johnson property. Rare and state-listed species can be well managed and protected by knowing exactly where they are (i.e., having current monitoring data) and planning training activities in space and time accordingly. For example, if a sensitive raptor is nesting in a particular area on the installation, training will be limited there during the nesting season but allowed at other times of the year. If, in the following year, nesting is not occurring in the same location, training activities will not be restricted.

5.10 PEST MANAGEMENT

The following discussion is a brief overview of the pest management program, which is described in full in the Integrated Pest Management Plan for Camp Johnson (July 1999). Pest management priorities at Camp Johnson include control of disease vectors, protection of stored food products, protection of real estate, control of nuisance pests, control of undesirable vegetation, protection of beneficial plants, and control of miscellaneous animal pests (e.g., rodents, birds, bats).

The pest management plan for the VTARNG describes the command's pest management requirements, outlines the resources necessary for surveillance and control, and describes the administrative, safety and environmental requirements of the program. The program for the VTARNG relies on building occupants, building administrators, and contracted pest management technicians to control pests. Pests addressed in this plan include weeds and other unwanted vegetation, termites, mosquitoes, and other miscellaneous vertebrate pests such as skunks, raccoons and squirrels. Without control, these pests could interfere with the military mission, damage real property, increase maintenance costs and expose installation personnel to diseases.

5.10.1 Management Measures

Detailed management approaches for the control of pests on the installation have been documented as part of the Integrated Pest Management Plan (1999). The pest management plan for the VTARNG describes the command's pest management requirements, outlines the resources necessary for surveillance and control, and describes the administrative, safety and environmental requirements of the program. The program for the VTARNG relies on building occupants, building administrators, and contracted pest management technicians to control pests. Pests addressed in this plan include weeds and other unwanted vegetation, termites, mosquitoes, and other miscellaneous vertebrate pests such as skunks, raccoons and squirrels. Without control, these pests could interfere with the military mission, damage real property, increase maintenance costs and expose installation personnel to diseases.

5.10.2 Other Management Alternatives Considered

Two other management alternatives for pest management were considered: (1) less intensive management, and (2) more intensive management. The pest management measures currently in use at Camp Johnson, and as described in the Integrated Pest Management Plan (July 1999) are relatively low in intensity. Lowering that intensity further would not provide sufficient control of pest species. More intensive pest management measures would result in increased usage of pesticides. This would be counterproductive and counter - directive to the NGB-ARE all states Log Number P97-0027 which states that as part of the DoD Measure of Merit, quantities of pesticides applied at DoD installations are to be reduced 50 percent from a FY 93 baseline by the end of FY 2000. Therefore, both less and more intensive management approaches were dismissed.

The VTARNG will reduce pesticide usage by only using chemical controls when absolutely necessary. Mechanical control (hand pulling, burning, steam, etc.) will be the primary method for weed control. Integrated Pest Management Practices such as maintaining clean buildings and premises will be the primary method for animal pest control. These two methods should reduce pesticide usage on the VTARNG.

5.11 FIRE MANAGEMENT

Since live-fire training at Camp Johnson is restricted to small arms ranges, fires caused by training are not very likely. Still, there is always the possibility of fires resulting from training, bivouacking, vehicle malfunction, or lightning. There is no fire fighting equipment currently staged on Camp Johnson. The Colchester and St. Michaels Fire Department should provide a quick response time in the event of a fire.

5.11.1 Controlled burning

Controlled Burning. Controlled burning will be used on Camp Johnson for the purpose of creating or improving habitat in the pitch pine-oak–heath sandplain habitat. All proper permitting procedures and notification of appropriate agencies will carried out before any controlled burning is implemented. All controlled burns will be in consultation with the VTNNHP personnel.

Wildfire Suppression. All wildfires will be extinguished as quickly as possible. The person(s) that first notices the fire will contact the Colchester Fire Department and the Environmental Office and then attempt to control and extinguish it.

5.11.2 Other Management Alternatives Considered

Fire management measures proposed for Camp Johnson are those minimally required for effective fire management. Other management alternatives that require more or less aggressive fire management were considered, but rejected. Unchecked wildfires could potentially leave large tracts of training areas unsuitable for training. In addition, the threat these fires could pose to the surrounding communities would be unacceptable; therefore, this strategy was also rejected.

5.12 INTEGRATION AND SUMMARY OF MANAGEMENT MEASURES

As previously stated in Section 5.1, the goal of the INRMP for Camp Johnson is to ensure that the natural resources located on the installation are managed in such a way as to provide the optimum environment that sustains the military mission and provides the conditions required for realistic training. The management measures in this INRMP that will be implemented have been developed to successfully achieve the stated objectives necessary to meet this goal.

The overlap of similar management measures for different resource areas is indicative of the relationship that various components of an ecosystem have with one another. The need for integrated natural resources management is evident by the complexity of these relationships. For example, significant portions of the watershed on the installation are forested and provide the cover required to support the military mission. In addition to being essential for the military mission, the condition of the forests directly influence the quality of wildlife habitat and, therefore, the condition and diversity of wildlife inhabiting Camp Johnson. The condition of the watershed also directly influences water quality, the condition of the fisheries, and sensitive habitats, such as the numerous wetlands, and riparian areas. These habitats are necessary to maintain or to increase the biodiversity at Camp Johnson. Managing the forests using an ecosystem approach will maintain, protect, and enhance the natural resources. Furthermore, the results from screening level watershed and habitat assessments serve as indicators to the overall condition of the natural resources. Degraded watershed and habitat conditions will result in loss of ecological integrity and biodiversity. Soil stabilization and revegetation projects conducted ultimately improve the habitat conditions on a small scale and watershed conditions on a larger scale. The effects from these types of improvements are more far-reaching than the particular area in which they are performed. Soil stabilization and revegetation stops erosion, decreases sediment loads to streams, lakes, and wetlands and ultimately improves the habitat for the biological communities, including fish, inhabiting those waterbodies. Soil stabilization and revegetation also creates or improves habitat conditions for terrestrial wildlife species.

GIS can serve as a powerful management tool for facilitating the integration and implementation of the resource-specific management measures that have been presented in this INRMP. An overlay of the coverages for the natural and cultural resource areas serves to graphically illustrate the complexity of the environment, and provide the means to readily identify and resolve potential conflicts between natural resource issues and mission requirements.

SECTION 6.0:
IMPLEMENTATION OF THE INRMP

6.1 ORGANIZATION, ROLES, AND RESPONSIBILITIES

The ecosystem approach described in this INRMP to manage the natural resources of Camp Johnson can be implemented by the existing environmental organization based at Camp Johnson with assistance from personnel at Camp Johnson, as well as other outside sources of assistance. The CFMO and Environmental Offices have joint cooperation and responsibility for the implementation of this INRMP, which is in effect from FY 2002 through FY 2006.

6.2 MANPOWER

6.2.1 Staffing

Currently, the natural resources management staff at Camp Johnson consists of the Natural Resources Manager. It is unlikely that a staff of one will be able to fully implement this INRMP. Therefore, to fully and adequately implement this INRMP, VTARNG will find it necessary to hire additional sources of labor to assist in the completion of some projects and tasks. These could be temporary hires, which would be hired with term limitations and could include seasonal employees, university hires and/or interns, and outside agency reimbursable hires.

6.2.2 Outside Assistance

Implementation of a number of the projects discussed in this INRMP will require active outside assistance. This outside assistance, which is described as needed in Sections 1.0 and 5.0, will come from State and Federal agencies, and contractors. Using these resources is the most efficient and cost-effective method for acquiring expertise on a temporary basis. Some of the parties will be reimbursed for their assistance, as agreed based on MOU and contractual agreements, whereas others will supply their assistance in accordance with cooperative agreements**.**

6.3 PROJECT/PROGRAM PRIORITIES

The Office of the Secretary of Defense (OSD) considers funding for the preparation and implementation of this INRMP, as required by the Sikes Act, and the associated NEPA analysis and documentation to be a high priority. However, the reality is that not all of the projects and programs identified in this INRMP will receive immediate funding. As such, these programs and projects have been placed into two priority-based categories: 1) high priority programs and projects and 2) important projects. The prioritization of the projects is based on need, and need is based on a project's importance in moving the natural resources management program closer towards successfully achieving its goal. The time frame during which these projects are to occur is provided in parenthesis following the project description.

6.3.1 High-Priority Programs and Projects

- Annually update GIS coverages for all natural resource areas as new data become available. (FY 02-06)

- Develop and provide users of training areas with detailed maps indicating sensitive areas. These maps will be developed by compositing GIS coverages of sensitive species; ecological preserves; wetlands; riparian, wetland, and water resource buffer zones; steep slopes and highly erodible soils; rare plants; threatened and endangered species; and locations of cultural and archeological resources. (FY 02-06)

- Establish and maintain protective vegetative buffer zones around streams, lakes, ponds, and wetlands. (FY 02-06)

- Maintain and update wetlands inventory and assessment database by compiling information on wetland characteristics. (FY 02-06)

- Conduct prescribed burns to maintain and enhance pitch pine-sandplains habitat. (FY 02-06)

- Develop signage to be used on the trails in the pitch pine-sandplains area explaining the natural history and instructing users to stay on the trail to protect rare plant species.

- Implement pest management measures. (FY 02-06)

- Restrict the use of pesticides. (FY 02-06)

- Protect cultural resources while implementing this INRMP. (FY 02-06)

- Provide training to National Guard Personnel on environmental awareness and training in accordance with this INRMP.

- Complete vegetation survey (FY 02)

6.3.2 Important Projects

- Conduct a comprehensive vegetation survey of the pitch pine-sandplains habitat and use this information for monitoring long-term changes in species and community composition.

- Conduct reptile and amphibian surveys in the sandplains community (FY 04).

6.4 IMPLEMENTATION OF FUNDING OPTIONS

The natural resources program at Camp Johnson receives financial support from appropriated funds (e.g., Operations and Maintenance), and funded reimbursements (forestry). The use of funded reimbursements are restricted by Federal law and can be used only for timber management-related expenses. Expenses not directly associated with timber management must be funded from appropriated funds. The use of ITAM funding may be used in maneuver areas, but ITAM funding has not been utilized on Camp Johnson as of yet. The possibility of utilizing these funds in the small maneuver area of Camp Johnson (TA-C, Figure 3-6) will be researched, but at this point, those funding possibilities will not be counted upon.

The following section presents the funding options and anticipated budgets (revenues) expected to be available to fund the natural resources program at Camp Johnson from 2002 through 2006.

6.4.1 Summary of INRMP Implementation Costs

Implementation of this INRMP will not require further dollars above and beyond the current levels of Environmental budget dollars for the VTARNG. Additional and/or alternate sources of funding will continue to be explored, in an effort to fund additional lower priority items.

6.4.2 Optional Funding Sources

Other funding sources are available for specific projects within the Department of Defense. These funding sources are not always available and their amounts may vary. Most of these programs are funded using the grant proposal selection method and may involve partnering with other state or federal agencies or private entities or non-profit organizations. The following is a list of some of these optional funding sources that the VTARNG will occasionally try to utilize when the situation arises and fits our needs.

Legacy Resource Management Program

In 1990, Congress passed legislation establishing the Legacy Resource Management Program to provide financial assistance to DoD efforts to preserve our natural and cultural heritage. The program assists DoD in protecting and enhancing resources while supporting military readiness. A legacy project may involve regional ecosystem management initiatives, habitat preservation efforts, archaeological investigation, invasive species control, and/or monitoring and predicting migratory patterns of birds and animals.

National Public Lands Day

National Public Lands Day is an event that occurs once a year when volunteers come together to improve the countries largest natural resource – our public lands. These volunteers gather on a Saturday every September to help improve the public lands that they use for recreation, education and enjoyment.

National Public Lands Day is a unique public-private partnership involving many federal, state, and local land agencies. These agencies work closely with business partners such and numerous non-profit organizations. The National Environmental Education & Training Foundation manages, coordinates, and generates financial support for the program

6.5 COMMAND SUPPORT

The Adjutant General and other personnel in command positions at Camp Johnson fully support this INRMP. The command is dedicated to ensuring the long-term sustainability of the natural resources and the management of those resources necessary to support the military mission.

Command support is essential for the implementation of this INRMP. Also, in accordance with AR 200-3, the Sikes Act, and other federal laws, the Adjutant General of Camp Johnson is personally liable for noncompliance with the environmental laws affected by this INRMP and therefore has a personal interest in ensuring the full and complete implementation of the plan.

6.6 PLAN REVIEW

The Natural Resources Branch will annually conduct a review of this INRMP in light of the preceding year's accomplishments. The schedule of activities as appear in Sections 5.0 and 6.0 will be the basis for monitoring plan implementation.

SECTION 7.0:
ENVIRONMENTAL CONSEQUENCES

This section of the document assesses known, potential, and reasonably foreseeable environmental consequences related to implementing the INRMP and managing natural resources at Camp Johnson. Section 7.1 addresses implementation of the no action alternative, which reflects the continuation of existing baseline conditions as described in Section 3.0. Section 7.2 presents potential effects in the context of the scope of the proposed action and in consideration of the affected environment. This assessment is organized by resource area (as presented in Section 3.0) and considers implementation of the selected management measures in their entirety (as presented in Section 5.14). Cumulative effects are discussed in Section 7.3. Implementing the proposed action is Camp Johnson's preferred alternative. A summary of the potential environmental consequences associated with the no action alternative and the proposed action is presented in Section 7.4.

As discussed in Section 1.4.5, *Description of the Proposed Action and Alternatives*, the EA addresses two alternatives—the proposed action and the no action alternative. Other management alternatives were considered during the screening process, but eliminated because they were economically infeasible, ecologically unsound, or incompatible with the requirements of the military mission. Section 5.0, *Natural Resources Management*, provides a description of the methods used to develop management measures for each resource area and the rationale for why certain management measures were selected. Therefore, the analytical framework supporting the management measures for each resource is not repeated in this section. This approach supports Army guidance for concurrent preparation and integration of the INRMP and NEPA documentation.

As discussed in Section 1.4.5, the Camp Johnson INRMP is a "living" document that focuses on a 5-year planning period based on past and present actions. Short-term management practices included in the plan have been developed without compromising long-range goals and objectives. Because the plan will be modified over time, additional environmental analyses will be required as new management measures are developed over the long term (i.e., beyond 5 years).

7.1 NO ACTION ALTERNATIVE

Adoption of the no action alternative would mean that Camp Johnson's INRMP would not be implemented and current natural resource management practices at Camp Johnson would continue "as is." Existing conditions and management practices presented in Section 3.0, *Affected Environment*, would continue and no new initiatives would be established. Under the no action alternative, Camp Johnson would continue to comply with all applicable federal, state, and local laws and regulations.

Potential consequences associated with the no action alternative are discussed in this section for each resource area described in Section 3.0, *Affected Environment*. Section 7.4 summarizes the analysis of potential consequences for the no action alternative and compares the consequences of the no action alternative to the consequences of the proposed action. As shown, no significant or adverse effects would be expected under the proposed action alternative. Under the no action alternative, the environmental conditions at Camp Johnson would not benefit from the management measures associated with implementing the proposed INRMP.

Expected consequences of the no action alternative for each resource area are presented in the following paragraphs.

Environmental Setting. No effects on the environmental setting would be expected on a regional level. Camp Johnson has limited space for large maneuver areas or training that would have an impact on the environmental setting. Training would continue in its current state.

Climate. No effects on climate would be expected. See above paragraph for same explanation.

Air Quality. No effects would be expected. The primary concerns regarding air quality and potential environmental effects pertains to increases in pollutant emissions; exceedances of NAAQS and other federal, state, and local limits; and impacts on existing air permits. Potential effects on existing pollutant emissions are precluded by the fact that current natural resource management actions do not involve any activities that would contribute to changes in existing air quality. Therefore, there would be no effects regarding air quality as a result of implementing the no action alternative.

Noise. No effects would be expected. The major concerns regarding noise and potential environmental effects pertain to increases in sound levels, exceedances of acceptable land use compatibility guidelines, and changes in public acceptance (i.e., noise complaints). Potential effects are precluded by the fact that current natural resource management actions do not involve any activities that would affect noise

conditions. Therefore, there would be no effects regarding noise levels or sound quality as a result of implementing the no action alternative.

Topography. Adverse effects would be expected. By failing to implement a comprehensive soil resource management program, impacts on the micro topography associated with erosion and sedimentation on Camp Johnson would be expected to continue.

Geology. Adverse effects would be expected. By failing to implement a comprehensive soil resource management program, impacts on geologic resources associated with erosion and sedimentation on Camp Johnson would be expected to continue.

Soils. Adverse effects would be expected. By failing to implement a comprehensive soil resource management program, impacts on soils associated with erosion and sedimentation on Camp Johnson would be expected to continue. The no action alternative does not include the implementation of comprehensive soil resource monitoring, conservation measures, or a plan of action to prevent or minimize potential soil problems related to erosion and sedimentation prior to their occurrence. Implementation of the no action alternative would involve reactive management to problems after their occurrence, rather than managing the resource to prevent impacts or to minimize the extent of unavoidable impacts.

Water Resources. Adverse effects would be expected to continue. The no action alternative does not provide a formal plan of action for monitoring and protecting the water resources at Camp Johnson. The water resources are vulnerable to degradation without the implementation of a formal plan of action that includes watershed protection measures, nonpoint source pollution controls, and a comprehensive monitoring program designed to identify water quality problems at their onset.

Wetlands. Adverse effects would be expected to continue. The no action alternative does not provide a formal plan for mapping, evaluating, and monitoring wetland habitats; nor does it establish formal protection measures to prevent or minimize potential impacts that could result from training and other mission-related activities.

Riparian Habitat. Adverse effects would be expected to continue. As with aquatic habitats, the no action alternative does not provide for the implementation of a routine habitat assessment and monitoring program to protect these habitats. Also, the no action alternative does not establish limited use riparian

buffers to protect water quality by reducing nonpoint source impacts associated with runoff and adjacent land uses, nor does it establish a formal set of management measures to protect and enhance these habitats by preventing or minimizing potential impacts resulting from training and other mission-related activities.

Communities and Ecosystems. Moderate adverse impacts would be expected to occur. Under the no action alternative, there would be no formal plan of action to improve and maintain terrestrial habitat conditions and diversity, resulting in a continued challenge for Camp Johnson to maintain or improve overall biodiversity. Under the no action alternative, there also would be no coordinated effort or plan to create or maintain the quality of habitat attractive to or required by a diverse population of wildlife.

Flora. Adverse effects would be expected to continue. Under the no action alternative, the health and condition of the plant communities on Camp Johnson would not be improved, and the management measures to improve and enhance the unique flora of the pitch pine-sandplains habitat would not be implemented. Decline in habitat quality and complexity would continue to adversely affect biodiversity.

Special Natural Areas (pitch pine-sandplains). Adverse effects would be expected to continue. Without implementation of the management measures provided in this INRMP, these sites would not be provided any enhanced protection, thereby leaving these ecologically important habitats vulnerable to future degradation.

Fauna. Moderate adverse effects on game and nongame species would be expected to continue. Management measures designed to protect and enhance wildlife habitats (i.e., aquatic, riparian, wetlands, terrestrial) would not be implemented; thereby, continuing to decrease the quality and complexity of the habitat. Decline in habitat quality and complexity would continue to adversely affect wildlife and biodiversity, particularly for wildlife that utilize the open and forested areas on the installation.

Endangered, Threatened, and Rare Species. Adverse affects would be expected to state rare plants. No special programs would exist to improve or create habitat for these species.

Cultural Resources. Adverse effects on the cultural resources at Camp Johnson could occur. The primary concern regarding cultural resources pertains to protecting sites within the training areas of Camp Johnson. Under the no action alternative, there is no formal plan which integrates cultural

resource issues into the natural resource management planning process, thereby increasing the potential for disturbance of important cultural resource sites.

Land Use. No effects would be expected. Under the no action alternative, no changes to on-site land uses or land use patterns would occur. Because land uses would not be expected to change on-site, land use patterns in the surrounding area would not be affected.

Facilities. No effects would be expected. All facilities would continue to be maintained and operated in accordance with required permits and capabilities of the systems. Under the no action alternative, the demand for utilities and roads would not be expected to change, and therefore would not adversely affect existing facilities.

Hazardous and Toxic Materials. No effects would be expected. All hazardous and toxic materials would continue to be handled in accordance with federal laws and Army regulations, including the Resource Conservation and Recovery Act (RCRA), the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), the Toxic Substances Control Act (TSCA), and AR 200-1. Thus, no adverse effects regarding the generation of hazardous and toxic materials would be expected under the no action alternative.

Socioeconomic Resources. No effects would be expected. Under the no action alternative, various changes in population, housing, and economic conditions would continue. Potential effects are precluded by the fact that the no action alternative does not involve any activities that change existing socioeconomic resources.

Environmental Justice. No effects would be expected since existing conditions would continue under this alternative. The primary concern regarding environmental justice and potential environmental effects pertains to disproportionately high and adverse consequences occurring on children or minority and low-income communities. The no action alternative in itself does not create any advantage or disadvantage for any group or individual, and is not expected to create disproportionately high or adverse human health or environmental effects on children or on minority or low-income populations or communities at or surrounding Camp Johnson. Camp Johnson would address, however, any project-specific issues regarding disproportionate adverse health or environmental effects on children, minority, or low-income groups should they arise and use best environmental management practices to ensure

compliance with applicable regulatory requirements. Therefore, there would be no effects as a result of implementing the no action alternative.

In summary, although the analysis of existing (i.e., baseline) conditions identifies no "significant impact issues", the installation has several minor adverse impacts related to soil resources; water resources; aquatic habitat; terrestrial habitat; flora; and rare, threatened, and endangered species which need to be addressed. Furthermore, the installation does not currently have a formal, integrated management plan for the conservation, management, or restoration of its natural resources. The condition conflicts with Camp Johnson's underlying need to train and support the Army National Guard and other military units by providing a realistic and natural setting while simultaneously meeting mission requirements and complying with environmental regulations and policies. In addition, the absence of a formal set of management measures inhibits the installation's ability to adequately engage in future planning initiatives and does not capture benefits derived from identifying and executing comprehensive, integrated environmental and natural resource management actions. Without comprehensive planning, there is the potential that adverse effects on natural resources might occur over the long term. Therefore, implementation of the no action alternative is not favored.

7.2 PROPOSED ACTION (PREFERRED ALTERNATIVE)

Potential consequences associated with the proposed action are discussed in this section for each resource area described in Section 3.0, Affected Environment. Section 7.4 summarizes the analysis of potential consequences for the proposed action and compares the consequences of the proposed action to those of the no action alternative (i.e., baseline or existing conditions). Potential environmental consequences associated with implementing the INRMP would result in either no effects or beneficial effects on the resource areas. Compared to the no action alternative, environmental conditions at Camp Johnson would improve as a result of implementing the proposed INRMP. Therefore, the proposed action is the preferred alternative. Expected consequences of the preferred alternative for each resource area are presented in the following paragraphs.

Environmental Setting. No effects on the environmental setting would be expected on a regional level. Because of Camp Johnson's small size and low impact type training, effects to the environmental setting would be minimal whether or not this INRMP is implemented.

Climate. No effects on climate would be expected. See above paragraph for explanation.

Air Quality. No effects would be expected. The primary concern regarding air quality and potential environmental effects pertains to increases in pollutant emissions; exceedances of National Ambient Air Quality Standards and other federal, state, and local limits; and impacts on existing air permits. Examples of activities that would result in potential adverse changes in air quality conditions include (1) changes in military equipment, (2) increase in the number or location of personnel, (3) construction of new facilities or modification of existing facilities, or (4) increase or change in military operations. However, potential effects on existing pollutant emissions are precluded by the fact that the proposed action does not involve any activities that would contribute to changes in existing air quality conditions. Therefore, there would be no effects regarding air quality as a result of implementing the proposed action.

Noise. No effects would be expected. The major concerns regarding noise and potential environmental effects pertain to increases in sound levels, exceedances of acceptable land use compatibility guidelines, and changes in public acceptance (i.e., noise complaints). However, potential effects are precluded by the fact that the proposed action does not involve any activities that would affect noise conditions, such as (1) changes in military equipment, (2) increase in the number or location of personnel, (3) construction of new facilities or modification of existing facilities, or (4) increase or change in military operations. Therefore, there would be no effects on noise levels or sound quality as a result of implementing the proposed action.

Topography. Short and long-term beneficial effects would be expected. By implementing a comprehensive soil resource management program, impacts on micro topography associated with erosion and sedimentation at Camp Johnson would be minimized.

Geology. Short and long-term beneficial effects would be expected. By implementing a comprehensive soil resource management program, impacts on geologic resources associated with erosion and sedimentation on Camp Johnson would be minimized.

Soils. Short and long-term Short and long-term beneficial effects would be expected. By implementing a comprehensive soil resource management program, impacts on soils associated with erosion and sedimentation on Camp Johnson would be minimized. In addition, monitoring of soil conditions on the installation to identify potential problem areas, the implementation of conservation measures in areas where exposure of soils is necessary and, when possible, the avoidance of activities likely to result in

erosion would minimize potential impacts on the soil resource and result in a reduction in erosion at Camp Johnson.

Water Resources. Short and long-term beneficial effects would be expected. The establishment of a water quality monitoring and watershed assessment program would result in beneficial effects on water quality by providing a mechanism for early detection of problems. This would allow solutions to problems to be implemented in a timely manner. Established vegetative riparian buffer zones would reduce impacts to waterbodies from nonpoint source pollutants. The proper application of approved pesticides would minimize the potential impacts on water bodies and the associated biological communities.

Wetlands. Short and long-term beneficial effects would be expected. Implementation of the proposed action would protect wetlands by providing a basis to evaluate and monitor habitat conditions through the continued development of a wetland database for Camp Johnson. The establishment of buffers would minimize potential impacts to wetlands associated with adjacent activities. Additional efforts would be made to reduce impacts on wetlands by planning mission activities, when possible, in a manner consistent with wetland protection objectives. Where current activities might be affecting wetland functions, efforts would be made to identify the types and sources of impacts and, where applicable, restoration of affected habitats would be implemented.

Riparian Habitat. Short and long-term beneficial effects would be expected. The assessment of riparian habitats at Camp Johnson would provide a basis to develop a management program that would both protect and enhance these habitats on the installation. Assessment of riparian habitats at Camp Johnson would also provide a baseline that can be used in tracking conditions and trends of these habitats which would allow management practices to be applied where and when needed. The establishment of wider and limited use riparian buffers would result in beneficial effects on water quality at Camp Johnson by reducing nonpoint source impacts associated with runoff and adjacent land uses. Additional management measures established to protect or enhance riparian habitats from the effects of sedimentation include proper planning of training exercises; limiting activities within 100 feet of surface waters; proper location, construction, and design of stream crossings to reduce impacts on flora and fauna, to minimize the modification of existing hydrologic characteristics and minimize erosion and sedimentation; and the continued implementation of firebreak management and recovery projects to minimize sediment loads to nearby waterbodies.

Communities and Ecosystems. Short and long-term beneficial effects would be expected. From the perspective of habitat, implementation of the proposed action would result in improved terrestrial habitat conditions for flora and fauna since maintaining a high level of habitat diversity is a priority of the INRMP. As part of this action, additional open areas would be maintained and expanded in order to enhance unique grassland habitat. In addition, snags and downed woody material would be preserved for potential nesting and forage sites, additional nest boxes would be erected; native trees and shrubs would be planted to provide additional habitat for wildlife; and unique forested areas would be improved to provide higher quality habitat for targeted species.

Forest management practices recommended as part of the proposed action would similarly result in improved terrestrial ecosystem conditions by focusing on the long-term balance between maintaining forest ecosystem integrity and producing commercially valuable forest products.

Flora. Short and long-term beneficial effects would be expected. Implementation of the proposed action would result in improved habitat conditions, and control of nonnative invasive species at Camp Johnson.

Special Natural Area (pitch pine-sandplains). Short and long-term beneficial effects would be expected. Implementation of the proposed action would result in minimal impacts occurring as a result of training exercises and foot traffic. Protective efforts within the special natural areas would include protection of endangered, threatened and rare species, controlled burning to create habitat for threatened and rare species, and controlling invasive species and monitoring for long-term changes in species composition.

Fauna. Short and long-term beneficial effects would be expected. Implementation of the proposed action would result in improved habitat conditions for wildlife species and diversity.

Endangered, Threatened, and Rare Species. Beneficial effects on state rare and listed species at Camp Johnson would be expected. Implementation of the proposed action would provide protection and management for these species. Furthermore, these species would be treated with added importance and valued for their contributions to the unique natural heritage of Camp Johnson.

Cultural Resources. Beneficial effects on the cultural resources at Camp Johnson would be expected. For this INRMP, the primary concern regarding cultural resources pertains to protecting cultural resource sites located within the training areas of Camp Johnson. Implementation of the proposed action would

provide for added coordination and integration of cultural resource issues into the natural resource management program. Under the proposed action, the probability of disturbing potential cultural resource sites would be reduced.

Land Use. Beneficial impacts would be expected. Training area lands would be improved through habitat manipulation (i.e., grasslands and forested areas) thereby improving land use function for various needs including military training and recreational use.

Facilities. No effects would be expected. All facilities would continue to be maintained and operated in accordance with required permits and capabilities of the systems. Under the proposed action, the demand for utilities and roads would not be expected to increase and therefore would not adversely affect existing facilities. Minor upgrades to the existing systems would be anticipated over time but would occur regardless of the implementation of the INRMP.

Hazardous and Toxic Materials. No effects would be expected. All hazardous and toxic materials would continue to be handled in accordance with federal laws and Army regulations, including RCRA, the FIFRA, TSCA, and AR 200-1. Thus, no adverse effects regarding the generation of hazardous and toxic materials would be expected under the proposed action.

Socioeconomic Resources. No effects would be expected. The primary concern regarding potential effects on socioeconomic resources pertains to changes in population, housing, and economic conditions. Potential effects are precluded by the fact that the proposed action does not involve any activities that would contribute to changes in socioeconomic resources. Therefore, there would be no effects regarding socioeconomic resources as a result of implementing the proposed action.

Environmental Justice. No effects would be expected. The primary concern regarding environmental justice and potential environmental effects pertains to disproportionately high and adverse consequences occurring on children or minority and low-income communities. Implementation of the proposed action in itself would not create any advantage or disadvantage for any group or individual. The proposed INRMP is not expected to create disproportionately high or adverse human health or environmental effects on children or on minority or low-income populations or communities at or surrounding Camp Johnson. Camp Johnson would address, however, any project-specific issues regarding disproportionate adverse health or environmental effects on children, minority, or low-income groups should they arise

and use best environmental management practices to ensure compliance with applicable regulatory requirements. Therefore, there would be no effects as a result of implementing the proposed action.

The EA findings are consistent with the goals of the natural resource management program to maintain ecosystem variability and ensure sustainability of desired military training area conditions; to maintain, protect and improve ecological integrity; to protect and enhance biological communities, particularly sensitive, rare, threatened and endangered species; to protect the ecosystems and their components from unacceptable damage or degradation, and to identify and restore degraded habitats. The management measures recommended by the INRMP, if implemented, would directly and positively affect the health and condition of natural resources at Camp Johnson.

7.3 CUMULATIVE EFFECTS

A cumulative effect is defined as an effect on the environment that results from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place locally or regionally over a period of time.

Implementation of the INRMP would result in a comprehensive environmental strategy for Camp Johnson that represents compliance, restoration, prevention, and conservation; improves the existing management approach for natural resources on the installation; and meets legal and policy requirements consistent with national natural resources management philosophies. Implementation would be expected initially to improve existing environmental conditions at Camp Johnson, as shown by the potential for beneficial effects in Section 7.4. Over time, adoption of the proposed action would enable Camp Johnson to achieve its goal of maintaining ecosystem viability and ensuring sustainability of desired military training area conditions.

As described in Section 1.2, Background; 1.3, Responsible and Interested Parties; and 2.5, Future Military Mission Impacts on Natural Resources, Camp Johnson and neighboring lands can be viewed as generally stable, well-managed natural systems surrounded by areas of moderate growth and development. There are no known changes planned for the Camp Johnson military mission or to the intensity and extent of training that currently occurs on the installation.

Although growth and development can be expected to continue outside Camp Johnson and the surrounding natural areas, the environmental effects, although possibly somewhat adversely affecting natural resources within the ecoregion, would not be expected to result in cumulatively adverse effects on these resources when added to the effects of activities associated with the proposed management measures contained in the INRMP.

7.4 SUMMARY OF POTENTIAL ENVIRONMENTAL CONSEQUENCES

Table 7-1
Summary of Potential Environmental Consequences

Resource Area/Environmental Condition[1]	Environmental Consequence	
	No Action	Proposed Action
Environmental Setting	None	None
Climate	None	None
Air Quality	None	None
Noise	None	None
Topography	Minor Adverse	Beneficial
Geology	Minor Adverse	Beneficial
Soils	Minor Adverse	Beneficial
Water Resources	Minor Adverse	Beneficial
Wetlands	Minor Adverse	Beneficial

Riparian Habitat	Minor Adverse	Beneficial
Communities and Ecosystems	Moderate Adverse	Beneficial
Flora	Minor Adverse	Beneficial
Special Natural Areas	Minor Adverse	Beneficial
Fauna	Moderate Adverse	Beneficial
Endangered, Threatened, and Rare Species	Minor Adverse	Beneficial
Cultural Resources	Minor Adverse	Beneficial
Land Use	None	Beneficial
Facilities	None	Beneficial
Hazardous and Toxic Materials	None	None
Socioeconomic Resources	None	None
Environmental Justice	None	None
Cumulative Effects [2]	None	Beneficial

[1] Resource areas presented in this column are the same resource areas presented in Section 3.0, *Affected Environment.*

[2] Cumulative effects (see Section 7.3) have been added to this table for reader convenience.

SECTION 8.0: CONCLUSIONS

INRMP Summary. This document reflects the commitment set forth by the Army to conserve, protect, and enhance the natural resources necessary to provide realistic military training for Army National Guard and other military units that utilize Camp Johnson. The primary purpose and objective of this document is to present an implementable INRMP that guides Camp Johnson in meeting mission requirements, achieving natural resource management goals, and complying with environmental policies and regulations. In addition, the NEPA analysis required for undertaking this major federal action (i.e., implementation of this plan) is embodied within the INRMP. This document includes a comprehensive description, evaluation, and assessment of environmental conditions and natural resources at Camp Johnson.

This INRMP is the final plan that will direct the natural resources management program at Camp Johnson from 2002 through 2006. An ecosystem approach was used to develop the management measures for each resource area. Implementation of the management measures will maintain, protect, and enhance the ecological integrity of the training lands and the biological communities inhabiting them. In addition, the natural resources management measures described in this plan will protect Camp Johnson ecosystems and their components from unacceptable damage or degradation and identify and restore previously degraded habitats.

Command support is essential for the implementation of this INRMP and is required for many of the natural resources management projects described herein. This INRMP has the full support of the Post Commander and other personnel in command positions at Camp Johnson.

NEPA Findings and Conclusions. The proposed action to implement the INRMP for Camp Johnson was analyzed by comparing potential environmental consequences against existing conditions. Findings indicate that, under the preferred alternative, potential consequences would result in either no significant adverse effects or only beneficial effects on each resource area (see Section 7.1). The affected environment would not be significantly or adversely impacted by proceeding with the preferred alternative. Additionally, no significant cumulative effects would be expected.

Based on this EA, implementation of the proposed action would have no significant environmental or socioeconomic effects. Because no significant effects would result from implementation of the proposed action, preparation of an EIS is not required, and preparation of a Finding of No Significant Impact is appropriate.

ATTACHMENT C

CAMP JOHNSON FLORA
preliminary plant list B. Engstrom, 1993

Acer pensylvanicum
Acer rubrum
Achillea sp.
Agrostis sp. (small woodland)
Agrostis sp. (large, open) - collected 8-15-93
Amelanchier sp.
Amelanchier cf stolonifera
Amphicarpa bracteata
Anemone quinquefolius
Aralis nudicaulis
Aralia racemosa
Arisaema triphyllum
Aronia melanocarpa
Aster acuminatus
Aster cordifolius
Aster macrophyllus
Aster undulatus
Betula alleghaniensis
Betula papyrifera
Betula populifolia
Carex cf rosea - collected
Carex cf pensylvanica
Carpinus caroliniana
Ceanothus americana
Chimaphila umbellata
Chrysosplenium americanum
Cinna latifolia
Clemetis occidentalis
Clintonia borealis
Coptis groenlandica
Comandra umbellata
Comptonia peregrina
Corylus cornuta
Cyperus filiculmis
Cypripeium acaule
Dalibarda repens
Danthonia flexuosa
Danthonia spicata

Daucus carota
Desmodium nudiflorum
Dianthus ameria
Diervilla lonicera
Dryopteris intermedia
Dryopteris marginalis
Epigea repens
Eragrostis spectabilis
Eupatorium perfoliatum
Fragaria sp.
Fraxinus americana
Fraxinus nigra
Galium sp.
Gaultheria procumbens
Gaylussacia baccata
Gerardia tenuiflora
Goodyera sp.
Hamamelis virginiana
Helianthemum canadense - B. Popp collection
Helianthus strumosus - collected
Hepatica americana
Impatiens capensis
Isotria verticillata - collected
Kalmis angustifolia
Lilium philidelphicum
Linnaria canadensis
Lycopodium dendroidium
Lycopodium digitatum
Lysimachia quadrifolia
Maianthemum canadense
Medeola virginiana
Melampyrum lineare
Mitchella repens
Monotropa uniflora
Muhlenbergia sp.
Oryzopsis asperifolia
Oryzopsis pungens
Osmunda cf cinnamomea
Panicum cf columbianum - collected
Panicum depauperatum
Panicum cf latifolium - collected 8-18-93
Panicum xanthophysum

Pilea pumila
Pinus rigida
Pinus strobus
Plantago aristida
Poa compressa
Poa cf pratensis
Polygala pauciflora
Polygala polygama
Polygonum (tenue?) - collected
Polypodium virginianum
Polystichum acrostichoides
Populus grandidentata
Prenanthes sp.
Prunus serotina
Pteridium aquilinum
Pyrola elliptica
Pyrola rotudifolia
Pyrola secunda
Quercus alba
Quercus rubra
Quercus velutina
Ranunculus simples
Rubus alleghaniensis
Rubus idaeus
Setaria sp. - collected 8-18-93
Smilacina racemosa
Solidago altissima
Solidago caesia
Solidago gigantea
Solidago nemoralis
Solidago cf odora
Solidago puberula - collected
Solidago squarrosa
Sorbus americana
Spiranthes cernua
Spirea latifolia
Tiarella cordifolia
Trientalia borealis
Trillum erectum
Tsuga canadensis
Uvularia sessilifolia
Vaccinium angustifolium

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Vaccinium cf corymbosum
Vaccinium vacillans
Veronica vulgaris
Viburnum acerifolium
Viburnum alnifolium
Viola sp.
Woodwardia virginica

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129 species

RESULTS OF FISH SURVEYS OF

THE ETHAN ALLEN FIRING RANGE

AND CAMP JOHNSON

DURING SUMMER, 1999

Douglas E. Facey
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Colchester, VT 05439

August 23, 1999

Executive Summary

During the months of June and July in 1999, we sampled fishes in numerous locations on the Ethan Allen Firing Range (Jericho, Underhill, and Bolton, VT), and Camp Johnson (Colchester, VT). We used a backpack electroshocker, which allowed sampling in water up to about 1 m deep. When reasonable, we counted all fishes before releasing them. In some cases, such as more remote sites, or to reduce stress on the fish, we simply noted relative abundance as we sampled. "Abundant" indicates that many individuals were present nearly everywhere that we looked at that site, "common" indicates that the species was quite widespread, "several" indicates from 5 to 10 individuals, and "few" indicates less than 5.

In all, we sampled 19 Ethan Allen Firing Range sites and 4 Camp Johnson sites, and covered a variety of habitats. We found a total of 13 species, representing 5 families, on the Ethan Allen Firing Range, and 8 species, representing 3 families, on Camp Johnson.

The spring and summer of 1999 were unusually dry, and water levels in lakes, ponds, rivers and streams throughout Vermont were lower than normal. Several smaller streambeds were completely dry by the end of June, and beaver ponds appeared to be lower than usual. This lack of water made it impossible to sample some locations. Nevertheless, given the variety of habitats that we sampled, I feel that we did get a reasonably good idea of the species present on these two properties.

This report summarizes the field collection data from each site sampled, including habitat notes and the number or relative abundance of each species of fish caught at each site. In addition, a map indicating the location of each site sampled and a summary table of species found at each site are provided. Site numbers on the maps indicate the order in which sites were sampled.

Camp Johnson
Fish Collection Summary

Date: July 14, 1999
Location: Map Location 1
Habitat description: Lily Pad Pond - soft, mud bottom

Species caught and relative abundance:
northern redbellied dace (*Phoxinus eos*) common

Miscellaneous notes: we were only able to sample along margin in a few locations, bottom was too soft to get to deeper sections of the pond

Camp Johnson
Fish Collection Summary

Date: July 15, 1999
Location: Map Location 2
Habitat description: Sunderland Brook, rocky cascades with some silt and mud; brook averaged about 1 m wide; sampled about 50 m

Species caught and relative abundance:

blacknose dace (*Rhinichthys atratulus*)	abundant
fathead minnow (*Pimephales promelas*)	common
northern redbellied dace (*Phoxinus eos*)	common
creek chub (*Semotilus atromaculatus*)	abundant
common shiner (*Luxilus cornutus*)	few

Miscellaneous notes: hiked in along brook from Route 7, followed brook upstream to next site (a beaver pond)

Camp Johnson
Fish Collection Summary

Date: July 15, 1999
Location: Map Location 3
Habitat description: beaver pond; soft muddy bottom; sampled about 100 sq. m.

Species caught and relative abundance:

northern redbellied dace (*Phoxinus eos*)	abundant
banded killifish (*Fundulus diaphanus*)	few
pumpkinseed sunfish (*Lepomis gibbosus*)	common

Miscellaneous notes: newts, frogs and tadpoles also seen

Camp Johnson
Fish Collection Summary

Date: July 20, 1999
Location: Map Location 4
Habitat description: series of beaver ponds along tributary to Sunderland Brook

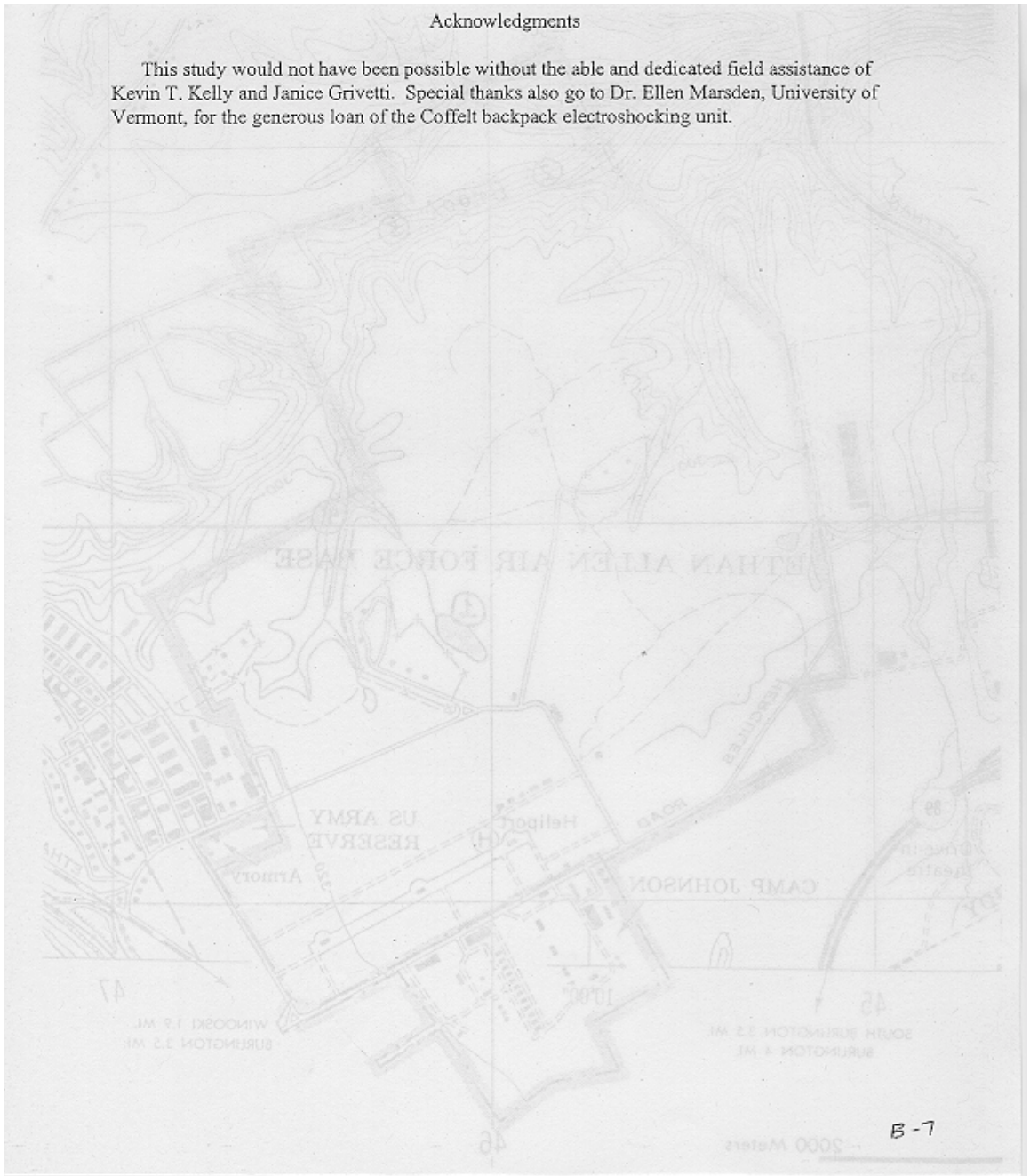
Species caught and relative abundance:

blacknose dace (*Rhinichthys atratulus*)	several
fathead minnow (*Pimephales promelas*)	abundant
northern redbellied dace (*Phoxinus eos*)	abundant
golden shiner (*Notemigonus crysoleucas*)	1
pumpkinseed sunfish (*Lepomis gibbosus*)	abundant

Miscellaneous notes:

Acknowledgments

This study would not have been possible without the able and dedicated field assistance of Kevin T. Kelly and Janice Grivetti. Special thanks also go to Dr. Ellen Marsden, University of Vermont, for the generous loan of the Coffelt backpack electroshocking unit.



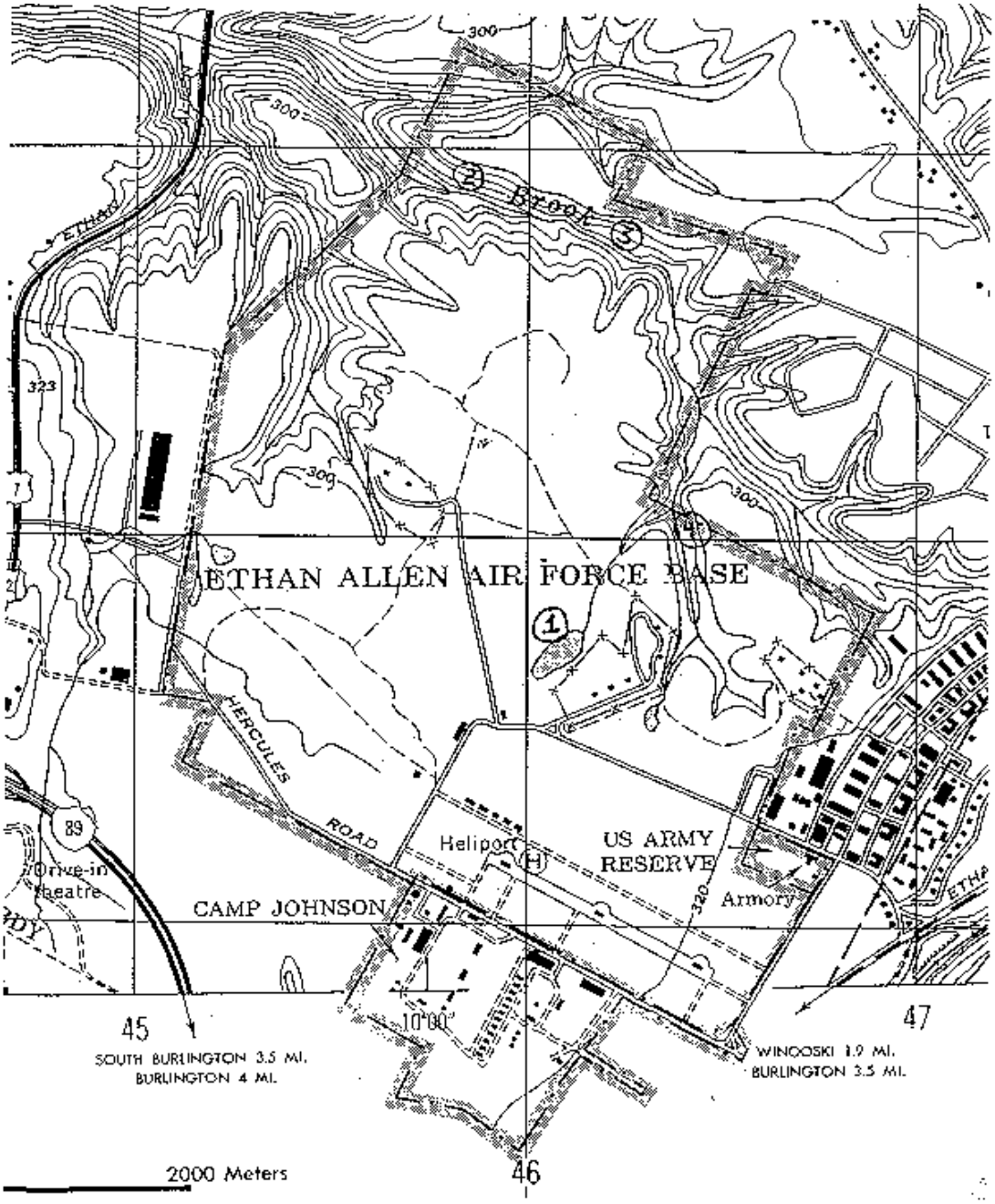

ETHAN ALLEN AIR FORCE BASE
HERCULES ROAD
Heliport
US ARMY RESERVE
Armory
CAMP JOHNSON
Drive-in Theatre
89
323
320
300
2) Brook
3
1
45
SOUTH BURLINGTON 3.5 MI.
BURLINGTON 4 MI.
47
WINOOSKI 1.9 MI.
BURLINGTON 3.5 MI.
46
2000 Meters

Table 2. Fishes caught at sites sampled on Camp Johnson

			Map Location			
Family	**Common Name**	**Scientific Name**	1	2	3	4
Cyprinidae	blacknose dace	*Rhinichthys atratulus*		x		x
	fathead minnow	*Pimephales promelas*		x		x
	northern redbellied dace	*Phoxinus eos*	x	x	x	x
	creek chub	*Semotilus atromaculatus*		x		
	golden shiner	*Notemigonus crysoleucas*				x
	common shiner	*Luxilus cornutus*		x		
Cyprinodontidae	banded killifish	*Fundulus diaphanus*			x	
Centrarchidae	pumpkinseed sunfish	*Lepomis gibbosus*			x	x

Report on a survey for the orders Coleoptera and Hymenoptera on the Ethan Allen Firing Range, Jericho, Bolton & Underhill, Vermont

7 July 2000

by
Jeffrey Collins

with
Mark Ward

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Introduction

This study was conducted at the request of Major Raymond P. Bouchard, Environmental Protection Manager, on behalf of the State of Vermont Adjutant General's Office. The goal was to collect and identify a representative sample of beetles (order Coleoptera) and bees, wasps, and ants (order Hymenoptera) present on the Ethan Allen Firing Range located in the towns of Jericho, Underhill, and Bolton, Vermont. This information on the relative abundance and species diversity of Coleopterans and Hymenopterans in different locations on the Firing Range could contribute to determining the relative importance of the forest types at these locations to biodiversity conservation at the Firing Range.

Terrestrial invertebrates, which include insects, spiders, centipedes, millipedes, and a few other groups, constitute an enormous percentage of the planet's biological diversity. Insects alone compose more than three fourths of the known animal species in the world (Freeman, 1979). Despite their important contribution to biological diversity, however, terrestrial invertebrates have generally received little attention in conservation planning. This can be attributed, in part, to the fact that a thorough inventory of invertebrates to the species level in any ecosystem is usually both a time- and cost-prohibitive endeavor, which requires the dedication of numerous taxonomic specialists.

Recently however, invertebrates have received more attention from conservationists and ecological planners (Kremen, et al. 1993) both for their contribution to biodiversity and for their potential usefulness in biomonitoring. Invertebrates can provide an attractive alternative to large animals in ecosystem monitoring for several reasons. Invertebrates are:

- abundant and highly diverse;
- found in a wide variety of habitats and ecological niches;
- of small size and wide distribution relative to vertebrates;
- subject to rapid population turnover; and
- easily sampled in statistically significant numbers (Kremen, et al., 1993).

Furthermore, terrestrial invertebrates are low on the food chain and thus respond more rapidly to subtle environmental changes than vertebrate groups. Finally in small preserves, invertebrates offer a way of monitoring ecological integrity that may not be feasible with relatively small vertebrate populations.

Some efforts have been made by ecologists (Oliver and Beattie, 1996a; Colwell and Coddington, 1994; Hammond, 1994) to establish time- and cost-effective shortcut methods for the estimation of invertebrate species richness and diversity. The use of focal groups, extrapolation, and morphospecies are among the methods that have thus far been developed. The "focal group" method (Hammond, 1994) uses selected taxonomic groups as surrogates for larger invertebrate assemblages. In this approach, a subgroup of the collection is identified to species and its species richness is then correlated with the richness of the larger group to which it belongs. For example, wolf spider richness could represent the richness of all spiders. A second method for estimating species richness is to extrapolate from a small sample size in which all specimens are identified to species (Colwell and Coddington, 1994). A third shortcut involves separating specimens into "morphospecies" by grouping specimens that look alike regardless of their scientific names. This method does not require specialists for taxonomic identification and in at least one case morphospecies were used to generate estimates of species richness that were very similar to exact species identification (Oliver and Beattie, 1996b). The utility of these methods is currently being debated, however and studies that test their effectiveness are scarce.

In the current study, we sampled Coleoptera and Hymenoptera and use these two groups as indicators of invertebrate diversity in six cover types on the Ethan Allen Firing Range.

Beetles

Coleoptera is the largest order of living things. Of the roughly 290,000 described species in the world, 28,600 are known to occur in North America. Beetles are found on nearly every part of the globe feeding on a variety of plant and animal material. They can be found on live or decaying vegetation, under stones, on or in the ground, or in water. They have two sets of wings, with the front pair – the elytra – typically hardened or leathery, meeting in a straight line down the middle of the abdomen, and covering the membranous hind wings. Beetles have chewing mouthparts and are important decomposers of forest litter, predators of other invertebrates, and prey for birds and small mammals (Borror & White, 1970).

Bees, Wasps, and Ants

The Hymenoptera is another extremely large order which includes the bees, wasps, sawflies, and ants. North America is home to 16,700 of the roughly 105,000 species described in the world. The adults of most families have chewing mouthparts and two pairs of membranous wings. They typically feed on plants and are extremely important as pollinators and parasites of other insects.

Methods

We employed four different sampling techniques to gather a wide variety of species: pitfall trapping, sweep netting, litter sampling, and aquatic sampling. We also received Coleoptera and Hymenoptera specimens from light traps deployed by Scott Griggs. With the goal of capturing the widest diversity of the two orders represented at the Firing Range, we sampled in a variety of cover types found at a range of elevations. For pitfall and sweepnet sampling, we used the Ethan Allen Firing Range Forest Types map to identify six different cover types and selected sampling locations within each of those forest types (Figure 1). The six cover types sampled were:

- White pine (elevation ~920') — a mature stand of 50-foot tall, even-aged white pine (*Pinus strobus*), with very sparse understory on level sandy soil; shallow pond adjacent.
- Hemlock (920') — mature stand of Eastern hemlock (*Tsuga canadensis*) with white birch (*Betula papyrifera*) and red maple (*Acer rubrum*), sparse understory and very little ground cover on rolling ground surface; soil sandy with organic horizon of decaying duff; adjacent to Otter Bog.
- Pioneer forest (950') — 20 to 30 foot canopy of red maple, quaking aspen (*Populus tremuloides*), white birch, with serviceberry (*Amelanchier* sp.) in the understory, and sparse groundcover of ferns; ground flat; soil loamy with 3 cm organic horizon.
- Cove forest (1160') — rich stand of sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), red oak (*Quercus rubra*), and black cherry (*Prunus serotina*) to 60 feet tall, with open understory of same species and groundcover including Christmas fern (*Polystichum acrostichoides*), wild leek (*Allium* sp.), wood fern (*Dryopteris* sp.), red trillium (*Trillium erectum*), spring beauty (*Claytonia caroliniana*), trout lily (*Erythronium americanum*), sessile-leaved bellwort (*Uvularia sessilifolia*), blue cohosh (*Caulophyllum thalictroides*), wood violet (*Viola palmata*), and dutchman's breeches (*Dicentra cucullaria*); ground rolling, on gentle slope with southern aspect; soil derived from rocky till with 3 cm organic horizon.
- Forest opening (1400') — open meadow, ~10 acres, logged in the past 5-10 years, with a few large white pines remaining and many saplings (< 2m) of quaking aspen, as well as spirea (*Spirea latifolia*), and sedges (*Carex* spp.); ground flat; soil loamy with 2-3 cm organic horizon.
- Northern hardwood forest (1600') — 60 to 70-foot tall canopy of sugar maple, American beech, and white ash (*Fraxinus americana*) with understory of same plus striped maple (*Acer pensylvanicum*), and hobblebush (*Viburnum alnifolium*), and groundcover including Canada mayflower (*Maianthemum canadense*), spring beauty, trout lily, and blue cohosh; ground sloping gently to north; soil a dark loam with 2-3 cm organic horizon.

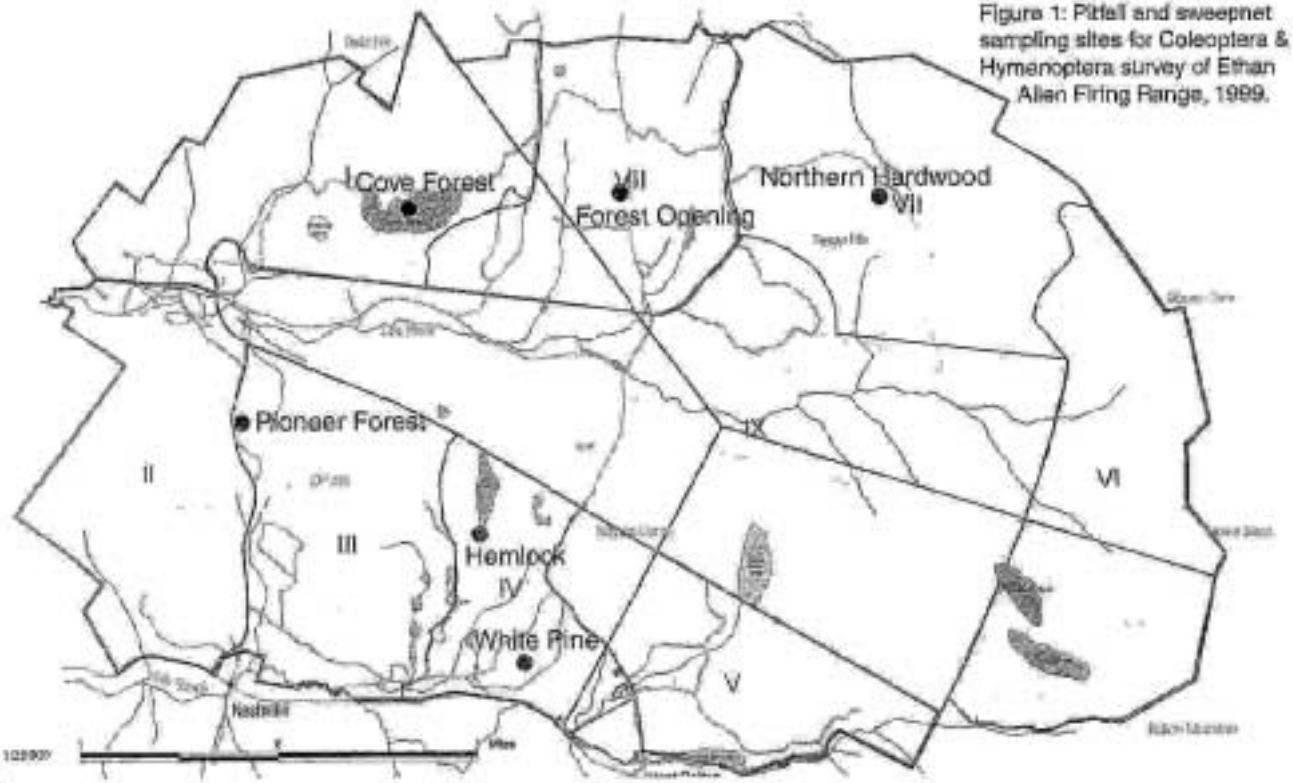

Figure 1: Pitfall and sweepnet sampling sites for Coleoptera & Hymenoptera survey of Ethan Allen Firing Range, 1999.

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Pitfall traps were set in May and July, 1999. Five traps were set in each sampling site, 10 meters apart from each other along a straight line. The traps were left out for a week and collected at the end of that period. Each trap consisted of a plastic cup set flush in the ground, containing 2-3 cm of water and one eyedropper full of 39% formaldehyde, and loosely covered with a piece of bark to prevent overflowing with rain. Invertebrates collected from each trap were transferred to a whirlpak bag filled with 75% ethyl alcohol. Each bag was labeled with a sampling site code, trap number, and collection date.

Sweep net samples were collected on one day in May and one day in July with 20 minutes of effort at each sampling site. Specimens were transferred from nets to killing jars labeled with a site code and the date, then pinned in the lab.

Three litter samples were collected at each sampling site in May and in July. Samples consisted of one gallon Ziploc bags of leaves, decaying wood, moss, and duff collected from the ground. The samples were either transferred directly to a Berlese funnel that day, or refrigerated and transferred within three days. In a Berlese funnel, a lightbulb is placed above the litter to dry it out; small invertebrates are driven out of the moist litter and into a jar of alcohol below. The jars were labeled with site code, litter sample number, and date.

Aquatic samples were collected from vernal pools in April and with a Surber sampler in riffles of 1st and 2nd order streams in October. Samples were labeled with site code, sample number, and date.

The light trap deployed by Scott Griggs was a vertical 15 watt fluorescent black light with a rain cover and four plexiglass vanes. The light was power by a car battery and positioned over a collecting bucket containing a killing agent.

Results

We collected 307 beetle specimens from 38 families, and 121 Hymenopterans from 12 families. The largest family of beetles was the Carabidae, the ground beetles, with 121 specimens representing 35 species; the ants, Formicidae, were the largest family of Hymenopterans, with 73 individuals of 14 species. The entire list of specimens is presented in Table 1.

Table 1a: Coleopterans collected on the Ethan Allen Firing Range, Jericho, Bolton and Underhill, Vermont, 1999. FO = Forest Opening, WP = White Pine stand, H = Hemlock stand, PF = Pioneer Forest, NH = Northern Hardwood forest, CF = Cave Forest.

	FO	WP	H	PF	NH	CF	light trap	vernal pools	Lee River
Coleoptera									
Alleculidae							5		
Anobiidae							4		
Bostrichidae									
Amnesioides mimitus							2		
Cantharidae							2		
Cantharis sp.		1				6			
Carabidae									
Agonum cupreum	1								
Agonum fidulentum							3		
Agonum metallicum							1		
Agonum retractum	2			1	3				
Agonum terme							4		
Agonum thoreyi							9		
Amara musculis							1		
Bradycellus nigrinus	1								
Chlaenius pensylvanicus							4		
Chlaenius sericeus							1		
Chlaenius sp.				1					
Clivina fossor				1					
Cymindis limbata							1		
Cymindis pilosa							1		
Dromius piceus							1		
Harpalus compar							1		
Harpalus pensylvanicus							3		
Harpalus rufipes							1		
Harpalus semiaeneus	1								
Lebia viridis							1		
Notiobia terminata							11		
Platynus decentis			1		1	2	5		
Platynus tenuicollis							5		
Platyparobus lacustris*							3		
Pterostichus adstrictus		1			1				
Pterostichus adstrictus	1				1				
Pterostichus coactus						1			
Pterostichus pensylvanicus	1								
Pterostichus rostratus						1			
Pterostichus stygicus	1								
Sphaeroderus canadensis			1		1				
Sphaeroderus lecontei	2		1			1			
Stenolophus ochropezus							1		
Synuchus impunctatus		7	3	3	2	3			
Tachyolichinus vulpeculus							4		

Table 1a: Coleopterans collected on the Ethan Allen Firing Range, Jericho, Bolton and Underhill, Vermont, 1999. FO = Forest Opening, WP = White Pine stand, H = Hemlock stand, PF = Pioneer Forest, NH = Northern Hardwood forest, CF = Cave Forest.

	FO	WP	H	PF	NH	CF	light trap	vernal pools	Lee River
Coleoptera									
Alleculidae							5		
Anobiidae							4		
Bostrichidae									
Amnesioides mimitus							2		
Cantharidae							2		
Cantharis sp.		1				6			
Carabidae									
Agonum cupreum	1								
Agonum fidulentum							3		
Agonum metallicum							1		
Agonum retractum	2			1	3				
Agonum terme							4		
Agonum thoreyi							9		
Amara musculis							1		
Bradycellus nigrinus	1								
Chlaenius pensylvanicus							4		
Chlaenius sericeus							1		
Chlaenius sp.				1					
Clivina fossor				1					
Cymindis limbata							1		
Cymindis pilosa							1		
Dromius piceus							1		
Harpalus compar							1		
Harpalus pensylvanicus							3		
Harpalus rufipes							1		
Harpalus semiaeneus	1								
Lebia viridis							1		
Notiobia terminata							11		
Platynus decentis			1		1	2	5		
Platynus tenuicollis							5		
Platyparobus lacustris*							3		
Pterostichus adstrictus		1			1				
Pterostichus adstrictus	1				1				
Pterostichus coactus						1			
Pterostichus pensylvanicus	1								
Pterostichus rostratus						1			
Pterostichus stygicus	1								
Sphaeroderus canadensis			1		1				
Sphaeroderus lecontei	2		1			1			
Stenolophus ochropezus							1		
Synuchus impunctatus		7	3	3	2	3			
Tachyolichinus vulpeculus							4		

Table 1a (continued): Coleoptera collected on the Ethan Allen Firing Range, Jericho, Bolton and Underhill, Vermont, 1999

	FO	WP	H	PF	NH	CP	Light trap	vernal pools	Lee River
Cerambycidae									
Anelaphus parallelus							2		
Strangalepta abbreviata							2		
Chrysomelidae							3	1	
Acalymma sp.				1					
Cicindelidae									
Cicindela sexguttata				1					
Coccinellidae						1			
Adalia conspectans						1			
Corylophidae									
Sericoderus lateralis			1						
Curculionidae		1	1				1		
Eugnamptus sp.	1								
Hypera punctata						2			
Hyperodes sp.	1						1		
Dascillidae									
Eurypogon niger							1		
Dytiscidae							1	15	
Dineutus americanus			1						
Graphoderus								3	
Ilybius biguttulus							1		
Laccophilus maculosus							1		
Elateridae		1					2		
Elmidae									
Optioservus immunis									3
Oulimnius latiusculus									2
Promoresia tardella									5
Stenelmis sp.									13
Eucnemidae							2	1	
Gyrinidae									
Gyrinus sp.								4	
Haliplidae									
Haliplus sp.								1	
Helodidae							4		
Histeridae							1		
Hydrophilidae							10		
Cymbiodyta sp.								1	
Lampyridae							1		
Photinus sp.		1		1					
Lucanidae							2		
Lycidae							3		
Melandryidae									
Dircaea sp.							1		

Table 1a (continued): Coleopterans collected on the Ethan Allen Firing Range, Jericho, Bolton and Underhill, Vermont, 1999.

	FO	WT	H	PP	NH	CF	tight trap	vernal pools	Lee Road
Mordellidae							1		
Nitidulidae									
Cillichrochilus rascinus	1								
Phalacridae						2			
Phalacrus sp.		1							
Pselaphidae						1			
Psephenidae									
Psephenus sp.								1	
Pilliidae		1		6		2			
Pyrocroidae							4		
Staphylinidae				3					
Scarabaeidae							71		
Diplotaxis sp.				1					
Popillia japonica	1				3	1			
Scydmaenidae					1				
Silphidae									
Nicrophorus marginatus							1		
Staphylinidae		8	2			1	2		
Paederinae							1		
Quedlinae					1	1			
Achenium sp.					1		1		
Oxytelinae									
Apocellus sp.		1							
Aleocharinae									
Oxypoda sp.		1							
Philonthus sublaevis	1								
Omaliinae					1				
Xanthopliinae									
Lithocharis sp.	1								
Tenebrionidae							1		
Diaperini sp.							2		
Strongylii sp.							2		

Table 1b: Hymenoptera collected on the Ethan Allen Firing Range, Jericho, Bolton and Underhill, Vermont, 1999. FO = Forest Opening, WP = White Pine stand, H = Hemlock stand, PF = Pioneer Forest, NH = Northern Hardwood forest, CF = Cove Forest.

	FO	WP	H	PF	NH	CF	light trap	vernal pools	Lee River
Hymenoptera									
Andrenidae		4			3				
Apidae/unidae			1						
Apidae									
Bombus affinis						1			
Bombus bimaculatus					1				
Bombus terricola	1			1					
Bombus vagans	1					1			
Psithyrus insularis					2	1			
Bracinidae		1							
Colletidae					1				
Formicidae									
Formicinae					1				
Camponotus			1						
Camponotus novaboracensis	1								
Formica fusca	1								
Lasius alienus americanus	3	17		21					
Myrmicinae									
Aphaenogaster rudis						19			
Aphaenogaster sp.	1			1					
Iridomyrmex humilis	1								
Myrmecina sp.				1					
Myrmica brevispinosa dietrichi				1					
Myrmica lobicornis fracticornis		1		11					
Myrmica pinetorum				1					
Myrmica punctiventris				1					
Stenamma diecki			1						
Halictidae						1			
Augochlora pura pura						1			
Dialictus sp.	8	2		3					
Parallictus sp.		2				1			
Ichneumonidae		2		1					
Scoliidae						1			
Sphecidae	1								
Tenthredinidae	2			1					
Vespidae						1			
Dolichovespula arenaria							1		
Dolichovespula maculata							1		
Vespula cf. germanica/saxonica							1		
Vespula crabro			1						
Vespula maculifrons			1			1			

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To estimate the relative importance of each cover type for invertebrate habitat, we compared species abundance, diversity, and the number of unique families collected with pitfall traps, sweep nets, and litter traps in each cover type. The results can be found in Table 2.

Table 2: Total number of Coleoptera and Hymenoptera species and number of unique species found in each forest type sampled on Ethan Allen Firing Range, Jericho, Bolton and Underhill, Vermont, 1999.

	FO	WT	H	PI	NH	CF
Species of Coleoptera	14	11	8	10	10	11
Unique Species of Coleoptera	10	7	6	2	3	4
Species of Hymenoptera	10	7	4	10	10	5
Unique Species of Hymenoptera	6	7	5	4	3	1
Total Species	24	18	12	20	20	16
Total Unique Species	16	14	11	6	6	5

We collected the greatest number of species (24) in the Forest Opening and the fewest species (16) in the Cove Forest. The Cove Forest was tied with the White Pine stand as the second most diverse site for beetles, but was second lowest in number of Hymenoptera (5); only the Hemlock forest had fewer Hymenopterans (4). The Pioneer Forest and Northern Hardwood forest tied the Forest Opening for the highest number of Hymenoptera (10).

The greatest number of unique species, that is, species collected in none of the other cover types, was found in the Forest Opening (16) with the fewest found in the Cove Forest (5). The Forest Opening also had the highest number of unique beetles (10); the Pioneer Forest had the fewest (2). The White Pine stand had the greatest number of unique Hymenopterans (7), while the Cove Forest had only one unique Hymenopteran.

We used non-parametric methods for the estimation of species richness from small samples to obtain both family and species richness estimates for each of the six cover types sampled. Colwell and Coddington (1994) reviewed several of these methods, and we used three in generating our richness estimates:

$$S_1 = S_{obs} + (\frac{a^2}{2b}) \qquad (1)$$

$$S_2 = S_{obs} + (\frac{L^2}{2M}) \qquad (2)$$

$$S_3 = S_{obs} + L(\frac{n-1}{n}) \qquad (3)$$

Table 1 continued. Summary of field observations of breeding birds at the Ethan Allen Firing Range, Jericho, Vermont.

SPECIES	# points	# individuals	min. elev.	max. elev.	habitats
Mourning Warbler	4	6	1300	1560	subtropshrubby talus opening; n. hardwood forest surrounding field; alder-willow thicket surrounded by secondary forest; along road opening through red oak-n. hardwood forest
Common Yellowthroat	19	25	660	1080	marshes and alder-willow wetlands; occasionally upland meadows
Canada Warbler	16	18	820	2960	mature n- hardwood or mixed forest, especially with shrubs; mixed talus woodland; montane birch-spruce-fir seepage glade forest
Scarlet Tanager	19	22	800	1700	mature oak and n. hardwood forests; secondary forest; hemlock forest
Northern Cardinal	1	1	1500	1500	mature red oak-n. hardwood forest
Rose-breasted Grosbeak	23	26	660	1980	mature n. hardwond, red oak-n. hardwood, and secondary forest; mixed seepage swamp
Indigo Bunting	4	4	750	1040	willow thickets adjacent river; small field in secondary forest, alder-willow wetland, successional forest
Chipping Sparrow	2	3	660	1560	fields
Savannah Sparrow	1	1	800	800	large field
Song Sparrow	11	13	660	950	beaver wetland, riparian forest fragment; fields/forest edges, bog; large marsh complex
Lincoln's Sparrow	1	1	940	940	bog
Swamp Sparrow	4	7	800	1020	beaver wetlands, large marsh
White-throated Sparrow	15	18	780	3700	beaver wetlands; montane birch fern glade woodland; stunted or broken canopy spruce-fir forest
Dark-eyed Junco	18	19	940	3480	montane spruce-fir-birch forest; hemlock forest; mixed talus thickets/woodland
Red-winged Blackbird	6	15	780	840	beaver wetlands, large marsh complex
Common Grackle	3	5	780	1020	beaver wetlands, bog
Brown-headed Cowbird	4	4	660	1040	oldfield openings in secondary forest, sugar maple-cottonwood riparian forest, beaver wetland; bog
Baltimore Oriole	1	1	660	550	riparian forest fragment
Purple Finch	4	4	860	2100	secondary mixed forest; hemlock forest; n hardwood forest
White-winged Crossbill	6	6	3180	3700	montane spruce-fir-birch forest
American Goldfinch	8	10	680	1560	oldfields, successional forest, beaver wetlands
Evening Grosbeak	3	4	860	1580	field/forest edge, oldfield openings in secondary hardwood forest

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Table 2. Species habitat affinities at the Ethan Allen Firing Range, Jericho, Vermont.

hardwood or mixed forest

Sharp-shinned Hawk
Broad-winged Hawk
Ruffed Grouse
Wild Turkey
Black-billed Cuckoo
Barred Owl
Yellow-bellied Sapsucker
Downy Woodpecker
Hairy Woodpecker
Northern Flicker
Pileated Woodpecker
Eastern Wood-Pewee
Least Flycatcher
Great-crested Flycatcher
Blue Jay
Common Raven
Black-capped Chickadee
Red-breasted Nuthatch
White-breasted Nuthatch
Brown Creeper
Veery
Hermit Thrush
Wood Thrush
American Robin
Blue-headed Vireo
Warbling Vireo
Red-eyed Vireo
Black-throated Blue Warbler
Black-throated Green Warbler
Blackburnian Warbler
Black-and-white Warbler
American Redstart
Ovenbird
Mourning Warbler
Canada Warbler
Scarlet Tanager
Northern Cardinal
Rose-breasted Grosbeak
Purple Finch

montane conifer forest

Yellow-bellied Flycatcher
Winter Wren
Golden-crowned Kinglet
Swainson's Thrush
Nashville Warbler
Magnolia Warbler
Yellow-rumped Warbler
Blackpoll Warbler
Dark-eyed Junco
White-winged Crossbill

wetlands

American Bittern
Great Blue Heron
Canada Goose
Wood Duck
American Black Duck
Virginia Rail
Common Snipe
American Woodcock
Belted Kingfisher
Alder Flycatcher
Northern Waterthrush
Common Yellowthroat
Song Sparrow
Lincoln's Sparrow
Swamp Sparrow
White-throated Sparrow
Red-winged Blackbird
Common Grackle

fields & shrubby lands

Red-tailed Hawk
American Kestrel
Killdeer
Spotted Sandpiper
Eastern Phoebe
Eastern Kingbird
American Crow
Eastern Bluebird
Gray Catbird
Brown Thrasher
Cedar Waxwing
European Starling
Yellow Warbler
Chestnut-sided Warbler
Indigo Bunting
Chipping Sparrow
Savannah Sparrow
Brown-headed Cowbird
Baltimore Oriole
American Goldfinch
Evening Grosbeak

aerial

Chimney Swift
Tree Swallow
Bank Swallow
Cliff Swallow
Barn Swallow

Table 4: Estimated family richness for each cover type sampled on the Ethan Allen Firing Range, Jericho, Bolton and Underhill, Vermont, 1999. F- for Northern Hardwood forest could not be calculated since I=0.

	FO	WP	FI	PE	NM	CF
F_{obs} (no. fam. observed)	10	13	8	12	12	8
a (no. fam w single individual)	3	8	5	6	3	4
b (no. fam. w two individuals)	4	1	2	2	0	3
I (no fam. in one subsample)	5	10	6	4	5	8
M (no. fam. in two subsamples)	3	1	1	1	1	4
n	14	14	14	14	14	14
$F_1=F_{obs}+(a^2/2b)$	12	45	18	23	N/A	10
$F_2=F_{obs}+(I^2/2M)$	14	63	26	53	25	16
$F_3=F_{obs}+(I_{(n-1)}/n)$	80	167	92	139	82	139

Discussion

The Forest Opening, a meadow of perhaps 10 acres on the north side of the tank range, exhibited the highest relative abundance of all cover types sampled. It is a relatively uncommon cover type at the Firing Range, the largest example being the tank range itself. Further study of the species found at this site may be warranted, and management may include maintenance of several forest openings on the property.

We collected only one species that is listed by the Vermont Nongame and Natural Heritage Program. Three specimens of *Platynatrolmus lacustris*, a ground beetle that lives in beaver lodges, were collected in a light trap by Scott Griggs. *P. lacustris* is found on the NNHP's list of rare and uncommon animals with a state rank of S1, which indicates a species that is "very rare, generally 1 to 5 occurrences believed to be extant [in Vermont] and/or some factor(s) making it especially vulnerable to extirpation from the state." According to UVM ground beetle expert Dr. Ross Bell, the three specimens collected on the Ethan Allen Firing Range add to 5 ever collected in Vermont previously. The specimens were collected on the margin of Otter Bog, coordinates 44°27'85" north by 72°54'58" west.

Other interesting species include the ground beetle *Harpalus rufipes* which is a newly-arrived species in the Champlain Valley.

Management Recommendations

As mentioned above, special attention could be given to maintenance, or possible creation of open meadow habitat. Large grasslands are important for several bird species that nest exclusively in that habitat. Inquiries to the Vermont Audubon Society or the Grassland Birds Program of the Massachusetts Audubon Society may lead to

more specific information on Vermont bird species likely to use large grasslands and appropriate management techniques.

The sole listed species we identified is a beetle associated with beaver lodges; special care should be taken on the Firing Range before disturbing beaver dams or beaver habitat.

Future Work

Future invertebrate surveys might be designed to resample the sites listed in this study in order to track changes over time, or to sample additional cover types to potentially add to the list of species collected on the Firing Range. Sampling sites could be stratified to compare areas that experience high and low use for training exercises, or areas near and far from roads.

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We would like to thank Major Raymond P. Bouchard for the opportunity to carry out this project and Michael O'Hara for assistance with maps of the Firing Range. Scott Griggs generously shared specimens caught in light traps. The staff of Massachusetts Audubon Society's Center for Biological Conservation generously allowed us the use of identification equipment. The encouragement and assistance of Dr. Ross Bell and Joyce Bell of the University of Vermont Biology Department were invaluable.

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A Survey of Aquatic Macroinvertebrates in Streams and Vernal Pools at Ethan Allen Firing Range, Jericho, Vermont 1999

Submitted by Mick Ward
Consulting Ecologist
November 2000

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Executive Summary

In 1999, a survey of aquatic macroinvertebrates was conducted in two habitats, streams and vernal pools, at Ethan Allen Firing Range, Jericho, Vermont. None of the specimens collected from either of the habitats were found to be rare, threatened, or endangered species.

Samples of stream macroinvertebrates collected in October 1999 were used to assess the biological integrity of the Lee River watershed in order to assess potential impacts from activities on the Ethan Allen Firing Range. A taxonomic list was compiled and the diversity, taxa richness, and EPT index were calculated for each study site. A total of 298 specimens were collected from six study sites representing 51 taxa and 25 EPT taxa. The total number of specimens collected in 1999 constituted approximately 17% as many as were collected in similar sampling in 1992. Low organism density in the 1999 sampling confounded attempts to draw firm conclusions about the water quality of the Lee River watershed. Habitat degradation and/or toxic impacts tend to cause decreases in organism density, but the more likely explanation for low organism density in 1999 was Hurricane Floyd. Despite low organism density, the overall taxa richness and number of EPT taxa were higher in 1999 than in 1992. Higher values for these metrics generally indicate good water quality conditions. These data suggest that if low density can be attributed to Hurricane Floyd, then other factors point to favorable water quality conditions in the Lee River watershed in 1999. However, without indisputable evidence that low organism density in 1999 was the result of Hurricane Floyd (such as samples from before and after the event), the most conservative interpretation is that the 1999 data are inconclusive. Therefore, a follow-up study is recommended using sampling techniques consistent with those utilized by the Vermont Department of Environmental Conservation in order to compare the biological condition in the Lee River watershed with other similar habitats throughout Vermont.

In April 1999, eleven pools were found that showed evidence of breeding activity by amphibians known to rely on vernal pools. Some of the pools appeared to be natural landscape features while others were artificial. Macroinvertebrates were sampled from six of these pools using funnel traps and standard sweeps with a D-shaped dip net. A total of 887 specimens were collected. Vernal pool #4 yielded the highest number of specimens, while VP3 had the highest taxa richness. Metrics that indicate the biological integrity of vernal pools from macroinvertebrate assemblages have not yet been developed. Therefore it is difficult to draw firm conclusions about the biological integrity of the vernal pools at the Ethan Allen Firing Range. The baseline data collected in this study may become more useful over time as metrics being tested become accepted as reliable indicators of biological integrity in vernal pools.

Stream Macroinvertebrates

Objectives

The main objective of sampling stream macroinvertebrates was to assess the biological integrity of the Lee River watershed in order to assess potential impacts from activities on the Fabon Allen Firing Range. In addition, the sampling provided the opportunity to report on any rare, threatened, or endangered species.

Methods

The sampling of stream macroinvertebrates in 1999 followed the procedures that were outlined in the 1992 Receiving Water Biological Study (RWBS ,1993). In that study, macroinvertebrates were collected from five study sites in the Lee River Watershed in September of 1992 (Figure 1). The study sites were located at elevations ranging from 650 – 1300 ft. to determine if contaminants might be leaving the "Impact Area". The study site furthest upstream (01) was considered a reference site for the other study sites which lie within, adjacent to, or downstream from the "Impact Area." At each site, a Surber Sampler was used to collect three replicate subsamples from similar riffle habitats. The area sampled by each replicate was 1 ft^2. All organisms in the delineated area were dislodged from rocks and sediment and allowed to float downstream into the capture net of the Surber Sampler. Sampling was carried out to bedrock or to a maximum depth of 3 inches (RWBS, 1993). Macroinvertebrate specimens were identified in the laboratory to the greatest extent of taxonomic specificity. A taxonomic list was compiled and the diversity, taxa richness, and EPT index were calculated for each study site.

The study site locations in 1999 did not precisely correspond to the study site locations in 1992. In the summer of 1999, Michael O'Hara took GPS readings of the 1992 study site locations to accurately map them (Figure 1). However, only two of the GPS locations (02 & 05) actually corresponded to the 1992 study site locations. Sampling in 1999 was carried out at the new GPS locations. For the sake of clarity, I have referred to the GPS locations as 01-05, while using single digits (1, 2, 3...) to refer to the 1992 study sites. On October 17 & 18, 1999, Jeff Collins and I collected three replicate subsamples from six locations (1, 01, 02, 03, 04, & 05) in the Lee River Watershed (Figure 1). In addition to the five GPS locations, a sample was taken at the original reference site (1), because of concerns that the 01 site was too close to the "Impact Area" and an old artillery range (Cpt. Werner Barthas, EAFR, pers. comm.) to act as an adequate reference site.

Data Analysis

Several metrics that measure biological integrity were used to evaluate the water quality of the Lee River Watershed (RWBS, 1993). The metrics were:

a) Taxa richness. Taxa richness is the total number of distinct taxa present. In general, the higher the taxa richness the higher the water quality.

Every attempt was made to identify specimens at least to the level of genus. Nevertheless, some poor quality specimens were identifiable only to the family or order level. However, the values of taxa richness were conservative and represent a minimum value in all cases. For example, if in a single sample there were specimens identifiable to the order Ephemeroptera, the family Ephemerellidae, and the genus *Ephemerella*, the net contribution to the taxa richness was counted as one rather than three. This conservative tallying accounts for the possibility that unidentified specimens of the order Ephemeroptera and Ephemerellidae might belong to the genus *Ephemerella*.

b) *EPT Index*. The EPT Index is the total number of distinct taxa belonging to the insect orders Ephemeroptera, Plecoptera, and Trichoptera. These three orders contain taxa that are generally believed to be pollution sensitive. In general the higher the EPT Index, the better the water quality.

The EPT Index values were calculated in the same conservative manner as those of taxa richness and therefore represent a minimum value in all cases.

c) *Diversity*. Diversity calculations were made using a modified form of Brillouin's Diversity Index (H) that uses Stirling's approximation for logarithms of factorials in order to minimize bias from rare species (RWBS, 1990):

$$H = C/N \left[N(\ln N - 1) + \tfrac{1}{2} \ln 2\pi N - \sum_{i=1}^{S} [n_i(\ln n_i - 1) + \tfrac{1}{2} \ln 2\pi n_i] \right]$$

where: n_i = total number of individuals in the i^{th} taxon
N = the total number of individuals from all taxa
C = 1.442695 for conversion of natural logarithms
S = number of taxa

This index results in diversity values that range from 0 to 3.321928 log N, where values of H>3 generally represent clean water streams and, 3>H>1 indicates streams of intermediate quality, and 1>H indicates polluted streams (RWBS,1990).

In diversity calculations, the number of individuals in the i^{th} taxon (n_i) was calculated using the number of individuals in the taxon with the greatest degree of specificity. If there were specimens identifiable only to a higher taxonomic level, they were counted as belonging to the more specific taxon. For example, if in a single sample there were 4 specimens identifiable to the family Ephemerellidae, and 2 specimens identifiable to the genus *Ephemerella*, the number of individuals belonging to the i^{th} taxon (*Ephemerella*) would have been 6. In the rare instance when there was more than one taxon at the most specific level of identification and specimens identifiable only to a higher taxonomic level, they were divided up in a manner proportional to those already identified at the most specific taxonomic level. For example, if in a single sample there were 4 specimens identifiable only to the family Ephemerellidae, 3 specimens identifiable to the genus *Ephemerella*, and 1 specimen identifiable to the genus *Serratella*, the number of individuals counted as belonging to the i^{th} taxon (*Ephemerella*) would have been 6 (3 + 3 from Ephemerellidae), while the number counted as belonging to the j^{th} taxon (*Serratella*) would have been 2 (1 + 1 from Ephemerellidae). Pupae were not included in the calculations of diversity since no reliable keys were available to determine their taxonomic identity.

Results

In 1999, a total of 298 specimens were collected from the six study sites. The specimens belonged to 51 distinct taxa. The number of EPT taxa represented was 25. None of the specimens collected were rare, threatened, or endangered species. A complete list of all taxa and the study site locations at which they were collected is provided (Appendix I).

Overall Comparison of Specimens from 1992 and 1999

An overall comparison of the specimens collected from all 1999 study sites with those collected from all 1992 study sites revealed that the total number of specimens collected in 1999 constituted approximately $1/7^{th}$ as many as were collected in 1992 (Table 1). This was despite the fact that six study sites were sampled in 1999 while only five were sampled in 1992. Despite the

low specimen density. The overall number of taxa found was higher in 1999 than it was in 1992 (Table 1). *Similarly the number of EPT taxa found was higher in 1999 than in 1992* (Table 1). A comparative list of all taxa collected in 1992 and 1999 is provided (Appendix II).

Table 1. Overall comparison of stream macroinvertebrates collected from all study sites at Ethan Allen Firing Range, Jericho, Vermont, in 1999 and 1992.

Year	1999	1992
Total # of specimens	298	2092
Total taxa	51	38
EPT taxa	25	19

Site by Site Comparisons

The number of specimens collected from each of the individual 1999 study sites was quite low (Table 2). This was especially true from the two potential reference sites (1 and 03). With only 8 and 2 specimens collected from the potential reference sites (Table 2), it was impossible to make meaningful comparisons between the downstream locations and these "reference" sites as was done in the 1992 study.

While the specimen numbers from the other 1999 study site locations (02-05) were also low, they were not so low as to render analysis meaningless. The diversity values for study sites 02-05 were all greater than 3.0 (Table 2), which generally constitutes clean water (RWBS, 1993). The number of taxa at the 1999 study sites ranged from 20-31, while the number of EPT taxa ranged from 6-16.

Table 2. A summary of data analysis for stream macroinvertebrates from six study sites at Ethan Allen Firing Range, Jericho, Vermont, October 15&16, 1999.

Study Site	1	01	02	03	04	05
Number of Specimens	8	2	76	60	55	97
Diversity (H)	1.40	0.69	3.13	3.39	3.43	3.11
Taxa Richness	5	1	24	24	20	20
EPT Index	4	1	16	12	8	12

Direct site by site comparison from 1992 and 1999 was only possible at the study sites in which sampling was conducted at the same location (1&1, 2 & 02, and 5 & 03). At study site 2/02, despite a lower number of specimens in 1999, the numbers for diversity, taxa richness and EPT taxa were all higher than those reported in 1992 (Table 3). At study site 5/03, the diversity was slightly lower in 1999 (though still in the clean water range). Taxa richness was also lower in 1999, but the EPT Index was higher than in 1992 (Table 3). The extremely low number of specimens at study site 1/1 in 1999 made comparisons of the values for the other metrics with the 1992 data from the same location pointless.

Table 5. Site by site comparison of stream macroinvertebrates collected in September 1992 and October 1999 at Ethan Allen Firing Range, Jericho, Vermont.

Study Year	99		99	92	99	92	99	92	99	92	99	92
Sample	01		1	1	02	2	03	3	04	4	05	5
Number of Specimens	2		8	274	76	341	60	281	75	291	77	905
Diversity (H)	0.58		1.00	3.04	3.37	2.47	3.35	2.84	3.43	3.29	3.31	3.38
Taxa Richness	1		5	17	24	11	24	16	24	18	20	36
EPT Index	0		4	8	16	2	12	7	6	7	13	11

Comparison with other historical data

A search of records at the Vermont Department of Environmental Conservation (VTDEC) revealed that stream macroinvertebrates had been collected in the Lee River at a location about 0.5 miles downstream from the Ethan Allen Firing Range boundary in September of 1988. This sampling location was only a short distance downstream from study site(s) S/05 and yielded yet another piece of baseline data for historical comparison of water quality in the Lee River Watershed. The overall community assessment based on the 1988 macroinvertebrate sampling was that the stream community was in excellent condition (at that location). For purposes of comparison, the results of the 1988 sampling were summarized and compared with those from study site(s) S/05 in 1992 and 1999 (Table 6). However, direct comparisons of these data should be treated cautiously since the 1988 sampling scheme differed from that used in 1992 and 1999. In 1988 specimens were collected using fixed kick net samples, whereas in 1992 and 1999 specimens were collected using semi-defined Surber Sample techniques. A complete taxa list for specimens collected in 1988 is provided (Appendix III).

Table 6. Comparison of results from 1988 stream macroinvertebrate sampling in the Lee River with data from 1992 and 1999. (* 1988 data analysis used the Biotoxin Water Index to calculate diversity, which is not directly comparable to the indices used in 1992 and 1999.)

	9/15/88	09/16/92	10/15/99
Sampling location	Lee River downstream, East of ENFR boundary	Lee River downstream of ENFR boundary	Lee River downstream of ENFR boundary
Sampling Method	Kicknet	Surber Sample	Surber Sample
Number of Specimens	950	905	77
Taxa Richness	45.0	36.0	20.0
EPT Index	28.0	11	13
EPT Richness	7.00	11	6
Shannon Index	1.53	---	---
Diversity*	3.66	3.38	3.31
# EPT Taxa	13.0	---	---
Intolerant Taxa %	3.0	---	---
Chloroptera %	0.0	---	---
Diptera %	10.0	---	---
Ephemeroptera %	15.0	---	---
Trichoptera %	1.0	---	---
Plecoptera %	0.0	---	---
Hydropsyche %	0.0	---	---
Coleo %	1.0	---	---
Tanytarsini / Micropsectra	0.0/11.0/0.0	---	---

Discussion

Low Density: Consequences and Possible Causes

The most striking aspect of the 1999 stream macroinvertebrate sampling was the low density of organisms. One consequence of low organism density is that it tends to obscure the accuracy of numerical metrics like diversity. Brillouin's diversity index, for example, relies on the use of Stirling's approximation, which is only accurate for samples with large numbers of specimens (Pielou, 1975). Therefore the 1999 diversity data should be treated skeptically. By contrast, straight tallied metrics like taxa richness and EPT index, are somewhat more reliable in instances of low organism density. The particularly low organism density for the two potential reference sites, however, was especially frustrating because it made impossible the comparison of downstream locations with the presumably more pristine upstream reference locations.

There are several possible causes for low density. Habitat degradation and/or toxic impacts tend to cause decreases in organism density. However, these factors should simultaneously cause a decrease in taxa richness and the EPT index, neither of which was observed in 1999. In other words, the types of organisms observed were generally indicative of good water quality conditions, but their low numbers were not. The most likely explanation for low organism density was Hurricane Floyd, which hit Vermont in the latter half of September 1999. Large storm events like a hurricane, tend to decrease organism density through the scouring action of floodwaters (Steve Fiske, VTDEC, pers. comm.). Sampling took place about three weeks after the hurricane. Hurricane Floyd probably depleted macroinvertebrate populations in the Lee River watershed. The subsequent period before sampling was presumably too short to allow significant recovery. This event would also explain the extremely low densities of the upstream reference sites. High elevation, high gradient streams with a low percentage of fine sediments are more susceptible to biotic devastation by flooding. The present evidence does not allow certainty that low organism density in 1999 was the result of Hurricane Floyd, but it seems the most probable explanation.

Comparisons with Past Studies

It is remarkable that, despite lower specimen numbers, overall taxa richness and EPT index numbers were higher in 1999 than they were in 1992. Aside from low organism density, none of the 1999 study sites showed other indications of poor water quality when compared with the 1992 data. Moreover, although direct comparisons of 1999 and 1988 data must be treated cautiously, the species lists indicate many similarities between 1988 and 1999. These data suggest *that if low density can be attributed to Hurricane Floyd, then all other indications point to favorable water quality conditions in the Lee River Watershed in 1999.*

Study Design

The study design for 1999 sampling mirrored that performed in 1992. The most recent reference cited in the 1992 study was from 1973 (WWBS, 1993). The design of macroinvertebrate sampling for the assessment of water quality at Ethan Allen Firing Range could be improved dramatically by incorporating recent understandings of stream invertebrate communities in Vermont. Ongoing work by the Vermont Department of Environmental Conservation has demonstrated that different stream types exist in the state that harbor very different macroinvertebrate assemblages even in pristine conditions (VTDEC, 2000). One of the findings of the DEC work has been to show that elevation is an important factor in determining stream type. Because the study sites at Ethan Allen Firing Range cover an elevational range of 650 to 1300 ft., they also belong to distinct stream types. The reference sites (1 & 01) apparently belong to the small mountain stream category (SMT) while the lower elevation sites (2/02, 3/03, & 5/05)

probably belong to the medium mountain stream category (MMT). Therefore, *the reference sites would be expected to have different macroinvertebrate assemblages from the lower elevation sites even under pristine conditions*. This represents a serious weakness of the study design of the 1983 Receiving Water Biological Study.

A more appropriate study design would compare the macroinvertebrate assemblages from a given study site with established biocriteria values for that stream type in Vermont using several metrics. The DEC work has tested a number of different metrics and demonstrated that only seven actually act as indicators of biological condition (VTDEC, 2000). *Significantly, the DEC work found that diversity measurements were not among the metrics useful in assessing stream integrity* (VTDEC, 2000). The work has found that both taxa richness and EPT Index are among the seven useful indicators of biological condition.

Unfortunately, in this study it was impossible to compare the results of the 1999 sampling with the established biocriteria values, because the DEC protocol used kick net sampling (as opposed to Surber Sampling) to establish its biocriteria values. Moreover, the DEC requires that a minimum of 300 organisms per sample be collected in order to assess the accuracy of its metrics (the largest sample taken in 1999 had only 77 specimens). If less than 300 organisms are collected using DEC standardized kick net sampling it is ordinarily taken to indicate poor biological condition of the stream.

Conclusions & Recommendations

Low organism density in the 1999 sampling could not be used to draw firm conclusions about the water quality of the Lee River Watershed. Habitat degradation and/or toxic impacts tend to cause decreases in organism density, but the more likely explanation for low organism density in 1999 was Hurricane Floyd. Despite low organism density, the overall taxa richness and number of EPT taxa were higher in 1999 than in 1992. Higher values for these metrics generally indicate good water quality conditions. These data suggest that if low density can be attributed to Hurricane Floyd, then other factors point to favorable water quality conditions in the Lee River Watershed in 1999. However, without indisputable evidence that low organism density in 1999 was the result of Hurricane Floyd (such as samples from before and after the event), the most conservative interpretation is that the 1999 data are inconclusive.

Because of the inconclusiveness of the 1999 sampling, a follow-up study is recommended. The most prudent approach to future water quality monitoring of the Lee River Watershed is to use sampling techniques consistent with those utilized by the Department of Environmental Conservation. The resultant data could then be compared using the metrics that have been demonstrated to act as indicators of biological condition with the established biocriteria values for that stream type in Vermont. In this way, the biological condition at a given location in the Lee River watershed could be assessed by comparing the macroinvertebrates found with other similar streams throughout Vermont.

Vernal Pool Macroinvertebrates

Objectives

The main objective of sampling vernal pools was to identify pools with high taxa richness. In addition, the sampling provided the opportunity to report on any rare, threatened, or endangered species.

Vernal Pools

Vernal pools are small, temporary water bodies that are filled in spring by snowmelt and surface runoff and that typically dry over the course of the summer. Their ephemeral nature keeps them free of fish and makes them important breeding habitats for certain species of amphibians and invertebrates (Colburn, 1997).

Methods

On April 21, 1998 I made a visit to the Ethan Allen Firing Range with Jan Andrews to relocate temporary pools that he had identified during amphibian survey work in 1998. Carl Anderson and Sean McFadden accompanied us to take GPS coordinates of potential study sites. We identified eleven different temporary or semi-permanent pools at the Firing Range (Figure 2). All pools were easily accessible and showed evidence of breeding activity by amphibians known to rely on vernal pools (Table 5). Some of the pools appeared to be natural landscape features while others were artificial (Table 5). The most common type of artificial pool was created by blockage of surface runoff by road building.

Table 5. A summary of vernal pools found at Ethan Allen Firing Range, Jericho, Vermont, April 21, 1998.

Pool Name	Amphibian presence	Pool Type
VP1	Wood Frog & Spotted Salamander egg masses	Artificial-Road blockage
VP2	Wood Frog egg masses	Natural?
VP3	Wood Frog egg masses	Artificial-Road Blockage
VP4	Wood Frog & Spotted Salamander egg masses	Artificial-Road Blockage
VP5	Wood Frog egg masses & adult green frogs	Artificial-Road Blockage
VP6	Spotted Salamander spermatophores & adult Wood Frogs	Natural
VP7	Wood Frog egg masses	Natural
VP8*	Wood Frog egg masses	Natural
VP9	Wood Frog egg masses, adult Green Frogs & Red spotted newt	Artificial-Sand pit
VP10	Wood Frog & Spotted Salamander egg masses	Natural? (semi-permanent)
VP11	Wood Frog egg masses	Natural

On April 28-30, 1999, macroinvertebrate samples were collected from three natural pools and three artificial pools. The pools sampled were VP3, VP4, VP5, VP8, VP10 & VP11. Macroinvertebrates were sampled at each pool using two different techniques consistent with those utilized by the Vermont Department of Environmental Conservation (VTDEC). A single funnel trap (Figure 3) was placed overnight at each pool to collect free swimming invertebrates. Funnel traps were emptied the following day by shaking specimens out into a white porcelain tray and then hand-picking the trap for any specimens that were not dislodged from the wire screening of the funnel trap. In each pool, three randomized 1- meter standard sweeps with a D-shaped dip net were also made. At least one of the sweeps included muck and leaf litter from the pool bottom. The samples were sorted in a porcelain tray in the field and the specimens from all three sweeps were collected in a single vial containing 80% alcohol. Specimens were identified in the laboratory. The study sites were revisited in mid-June, but a second sampling was not conducted because most pools were dry. For each study site, a taxonomic list was compiled and a taxa richness value was calculated.

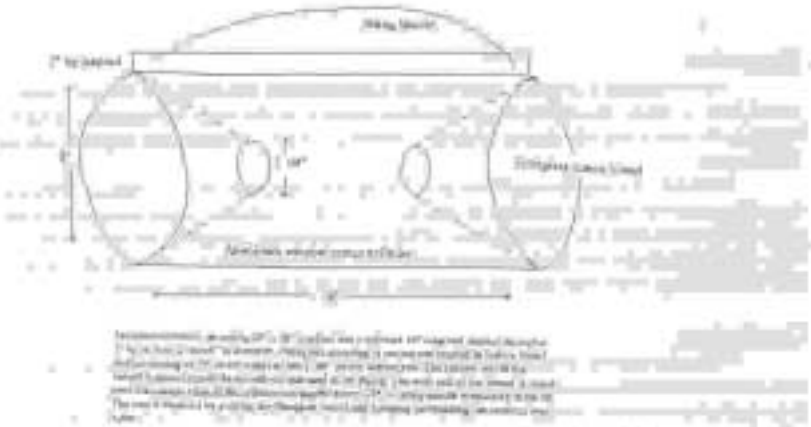

Figure 3. The funnel trap design used for sampling vernal pool macroinvertebrates at Ethan Allen Firing Range, Jericho, Vermont in April 1999.

Results

A total of 887 specimens were collected from the sampled pools. Vernal pool #4 yielded overwhelmingly the highest number of specimens (Table 6). Vernal pool #3 had the highest taxa richness (Table 6). On average, artificial pools yielded generally higher specimen numbers and had higher taxa richness values than natural pools. The most abundant type of organism collected were members of the Chaoboridae (phantom midges). None of the specimens collected were rare, threatened, or endangered species. A complete list of all taxa collected is provided (Appendix IV).

Table 6. Specimen numbers and taxa richness values for six vernal pools sampled on April 28-30, 1999 using funnel traps and dip net sweeps at Ethan Allen Firing Range, Jericho, Vermont.

Pool Name	VP2	VP4	VP5	VP8	VP10	VP11
Pool Type	Artificial	Artificial	Artificial	Natural	Natural	Natural
# of specimens	85	526	79	54	49	94
Taxa richness	12	9	10	6	11	5

Discussion

The identification of vernal pools was not comprehensive. It is likely that there are more vernal pools at Ethan Allen Firing Range than those identified in this study. Nevertheless, at least eleven pools were found that showed evidence of breeding activity by amphibians known to rely on vernal pools.

Unusually dry weather conditions in the spring and summer of 1999, confounded attempts to conduct a second round of sampling in June. Moreover, dry conditions caused lower water levels early in the season than was expected. Even VP10, the deepest pool identified, had dried up by July. Judging by its size and depth, this pool is probably semi-permanent (i.e. does not dry up in most years, except under extremely dry conditions like those in the spring and summer of 1999).

Conclusions

Unlike the case for streams, metrics that indicate the biological integrity of vernal pools from macroinvertebrate assemblages have not yet been developed. Therefore it is difficult to draw firm conclusions about the biological integrity of the natural and artificial vernal pools at the Ethan Allen Firing Range. The VTDEC has been studying vernal pools in Vermont to determine what metrics can be used to evaluate the biological integrity of these wetland types. As a result the baseline data collected in this study may become more useful over time as the metrics being tested become accepted as reliable indicators of biological integrity.

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Appendix 1. A complete list of all stream macroinvertebrate specimens collected at Ethan Allen Firing Range, Jericho, Vermont in October 1999.

Study Site	1	01	02	03	04	05
Insecta (Class)						
Ephemeroptera				1	2	1
Ephemerellidae	1					12
Ephemerella sp.			5	1		3
Serratella sp.			2		3	1
Heptageniidae					1	9
Stenonema sp.			1		1	
Rhithrogena sp.						6
Leptophlebiidae				5		
Paraleptophlebia sp.				4		2
Baetidae						
Baetis sp.			1			1
Acentrella sp.			2			
Plecoptera						
Perlidae				1		
Agnetina sp.			7		2	1
Acroneuria sp.	1		1			2
Chloroperlidae						
Sweltsa sp.			7			1
Leuctridae						
Paraleuctra sp.			1			
Pteronarcidae						
Pteronarcys sp.			1			
Trichoptera				1		
Lepidostomatidae	1		2	1		
Lepidostoma sp.	2		22			2
Uenoidae						
Neophylax sp.	1					
Limnephilidae			1	1	1	
Hydatophylax sp.			1			
Apatania sp.			1			
Glossosomatidae						
Glossosoma sp.			1	2		
Hydropsychidae					2	5
Ceratopsyche sp.				1		
Hydropsyche sp.				1	12	11
Cheumatopsyche sp.				1	5	1
Philopotamidae				1		
Dolophilodes sp.			1	8		
Rhyacophilidae						
Rhyacophila sp.				6		1
Brachycentridae						
Brachycentrus sp.						6
EPT Taxa	4	0	16	12	5	13

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Appendix I (continued). A complete list of all species macroinvertebrate specimens collected at Ethan Allen Firing Range, Jericho, Vermont in October 1999.

Study Site	1	O1	O2	O3	O4	O5
Insecta (continued)						
Coleoptera						
Elmidae						
Stenelmis sp. (adult)				1	12	
Stenelmis sp. (imm.)				1	2	2
Promoresia tardella				6		
Optioservus fastiatus					1	2
Optioservus sp. (imm.)				1	3	
Oulimnius sp. (imm.)			2	1	1	
Oulimnius latiusculus					2	
Psephenidae						
Psephenus sp.					1	
Megaloptera						
Sialidae						
Sialis sp.						
Corydalidae						
Nevhermes sp.					2	
Nigronia sp.					2	
Odonata						
Aeshnidae						
Aeshna sp.			1	1		
Cordulegastridae						
Cordulegaster sp.				1	2	
Gomphidae						
Lanthus sp.					1	
Diptera		1				
Chironomidae				1	1	
Micropsectra sp.			1	3	2	
Microtendipes sp.				1	4	1
Rheotanytarsus exiguus				1		
Polypedilum sp.					1	
Thienemanniella sp.					1	
Cricotopus sp.						1
Tipulidae						
Tipula sp.		1	1	1	3	3
Limnophila sp.				2	1	
Athericidae						
Atherix sp.			1		1	
Ceratopogonidae						
Sphaeromias sp.			1			
Tabanidae						
Hexatoma sp.					1	
Pupae (undetermined)			2	1		
Non-EPT insect taxa	0	1	6	11	17	5

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Appendix I (continued). A complete list of all stream macroinvertebrate specimens collected at Ethan Allen Firing Range, Jericho, Vermont in October 1995.

Study Site	1	Q1	Q2	Q3	Q4	Q5
Oligochaeta (Class)						
Tubificida				2		3
Arachnida (Class)						
Hydrachnida			1			1
Araneida	1		2			
Hirudinea (Class)						
Rhynchobdellida						
Glossiphoniidae						
Helobdella triserialis					1	
Non-insect taxa	1	0	2	1	1	2
Total # of taxa	5	1	24	24	24	20
Total # of specimens	8	2	76	60	75	77

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Appendix II. A comparative list of all stream macroinvertebrate taxa collected at Ethan Allen Firing Range, Jericho, Vermont in 1992 and 1999.

Taxa	1992	1999	Taxa	1992	1999
Insecta (Class)			Philopotamidae		1
Ephemeroptera		4	Dolophilodes sp.	350	10
Ephemerellidae		12	Rhyacophilidae		
Eurylophella sp.		12	Rhyacophila sp.	2	7
Serratella sp.		6	Brachycentridae		
Drunella [illegible]	15		Brachycentrus sp.	6	3
Heptageniidae		10	Polycentropodidae		
Stenonema sp.	135	2	[illegible]	40	
[illegible] sp.		8	Coleoptera		
Leptophlebiidae		5	Elmidae		
Paraleptophlebia sp.	125	8	[illegible] sp. (adult)	11	12
Baetidae			[illegible] sp. (larva)	2	8
Baetis sp.	100	5	Promoresia tardella		9
Acentrella sp.		2	Oulimnius latiusculus		2
Pseudocloeon sp.	25		[illegible] sp. (larva)		8
Plecoptera			[illegible]		2
Perlidae		1	[illegible]		2
Acroneuria sp.		10	Psephenidae		
[illegible] sp.		4	Psephenus sp.		1
Acroneuria abnormis	40		Megaloptera		
[illegible]	7		Sialidae		
Phasganophora capitata	31		Sialis sp.		1
Chloroperlidae			Corydalidae		
Sweltsa sp.		8	[illegible] sp.		2
Alloperla sp.	175		Nigronia sp.		12
Leuctridae			Odonata		
Leuctra sp.		1	Aeshnidae		
Peltoperlidae			[illegible] sp.	1	6
Tallaperla sp.		1	Cordulegastridae		
[illegible]	20	1	Cordulegaster sp.		1
Perlodidae			Gomphidae		
[illegible] sp.		5	[illegible] sp.	1	1
Pteronarcyidae			Diptera		5
Pteronarcys sp.	12	1	Chironomidae		12
Trichoptera		4	Micropsectra sp.		8
Lepidostomatidae		1	Microtendipes sp.		4
Lepidostoma sp.		25	Rheotanytarsus exiguus		1
Uenoidae			Polypedilum sp.	56	5
Neophylax sp.		1	Thienemannimyia sp.		1
Limnephilidae		8	[illegible] sp.	27	1
[illegible] sp.		1	[illegible]	2	
Apatania sp.		1	[illegible] sp.	5	
Glossosomatidae			Tipulidae		
Glossosoma sp.	52	12	Tipula sp.	24	6
Hydropsychidae		7	Limnophila sp.		2
Diplectrona sp.		2	Dicranota sp.	12	
Hydropsyche sp.	225	34	Athericidae		
Cheumatopsyche sp.		7	Atherix sp.		4
Symphitopsyche bronta	11		Ceratopogonidae		
Symphitopsyche slossonae	2		[illegible] sp.		1

Appendix II (continued). A comparative list of all stream macroinvertebrate taxa collected at Ethan Allen Firing Range, Jericho, Vermont in 1992 and 1999.

Year	1992	1999
Diptera (continued)		
Tipulidae		
[illegible] sp.		1
Dixidae		
Dixa sp.	1	
Simuliidae		
Metacnephia sp.	3	
		1
Insect Pupae (undetermined)		
Oligochaeta (Class)		
Tubificidae	8	2
Arachnida (Class)		
Hydrachnidia		2
Acarina		9
Bivalvia (Class)		
[illegible]		
[illegible]		
[illegible]		1
Gastropoda		
Physa sp.	1	
Crustacea		
Asellus sp.	1	

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Appendix III. A list of all stream macroinvertebrate taxa collected in the Lee River, 0.5 miles downstream from the Ethan Allen Firing Range boundary in September 1988. (Courtesy of Vermont Department of Environmental Conservation—Biomonitoring and Aquatic Studies Unit)

Location: Lee River # 2.8 Town: Jericho Site Id: 461111000028
Device: Kick Net Composites/Rep: 1
Lab Id: 88.074 Date: 9/15/88 Area: 1.00 m2 Number of Reps: 2

Order	Genera	Species	Density	% Comp	Std Err	Minimum	Maximum
TRICHOPTERA	RHYACOPHILA	fuscula	12.3	1.41			
	RHYACOPHILA	carolina	3.9	.45			
PLECOPTERA			76.2	8.78	20.72	64.2	96.0
	CHLOROPERLIDAE	unid	15.7	1.79			
	PELTOPERLA	sp	0.0	0.00			
	ACRONEURIA	sp	1.5	.33			
	PARAGNETINA	immarginata	4.5	.53			
	AGNETINA	capitata	15.1	1.76			
	ISOGENOIDES	hansoni	16.2	1.88			
	ISOPERLA	bilineata	0.0	0.00			
	ISOPERLA	marlynia	15.2	1.76			
	PTERONARCYS	biloba	3.3	.38			
	PTERONARCYS	proteus	1.1	.13			
	TAENIOPTERYX	sp	1.7	.20			
ODONATA			1.1	.13	1.06	0.0	4.2
	UNID		1.1	.13			
MEGALOPTERA			5.0	.58	1.96	1.1	8.8
	NIGRONIA	sp	5.0	.58			
GASTROPODA			5.5	.63	5.46	0.0	12.5
	FERRISSIA	rivularis	5.5	.63			
BIVALVIA			1.1	.13	1.09	0.0	2.2
	PISIDIUM	sp	1.1	.13			
HIRUDINEA			1.7	.20	1.72	0.0	3.4
	GLOSSIPHONIIDAE	unid	1.7	.20			
TOTAL			860.4	100.00	86.97	774.5	946.3

Appendix IV. A list of all vernal pool macroinvertebrate taxa collected at Ethan Allen Firing Range, Jericho, Vermont in April 1999.

	VP3	VP4	VP5	VP8	VP10	VP11
Insecta (Class)						
Coleoptera						
Dytiscidae	3	2			2	
[illegible] sp.			1		1	
Gyrinidae						
Gyrinus sp.			1		1	2
Hydrophilidae						
Cymbiodyta sp.						
Haliplidae						
Haliplus sp.					1	1
Eucinetidae?						
Chrysomelidae?						
Diptera						
Culicidae	4	3	40			2
Chironomidae	20	27				4
Ceratopogonidae	16	376	1	46	38	110
Ephemeroptera						
Siphlonuridae	2		2			
Hemiptera						
Gerridae		5				
Corixidae		5	19		2	
Hymenoptera	2					
Lepidoptera	3					
Megaloptera						
Sialidae	3					
Odonata						
Aeshnidae					2	
Coenagrionidae					1	
Trichoptera						
Limnephilidae					1	
Phryganeidae	9			4		
Gastropoda (Class)						
Lymnaeidae			1			
Physidae			2		3	
Planorbidae					2	
Crustacea (Class)						
Amphipoda						
Gammaridae					1	
Ostracoda	7	95				
Oligochaeta (Class)	6	45				1
Bivalvia (Class)						
Sphaeriidae	2	5	11			
Arachnida (Class)						
Araneida				2		
Hirudinea (Class)			1			
# of Specimens	88	520	79	54	48	104
Taxa richness	12	9	10	6	11	5

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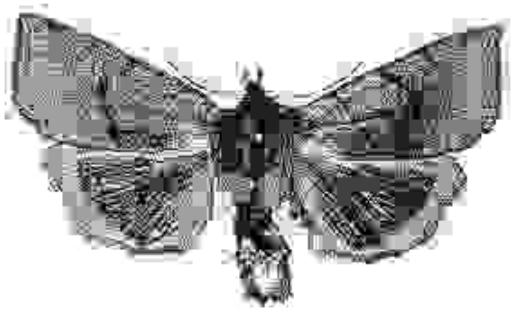
Biodiversity of the Moth Fauna from a Light Trap Survey at Ethan Allen Firing Range



by

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2008

Biodiversity of the Moth Fauna from a Light Trap Survey at Ethan Allen Firing Range

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Cover Illustration: Brain of *Epiglaea apiata* (Grote, 1874)

Abstract

A light and bait trapping survey was carried out at the Ethan Allen Firing Range from April through October, 1999. A total of 535 species representing 22 families were identified. Provisional State conservation ranks were assigned to each species, and species of conservation interest were discussed. Three new State records were obtained for Vermont. Several species were identified as wetland associates, including the obligate bog endemic (*Exyra fax*).

Management recommendations include special consideration to maintaining environmental quality for the bog, further bog inventory if surrounding land management should affect drainage patterns, and further vegetation surveys of the diverse vegetation mosaic within the Ethan Allen Firing Range.

Introduction

In 1998 the Vermont Army Guard published a request for research proposals to document the species diversity of insects at the Ethan Allen Firing Range. This report presents the results of a light trap survey for moths at two sites in 1999.

Methods

The Ethan Allen Firing Range comprises an area of 17.2 square miles over a hilly topography ranging in elevation from 600 to 3100 feet. The vegetation cover comprises forty different forest types with mixed hardwoods being dominant, but also including small areas of hemlock, red spruce, and pines.

A black light trap was placed at two sites. Site #1 (44°27'85" N by 72°54'58" W) at an elevation of 700 feet on the margin of Otter Bog adjacent to a forest of hardwoods, hemlock, birch, and pine. Site #2 (44°29'10" N by 72°55'63" W) at an elevation of 1100 feet within a northern hardwoods/red oak forest (Fig. 1).

Each light trap comprised a vertical 15-watt fluorescent black light with rain cover and four plexiglass vanes (Fig.2). The light was positioned over a collecting bucket containing a killing agent. The light was powered by a 12-volt car battery. Lights were operated for one night each week from April until the middle of October, and twice a week during the heaviest collecting period, June and July. Moths were collected the following morning, sorted, and up to five specimens of each species were pinned, labeled, and stored for identification.

Supplemental trapping was provided by a cylindrical bait trap comprising a bait tray containing fermenting beer and fruit beneath a collecting net (Fig.3), and a pheromone trap for clearwing moths comprising a plastic bucket with killing agent and pheromone bait suspended from a branch.

Identifications were made by comparison with material held in the personal collection of Scott Griggs, the University of Vermont Entomology Research Collection specialist confirmations, and reference to the following publications: Covell (1984), Ferguson (1974), Forbes (1923, 1948, 1954), Grehan et al. (1995), Hodges (1983), Holland (1968), Lafontaine (1998), Miller (1987), Monroe (1972-3), Neunzig (1986), Rings et al. (1992), and Rockburne and Lafontaine (1976).

Results

A total of 535 species representing 22 families were identified (Table 1). Site #2 (hardwoods) provided 413 species with 206 being from this site only. Site #1 provided 329 species with 122 from this site only. This sampling indicates a high proportion of difference in the species composition of moths between the two sites with only 207 species shared between both. Some species have not been identified at this time because they require specialist taxonomic examination that was not available within the time period for this survey.

The survey sample primarily represents moth species attracted to black lights. Under represented in this sample are the underwings (Catocala), hibernating species (mostly Noctuidae and Tortricidae), and clearwing moths (Sesiidae). Underwings are best collected using bait traps, and while a single bait trap was used at each site for the entire collecting period, this was insufficient to provide a full survey of the underwing moths. Many moths that hibernate over winter do not come to light or are rarely collected, but they may be collected using baits placed on tree trunks. Successful bait trapping requires a coincidence of ideal weather conditions which were not available in the fall of 1999. Usually several years are required to obtain a reasonable sampling of hibernating species. Clearwing moths require the use of pheromone traps and these moths also often require repeated sampling to obtain a representative sample.

(i) Moth Biodiversity

Most species recorded represent only two moth families - the Noctuidae (cutworm moths) and Geometridae (geometrid moths). This pattern (Fig. 4) is similar to that reported for the Mount Mansfield survey (Grehan and Boone 1996). The number of families recorded for the Ethan Allen Firing Range is lower than Mount Mansfield, but these groups are less attracted to lights and require specialist taxonomic expertise for identification due to their small size and lack of external distinguishing features. The total number of species recorded in this survey is 535 while the Mount Mansfield survey resulted in 1525 species over a five year period for three different elevations.

(ii) Examples of Regional Significance

Most species recorded in this survey are common and widespread in Vermont and are typical for lowland hardwood/conifer forests mixed forest and farmland. There is no comprehensive biotic inventory of Vermont's Lepidoptera fauna, but an informal estimation of the probable conservation status of Vermont Lepidoptera was compiled by Grehan and Sabourin (1996). Species were ranked using the following Nature Conservancy conservation categories:

- **S1** Critically imperiled in the state
- **S2** Imperiled in the state
- **S3** Rare or uncommon
- **S4** Widespread, abundant, apparently secure, but cause for long-term concern
- **S5** Widespread, abundant, and secure

Ranking categories for Vermont Lepidoptera can only be regarded as provisional as they have no foundation in any Statewide survey and reflect the collecting experience of the authors. All Vermont State ranks must, therefore, be considered unsubstantiated although some confidence may be given to **S3** or **S4** ranks for species with restricted habitat requirements, such as bogs or other limited wetlands.

Provisional State ranks for the Ethan Allen species list are presented in Table 1. Only fourteen species from this survey are considered rare or uncommon (**S 3**) although several classified here as **S 5** are not often collected. However, this survey produced new State records for *Abagrotis brunneipennis*, *Probole nebulosaria*, and *Exyra fax*. The following list presents some examples of uncommon species records for Ethan Allen Firing Range.

(a) *Acronicta lepusculina* (Guenee,1852). Collected 12 June 1999. Site #2. **S5**. Not commonly collected in Vermont.

(b) *Mericisca diversicolor* (Morrison, 1874). Collected 21 August, 1999. Site #1. **S5**. Not commonly collected in Vermont.

(c) *Prusia venusta*. (Walker, 1865). Collected 26 June, 1999. Site #1. **S3**.

(d) *Pachypolia atricornis* (Grote, 1874). Collected 1 October, 1999. Site #2. **S3**.

(e) *Archanara oblonga* (Grote, 1882). Collected 11 September, 1999. Site #1. **S3**.

(f) *Conservula anodonta* (Grote, 1874). Collected 25 June, 1999. Site #1. **S3**.

(g) *Platypolia anceps* (Stephens, 1850). Collected 24 September, 1999. Site #2. **S3**.

(h) *Abagrotis brunneipennis* Grote, 1875). Collected 4 September, 1999. site #2. Predicted **S4**. Blueberry feeder (Lafontaine 1998).

(iii) Species Associated with Bog Habitats

The Ethan Allen Firing Range bog represents a significant element of Vermont's biodiversity. Many bog species are either restricted to, or most abundant in this habitat. The following list presents some examples of bog associated species recorded for Ethan Allen Firing Range.

(a) *Ematurga amitaria* (Guenee, 1857). Cranberry Spanworm. (Geometridae). Collected 7 July, 1999. Site #1. **S4**.

(b) *Exyra fax* Grote, 1873). (Noctuidae). Collected 6 July, 1999. Site #1. New State record. Predicted **S3**. Bog endemic (Lafontaine and Poole, 1991).

(c) *Epelis truncataria*. (Walker, 1862). (Geometridae). Collected 7 June, 1999. Site #1. **S4**.

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(d) *Probole replaressata* (Walker, 1860). Heath Probole. (Geometridae). Collected 15 May, 1999. Site #1. New State record. Predicted **S4**. Associated with bog habitats (D.M. Schweitzer, 1999 personal communication).

(e) *Sphinx poecila* (Stephens, 1828). (Sphingidae). Collected 22 May, 1999. Site #1. **S4**.

(f) *Muhlbeia rotundata* (Walker, 1859). (Pyralidae). Collected 7 June, 1999. Site #1. **S5**. (Aquatic species).

(g) *Parapoynx allionealis* (Walker, 1859). (Pyralidae). Collected 17 July, 1999. Site #1. **S5**. (Aquatic species).

(h) *Parapoynx badiusalis* (Walker, 1859). (Pyralidae). Collected 19 June 1999. Site #1. **S5**. (Aquatic species).

(iv) Notes on General Biological Associations (Table 2)

The following notes summarize some of the main features of host-plant associations known for the families of moths recorded at the Ethan Allen Firing Range with the exception of families where only one or two species were recorded (see Table 2).

Arctiidae: Three species are lichen feeders. Lichens are widely recognized as indicators of atmospheric environmental quality.

Drepanidae: Mostly tree and shrub feeders.

Geometridae: Tree, shrub, and perennial feeders. Hosts probably include all major tree species present in the Ethan Allen Firing Range.

Lasiocampidae: The eastern tent caterpillar is a periodic pest of trees and shrubs along forest margins.

Lymantriidae: The gypsy moth is a periodic forest defoliator.

Noctuidae: Tree, shrub, and perennial feeders. Hosts include all major tree species present in the Ethan Allen Firing Range. Five collected are known to feed on fungi and two species feed on lichens. Six species are restricted to feeding on dead forest leaves. One species is a bog endemic specialized as a pitcher plant feeder.

Notodontidae: Species collected feed on a wide variety of hardwood trees and shrubs.

Pyralidae: Feed on trees, shrubs, and perennials. Four species feed on aquatic plants, one species is a moss feeder.

Sphingidae: Feed on a variety of hardwood trees and shrubs.

Tortricidae: Tree and shrub feeders. Includes leaf rollers and leaf miners.

(V) Additional Insect Record of Note

Coleoptera: Carabidae

Platynetrobus lacustris (Darlington, 1939) Beaver hut carabid.

Five specimens collected from light trap at Site #1. This species is restricted to wetlands and usually found in association with beaver huts. It is generally considered a rare by coleopterists and Vermont is at the southern edge of its range. Potential Vermont Rank **S3** (R.T. Bell, 1998 personal communication).

Conclusions

The Ethan Allen Firing Range supports a diverse range of moths characteristic of lowland and mixed habitats in Vermont. Most species are widespread and have a secure future in Vermont if forest and other mixed habitats continue to dominate the landscape. With the exception of the three aquatic species, the moths recorded from the bog habitat represent a biotic element of special concern for Vermont's biodiversity. The number of bog species sampled in the survey represents only a small proportion of the total species that may be present. The record of one species endemic to bog habitats suggests that other bog endemics could be found in Otter Bog if the habitat were subject to an intensive survey.

Management Recommendations

(a) Special consideration needs to be given to the water quality and surrounding habitat management policies that could have an impact on the environmental conditions of the bog.

(b) An intensive biotic survey of the bog be initiated should landscape management policy within the Ethan Allen Firing Range affect the drainage area surrounding the bog catchment (e.g. logging, earthworks).

(c) Future surveys should be initiated to fully sample the diverse vegetation mosaic of the Ethan Allen Firing Range.

Acknowledgments

Our thanks to Dr. Dale M. Schweitzer for comments and taxonomic verification (Entomologist, The Nature Conservancy), and Dr. John E. Rawlins (Carnegie Museum of Natural History) for identification.

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A report of selected insect groups at the Camp Johnson, Colchester and the Ethan Allen Firing Range, Jericho-Chittenden County, Vermont, during the 1999 field season.

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(Submitted December 1999)

Introduction

Emphasis in this report is on butterflies. However, I suggested and was encouraged to spend some time studying adult odonates and selected macro-moths. I worked at **both** Camp Johnson (CJ) and the Ethan Allen Firing Range (EAFR) so that the two areas could be compared, thus permitting a better understanding of the insect fauna of each, relative to both questions of basic biological interest (ecology and zoogeography) but more importantly, to (more applied) issues of conservation biology as these might assist in formulating good management practices. Central to such questions is a knowledge of which species are present and when and where they occur and at what densities. Prior to this I did not deal with in any substantial manner. Similar studies of localities, at the same general time, often help substantially our understanding of such questions, both from a practical and an ultimate perspective. The proximate goal with many of these studies is primarily to resolve legal questions of protection, especially to look for species that are listed under the more critical levels (for protection and concern) of various Natural Heritage criteria. I checked all the species I report here against the latest Natural Heritage lists available to me, specifically the list, dated 9/13/99, version, taken off the internet this month on 12/17/99.

No odonates nor any of the lepidoptera reported here are on that list.

Methods:

Both butterflies and adult odonates were observed by "random walks" through as many different habitats as possible. This seemed to be the most efficient way to cover the greatest variety of habitats in the limited time available. Since these insects (butterflies and lepidoptera) are relatively good fliers, it is obviously not always possible to have specimens in hand (as with plants) for close observation. Thus, some records of species reported are based just on sight (with or without binoculars). Other species were netted and released, and problematic ones were sectured whenever feasible or possible, as voucher specimens, for closer scrutiny and taxonomic determination or to simply have a more fully record of anything extremely unusual. I made every reasonable effort to do field work when the weather maximized the activity of the insects and to sample areas over as wide a range of dates as possible.

As I have indicated elsewhere, I am not a professional insect taxonomist. However, I feel that I know the taxonomy of the local butterfly fauna very well, the odonates and macro-moths less so. Every effort was made to check difficult determinations against vouchers, if available (from acknowledged experts), or to have specimens checked by an authority. Warren J. Kiel of Whitefield, NH, kindly checked most of the moths and a few of the more problematic butterfly species, either to verify my identifications or (as with the majority of the moths) to make the original determinations. I am highly confident of the veracity of all the determinations of the butterflies and moths.

All ultimate determinations in this report are mine. Although there are a few that I would ultimately like to have checked, by some acknowledged expert (see discussion on nomenclature and taxonomy below). I am reasonably confident that most of my species determinations are correct. Many of the odonate species, especially the Zygoptera, can readily be identified in the field. One sometimes needs a "lupe" to field-check the 2nd genitalia of the males with other characters. I also had access to my own albeit small collection of voucher specimens of odonates, identified by various experts. I utilized essentially all the most recent or classic literature to identify the odonates (see the bibliography).

Voucher specimens were prepared in a standardized manner for selected butterflies (see tables 1 and 2), the majority of the moths, and most of the odonates. Vouchered specimens (or extremely good photographs) are extremely critical in resolving any issues regarding the authenticity of identifications. The trend toward non-collecting of most taxa, now permeating even legitimate science, is deplorable (Westfall and May, 1996). It is becoming a serious impediment to research, especially with invertebrates.

Some of the odonates were processed through the routine acetone cleanup and are stored in glassine envelopes. All have complete labels. All voucher specimens are temporarily in my possession

and are available to any qualified persons who may wish to study them.

Itinerary and general notes

I have recorded in the tables for the butterflies (Tables 1 and 2) the specific dates of collection which are also (obviously) all the dates I was in the field. I did not include this elaborate detail for the odonates and the macro-moths; rather I have provided a species checklist for these taxa (tables 3 and 4 respectively). **Appendix I** includes further details of where I went on the two buses with anecdotal comments on the various groups, with emphasis on those observations and generalizations that seemed most germane to the overall report. I specifically tried to focus a lot of my available time at Otter Bog when at the Ethan Allen Firing Range(EAFR) since this was of great management concern. The elaborate appendix can be checked for much ancillary information.

Comments on taxonomy and nomenclatorial issues relevant to this report

Unfortunately, stability in nomenclature is **not** omnipresent, much less the evolving problems of taxonomy that relate to it. Even the best-known group of insects, the butterflies, suffers from differences of opinions regarding these matters. Issues apparently as simple as which common name should be used as the standard name for a species or the question of which genus should a common species be assigned have yet to be stabilized. I have chosen to be conservative in my taxonomy and have adopted lists of names and taxonomic arrangements that have been published by respected authorities or organizations, to wit:

odonata- the official list adopted by the Dragonfly Society of the Americas (Argia, vol 9, no.2, 1996). I am fully aware that an odonate expert, Dr. Frank Carle, has presented an **unpublished** preliminary list for the Vt. Natural Heritage Program (F.J. Carle, Dragonflies and Damselflies (Odonata) known to or likely to occur in Vermont, Nongame and Nat. Heritage Program, Vt. Fish and Wildlife Dept., Feb. 1994, 18 pp.). However, his taxonomy differs in several ways from the more widely-used DSA list. Therefore, I have followed the DSA list. However, I am not qualified to judge the relative merits of either. Dr.Carle's list presumably includes all the available records for the State at the time and is that information that I have primarily depended on to ascertain the relative status of any species that I report here, with respect to whether or not the specific odonate has been reported from Vt.

Some specimens of the gomphids, and the genera Lestes, Enallagma and Sympetrum can be exceedingly difficult to determine to species, even for acknowledged experts. I am quite sure that my lestid determinations are accurate. I have not attempted to distinguish between the subspecies of disjunctus. I have less confident about some of my Enallagma determinations. Also, I have made no attempt to deal with the question of whether vernale and carlingianum are separate species or conspecific. I determined one male specimen of Enallagma ex.cornutum which, if correct, would be a **new** State record! I carefully checked this one specimen I collected against several known voucher specimens in my collection that were verified by a noted authority Dr. Donnelly. However, I would eventually like to have him check the specimen to resolve any possible doubt about the identification and thereby provide absolute verification of a new State record for a species of damselfly. Surprisingly, this specimen was collected near Gate 3 amid a completely dried-up Typha stand at GJ. The date was the 25th of June.

Sympetrum is quite another matter. In general, I followed appendixes 1 and 2 of Dr.T.Donnelly's The Dragonflies and Damselflies of NY, a MS (prepared for the 1998 Int. Congress of Odonatology). So, if the male (specimen) in hand had a white (or pale/translucent) face, I gave it the name of obtrusum. Note that Dr. Donnelly reports that internum, contrary to much of the older literature reports, has a brown face in the East, not cherry-red. Unfortunately facial colors fade after treatment in acetone and I neglected to record the facial color of all the Sympetrum I collected **before** (became aware of this issue paper. Furthermore, I have made no effort to distinguish danae and internum as distinct species, but have listed both names together in the odonate tables. Two female meadowhawks have vulvar laminae that seem to fit rubicundulum, hence I have tentatively included that species. At best, the rubicundulum, internum, danae, and obtrusum determinations are daunting and I would like to have all my records of this genus verified by experts. Which and, if ever, possible. I feel that all the meadowhawks with the type of facial pattern described by Dr. Donnelly (above) are obtrusum.

I feel that my records of Leucorrhinia are indisputable. The species is exceedingly easy to identify

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seen in the field. Dr Carle reported one previous site for this species in Vt. but provided no details (in the unpublished report mentioned above). Moracovit, Westfall and May, 1996, do **not** include Vt. as a state from which sulphile has been reported. In any case, the records for sulphile reported here would at least be the 2nd and 3rd for the State. It is puzzling as to why this obvious species has not been reported more frequently; is it a new "immigrant" into the area? (Note: I several years ago also reported Hetaerina americana in Chittenden County, heretofore unknown from the State). I wonder if some odonate species are using the Champlain Valley as a relatively recent avenue of entry into the State (considering global warming, etc?). Since Dr. Carle worked in Chittenden County actively studying odonates a number of years ago, it seems highly unlikely that such a conspicuous species would have been over-looked.

lepidoptera-of those species I've listed only Phyciodes spp (the crescents) and possibly some of the female skippers pose any significant problems in identification. With the former, the question is always whether there are one or two species in this area (tharos and/or a closely related species variously named as selenis, or cocyta, depending on the authority). Even though female crescents (of these two species) are almost impossible to identify, the male voucher specimens I collected all had the antennal and other characteristics of cocyta, the Northern Crescent. They are reported under that name. One very large female taken near Gate 3 at CJ resembled typical tharos. My guess is that both tharos and cocyta occur, at least at CJ but only a careful long-range field study will adequately elucidate that problem.

I checked several recent sources to resolve the question of the correct determination of the **females** of the Dun Skipper (Euphyes vestris) versus the Northern Broken-dash (Wallengrenia egeremet), two members of the notoriously difficult (to identify) so-called "black witch" trio.

I also made no attempt to address the question of the species problem of the Spring Azure. I **saw no specimens that could be assigned to Celastrina neglecta** or the unnamed entity, the so-called Cherry Gall Azure. A detailed study of many more specimens (including possibly DNA data) would be needed to clarify these issues. Given that the dates for Celastrina are fairly widespread in this study, at least two species of Celastrina might be present, perhaps even three. I have only reported one species here, following a conservative approach, adopted by most authorities to date.

However, despite all the above highly specialized taxonomic issues, most species of butterflies can be readily easily identified in the field, perhaps even at a glance and certainly if close-focusing binoculars are present. Specimens in those butterfly taxa mentioned above, however, would generally have to be netted and/or prepared as voucher specimens, to properly identify.

I followed the names and the order of names, listed by Layberry et al (The Butterflies of Canada, Univ. Toronto P., 280 pp., 1998). This is perhaps the best book available that discusses the butterfly fauna of this region with respect to essentially all issues of taxonomy, biology, and conservation.

Mr. Scott Griggs kindly provided his limited records of butterflies for my use. He did report one species from EAFR that I did not find, the Black Swallowtail, Papilio polyxenes.

Results:

The lists of species, are essentially contained within the list of species in tables 1,2,3, and 4, coupled with many further details of behavior and natural history recorded in Appendix I.

To summarize (I use CJ for Camp Johnson and EAFR for the Ethan Allen Firing Range):

A. **Lepidoptera**:

A total of 49 butterfly species were recorded at **both** bases: 37 at CJ and 41 at EAFR. A simple comparison of faunal similarity showed the bases had 29 species or roughly 58% in common. With more collecting, these differences would probably be less (Tables 1 and 2 and Appendix).

The most notable records were:

1. **Butterflies**-At Camp Johnson, a population of both the Delaware Skipper and the Appalachian Brown were located along the Sunderland Brook area of the Natural Area. Both of these species are relatively rare, though neither are on the natural heritage list above). Also, one specimen of the Bronze Copper was located along the same brook and another was recorded at EAFR.

At EAFR I recorded the Silver-bordered Fritillary at one locale only(Otter Bog). Also the Harvester was recorded at EAFR (see table 2).

There was a general absence of hairstreaks and no 2nd brood of the Mustard White was seen, probably attributable to the very dry conditions. Also, a butterfly that one would normally expect, the Aphrodite, was **never** recorded.

The total number of butterfly species known from the State, including obvious vagrants, is approximately 98 spp. Thus, it seems that the butterfly fauna at both bases was somewhat depauperate. However, some relatively uncommon species were located, **all in wet lands**.

2. **moths**

Despite only a "part-time", but very intense effort, 93 species of moths, mostly "macros" and mostly Noctuidae (43 or 47.3%) were taken. I thought this was a rather surprising number for the limited collecting I did. Prolonged efforts, over several years, at many sites in the northeast would produce some 400-500 species and probably 250 species of Noctuidae. It seems to me that the biodiversity of moths at the EAFR site is relatively high. I only, incidentally, collected macro-moths that I didn't immediately recognize. Thus some of the more common species are not listed (Table 4).

I compared my butterfly results with the only other lists I know of from either area, namely the(unedited) report of Dr. John Grehan entitled "Insect Survey at Camp Johnson" (Colchester, Vermont). Ms,8 pp. He lists three species of butterflies that I did not record at CJ:Hesperia leonardus, Feniseca tarquinius, the Harvester, and a hairstreak, Satyrium liparops. No further information was given. Thus the combined total of butterfly species with this report would be 40 spp. at CJ.

3. **Odonata**

A total of 56 species is reported from both bases each with 39 species (Table 3). The two bases had 28/56 or 48% of the species in common. The similarity in fauna with both the butterflies and odonates between the two bases is interesting. Roughly, each taxon had about 50% in common between the two bases. This may merely be a statistical artifact of sampling effort although the total number of days spent at each base in collecting was the **same** for both butterflies and odonates at each base but differed between bases (9 at CJ and 10 at EAFR). Given the relatively greater size of the EAFR and variety of possible wetland habitats, I am surprised that both bases had the same number of odonate species. I would have expected proportionately more at EAFR, especially since Lee Brook is relatively large and runs most of the length of the area. Even though not many species were taken in the pitch-pine/oak woodland, this area was obviously a very important place in the early spring for several odonates to rest. Euphaea, e.g., was taken in relatively good numbers there.

As discussed above, I recorded two species of damselflies of considerable interest: one was the possible new state record of Enallagma carunculatum. The other was the three site records of Lestes dryas which had only been reported once before from the State (in Carle's list). At CJ this latter species was taken at a marsh that dried-up as the season progressed. At EAFR it was recorded at both IB and at a large pond in the northwest of Cushing Hill (see the Appendix).

Carle's 1994 report lists 80 species of odonates with records in the State;39 of these were gomphids. Since gomphids are primarily stream species and, say, 5 gomphid species are deducted from the known State list, a large area **without** many streams would probably yield some 56 species. The 56 species reported here comes remarkably close to that number. I did very little sampling along streams, both because there was few of them on either base. In addition, most of the length of Lee Brook was not accessible for observation. However, I did check one accessible site by a bridge over that stream many times but **never** saw a gomphid. I think that suggests that the species list of odonates is fairly complete, as compared to the **known** list of species from the State. Any further work in canvassing odonates at the two bases should probably concentrate on the stream habitats and, possibly, at least with some effort in late March to April, to see whether Williamsonia might be present. Ultimately, surveys of larvae would be absolutely necessary to ultimately determine which species actually reproduce in any habitat.

I believe the data suggests that Sunderland Brook is a very important natural area in need of continued protection. It also reaffirms the importance of Otter Brook. However, I strongly feel (for reasons indicated in the Appendix,) that several other areas, heretofore not recognized, deserve equal consideration for protection with the pitch-pine/oak woodland, Sunderland Brook, and Otter Brook. **The Cushing Hill pond site is, I feel, the one new site deserving of greatest protection.**

Table 1. Butterflies and skippers of Camp Johnson, Colchester, Vt., recorded during the field season of 1999. *

collection dates	IV	12V	8 VI	29 VI	30 VI	19VIII	25 VIII
Papilionidae-swallowtails							
Canadian s.			x				
Pieridae-whites and sulfurs							
cabbage white	x	x	x	x	x	x	x
Clouded S. (*philodice*)			x	x	x	x	x
Orange S.			x				
Lycaenidae-harvesters, coppers, hairstreaks and blues							
Ani. copper						v	
bronze copper						x	
E. pine elfin	x	v					
e-tailed blue						x	
spring azure	x	x		v	x	v	
Nymphalidae-brush-footed b.: fritillaries, crescents, anglewings, crescents.admirals and wood-nymphs							
great spangled f					x	x	x
meadow f.			?				
Harris's checkerspot			v				
pearl crescent				v			
northern crescent			v				
Question mark			x				
grey comma		v					
Milbert's t.			x				
white admiral		?	x				
viceroy			x				
N. pearly eye				x			x
eyed brown					x		
Appalachian brown					v		
little wood satyr			x				
Common ringlet			v			x	x
Danainae-Milkweed butterflies							
monarch						x	

Table 1. Butterflies and skippers of Camp Johnson, Colchester, Vt., recorded during the field season of 1999 (cont.)

collection dates	IV	12V	8 VI	29 VI	30 VI	19VIII	25 VIII
Hesperidae-Skippers							
Pyrginae-Pyrgine skippers							
silver-spotted s.			?		x	x	
Northern cloudywing			v				
dreamy duskywing	?	v	x				
juvenal's duskwing		v	v				
Hesperiinae-Branded skippers							
species unknown					x		
least skipper			v				x
European s.			x	x	v		
long dash				x	x		
n. broken dash				v			
Delaware s.			x	v	x		
dun s.				v	x		
hobomok s.			v				
species totals	4	7	21	10	12	10	6

* v=voucher specimen, x=field record (seen, netted, and/or photographed), ?= almost certain of species or genus but not netted for full verification (see text).

Total number of species recorded at CJ= 57.
Total number of species at CJ and EAFR= 49
Total number of species in common at both sites= 28 or 28/49= 58.3 %

Table 2. Butterflies and skippers of Ethan Allen Firing Range, Jericho, Vt., recorded during the field season of 1999.*

collection dates	23IV	13V	9VI	10VI	30VI	1VII	19VIII	20VIII	25VIII	28IX
Papilionidae-swallowtails										
Black Swallowtail	(reported by Mr Scott Griggs-slight record-no data available)									
E. tiger s.					.....			?		
Canadian s.		v,ob	v	x	...x...	x				
Pieridae-whites and sulfurs										
mustard white		x	?		.....					
cabbage white					...x..			oo	x	x
Clouded S. (*philodice*)					.....		...x	x	x	v
Orange S.					.....		...x	x		x
Lycaenidae-harvester, coppers, hairstreaks and blues										
harvester					.....				v	
bronze copper					.....				x	
Satyrium sp.					.....	?				
E. pine elfin		v			.....					
g-tailed blue					.....		v	x		
spring azure		ob			...x..	oo				
Nymphalidae-brush-footed b.: fritillaries, crescents, anglewings, crescents,admirals and wood-nymphs										
great spangled f.					...x..	x		oc	x	v
atlantis f.				ob,v	.....	ob	x	oo		
silver-bordered f.					.....			oo		
Hams's checkerspot				ob	.....					
northern crescent			x	x	...x..	x	v	x	v	
Question mark					.....		x	x	x	
e. comma or hop m.					.....			v	x	
old anglewing	x				.....					
grey comma					.....	? ob		v	x	
mourning cloak					.....		x	x	x	x
Milbert's t.				x	.....					
Vanessa sp. (re cardui?)					.....					x
American lady				x	.....		x			
white admiral			x	x	...x.		x	x	x	
N. pearly eye					...x...					
eyed brown					.....	v,ob				
little wood satyr			x	x	.....					
common ringlet			x	ob	.....	x	x	x		

Table 2. Butterflies and skippers of Ethan Allen Firing Range, Jericho, Vt., recorded during the field season of 1999. *

collection dates	23IV	13V	9VI	10VI	30VI	1VII	19VIII	20VIII	26VIII	29IX
Danainae-Milkweed butterflies										
monarch									x	ob
Hesperidae-Skippers										
Pyrginae-Pyrgine skippers										
Northern cloudywing				v						
dreamy duskywing		x		x						
juvenal's duskwing				v						
Hesperiinae-Branded skippers										
least skipper									?	
European s.					x	x				
long dash				v	x	ob				
tawny-edged s.				x						
n. broken dash						v				
dun s.				x		x				
hobomok s.				v						
species totals	1	5	6	16	9	13	10	15	13	7

* v=voucher specimen, x=field record (seen, netted, and/or photographed), ?= almost certain of species or genus but not netted for full verification (see text).

Total number of species recorded at EAFR= 41
Total number of species at CJ and EAFR= 49
Total number of species in common at both sites=58.3 %

Total number of species recorded from Otter Bog= 11

Table 3. Preliminary List of Odonata of Camp Johnson and Ethan Allen Firing Range, Chittenden Co., Vt. *

Calopterygidae-BROAD-WINGED DAMSELS

Calopteryx aequabilis	C	
C. maculata	C E	

Lestidae-SPREADWINGS

Lestes congener	C E	
L. disjunctus	C E	Other Bog
L. unguiculatus	C	Other Bog
L. australis	C E	New or (?) second state record. Other Bog
L. forcipatus	C	
L. rectangularis	C E	

Coenagrionidae-POND DAMSELS

Argia fumipennis violacea	C	
Chromagrion conditum	C	
Coenagrion resolutum	C E	Other Bog
E. aspersum	C E	
E. boreale	C E	
E. carunculatum	C	New state record. If identification is verified.
E. civile	C	
E. cyathigerum/annexum	C	
E. ebrium	C E	Other Bog
E. hageni	C E	Other Bog
Ischnura posita	C E	
I. verticalis	C E	Other Bog
Nehalennia irene	C E	Other Bog

Aeshidae-DARNERS

Boyeria sp.	C	
Aeshna canadensis	C E	Other Bog
A. eremita	E	
A. interrupta	E	Other Bog
A. tuberculifera	E	Upland clearing just west of Other Bog
A. umbrosa	C E	Other Bog
Basiaeschna janata	C E	Other Bog

Gomphidae-CLUBTAILS

Arigomphus furcifer	C E	
Gomphus borealis	E	
G. descriptus	E	
G. exilis	C E	
G. vastus	C E	
Ophiogomphus rupinsulensis	C	

Cordulegastridae-SPIKETAILS

Cordulegaster diastatops	E	
C. maculata	E	Other Bog

Corduliidae-EMERALDS

Cordulia shurtleffi	C E	Other Bog
Dorocordulia libera	C	
D. lepida	E	
Epitheca cynosura	C E	Other Bog
Somatochlora sp.	E	Other Bog (definitely a species of the genus; unable to be more precise right now)

Table 3. Preliminary List of Odonata of Camp Johnson and Ethan Allen Firing Range, Chittenden Co., Vt.

Libellulidae-SKIMMERS

Erythemis simplicollis ✓	C	
Leucorrhinia frigida	C E	Otter Bog
L. hudsonica	E	
L. intacta	C	
L. proxima	C E	Otter Bog
Libellula julia	C E	Otter Bog
L. lucrosa ✓	C E	Otter Bog
L. pulc	C	
L. pulchella ✓	C E	
L. quadrimaculata	C E	Otter Bog
S. internum/illotum	C E	Otter Bog
S. obtrusum	C E	
S. rubicundulum	C	
S. semicinctum	C E	
S. vicinum ✓	C E	Otter Bog

*Note:C=Camp Johnson and E=Ethan Allen Firing Range records, respectively.

Nomenclature follows the OSA (DragonflySociety of the America's) List of Aug. 1996 published in Argia Vol.8,no.2:1 (see discussion).

Summary: Total number of species reported: 59 both localities (each locale had a total of 39 with 26 species 2%/ 59= 46.4% common to both.

27 species were recorded from Otter Bog proper, that is, either over the bog or the immediately adjacent shrubby area (within a few meters of the edge of the bog).

Table 4. Moths of the Ethan Allen Firing Range, Jericho, Vt., primarily taken at white lights, outside the BOQ facility, during the summer of 1999.

Sesiidae-Clear-winged moths

Synanthedon acerni (Clem.)

Cossidae-Carpenterworms

Acossus centerensis (Lint.)

Pyralidae-Webworms, pyralids

Agriphila vulgivagella (Clem.)
Tetralopha melanogrammos Zell.

Geometridae-Inchworms, looper moths, geometrids

Biston betularia (L.)
Campaea perlata (Gn.)
Cepphis armataria (H.-S.)
Ennomos magnaria Gn.
Epirrhoe alternata (Müller)
Eubaphe meridiana (Wlk.) (not at lights: [illegible] edge of [illegible] of Otter Bog, [illegible])
Euchlaena serrata (Drury)
Euphyia unangulata intermedia (Gn.)
Eutrapela clemataria (J.E.Smith)
Heterophleps triguttaria H.-S. (not at lights-in mesic woodland at Castle Rock)
Hethemia pistasciaria (Gn.)
Hydrelia [illegible] (Wlk.)
Hypagyrtis unipunctata (Haw.)
Lambdina fiscellaria (Gn.)
[illegible] (J.E.Smith)
[illegible] Gn.

Thyatiridae-Thyatirids

Habrosyne scripta (Grote)

Notodontidae-Prominents

Heterocampa guttivitta (Wlk.)
Macrurocampa marthesia (Cram.)
Oligocentria semirufescens (Wlk.)
Peridea basitriens (Wlk.)
P. ferruginea (Pack.)
Pheosia rimosa Pack.
Schizura leptinoides (Grt.)
Symmerista nr. *albifrons*?

Sphingidae-Sphinx moths

Ceratomia undulosa (Wlk.)
Darapsa myron (Cram.)
Hemaris thysbe (F.) not at lights, seen nectaring at Otter Bog
Lapara bombycoides Wlk.
Pachysphinx modesta (Harr.)
Paonias myops (J.E.Smith)
Sphinx kalmiae (J.E.Smith)

Arctiidae-Tiger, lichen and wasp moths

Cisseps fulvicollis (Hbn.)
Ctenucha virginica (Esper)
Holomelina laeta (Guér.)
Hypoprepia fucosa Hbn.
Lophocampa caryae Harr.
Pyrrharctia isabella (J.E.Smith) not at lights; caterpillar (woolly bear) seen on roads in [illegible]

Table 4. Moths of the Ethan Allen Firing Range, Jericho, Vt., primarily taken at white lights, outside the BOQ facility, during the summer of 1999 (cont.).*

Lymantriidae-Tussock moths

Dasychira vagans (B.&McD.)
Orgyia antiqua (L.)
O. definita Pack.

Saturniidae- Giant Silkworm moths

Actias luna (L.)
Antheraea polyphemus (Cram.)
Dryocampa rubicunda (F.)
Hyalophora cecropia (L.)

Noctuidae-Owlet or noctuid moths

Acronicta americana (Harr.)
A. hasta Gn.
A. increta Morr.
A. innotata Gn.
Anathix puta (G.&R.)
A. ralla (G.&R.)
Autographa ampla (Wlk.)
Allagrapha aerea (Hbn.)
Baileya doubledayi (Gn.)
Bomolocha deceptalis (Wlk.)
Colocasia propinquilinea (Gn.)
Catocala cerogama Gn.
C. relicta Wlk.
C. neogama (J.E.Smith)
Cerma cerintha (Tr.)
Charadra deridens (Gn.)
Eosphoropteryx thyatyroides (Gn.)
Eudryas grata (F.)
Euclidea cuspidea (Hbn.)
Feltia herilis (Grt.)
F. jaculifera (Gn.)
Hapsa confusa (Lyman)
Hyppa xylinoides (Gn.)
Lacanobia lutra (Gn.)
Lithophane innominata (Sm.)
L. petulca ?Grt.
Melanchra adjuncta (Gn.)
Noctua pronuba (L.)
Ochropleura plecta L.
Oligia semicana (Sm.)
Orthodes cynica Gn.
Papaipema [illegible] (Lyman)
P. pterisii Bird
Phlogophora iris Gn.
P. periculosa Gn.
Plusia putnami Gn.
Polia nimbosa (Gn.)
P. purpurissata (Grt.)
[illegible] (Wlk.)
Raphia frater Grt.
Spaelotis clandestina (Harr.)
Sunira bicolorago (Gn.)
Xestia adela Franc.
X. smithii (Snell.)

* Voucher specimens prepared for **all** but those in bold face type which were identified in the field.
Total number of species: 87. (45 or 47.3% were noctuidae)

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Appendix I. General chronology of field work at Camp Johnson and Ethan Allen Firing Range during the field season of 1999-with annotated remarks.

(text is purposely written in a cryptic style for the purposes of brevity and the emphasis is on highly selected information, not a detailed account of all observations and localities)

Locality codes: CJ=Camp Johnson, E=Ethan Allen Firing Range, NA=the Natural Area at Camp Johnson and OB=Otter Bog. Faunal codes:O=odonata, B=butterflies.

23 April (CJ,E)

General reconnaissance of both areas with Mike O'Hara. Cool but bit anglewing (Polygonia sp.) of season seen at SE corner of E.

1 May (CJ)

Brief visits to the NA and nearby ruderal fields during and after the Sand Plains Conference. The small marsh s. of access road to NA was fairly full of water, perhaps 30 cm or so.

12 May (CJ)

O-I Ischnura common throughout woodland area, many seemed to be teneras (not yet hardened). Several E. cara males in woodland. Appeared to be resting while their cuticles hardened-very fresh.

B-Erynnis spp. "all over", there were mostly juvenalis and fewer lucilius.

13 May (E)

Walked around OB.

O-An obvious mass emergence (exclusion) of some odonates was occurring. These appeared to be mostly Libellula julia, many of which flew up into the mass as I approached. Many were (still) teneras. Also, there were tens, if not hundreds -of an unl Lestes species emerging all over the area.

B-Saw first **Canadian Swallowtail** of season-seemed a bit early. Also encountered, almost by chance, one somewhat worn Mustard White male (spring form) about 200 meters south of the entrance gate on the n. side. It appears that the spring brood had been flying for about week or so already in the area. It is notable that I recorded only one other individual of this species at E during the remainder of the season; that is, absolutely none of the summer brood were seen. Because of the extremely dry conditions, I strongly suspect that the summer brood stages before the imago are continuing to diapause, probably until 2000. This phenomenon (of missing a year of emergence) has been reported in other periods. No napi were ever seen at CJ. My guess is that it isn't there.

6 VI (CJ)

Checked the NA and the adjacent ruderal areas. Many dead and dying and decaying tadpoles (probably Rana sylvatica) in the drying marsh of the NA. Enormous numbers of aeshids in the fields.

O-Saw the first Lestes eurinus in the drying marsh s. of the access rd. to the NA. Several other spp. of odonates were flying over the marsh, despite the obvious drawdown of the water and the hot conditions.

B-Recorded the greatest number (21) of species for any date at either locale during the season. Amazingly there was even a **Least Skipper** at an almost completely dry and small cattail stand in the open ruderal area. Very little evidence of available nectiverous plants. I vaguely remember seeing the **Arctic Skipper** along the RSW but I can find no record in my notes; hence I decided to omit any reference to the species in the Tables (1 and 2). Erynnis juvenalis still fairly common in the general NA and even in the open ruderal. A few sylvia were present but definitely in the minority. The pitch-pine/oak community seems ideal for juvenalis.

9 VI (E)

Quite a few moths at the white lights of the BBQ. I checked the lights in the very early AM. It was fairly overcast and cool. It rained very heavily at dusk of the 8th and was generally quiet during most of the 8th.

O-I recorded four spp. of zygoptera but only one anisoptera, Libellula julia. Does this mean that the former are more able to be active at lower temperatures? And that julia is more tolerant of, or adapted to, low temperatures than most other libellulids?

B-Very little activity in the field. The first butterfly wasn't seen until 1240 hrs. However, since moths were not fairly encountered most of the day. It seems that moths are much more active in cool rather than warm days, during the daylight hours. It is almost as if they are reflecting, work-wise, the butterflies during these cooler daytime periods.

I glimpsed what I was quite sure a **napi** along a woodland edge. I recorded this in table 2 as ?.

10 VI (E)

Moth activity really picked up-checked lights at 0020 and 0545. Went to OB and surrounding area in the AM, + the PM I went to the Crushing Hill area, in the NE sector of the E and briefly checked the general area, especially at the large drying pond near the old gravel pit but also a small beaver pond to the NE-the latter seemed to be at normal water levels and there was considerable odonate activity around it. Chrysops spp. were abundant and vicious.

O-I took two spp. of Corduliegaster: today dasteocos at the small beaver pond and maculata at OB. The most interesting observation was that of some 15 individuals of Gomphaes, nested along the roads to the west of OB.

All were female **borealis**! I never saw a male. They appeared to be basking in the sun along the banks as they rested on the ground. I **recorded two more (State) sites for Lestes eurinus**. DB and a small beaver pond east of Gushing Hill. To my eye, this beaver pond looked quite like the myriad others that I have observed, yet two very interesting species were found there: dilatanops an eurinus.

B recorded the only site for the **N. Cloudywing** at E for the season-several were along the same woodland roads as where the gomphid females were observed. I also saw my 1st Spicauda atlantis of the season. Scott Gritzka had seen this species on 7 VI, so, apparently, the flight season had just begun during the 1st week of June. This seems a bit early to me. Overall, 18 spp. of butterflies were recorded at E for this date, the highest number for any date at E.
29 VI (CJ)

Exceedingly dry in the area. I checked the upland NW woods again, the ruderal area, and then walked down the ROW to the stream valley of Sunderland Brook.

6-Many Calopteryx maculata along the ROW, especially along the lower and more mesic section near the stream.

B-1st **Delaware Skipper** of year. A very bright and obviously recently eclosed individual. And a most pleasant discovery of this beautiful animal. One of ten species recorded, a considerable drop from the 21 spp. at the start of the month of June. Asclepias was in bloom along the brook, providing some nectar. **Meadow eyed-brown** was seen for the 1st time, more or less on schedule, in my experience. This was along the stream amid the high and lush grasses.
30 VI (CJ and E)

I observed the entire reach from the E side of the NA west to the ROW, down along the string of beaver ponds and the extremely lush vegetation of the stream floodplain. In the PM, I went over to E and checked several sites in the Diligat road areas, including the most northern of the beaver ponds in the valley to the nw of the road. And, in the late part of the PM, I went back to the pond area near Gushing Hill.

B-took first damsel of the season, a female several of Lestes eurinus along the ROW, perched in the dense forbs half-way up the inclining slope S. of Sunderland Br. I saw but could not nail an LBD odonate in the brook area. It appeared to be a Libellula but not one that I could ID under the prevailing circumstances.

At E I saw my 2nd Asterias sp. of the season, a male, fully nuptial pruinosus, that was flying low over the high vegetation in the valley beaver pond area. It was bending its posterior ventrally and anteriorly as it flew; I assume it must have been transferring sperm to its 2nd genitalia.

I also recorded several C. aequabilis along Sunderland Brook, in the open. It seemed to be sympatric with maculata although the latter also occurs in more shady sites. This was the only record for the former species at either locale (CJ or E). Sunderland Brook, especially in the more open areas, seems also to be an ideal habitat for Helocordulia americana which I had taken at Lewis Brook several yrs ago, the 1st record for the State. It emerges in the flight period later than aequabilis or maculata. It may still be found at the CJ Natural Area along Sunderland Brook.

B-I was extremely pleased to find apparent breeding populations of the **Delaware Skipper** and the **Appalachian Brown** along Sunderland Brook, the latter near the ecotone edge and primarily in the adjacent mesic deciduous upland where there was fairly dense shrub cover. The former was generally distributed along the floodplain of the Brook in the open grassy areas and was actively nectaring on Asclepias and other flowering species. I never saw the Appalachian Brown nectaring. The **Meadow-eyed Brown** was also present, more or less, in the open flood plain meadow. That these two species of Satyrodes, though seemingly sympatric in a geographic sense, were actually ecologically allopatric. This site would be an ideal location to study the comparative ecology, behavior, and life history of the two spp. (appalachia and eurydice). It is **extremely easy** to overlook the Appalachian Brown since it is superficially so similar to its congeneric relative. Any Satyrodes sp. that flies well into a woodland from an edge should be checked to see if it might be appalachia. Alternatively, some eurydice are quite dark, like appalachia-in this color pattern **should not be relied on** to distinguish between the two species in the field or laboratory. The hindwing pattern must be checked.

There was a species of hesperiid skipper nectaring on a flower on the floodplain that I was sure was a species new to this record. However, I did not net it not one it well enough to ID in the field. I do have a photograph, however, albeit not an excellent one from which I hope to render a positive determination. It definitely was not one that I was readily familiar with. Alas, there is no voucher specimen. I did record it as a distinct species for the record (Table 2).

B ALE were very few! I did however see very fresh and active **N.Pearly Eyes** the open pine woods just east of the beaver dam complex. They are arguably the one butterfly most adapted to strict woodland conditions (as opposed to clearings in woodlands) of any of our **native** species and always a delight to watch.
1 July (B)

I checked the BOG trp again in the early evening and again at 0351 (since some moth spp. are known

CSB

Appendix I (cont.)

only to fly extremely late in the "evening" or "early" in the morning. To date, I've seen no live eburneks although there were remains of the wings of a pelidnensis beneath the BOD lights, my 1st eburnid record. Today, I and Mike O'Hara went around 08. Later, I briefly reconnoitered the nearby upland dirt roads. After Brett E. and I went to the Castle Rock area. There I saw several and collected one interesting small geometer that I had never seen before, Heterophleps triguttata. Covell (1984) reported that this species feeds on maples and that it is "locally common". There were several flying about the herbaceous layer in the area, presumably searching for maple seedlings on which to deposit ova.

0-I collected one individual (Bombylius sp.) where I had previously collected (10 VI) and seen all the female karnella; thus, I assumed this was the same species. It was, however, B. descriptus. Without a voucher specimen to confirm the identification, I probably would have mistakenly assumed it was karnella.

8- The **Atlantis Fritillary** was still quite in evidence but at much lower relative densities than the last visit to 08 (10 VI). The **Meadow-eyed Brown**, though,was at or near peak density. I made a specific point of looking for appalachia, especially among any Satyrodes that flew into or along the woodland edge. All I checked were eurydice.

While with Brett Engstrom at Castle Rock, I saw two hairstreaks chasing each other, either a courtship flight or two males interacting. They were almost certainly a sp. of Satyrium but I could not nail them to verify. Nevertheless, these were the first (and only) hairstreaks I saw all season (Scott Griggs, however, reported he had seen the genus no doubt are currently available). In general, I'm amazed by the **general absence of most hairstreaks** throughout the entire region; that is, anywhere where I've been this season in VI. This is probably directly related to the extremely dry season.

There were one or ten individuals of Polygonia sp. in the same area but I couldn't net them. I thought their outer wing border resembled faunus but I wasn't positive. I never recorded hylas all summer at either C-I or E. If it is present, it would be in cooler, mesic woodland habitats where its food plant (Ribes) occurs. I checked the Dilligaf road area, and nearby upland, very closely for this species, but never found it. Unfortunately, anglewings are notoriously difficult to find and a less common species can easily be overlooked among the more common progne and comma. Faunus undoubtedly occurs at the highest elevations of E. west of the Long Trail.

2 July

I collected moths at night (both the evening of the 1st and AM of the 2nd). There were no eburnids but I took the first Sphinx kalmiae of the season. Paonias myops was still present in good numbers. I checked the lights early in the evening of the 1st and during 0215 to 0240 of the 2nd.

19 Aug. (C-I,E) I

The small marsh s.of the access road to the NA was complete dry. I again surveyed most of the same stretch of Sunderland Brook that I had traversed before (29 June). I was particularly anxious to see if the **Delaware Skipper** was still flying. In the PM I returned to the Cushing Hill area to survey the large northern pond.

0-At C-I, amazingly, there were several Aeshna spp. cruising low over the vegetation of the dried-up marsh. And, even more remarkable, one female Anax junius was crawling up the grass-stem in the marsh even though **no** surface standing water was apparent. Where had this individual spent its past few days as a last-instar larva? At the Cushing Hill large pond, I recorded 13 species of odonates. This is equal to the max. number collected in one day at 08, on 19VI. But, the early June date for 08 was during the period when odonate activity was close to peak.

B-I saw no **Delaware Skipper** nor either species of Satyrodes, along Sunderland Br. which was expected. Hardly any flowers were in bloom that appeared suitable as nectar sources; only a few Solidago. I did see, netted and released a single **Bronze Copper** (I later recorded a 2nd specimen on 29 Aug. at a beaver pond in the valley w. of Dilligaf Road). Only these ten individuals were recorded all season. The Least Skipper seemed quite abundant amid the grasses of the floodplain of Sunderland Brook.

29 Aug. (E)

I again checked the CB area and Dilligaf Road.

0-Saw three species of Aeshna but no evening. at 08. I surveyed a small beaver pond just west of Dilligaf road and found a lot o f odonate activity. The water level here was high, barely below the top of the dam bordering its north side. I think that is testimony to the importance of the beaver in shaping this wetland lentic ecosystems. In effect, even during a drought, a lot of ponds have ample water, all because of this keystone mammal which now is all too often regarded as a nuisance species because of its propensity for damming culverts. If there ever was a temperate/boreal forest keystone species, this is it.

I took a remarkably marked male Ischnura verticalis at a small pool just east of the lower Wing Ranch, west of the Dilligaf road area. It had the thoracic antehumeral stripe marking of posita but it was a verticalis, based on the fact that it had the classic terminal appendages of verticalis. According to Westfall and May (1996), such marked individuals of verticalis are very unusual, that is, with respect to the antehumeral stripe (to quote from p. 451)- "rarely divided as in posita". If I hadn't collected and closely examined this specimen, I would have undoubtedly recorded it as posita.

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Appendix I (cont.)

B-Four spp. of B were recorded at OB, including a very fresh B. selene. About the Dilligat road area, Polygonia numbers were low. I saw no more than 5 individuals; three spp. were identified among this low number, yielding interestingly, a rather high species/total number ratio. The presence of B. selene at the OB is of no small moment because, although it still seems fairly common in Vt. at appropriate wetland sites, it has almost completely disappeared from much of its former range around the New York City metropolitan area, up to at least 150 km or more from the city, not just in its immediate environs. The reasons are not at all clear since much of its habitat still seems relatively intact. Otter Bog was the **only** site where this species was observed at either military base. This population probably needs to be monitored during its presumed flight season (mid-June into July, in Canada).

I briefly viewed a large yellow Papilio along Dilligat road. It was almost certainly glaucus, the **Tiger Swallowtail** and I have recorded it as such (Table 2). It appears to be **much too late** in the season for the single-brooded canadensis to be flying. However, there is an interesting problem here that needs further study. Does glaucus occur in the area as a breeding species or do records such as this represent individuals that have strayed northward?

28 Aug. (CJ)

I spent the PM at three sites, the drying marsh and adjacent areas near the ordnance storage units, the ROW area down to Sunderland Brook, and I walked across the entire deciduous woodland of the NA, east to the ROW adjacent to the extensive urban development. While walking up and down the series of low ridges, I was amazed to discover a population of some 15-20 adult Rana clamitans in a seepy/spring area along one of the paths.

O-I was surprised to see a lone Erythemis perched on Rubus sp. at the very dry ROW. I identified it as [illegible]-my only record of this species for either base.

I later saw several Aeshna and perhaps one or two individuals of a Boyeria sp. coursing low along Sunderland Brook just east of where the ROW crosses. Unfortunately, I could net neither; although I'm certain that one was Boyeria, my only record of this genus for either area. One must envy botanists in such situations.

B-Only five spp. were recorded, including the **Gr.Spangled F.** which seems to be common along the valley of Sunderland Br. I also saw well an unusually marked **Viceroy**. It had an extremely reduced almost 90% gone, post-medial black line on its dorsal hind wing surface. Superficially, to the casual eye, it looked like a Monarch. I did not collect the specimen. The individual was somewhat worn suggesting it had been flying for a week or more but I don't believe that was why the hindwing markings were reduced. One can't help but speculate that natural selection might favor such individuals of viceroys if they are truly Batesian **mimics** of the monarch. However some authorities think that the Monarch may be the mimic of the Viceroy and not vice-versa, contrary to almost all the lit. on the subject.

I know of only one other report of such marked viceroys and that was from Thetford, Vt., years ago.

28 Aug. (E)

I checked the lights at the BOQ after dusk (of the 25th) and then again at 0215 of the 26th. I recorded my first Catocala of the year. I spent most of the day again in the Dilligat road, again with the specific goal of trying to find Polygonia spp. Also, I went back to the large pond near (northwest) of Cushing Hill in the PM.

O- I recorded A. eremita at the large (Cushing Hill) pond. This species is superficially similar to the usually more common canadensis and can be easily overlooked. I also saw a rather large feeding swarm of damsels well over the area to the west of the pond, my first real large swarm of darners for the season. This pond is undoubtedly a very important **source** site for the repopulation of odonates to the **sinks** of ephemeral ponds and shallow wetlands. In fact, I feel this pond **may rival or even exceed the value** of Otter Bog as an important wetland site of high biodiversity. It is larger, has a very extensive related undisturbed edge and is relatively remote. There is an extremely nice esker coursing through the area that, in part, divides the pond into two discrete areas (this is not apparent on the topographic maps). In short, it, too, seems well worth protecting. One possible threat, to both the pond and the esker, is the utilization of the gravel of the esker for road construction. Currently, there are signs of active "mining" just south of the south edge of the pond. I feel this should operation should be discontinued. It is to the credit, however, of the management of this significant natural resource at E that this pond is still largely undisturbed by anthropogenic activities. However, the "mining" operation at the south end of the pond does pose a rather significant potential threat to the ecosystem.

This esker that runs through the north end of the pond is one of the finest examples of any that I have ever seen.

(*)The unnamed pond, which I have constantly referred to above as "the Cushing Hill pond", is located east of the Helicopter Landing zone in Underhill Twp. as depicted on Sheet 5475 IV, series V713 edition DMATC for Camel's Hump. Most startling, this pond is **not** listed in Brett Engstrom's Dec. 1987 report entitled, "Field Survey for Rare, Threatened, and Endangered Plants, and Significant Natural Communities, at the Ethan Allen firing Range, Jericho Vermont," nor is it listed in Christopher Bramlett's [illegible]

Appendix I (cont.)

28 Feb. 1989 report on "sites of outstanding ecological significance on the Ethan Allen Firing Range." I feel that the rationale for identifying sites in both of these reports is **primarily** based more on specific taxa/plants (alpha diversity) rather than other biotic/abiotic criteria especially those above the species level (e.g. ecosystems). Clearly an area with no endangered or threatened species (although these have their own intrinsic and other values) can have a much higher level of alpha biodiversity that one with listed species. To not afford protection for the former would fly in the face of the ultimate goal in conservation biology.

To reiterate, I feel that Cushing Hill pond has been overlooked in the various reports and recommendations for protecting unique habitats at the EAFR and **should be considered as a site of great ecological significance. It should be given the highest priority for complete protection. It certainly supports a very diverse odonate population including only the third (or possibly 2nd!) site for a damselfly, Lestes eurinus, in the State.** The fact that it is at rather low elevations (where many more habitats are restricted) makes it even more critical that action be promptly taken to insure its protection. In my view, it is also and undoubtedly important source site (in the sense of metapopulation theory) for many animals and, of course, plants. Parenthetically, a similar argument could be made for the small pond west of Dillard Road. (These ponds are located east of Otter Bog and west of Meyers Dome and are not the main firing zone). The ponds are also not mentioned in either of the reports above.

I, incidentally, regularly saw relatively large flocks of wild ducks at both of these wetland locales.

The Cushing Hill pond, by comicide, is extremely significant as a unique wetland ecosystem on the EAFR. In addition, it has a completely intact geologic esker, save for some disturbance at the south end of the pond). Vehicular traffic, especially, should be completely kept off the esker.

Any protective zone around the entire pond should be extended in and beyond the eskers and the zone should be at least a 100 meters in width from the edge of the pond, around its entire circumference.

The fact that ski trails around it, in the, suggests how a military facility can be very important in the protection of critical natural resources even though the implementation of the mission of the facility imposes considerable stress on some ecosystems where the base is located. If the pond were outside the boundary of the EAFR, I'm reasonably certain it certainly would long ago have been severely degraded by anthropogenic agents. I and the adjacent watershed, including the extremely interesting esker, is a natural area of great potential for basic research and a reservoir of high biodiversity.

8-Two interesting species were taken, both the only records for either base. One was the **Bronze Copper**, a single female along the edge of a beaver meadow in the valley w. of Dillard road. The other butterfly record of great interest was that of two individuals of the (carnivorous) **Harvester** that were seen along the s. end of Dillard Rd. near aldes. This species is very moth-like in flight and can be very easily missed in the field (as a butterfly).

29 Sept. (E)

Unfortunately, this was a relatively dire day. In general there was relatively little insect activity although there were Aeshna flying along the edge of the large pond (mentioned above) near Cushing Hill. I did collect a very worn and almost dead Speyeria cybele (Great Spangled Fritillary) in a clearing west of Otter Bog. This record is extremely late for this species. As the latest records I'm aware of, for this species, are from early to mid-Sept.

With respect to Speyeria, it is remarkable to me that **not a single individual of aphrodite was seen at either** CJ or E. This is almost, in my extensive VT experience, without precedence. I did look carefully at many atlantis and examined many directly-in-hand but never found aphrodite. I don't think this was an artifact of sampling but feel that the dry conditions were somehow imposing more stress on aphrodite than on atlantis, the latter tends to fly earlier.

To conclude, this field season has been rather extraordinary. It would be most interesting to see how the year 2000 compares with this very dry season of 1999. In general, the odonates seemed to have fared better than the butterflies, if a 1st-order comparison of the species reported here, with potential State ists, is of any significance. Furthermore, the censusing of butterflies was probably more complete than that of the odonates (since the odonate larvae were not censused).

Paradoxically, although odonates require aquatic environments to complete their life cycles, they seem **less** affected by drought. I think the beaver is critical. The Cushing Hill pond showed hardly any drawdown during the summer even though many of the smaller ponds, pools, and marshes, on both bases, **completely** dried-up. Most adult butterflies require mature flowers so that they can secure nectar and pollen. The lack of sufficient nectar/pollen sources may have been one critical factor that negatively impacted the butterfly populations. Perhaps, even more importantly, the larvae of many butterfly species require fairly succulent plant tissue to complete their development. The larvae of odonates, by comparison, are strictly carnivorous. If they have standing or flowing water they probably will be able, even in years of drought, when upland communities are severely stressed, to continue and complete their metamorphoses. Hence, even during the active growing season of a drought year (for both plants and larva insects), it seems that odonate larvae, compared to butterfly larvae, on average, have a distinct advantage. I would assume, if my speculation has any merit, that this effect would result in both higher population levels and alpha diversity of adult odonates compared to adult butterflies. Such differential effects would resonate, ultimately, throughout the food webs of the ecosystems where these organisms live. Both top-down and bottom-up effects would probably pertain. Community-level studies are sorely needed to elucidate these obviously very complex effects. Accurate lists of species are a beginning in helping to understand these phenomena but higher-level (in terms of biodiversity) studies need to be implemented of relatively **intact** ecosystems.

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(The two above are "older" publications and both superb. Although dealing with Fla., the [illegible] descriptions are extremely enlightening and some of our species do occur in Fla. Dr. Dunkle's new field guide for Anisoptera was, unfortunately, not in print in time for use in this study.)

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*(I take complete responsibility for all errors of omission and commission in this entire report.)

Donald H. Miller, Box 576, Lyndonville, VT 05851; [illegible] (no email yet); 29 Dec. 1999

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MEMORANDUM OF AGREEMENT

between

VERMONT FISH AND WILDLIFE DEPARTMENT

and

VERMONT MILITARY DEPARTMENT

This Memorandum of Agreement, made and entered into by and between the Vermont Fish and Wildlife Department (hereinafter referred to as "FWD") and the Vermont Military Department (hereinafter referred to as "VMD") is for the purpose of developing and implementing a plan for the restoration and management of pine-oak-heath-sandplain habitat its constituent rare, threatened, and endangered plant species at Camp Johnson in Colchester, VT.

WHEREAS, it is the mission of FWD, acting through its Nongame & Natural Heritage Program (hereinafter referred to as "NNHP"), to identify, protect, and manage rare, threatened and endangered plant and animal species and ecologically significant natural communities in Vermont; and

WHEREAS, VMD is responsible to the "conservation, management, and restoration of land and the renewable resources that are consistent with the military mission and in consonance with national policies".

Objectives of this policy are to:

a) Develop, initiate and maintain progressive programs for land management and utilization.

b) Maintain, protect and improve the environmental qualities, aesthetic values and ecological relationships.

THEREFORE, in consideration of the above premises, the parties hereto agree as follows:

FWD, through NNHP, agrees to:

1. Organize and facilitate a steering committee for the restoration and management of sandplain habitat at Camp Johnson. This committee will recommend, approve, implement, and evaluate the components of a restoration and management plan.

2. Conduct background fire history research on Vermont sandplains, establish sandplain managment units and prepare management prescriptions for each unit, develop criteria for evaluation of management treatments, collect baseline vegetations data, and conduct management activities.

3. Collect post-treatment vegetation data and evaluate the effects of management activities.

4. Experimentally introduce rare native sandplain plant species to appropriate management units in order to reconstruct the component flora of Vermont sandplains and to assess the feasibility of transplantation as a technique for preserving endangered plants.

VMD agrees to:

1. Provide an area, as shown on the attached map, for the purpose of restoring and managing pine-oak-heath sandplain habitat on Camp Johnson. This area will be used for an experimental restoration of this sandplain natural community, including its various successional stages, and for the reintroduction of rare, threatened, and endangered plant species. Inventories of invertebrate fauna may also be conducted within this area.

2. Provide funding, equipment, and logistical support to assist with management and research activities related to the sandplain restoration effort.

FWD and VMD mutually agree to:

1. Cooperate to the fullest extent in all activities related to this agreement and maintain regular communication.

2. Have as primary contacts under this agreement:
   FMD: Christopher Fichtel, Inventory Coordinator/Zoologist
   VMD: Colonel Alan Nye, Facilities Management Officer

3. Prepare a long-term agreement management plan for the designated sandplain area.

Term of Agreement

The period of this agreement shall begin on the date signed by both parties and shall continue until terminated, with 30 days written notice, by either party.

FMD/VMD Memorandum of Agreement.

Agreed upon and Approved by:

J. Timothy Van Zandt
Commissioner
Vermont Fish and Wildlife
Department

September 28, 1992
Date

Donald E. Edwards
Adjutant General
Vermont Army National Guard
Vermont Military Department

October 2, 1992
Date

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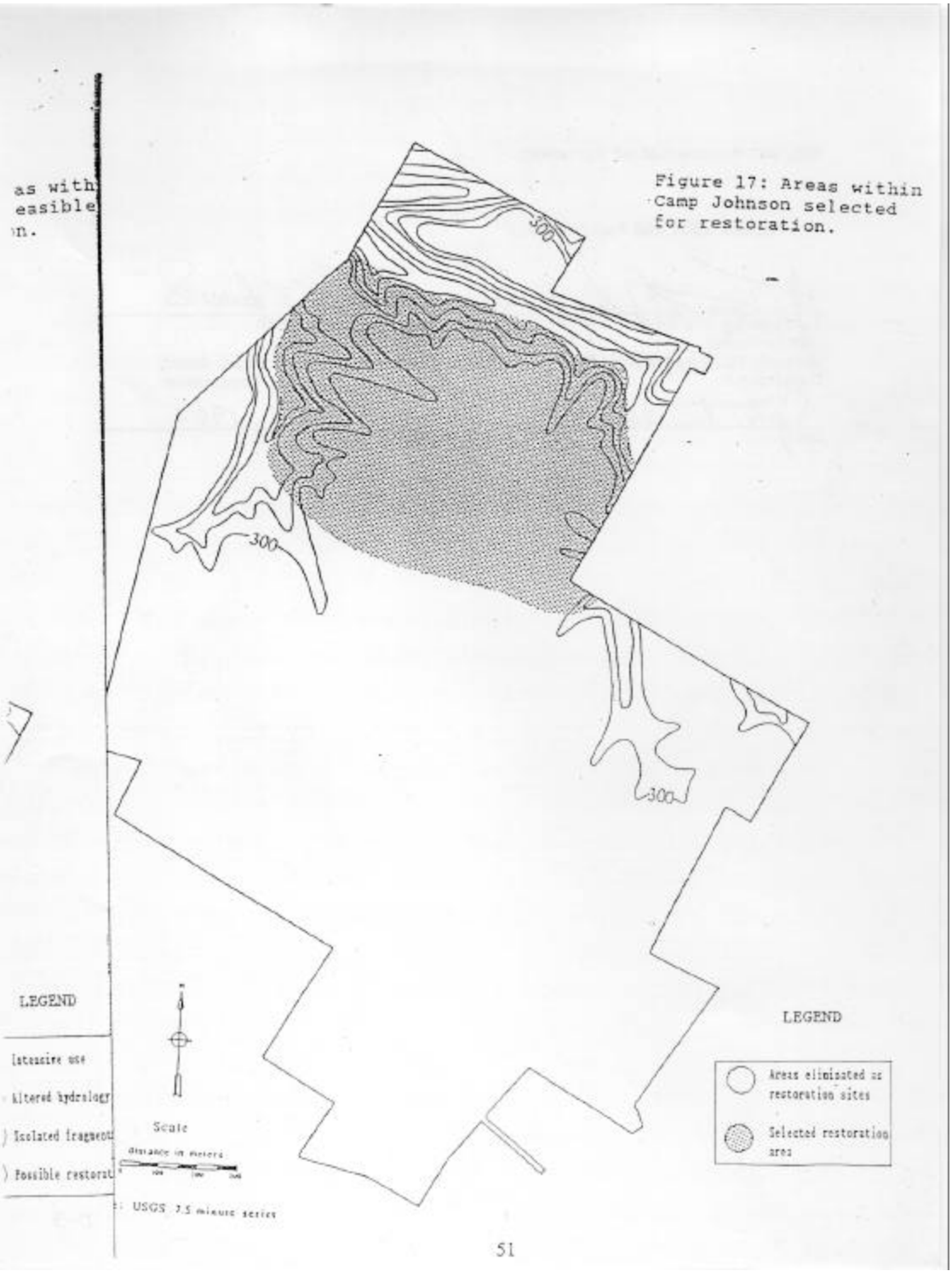
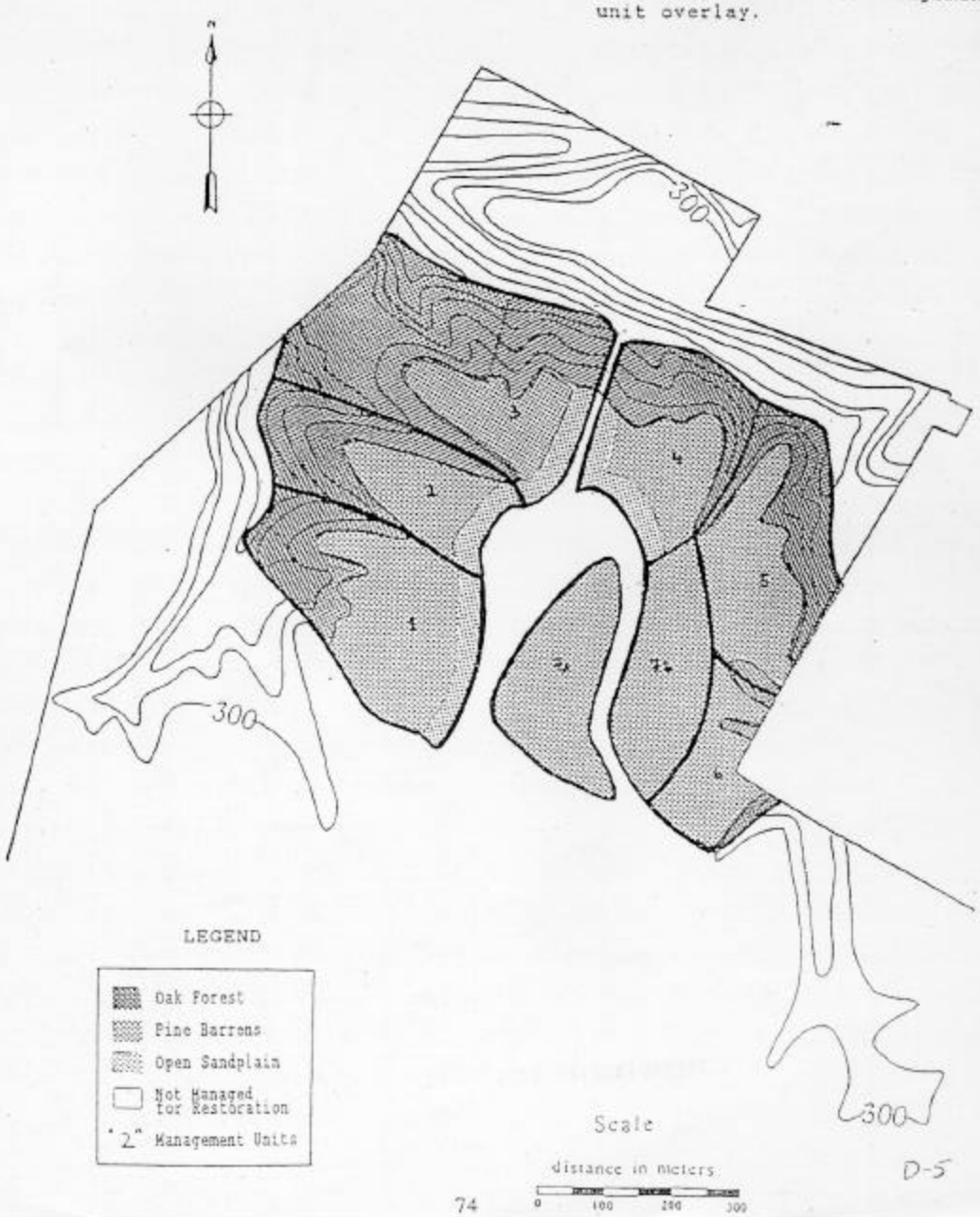


Figure 17: Areas within Camp Johnson selected for restoration.

Figure 21: Community/Management unit overlay.



D-5

Conserving Grassland Birds

Managing Small Grasslands Including Conservation Lands, Corporate Headquarters, Recreation Fields, and Small Landfills for Grassland Birds

Contents

Glossary

Old field - *An area that was formerly cultivated or grazed and where woody vegetation has begun to invade. If left undisturbed, it will eventually succeed into a forest. Many old fields occur at sites marginally suitable for crop production or pasturing. Old fields are highly variable in the Northeast, depending on soil, land use history, and management.*

Upland meadow/pasture - *Pastures are areas maintained in grass for livestock grazing; meadows are areas grown for hay production. Meadows may occur naturally in tidal marshes and inland flooded river valleys or, more frequently, at upland sites, through clearing of vegetation and planting of grasses. Meadows will revert to old field and eventually forest if they are not mowed, grazed, or burned. Grasses are usually similar in managed meadows and pastures, but herbs are often different in pastures because of selective grazing.*

Wet meadow - *Meadows located in moist low-lying areas, most often dominated by large colonies of reed canary grass. They are often created by collapsed beaver dams and exposed old pond bottoms. Salt-marsh meadows are subject to daily coastal tides.*

Sandplain grassland - *Dry grasslands that have resisted succession due to fire, wind, grazing, mowing, and salt spray. They are characterized by thin, acidic, nutrient-poor soils over deep sand deposits. Sandplains occur primarily coastally and on the islands off of Massachusetts, as well as inland where sands have been deposited by glaciers and river sedimentation.*

Restoration - *Involves taking a degraded grassland and re-establishing habitat for native plants and animals. Restoration usually involves the planting of native grasses and forbs, and may include shrub removal and prescribed burning.*

Native plant - *A plant that has grown in the region since the last glaciation and occurred before European settlement.*

Exotic - *A species not native to the place where it is found.*

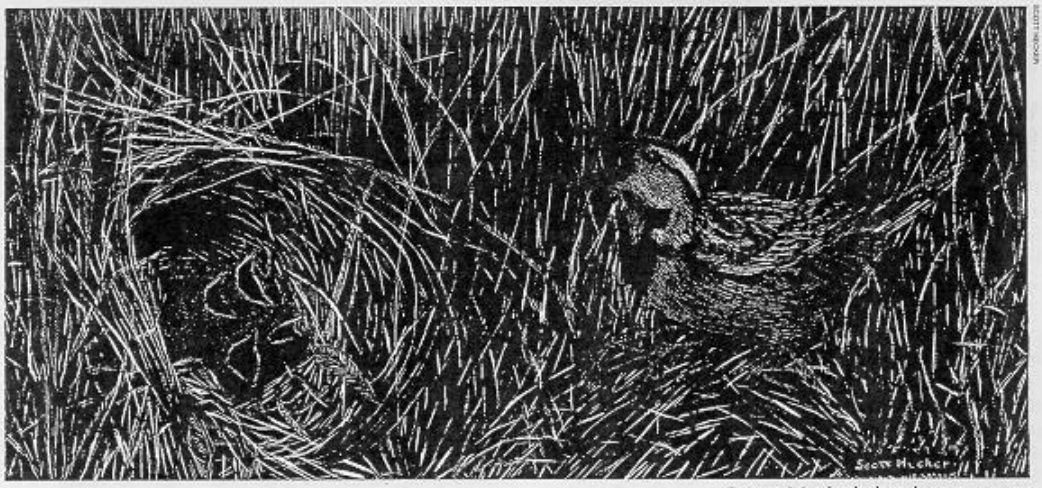
Forb - *A flowering plant, excluding grasses, sedges, and rushes, that does not have a woody stem and dies back to the ground at the end of the growing season.*

Warm-season grass - *Native prairie grass that puts on the most growth during summer when cool-season grasses are dormant.*

Cool-season grass - *Introduced grass for crop and pastureland that grows in spring and fall and is dormant during hot summer months.*

Mesic soil - *Sandy to clay loams, contain moisture-retentive organic matter, well drained (no standing water).*

Printed on recycled paper. Cover illustrations by Barry Van Dusen. Design by Valerie Bessette.



Eastern Meadowlark and young on nest

Introduction

Grasslands in the Northeast have provided home and sanctuary to grassland birds and other wildlife for many hundreds of years. In hayfields, pastures, and natural grasslands, birds such as bobolinks and eastern meadowlarks have raised their young, hunted for food, and returned each spring to continue this cycle. We are rapidly losing these and other grassland birds that were once a common and integral part of our countryside. As land use and agricultural practices have changed dramatically since the turn of the century, remaining grasslands have become smaller and isolated. With proper management, these small grasslands provide important habitat for some species of grassland birds.

This pamphlet addresses management issues on small grasslands, generally ranging in size from 10 to 75 acres, that are not in active agricultural use. These include areas such as conservation or recreation lands, small landfills, corporate parks, and small airports.

History of Grassland Birds in the Northeast

Historically, most of the Northeast was forested. Natural, permanent grasslands were uncommon, except for scattered openings that existed along river floodplains, wetlands, beaver meadows, salt marshes, and coastal sandplain grasslands and heathlands. Other forested areas opened periodically due to fires set by lightning strikes, and burning and clearing by Native Americans. With European colonization, forests were cleared to make room for growing agricultural demands.

By the 1800s, grasslands were widespread in the Northeast, as land was cleared for pastures and hayfields, and grassland birds undoubtedly benefited from this expanded habitat. In the early 20th century, changes in agricultural technology, movement of farms to the west, and an increase in human population in the Northeast caused a decline in the quantity and quality of grasslands for wildlife. Populations of grassland birds adapted to agricultural landscapes are now diminishing as farmlands are left idle, revert to forests, or are replaced by housing and business developments.

Old hayfields that were traditionally harvested late in the season provided ideal breeding habitat for birds. Today, remaining hayfields are mowed earlier and more frequently in the summer, or are planted in large monoculture crop fields. Coastal grasslands are threatened by fire suppression and fragmentation due to development.

The disappearance of the heath hen represents one of the most dramatic changes in grassland bird populations in the Northeast. Formerly abundant as a bird breeding in coastal sandplain grasslands and heathlands throughout the Northeast and along the Connecticut River valley, it became extinct in 1932 due to habitat loss. More recently, Breeding Bird Surveys (BBS) conducted by the Biological Resource Division of USGS and volunteers throughout the United States have shown alarming declines in the number of grassland birds nationwide. For instance, bobolinks have declined by 38 percent and grasshopper sparrows by 69 percent in the past 25 years. Within New England and New York, at least 9 species of grassland birds are now recognized as regionally

threatened or endangered in at least five states. Conservation of grassland habitats and changes in management practices can maintain good quality habitat for these rare birds.

Value of Small Grasslands to Wildlife

Farmland fragmentation has caused the remaining grasslands to become small and isolated. These smaller patches are not suitable for all species of grassland birds, such as upland sandpipers that require at least 100 acres of continous grassland habitat for breeding. However, there are other grassland birds, such as bobolinks, eastern meadowlarks, and savannah sparrows, that rely on these small areas throughout the year.

Bobolinks and eastern meadowlarks build nests, raise young, and forage in hayfields, meadows, and pastures during the summer. In the fall, fields provide food for migrating sparrows, larks, and warblers. Some songbirds that breed farther north, such as snow buntings, use these grasslands during the winter months. Many birds of prey, such as American kestrels, northern harriers, and short-eared owls, rely on grasslands for hunting small mammals during summer or winter. Waterfowl and shorebirds sometimes feed in flooded portions of fields during migration.

Grasslands also provide habitat to a variety of other wildlife, including mammals and many butterflies. Small mammals that inhabit fields, such as meadow voles and meadow jumping mice, are an important food source for many birds of prey. Larger mammals, such as white-tailed deer and red foxes, regularly visit grasslands for feeding. Butterflies, such as tiger swallowtails, monarchs, and fritillaries, can be found in fields feeding on wildflower nectar.

Management of Small Grasslands for Grassland Birds

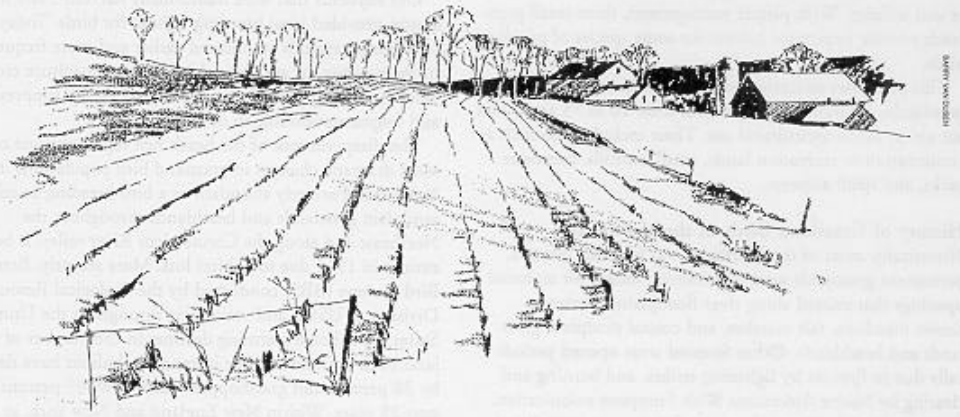
Mowing Small Hayfields (10 to 75 Acres)

Hayfields support a rich diversity of grasses, wildflowers, and invertebrates that are important for breeding grassland birds. Old hayfields, not replanted for at least eight years, are favored by some birds (particularly bobolinks) because of the developed ground cover and a greater variety of grasses and other plants. Mow every one to three years to maintain fields in grasses and prevent growth of woody vegetation. Timing of mowing is crucial to the survival of nesting grassland birds. Early mowing in June and frequent mowing destroy nests and young. Therefore, mowing after August 1 is recommended if increasing grassland bird habitat is a management goal.

Recommendations

Avoid mowing areas with ground-nesting birds before August 1. Early cutting usually destroys ground nests. It is common to see young birds in the fields by late June, but cutting should be avoided because some species, such as savannah sparrows and eastern meadowlarks, raise a second brood later in the season, and the young fledge in late July.

Be aware of where grassland birds are nesting in fields. If mowing is essential prior to August 1 (such as in fields leased to farmers for hay), try to avoid areas where birds are frequently seen or to leave small patches such as edges or strips unmowed as nesting areas. Even when young birds



Crop field in winter

BOBOLINK

Bobolinks, common in many hayfields throughout the Northeast, are known for their noisy bubbling songs and striking black and white plumage. Male birds are conspicuous as they fly while hovering over hayfields or perching atop a shrub or fence post to defend their territories and attract females. These farm birds were abundant at the turn of the century throughout the Northeast when hayfields and pastures dominated the landscape. Bobolinks are still distributed throughout the Northeast, but their numbers have declined notably in the past 30 years.

Life History

Bobolinks build their nests in late May and early June on the ground in a dense cover of grasses and wildflowers in hayfields, pastures, old fields, and wet meadows. Breeding dates typically range from May 25 to July 5. Therefore, mowing before mid-July can harm nesting birds and young. By late July, large groups of birds can be seen perched together on stalks of wildflowers, as they prepare for their journey south.

Bobolinks undertake one of the longest migrations of any land bird in North America. In the fall, these small birds make an extraordinary flight of approximately 6,000 miles to spend the winter in central South America (Argentina, Brazil, and Paraguay). The following spring, they return North, often to the same field they left the previous year.

Unlike many other grassland birds that require large grassland tracts, bobolinks will breed in grasslands as small as five acres. Quality and management of a hayfield are important for breeding bobolinks. Timing of hay mowing is usually the most important factor that affects breeding success.

Reasons for Decline

Reduction in field diversity. Bobolinks usually do not nest in pure legume/alfalfa fields; they prefer a mixture of grasses and wildflowers.

Bobolinks nesting in a hayfield

More frequent field rotation. Bobolinks prefer hayfields more than eight years old, where vegetation is sparser and dominated by grass and there is a greater litter cover and a mixture of forbs and small shrubs.

Introduction of cool-season grasses. Fields, once grown in native warm-season grasses, are now planted with cool-season varieties that allow earlier and more frequent mowing. Hay is cut up to three times per year, which does not give bobolinks enough time to raise young.

appear to have left the nest, small unmowed patches are still needed to provide cover and feeding areas for the remainder of the summer until they migrate south.

Limit mowing to every one to three years in fields not harvested for high-quality hay. It is not necessary to mow every year for grassland birds. Not mowing a field one year or delaying mowing until late August will allow development of late-blooming wildflowers and butterflies.

Maintain some areas of fields with patches of bare ground. Killdeers and horned larks, for example, require patches of bare ground for nesting and feeding. This can simply be in areas where grass growth is poor due to soil conditions, or in small areas intensively grazed. Bare ground can also be exposed by removing hay from fields where thatch (compressed dead grass) becomes thicker than two inches.

SAVANNAH SPARROW

This small brown sparrow, heard singing its buzzy insect-like song more than it is seen, has been the subject of a great deal of research in North America. This bird is known to return to its same natal or breeding site each year following migration to wintering grounds in the southern United States, the Caribbean, and Central America. There are 17 different races based on geographic variation and separation.

Life History

A grassland generalist, the savannah sparrow is found in a variety of grassland habitats in the Northeast, ranging from heathland to farmland. This species is associated with hayfields and pastures as well as coastal grasslands and blueberry barrens. Unlike many grassland birds, savannah sparrows use fields of all ages. They tolerate successional growth, breeding in areas with scattered saplings, shrubs, and forbs.

Because savannah sparrows often have two broods per year, mowing before mid July can harm nesting birds and young. Although each pair has a small territory size of one to two acres, they require relatively large areas of open space, 20 to 40 acres, for breeding habitat.

Reasons for Decline

Urbanization and reversion of farm fields to forest. Many successional fields that are suitable breeding habitat are often the first areas to be developed or to return to forest.

Early mowing. Mowing before mid-July results in a high percentage of nest failures.

Choose fields that are not used for hay production for wildlife habitat. Mowing high-quality hayfields in early June will discourage birds from nesting in those areas. Birds that do attempt to nest in these fields will probably fail due to mowing activities. In time, birds are not likely to return to fields where their nests were destroyed. However, if *adjacent* unmowed fields are available, birds can shift from high-production hayfields to those areas and renest.

Use conservative mowing practices where possible. These may include practices such as raising mower blades to six inches or more (may prevent the destruction of some nests and young in early mowing); avoiding night mowing because this often kills or injures roosting birds and young; using flushing bars on haying equipment to move birds hiding in the grass.

Manage multiple contiguous fields for conservation. Four adjacent fields are better than four isolated fields. Multiple adjacent small fields can provide the "look" of a large grassland, especially if hedgerows are removed and planted in grasses. This continuous landscape is necessary for some of the region's rarer grassland birds, such as the grasshopper sparrow and upland sandpiper, which require large grasslands. Multiple contiguous fields can be managed through rotational mowing and/or burning to provide a mosaic of grassland types and, therefore, can attract a greater diversity and abundance of grassland birds.

Grazing Small Pastures (10 to 75 Acres)

Grazing can benefit grassland wildlife by creating a mosaic of grass heights and structure. Many birds respond favorably to limited grazing, including killdeers and meadowlarks. However, intensive grazing leads to a loss of plant diversity and cover for wildlife. In the Northeast, the majority of grazed pastures are small and intensively grazed during the summer months, making them unsuitable for most nesting birds.

Recommendations

In grazed pastures with nesting birds, keep approximate-

EASTERN MEADOWLARK

During the summer, meadowlarks may be seen along farm roads displaying their bold yellow chests from a nearby fence post, telephone pole, or tree, where their rich melodic song can be heard. Meadowlarks nest in a variety of grassland types, including hay and alfalfa fields, shrubby overgrown fields, and pastures. Once common on farmlands, meadowlarks are mostly confined to larger hayfields, conservation lands, and airports.

Life History

Meadowlarks usually require at least 15 to 20 acres of grassland. Meadowlarks prefer grass-dominated fields with a thick layer of dead grass for cover and nesting material and scattered shrubs and forbs for song perches. Mature fields with a variety of grass heights and densities are preferred.

Because meadowlarks can have two broods per season, the breeding period extends into mid-August. Therefore, early summer mowing of hayfields is detrimental to meadowlark nests and young.

Reasons for Decline

Farmland fragmentation. Meadowlarks only use medium to large hayfields (greater than 15 acres). Many remaining hayfields are too small to be suitable breeding habitat.

Eastern Meadowlark

More frequent field rotation. Meadowlarks prefer old, mature hayfields that contain a dense ground cover and diversity of grasses and forbs.

Reduction in field diversity. Meadowlarks prefer mixed fields over fields of pure alfalfa. Alfalfa lacks sufficient ground cover.

ly 40 percent of the vegetation cover at a minimum height of 8 to 12 inches or at "knee height," with scattered forbs until August 1. This can be achieved by rotating grazing animals through several fields during the growing season. Keeping some areas ungrazed during the nesting season usually improves nest success.

Avoid overgrazing fields. Overgrazing creates excessive bare ground, which can cause erosion, reduce plant and invertebrate diversity, and lead to trampling of bird nests.

Experiment with different grazing regimes in your fields to determine the intensity of grazing and rotation that works best to provide wildlife habitat. This will vary from site to site, depending on the type of vegetation and the soil and moisture conditions.

Burning Small Hayfields

Burning reduces buildup of dead vegetation, adds nutrients to the soil, rejuvenates plant growth, and helps prevent the spread of woody vegetation. Hayfields that develop a thick layer of thatch are usually not used by nesting birds because they cannot effectively run on the ground to escape predators or forage for food. Although burning is not always feasible on small grasslands, when possible it can benefit grassland bird populations within one or two years following a burn.

Recommendations

Burning every two to six years provides the best habitat for birds nesting in small grasslands. If possible, provide adjacent unburned grassland habitat for nesting birds during the burn year.

Burning in early spring (before the arrival of birds in mid-May) is most beneficial to vegetation and nesting birds.

Careful planning is necessary before burning. Most grassland burns occur between mid-March and the end of April, after snow melt and before greening and bird nesting. The timing of the burn must also be done with consideration of relative humidity, wind conditions and direction, air temper-

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ature, and fuel conditions. Burn designs must incorporate existing firebreaks (roads, lakes, and streams), or firebreaks must be designed. Adjacent landowners should be notified prior to burning.

Contact your local fire department for guidance and permits before burning a field. "Burn bosses," individuals trained and certified in prescribed fires, from local universities or conservation organizations *(see Appendix 4 for list of state Audubon/conservation societies to contact)* can be contracted to consult and manage prescribed burns.

Grassland Restoration

Areas that have been neglected, invaded with woody vegetation, overgrazed, or planted with alfalfa or row crops can be restored into grasslands that will provide wetlands protection habitat for grassland birds.

Protection from overgrazing: Follow the above guidelines under "Mowing" and "Grazing" to restore a grassland to a more natural and diverse system and provide improved habitat for grassland birds.

Removal of woody vegetation: Field edges, particularly those dividing fields, can be removed to control invasive woody plants and create larger grasslands. Removal of woody vegetation can be achieved by a variety of means: mechanically, chemically, or by burning. Removal should be avoided during the nesting season to minimize disturbance to nesting birds. An intensive spring fire regime for several years helps kill shrubs and encourages growth of native species. Once shrub growth is retarded, burning can be reduced to a light burn every two to six years to maintain grasses. Spot treatment is often used to help remove particularly stubborn shrubs and trees. Some herbicides may be applied directly to the newly cut shrub stem. Read herbicide labels carefully and consult your local Cooperative Extension Service office for advice on use of herbicides *(see Appendix 4)*.

Replanting with warm-season grasses: Areas void of vegetation should be disked and plowed in the fall, and disked again in the spring and seeded with native warm-season grasses. Attention should be paid to soil type, moisture content, and slope in order to decide what grasses to plant. Providing firmly packed soil and a weed-free seedbed is necessary to successfully seed a field. After substantial growth, periodic rejuvenation, such as burning, will maintain a healthy stand of grass. Consult soils maps, available from state Natural Resources Conservation Service offices *(see Appendix 4)*, to determine what types of grasses will grow best on your soil type. *(See Appendix 3.)*

Use of pesticides: During restoration of a site formerly in crop production, attention should be paid to former use of pesticides and herbicides. If cropland was recently treated with certain chemicals, planted grasses may not grow. Consult your local Natural Resources Conservation Service office *(see Appendix 4)* to determine the best way to proceed.

Planting fields in warm-season grasses, in addition to the more commonly planted cool-season grasses, can benefit both the farmer and wildlife. *(See page 7.)*

Enhancing Public Interest in Grassland Conservation

The following suggestions can help local communities become involved in the protection of grassland habitats.

Volunteers: Use volunteers to monitor grassland bird populations. Observers can locate fields containing breeding birds, where they are breeding, and when they have successfully fledged young. If haying a field is contracted to a farmer, these observations can help determine a mowing schedule that will protect grassland birds. Local bird clubs or conservation organizations can provide knowledgeable volunteers *(see Appendix 4 for list of local Audubon societies)*.

Scouts/school groups: Use scouts or school groups to build nest boxes for bluebirds and swallows that can be placed along field edges. Volunteers can monitor these boxes for bird use and breeding success. Contact the North American Bluebird Society for guidelines on box designs.

North American Bluebird Society
P. O. Box 6295
Silver Spring, MD 20916-6295
Phone: (301) 384-2798

Education: Make grasslands visible to local residents. Displays showing birds, butterflies, and mammals that may be observed in a field and observation areas can increase public awareness and appreciation of protected grassland habitats. Protect nesting areas from human disturbance by placing "Grassland Bird Nesting Area" signs in fields and providing mowed paths along field edges for public use.

By following these suggestions, grasslands owned by land trusts, conservation organizations, and individuals can provide a diverse and healthy grassland system for wildlife and the enjoyment of the public visiting these areas.

Massachusetts Audubon Society and Agriculture

Massachusetts Audubon has consistently supported agriculture as a land use that is necessary for the production of food for human consumption. The Society recognizes that farms provide habitat for wildlife, and has supported federal and state laws and programs aimed at maintaining land in agricultural production and avoiding conversion of farmland to development. Massachusetts Audubon acknowledges the valid role of agriculture within the state's economy, its historic place as land use consistent with maintaining rural character, and its value in maintaining open space. This booklet is aimed at providing recommendations and options for managing open space for wildlife when appropriate, and is not intended to influence changes in agricultural production.

Warm-Season vs. Cool-Season Grasses

Bobolinks

Warm-season grasses: These are native grasses of the prairies and the Northeast. They grow in the summer, benefiting from groundwater when cool-season grasses are inactive. Because warm-season grasses are inactive in the winter and spring, they are susceptible to invasion by other grasses and weeds if stubble is removed. Warm-season grasses are drought resistant, winter hardy, and adapted to sandy, infertile soils. These grasses contain more nutrients than cool-season grasses and are equal or superior for livestock digestibility and yield. Because native grasses are mowed and grazed later in the season than cool-season forage crops, they provide nutritious feed for livestock for a greater portion of the year. Warm-season grasses provide suitable breeding habitat for ground-nesting birds.

Common warm-season grasses used for range and pasture in the Northeast: big bluestem, little bluestem, Indian grass, and switchgrass (mixtures are better for bird habitat; pure switchgrass stands can create poor bird habitat). *See Appendix 3 for a list of seed sources.*

Cool-season grasses: Cool-season grasses are primarily non-native species that have been introduced for crop- and pastureland because the moist, cool spring and fall weather in the Northeast provides ideal growing conditions. They grow in the spring and fall but are dormant during the summer. Cool-season grasses do not grow well in dry and/or nutrient-poor soils. They can be grazed closer to the ground than warm-season grasses without reducing vigor in summer and winter. Cool-season grasses form a dense cover that provides less suitable nesting habitat for some ground-nesting birds.

Typical cool-season grasses planted in the Northeast: timothy grass, Kentucky bluegrass, and orchard grass (tall fescue and reed canary grass are sometimes planted but are invasive, provide no diversity in vegetative structure, and create thick, dense stands that prevent use by nesting grassland birds).

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APPENDIX 1: Breeding Biology, Habitat Selection, and Management Options for Selected Grassland Birds

	GRASSHOPPER SPARROW	VESPER SPARROW	UPLAND SANDPIPER
Breeding Facts			
Breeding dates	May 20–July 30	April 15–August 30	May 30–July 30
Wintering status	Usually migrates to southern US and islands	Occasionally seen in winter; most migrate south to southern US and Mexico	Migrates to South America
Egg dates	May 25–July 15	April 15–August 11	May 30–June 30
# of broods/year	2	1–2	1
Type of nest	Cup nest in depression on ground under clump of overhanging litter and grasses or at base of shrub; mostly domed	Cup nest in depression on ground concealed by sparse vegetation at base of forb or thin clump of grass	Shallow depression on dry habitat, concealed with grass
Territory size (acres)	2-4	1–4	20–30
Habitat Requirements			
Grassland type	Upland meadow/pasture, old field, sandplain grassland (e.g., cultivated grasslands, old fields, coastal heathlands, blueberry barrens, reclaimed grasslands, capped landfills)	Upland meadow/pasture, old field, sandplain grassland (e.g., crop fields, weedy edges of potato fields, pastures, pine barrens, blueberry barrens, gravel pits, forest clearings)	Upland meadow/pasture, old field, sandplain grassland (e.g., pastures, old hayfields, dry meadows, airfields, blueberry barrens, extensive mixed agricultural areas)
Minimum grassland size (acres)	30	30	150
Vegetation structure	Short bunch grasses (ht.: 4-12") with minimal litter and grass cover, patches of bare ground, scattered tall forbs (ht.: 8-25") and short shrubs (ht.: 1-8") for song perches; favors well-drained upland sites; absent from fields with >35% shrubs	Open, sparse, short grass (ht.: 1-8") on dry upland sites with low grass and forb density, and scattered shrubs or small trees (ht.: <12") for singing perches	Mixture of short and tall (ht.: 24") grass interspersed with patches of bare ground and some tall singing perches; avoids fields with uniform grass and legumes and dense litter layer
Diet	Adult: Mostly grasshoppers, and also caterpillars, ants, bugs, and some grass and weed seeds Nestling: Caterpillars	Adult: Primarily beetles, grasshoppers, caterpillars, bugs and ants, and also grass and weed seeds	Adult: Mostly insects (grasshoppers, crickets, weevils, etc.) and occasionally weed, grass and grain seeds

Management Suggestions

Mowing/Haying	Mow fields annually outside breeding season (May 1–August 5)	Favors frequently mowed areas for foraging; leave nesting areas unmowed during breeding season (April 15–August 30)	Provide mixture of short grass (feeding) and tall grass (breeding); mow nesting areas after mid-July, every 1-3 years (provide 6-8" grass in nesting area for spring arrival)
Grazing	Light to moderate grazing to maintain short and sparse bunched vegetation	Moderate grazing to maintain 20-40% of vegetation at 10" tall	Moderate grazing (grass ht.: 8-12") with some scattering of forbs; restrict cattle May 1–July 15 in nesting areas
Prescribed burning	Nests in burned and unburned areas, increases for 4-5 years following burn until litter cover increases; burn every 5-7 years but leave sufficient unburned breeding habitat each year	Responds positively to short sparse vegetation created by burning, burn early spring or late fall; for grasslands >60 acres, burn 20-30% yearly; for smaller grasslands, do not burn >50-60% of area in given year	Nests in recently burned fields (prefers second year after burn) with short new growth and no litter; burn only a portion of large areas in a year to provide unburned habitat in spring; burn every 5-10 years after September 1 or before May 1
Restoration	Plant native warm-season bunch grasses rather than sod-forming grasses on well-drained or sandy soils with mixture of scattered forbs and shrubs	Plant native warm-season grasses in well-drained fields with lighter soils (sand and gravel), avoid heavy clays; provide undisturbed sparse vegetation and song perches along borders of crop fields	Plant native warm-season bunch grasses in large fields or combine existing fallow fields to provide mosaic of habitat types for feeding and breeding areas
Comments		In crop fields, nests confined to field edges; will forage in nearby brush and woods	Often nests near airfields but cause little threat to aircraft because of low and direct flights; nest territories often grouped and feeding areas shared

continued on next page

APPENDIX 1 *(continued)*

	BOBOLINK	EASTERN MEADOWLARK	SAVANNAH SPARROW
Breeding Facts			
Breeding dates	May 25–July 15	April 21–August 15	May 21–July 31
Wintering status	Migrates to South America	Southern Massachusetts, in salt marshes/moorlands, and south through eastern US	Some winter along Massachusetts coast; most winter along southern states to Mexico
Egg dates	June 1–8	April 21–July 28	May 21–June 29
# of broods/year	1	2	1–2
Type of nest	Cup nest in depression on ground at base of dense cover of forbs in mat of dead grass <4" tall	Well-concealed domed cup nest, often with a runway, in depression on ground in dense cover with vegetation 10-20" tall	Cup nest in shallow depression on ground, formed in grass clumps or at base of low woody shrub
Territory size (acres)	1–6	6–8	1–2
Habitat Requirements			
Grassland type	Upland meadow/pasture, wet meadow, old field (e.g., old hayfields, reclaimed grasslands, capped landfills)	Upland meadow/pasture, old field, (e.g., hayfields, croplands, reclaimed grasslands, and capped landfills, airports, shrubby overgrown fields)	Upland meadow/pasture, old field, sandplain grassland, salt meadow (e.g., cultivated fields, hayfields, pastures, successional fields, blueberry barrens, coastal grasslands, airports)
Minimum grassland size (acres)	5–10	15–20	20–40
Vegetation structure	Mixed grass (ht.: 8-12") old hayfields >8 years old with relatively sparse ground cover, usually in lowlands with moist soil; prefer mosaic of grasses, sedges, and scattered broad-leaved forbs with <25% shrub cover; use shrubs, posts, small trees as song perches	Sparse to dense grass-dominated cover (ht.: 10-20"), preferably in low-lying areas with damp soils, thick layer of dead grass, scattered shrubs (ht.: 1-8"), and tall forbs (ht.: 1-15") for song perches; prefer mixed grass fields to alfalfa	Dense ground vegetation with mixture of short and tall grasses (ht.: 1-25") in moist habitat with thick layer of dead grass, scattered saplings, shrubs, and forbs (ht.: 1-10"); use fields of all ages from alfalfa to grass
Diet	Adult: Insects (caterpillars, grasshoppers, beetles, ants, etc.), grain and weed seeds Nestling: Caterpillars, grasshoppers	Adult: Mostly insects (crickets, grasshoppers) and some seeds Nestling: Caterpillars, cutworms	Adult: Mostly insects (beetles, caterpillars, grasshoppers, ants, etc.) and some grass seeds, weed seeds, and fruit Nestling: Caterpillars and fruit

Management Suggestions

Mowing/Haying	Mow hayfields every 1-3 years after mid-July or in August to prevent nest destruction; remove hay to prevent thatch build-up	Mow every 1-3 years in August to avoid nest destruction	Mow yearly after mid-August to maintain short grasses
Grazing	Light grazing (grass ht.: 8-12"); will not use heavily grazed pastures	Fields ungrazed for 2 years or lightly grazed pasture (grass ht.: >5") with scattered forbs; rotate grazing to maintain variety of grass height and density during breeding season	Light grazing with approximately 40% vegetation cover (grass ht.: 10")
Prescribed burning	Nests in a field 1 growing season following burn; avoids recently burned areas that remove all litter; burn patches every 2-5 years but not all of an area in one year	Nests 2-4 years following burn as shrubs regrow; avoids areas with thick litter layer	Increases 2-4 years following burn and then decreases because of greater litter cover, short grasses, and not enough short shrubs
Restoration	Plant late-maturing hay species (warm-season native grasses) rather than legumes; can restore habitat on erodible, marginal farmland; use no-tillage method for reseeding	Restrict surface tilling for weed control or seeding during breeding season; plant mixed-grass hayfields (warm-season native grasses) in moist areas	Plant fields with mixture of tall and short grasses and forbs
Comments	Attempts renesting if nest destroyed before June 20; high site fidelity when breeding is successful; greatest nest success far from forest edge	Attempts renesting if nest destroyed early in season; sensitive to human disturbance while breeding	

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APPENDIX 2: Native Grasses/Sedges Recommended for Grassland Bird Habitat

COMMON NAME/ SCIENTIFIC NAME	WARM/COOL SEASON	HEIGHT (feet)	CHARACTERISTICS	HABITAT
Little bluestem *Schizachyrium scoparius (Andropogon scoparius)*	Warm	1.5–4	Bunch grass in dry or moist soils; drought tolerant; flowers July-October	Sandy fields and disturbed areas in sun; common invader of old fields in Northeast
Poverty grass *Danthonia spicata*	Warm	.5–2	Bunch grass; flowers June–July	Abundant in sandy disturbed sites; typical grass along East coast
Pennsylvania sedge *Carex pennsylvanica*	Cool	.5–1	Flowers in early spring to July	Sun to part shade; common ground layer in dry oak woods
Big bluestem *Andropogon gerardii*	Warm	3–8	Bunch grass; very drought tolerant, adaptable; flowers August–October	Dry sunny open places along roadsides and shores, moist to dry fields
Broom-sedge *Andropogon virginicus*	Warm	1–4	Bunch grass; slow spreading, tolerates seasonal saturation; flowers August–October	Dry sunny fields, pastures (invades overgrazed ranges); valuable winter seed source for birds
Switchgrass *Panicum virgatum*	Warm	2–7	Bunch grass; slow spreading, drought tolerant, prolific; flowers late July–September	Sunny areas in dry soils along sandy roadsides and upland edges of salt marshes; valuable fall and winter food and cover for birds
Red fescue *Festuca rubra*	Cool	1–3	Moderately drought resistant	Sunny fields and meadows
Kentucky bluegrass *Poa pratensis*	Cool	1–2	Sod-forming; shallow root system, cannot withstand drought; flowers mainly in spring	Very common in fields, roadsides, lawns, shores; native to northern North America; good seed for birds
Indian grass *Sorghastrum nutans*	Warm	2–9	Drought tolerant; flowers August–September	Dry sunny fields; in East found sporadically along dry roadsides and fields
Side-oats gramma (Tall gramma grass) *Bouteloua curtipedula*	Warm	1–3.5	Bunch grass; drought tolerant; flowers July–September	Sunny areas in dry woods and prairies

SOIL TYPE	PLANTING INSTRUCTIONS	AGRICULTURAL USES	NURSERIES *(See Appendix 3)*
Dry to moist, light, textured soil; average fertility; does not grow well in rich soils	Seed late summer to early fall or early spring	Stabilization, range reseeding, landscaping, forage; does not grow well with close mowing/grazing	1, 2, 4, 5, 6
Dry, poor soil	Plant in spring or mid to late summer		
Dry to moist, mesic, well-drained soil; acidic; average fertility	Plant or seed in fall or early spring		1, 2, 5, 6
Poor to well-drained soil; coarse sand to clay	Seed in spring or summer when soil is warm; blooms first year if sown early	Pasture, forage, hay	1, 2, 4, 5, 6
Tolerates dry to moist soil, prefers fertile well-drained soil	Plant in spring when soil is warm	Poor forage grass; good cover crop (sometimes becomes too dense for some birds)	1, 4
Tolerates many soils but grows best on fertile and moist sandy soil; tolerates moderate salinity	Seed or plant late summer/early fall or early spring; blooms first year if planted early; takes 1-2 years to become totally established	Pasture, forage, erosion control	1, 2, 4, 5, 6, 9
Moist to dry or rocky soil; tolerates salt, low fertility		Used as lawn grass in shady areas	1
Prefers limestone (neutral) porous soils; needs reliable moisture	*(See nursery)*	Widely used lawn, pasture, and turf grass; grows best after grazing	1
Mesic and dry to moist soil; poor to average fertility	*(See nursery)*	Pasture and range; nutritious for livestock.	1, 2, 4, 5, 6, 9
Dry to moist soils; grows best in well-drained rocky/shallow areas	Bloom first year planted	Pasture, range, erosion control	1, 5, 6

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APPENDIX 3: Nurseries Specializing in Native Grasses and/or Wildflowers

NAME	ADDRESS	PHONE	FAX/e-mail
1. Ernst Conservation Seeds	9006 Mercer Pike Meadville, PA 16335	1-800-873-3321	(814) 425-2228 cernst@gremlan.org
2. Native Gardens	5737 Fisher Lane Greenback, TN 37742	(615) 856-0220	
3. Native Seeds, Inc.*	14590 Tridelphia Mill Road Dayton, MD 21036	(301) 596-9818	
4. Pinelands Nursery	323 Island Road Columbus, NJ 08022	(609) 291-9486	(609) 298-8939
5. Praire Ridge Nursery	9738 Overland Road Mt. Horeb, WI 53572-2832	(608) 437-5245	(608) 437-8982
6. Prairie Nursery	P.O. Box 306 Westfield, WI 53964	(608) 296-3679	(608) 296-2741
7. Putney Nursery, Inc.*	Route 5 Putney, VT 05346	(802) 387-5577	(802) 387-4491
8. Thompson & Morgan, Inc.*	P.O. Box 1308 Jackson, NJ 08527-0308	1-800-274-7333	(888) 466-4769
9. Wild Earth Native Plant Nursery	49 Mead Avenue Freehold, NJ 07728	(908) 308-9777	

** specializes in native wildflowers only*

APPENDIX 4: Agencies and Organizations Specializing in Agricultural Land Management Issues

	NATURAL RESOURCES CONSERVATION SERVICE	DEPARTMENT OF AGRICULTURE	AUDUBON/CONSERVATION SOCIETIES
MASSACHUSETTS			
UMASS Cooperative Ext. System Dept. of Forestry and Wildlife Management Holdsworth Natural Resources Ctr. Amherst, MA 01003 *Phone:* (413) 545-2665	**Massachusetts State Office** 451 West Street Amherst, MA 01002-2995 *Phone:* (413) 253-4350	**Massachusetts Department of Agriculture** State Office Building 100 Cambridge Street Boston, MA 02202 *Phone:* (617) 727-3000 *Email:* unknown@state.ma.us *Information Specialist:* (617) 727-3018 ext 170	**Massachusetts Audubon Society** 208 South Great Road Lincoln, MA 01773 *Phone:* (617) 259-9500
CONNECTICUT			
UCONN Cooperative Ext. System College of Agriculture and Natural Resources Box U-66, 1376 Storrs Road Storrs, CT 06269-4066 *Phone:* (203) 486-2917	**Connecticut State Office** 16 Professional Park Road Storrs, CT 06268-1299 *Phone:* (860) 487-4011	**Connecticut Department of Agriculture** State Office Building 165 Capitol Avenue Hartford, CT 06106 *Phone:* (860) 566-4667 *E-mail:* ctdeptag@po.state.ct.us *Information Specialist:* (860) 566-6094	**Connecticut Audubon Society, Inc.** 118 Oak Street Hartford, CT 06106 *Phone:* (860) 527-8737
RHODE ISLAND			
URI Cooperative Ext. Services Kingston, RI 02881 *Phone:* (401) 874-2599	**Rhode Island State Office** 60 Quaker Lane, 2nd Floor Warwick, RI 02886 *Phone:* (401) 828-1300	**Rhode Island Division of Agriculture and Marketing** DEM - 83 Park Street, 6th Floor Providence, RI 02903-1037 *Phone:* (401) 277-2781 *Information Specialist:* (401) 277-2781 ext 4501	**Audubon Society of Rhode Island** 12 Sanderson Road Smithfield, RI 02917-2600 *Phone:* (401) 949-5454
VERMONT			
UVM Extension System 601 Main Street Burlington, VT 05401-3439 *Phone:* (802) 656-2990	**Vermont State Office** 69 Union Street Winooski, VT 05404 *Phone:* (802) 951-6795	**Vermont Department of Agriculture** 116 State Street, Drawer 20 Montpelier, VT 05620-2901 *Phone:* (802) 828-2430 *E-mail:* unknown@agr.state.vt.us *Information Specialist:* (802) 828-2361	**Vermont Audubon Council** *Phone:* (802) 388-4082 **Vermont Institute of Natural Science** RR2, Box 532 Woodstock, VT 05091 *Phone:* (802) 457-2779
NEW HAMPSHIRE			
UNH Cooperative Extension 59 College Road, Taylor Hall Durham, NH 03824-2618 *Phone:* (603) 862-1520	**New Hampshire State Office** 2 Madbury Road Durham, NH 03824-1499 *Phone:* (603) 868-7581	**New Hampshire Department of Agriculture** Caller Box 2042 Concord, NH 03302-2042 *Phone:* (603) 271-3551 *E-mail:* 103423.365@compuserve.com *Information Specialist:* (603) 271-3551	**Audubon Society of New Hampshire** 3 Silk Farm Road Concord, NH 03301-8299 *Phone:* (603) 224-9909
MAINE			
UMAINE Cooperative Extension 5741 Libby Hall Orono, ME 04469-5741 *Phone:* (207) 581-3240	**Maine State Office** 5 Godfrey Drive Orono, ME 04473 *Phone:* (207) 866-7241	**Maine Department of Agriculture** Augusta Mental Health Institute 28 State House Station Augusta, ME 04333-0001 *Phone:* (207) 287-3871 *E-mail:* agcommsr@state.me.us *Information Specialist:* (207) 287-752	**Maine Audubon Society** Gilsland Farm 118 U.S. Rt. 1 P.O. Box 6009 Falmouth, ME 04105 *Phone:* (207) 781-2330

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Prepared by Andrea L. Jones and Peter D. Vickery, Grassland Conservation Program, Center for Biological Conservation, Massachusetts Audubon Society, Lincoln, MA, in collaboration with Silvio O. Conte National Fish and Wildlife Refuge and the USFWS North American Waterfowl Management Program. Additional financial support provided by the:

- Sweet Water Trust
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- Wharton Trust
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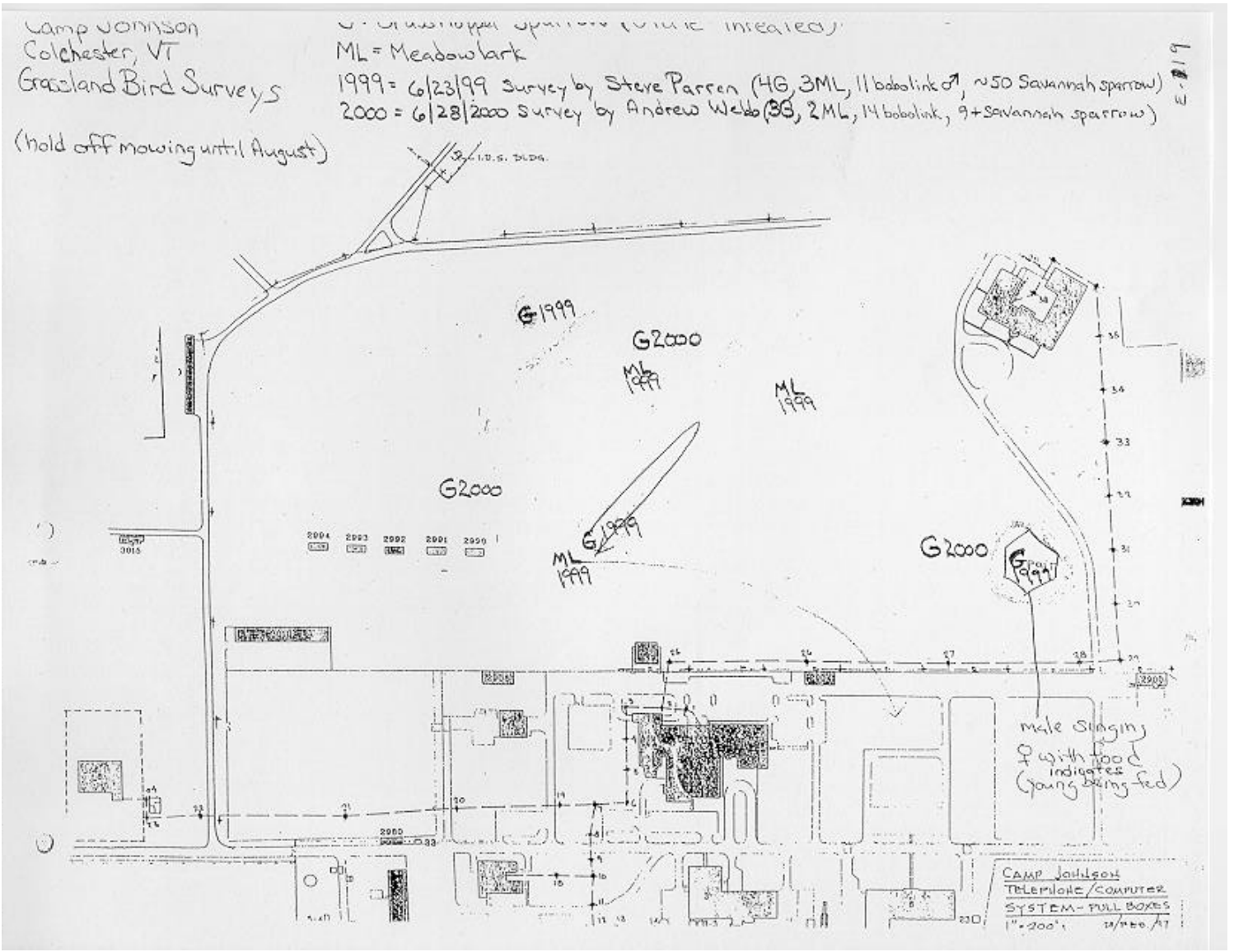
This pamphlet was reviewed by the Silvio O. Conte National Fish and Wildlife Refuge, USFWS North American Waterfowl Management Program, University of New Hampshire Cooperative Extension Program, USFWS Southern New England and New York Bight Estuary Program, Cornell Lab of Ornithology, New York Department of Environmental Conservation, Natural Resources Conservation Service (Massachusetts, New Hampshire), Massachusetts Department of Fisheries and Wildlife, Stewart B. McKinney National Wildlife Refuge, Green Mountain National Forest, Illinois Endangered Species Protection Board, Massachusetts Farm Bureau Federation, Pat Serrentino, and Greg Shriver.

Camp Johnson
Colchester, VT
Grassland Bird Surveys

(hold off mowing until August)

G = Grasshopper sparrow (future treated)
ML = Meadowlark
1999 = 6/23/99 Survey by Steve Parren (4G, 3ML, 11 bobolink ♂, ~50 Savannah sparrow)
2000 = 6/28/2000 Survey by Andrew Webb (3G, 2ML, 14 bobolink, 9+ Savannah sparrow)



FISCAL YEAR 2000 ANNUAL REPORT

Restoration of the Pine-Oak-Heath Sandplain Forest at Camp Johnson, Colchester, Vermont

BY

Brett Engstrom (Consulting Ecologist)
in cooperation with
The Vermont Nongame and Natural Heritage Program

This is the eighth annual report on monitoring and management activities in the Restoration Area at Camp Johnson. Because of its importance for sandplain pine-oak-heath forest conservation, this 150+-acre area was designated a Restoration Area through a Memorandum of Agreement between the Vermont Military Department and the Vermont Fish and Wildlife Department. Funding for this work has been provided through a Department of Defense Legacy grant, and by the Nongame and Natural Heritage Program of the Vermont Fish and Wildlife Department.

Fire Management

No ecological burns took place this year. Slash from late fall 1998 patch cuts in management units (MUs) 5 and 6 should be well cured by now. A map of the MUs within the Restoration Area is shown in Figure 1 on page 7. Given the heavy snowpack this (2000-2001) year and predicted wet and late spring, no spring burn is planned for 2001. Instead experimental summer patch burns are proposed for MU 5 and 6. Summer's high temperatures have the potential to dry out soil duff which, if consumed in a burn, leads to mineral soil exposure, one of the ecological objectives for these burns. This proposed burn, as with all burns, will be dependent upon appropriate weather conditions. By doing small (1/4 hectare or less) patch burns, logistics will hopefully be less cumbersome. This management activity will be another step in our long-term goal, which, restated from the first year's report (1993), is: "Restore and maintain a mosaic of old growth, presettlement white pine-oak forest and pitch pine-oak-heath woodland."

Effects of Ecological Burns on Vegetation

No observations were made directly on the effects of the 1995 and 1998 ecological burns. General appearance of both MU 7A and 7B were unchanged from 1999.

Pitch Pine Regeneration

Very little mortality has been noted in the three-year old pitch pines planted two years ago. Brush was cut around some of these planted pines growing in MU 7A openings by the Nongame and Natural Heritage Program. If not done by the Heritage Program this year, a complete resurvey of these planted pines should be done next year.

Kristin Hall, a student at Hartwick College in New York, completed her undergraduate thesis on the pitch pine at Camp Johnson. She mapped and took size measurements from all the trees in the Restoration Area. Her analysis of tree rings from several pines showed no correlation with precipitation, with individual pines varying widely in growth rates. Her tree map and measurements should be converted to a GIS digital map with accompanying attribute table.

Rare Plant Monitoring

The rare plant monitoring effort this year was light compared to previous years. Mike O'Hara gathered locational data via GPS at many rare plant sites in the Restoration Area this fall. Hopefully this digital mapping effort can be continued next year. A resurvey of the many-leaved bulrush (*Scirpus polyphyllus*) at Camp Johnson revealed a thriving population, with the number of plants likely a few thousand. This is an endangered species in Vermont. A brief review of several of the large whorled pogonia (*Isotria verticillata*) colonies shows the species to be site persistent, with numbers at equivalent to perhaps lower than other years.

After years of searching, hairy lettuce (*Lactuca hirsuta*), a state-threatened sandplain species, was finally discovered at Camp Johnson. This brings the number of state-listed species on the property to 10, though only nine are known to be extant. An additional 15 rare to uncommon, but not state-listed, plants are known from Camp Johnson. Table 1 (page 8) shows Camp Johnson's current list of uncommon, rare, threatened, and endangered plants. All tables and the single figure are attached to the end of this report, starting on page 7.

Results of Permanent Plot Vegetation Sampling

In order to help guide management activities, as well as more fully characterize the sandplain pine-oak-heath forest natural community, eight 400 meter-square (20x20 meters) permanent plots were established and sampled in 1993 and 1994. Approximate locations of these plots are marked on the Restoration Area map shown in Figure 1. Five years later, in 1998 and 1999, the first four plots were resampled. Placing one in each MU, these plots were chosen subjectively to reflect the forest variation found on the Restoration Area flats. Plot sampling methods follow those used by the Nongame and Natural Heritage Program's for forested natural communities. In this protocol plants are broken into vegetation strata and given percent cover values for the entire plot. Other edaphic information, including soil profiles, is also recorded at these natural community plots.

The resampled plots are located in MUs 5, 6, 7A and 7B. These four MUs located in the eastern half of the Restoration Area have received all the restoration activities in concurrence with the long-term plan and management activities set down in the first annual report dated November 3,

1993. Table 2 (page 9) details these activities according to management unit and permanent plot affected. Since the plot data generates many different types of information, the results presented in the remainder of this section will be broken down into numbered topics.

1. Plot Tree Data Summary

Table 3 (page 10) presents a summary of all the tree data collected in 1993-1994 from the eight permanent plots. Note that this data was collected prior to all of the restoration management activities listed in Table 2. This data includes diameters of all living and standing dead trees in the plots with diameters of 10 centimeters or greater. Tree diameters, rounded to the nearest centimeter, were taken at breast height (dbh) using a metric diameter tape. As a reference to be used in this table and the ones to follow, scientific names for common tree species are given at the bottom of Table 3.

Table 3 figures show that the number (tally) of live stems in the plots varied considerably, ranging from 14 to 34, or 350 to 850 stems per hectare. These stem number extremes mirror those found in total plot basal areas. Size distributions presented in the live stem tally section of the table are typical in that the smallest diameter size category (10-19.9 cm) has the most trees. However, while half of the plots show a logarithmic decrease in number of stems as size increases, the remaining four plots have a bimodal distribution, i.e. with the fewest trees in the intermediate size class. This latter distribution likely represents trees of two age cohorts. At 58 cm dbh, a black oak in plot #1 was the largest tree in any of the plots, and oaks in general were the largest trees in all the plots.

As for dead stems, plot #1 had the greatest number (14), most of which were gray birch. The presence of so many gray birch suggests that that part of the Restoration Area was completely cleared in the past. There were not exceptionally large standing dead trees, or live trees for that matter, in any of the plots. This translates to a history of forest disturbance where trees are not allowed to reach maturity.

Basal area figures in the same table place black oak as the dominant species overall with red maple not far behind. Red oak, white oak and bigtooth aspen are on the average of secondary importance in the canopy. However, bigtooth aspen appeared in only plot # 5 and 8. The aspen was dominant or codominant in both of these plots. This again reflects a patchy disturbance history in the Restoration Area.

Lastly, Table 3 figures show black oak with the largest average standing dead basal area, and white oak and bigtooth aspen in second place. In contrast the more numerous, but smaller, red maple, which is the second most important tree in terms of basal area, displayed the least mortality. While these figures are likely the result of natural mortality, the oaks' higher mortality might be a reflection of the its' vulnerability to gypsy moth attacks. The stress of the last gypsy moth infestation is clearly correlated with the restricted growth rings observed on tree stumps in the Restoration Area.

Several major management activities have occurred since 1993-1994 when the plot data was collected for Table 3. Figures in Table 4 (page 11) show the radical decrease in total basal area in plots # 1-3. This basal area decrease translates directly to loss of canopy cover. The canopy

decrease of 86% in plot #1 (MU 7B) and 41% in plot #3 (MU 6) is wholly attributable to the tree cutting activities in 1993 and 1998. In plot #2 (MU7A), however, only half of the decrease in basal area came from cutting. The other half was a result of the 1995 spring burn. Based on other plot data, over two thirds of the overstory died in the center of MU 7A as a result of the 1995 burn. In contrast, Table 4 figures show that the basal area in plot #4 (MU 5) has slightly increased. This is to be expected given that the vicinity of plot #4 has not been subjected to cutting or ecological burn.

2. Summary of Plant Cover Data, 1993-1994

Table 5 (pages 12-14) presents a summary of all the plot plant cover data gathered during the 1993-1994 sampling. The data is divided into five vegetation layers, then arranged in order of descending frequency. As set out in Natural Heritage Program protocol, all species' percent cover numbers are estimated for the entire 400m2 plot, as opposed to subsampling. Since there were essentially no nonvascular plants or lichens that were not on trees or logs, all the species occurring in this and subsequent tables are vascular plants.

Of the seven most frequent and abundant (i.e. high percent cover) ground layer species, three (*Maianthemum canadense*, *Trientalis borealis*, and *Aralia nudicaulis*) are very common species in a very wide variety of habitats in northeastern United States. Though also widespread the other four species (*Carex pensylvanica, Gaultheria procumbens*, *Lysimachia quadrifolia*, and *Pteridium aquilinum*) are generally more restricted to drier habitats (rocky or sandy) at lower elevations. Of these four important species in the ground layer, the *Lysimachia quadrifolia* is perhaps most uniquely associated with sandplain pine-oak-heath forest in Vermont. Found at the bottom of the ground layer list, the range of total plant cover runs from 25.7% in plot #1 to 90.4% in plot #5, with an average plot ground layer cover of 56%.

In the low shrub layer (_ 1 meter high) five species (*Vaccinium vacillans*, *Vaccinium angustifolium*, *Kalmia angustifolia* and *Gaylussacia baccata*), all in the heath family, clearly dominate. These are all inherently low shrub species. While there is considerable variation of total low shrub cover between the plots, the 26% overall average is high compared to most other upland habitats in Vermont. While most of the 15 species recorded in the high shrub layer (generally 1-4 meters tall) are young tree species, three of the most important species in this layer (*Corylus cornuta*, *Amelanchier* sp., and *Hamamelis virginiana*) are true shrub species. While some species of shadbush (*Amelanchier* sp.) can be of small tree form, the species at Camp Johnson mostly takes on the form of a tall shrub. Though not forming high cover, the frequent presence of white pine (*Pinus strobus*) and red maple (*Acer rubrum*) has implications for future forest canopy composition. Like the low shrub layer, the total high shrub cover varies among plots, but has an average of 23%.

Ranging generally from 4 to 15 meters in height, the small tree layer figures found on page 14 show red maple as the clear understory canopy dominant in all plots. These advanced regeneration maples are likely to reach the canopy over time, though disturbances such as fire or disease could prevent this. The total cover of this layer is consistently quite high, averaging 37 percent. The overstory layer figures are proportionally similar to the basal area figures in Table 3. They are a little different in that basal area figures are a combination of overstory and small trees.

Table 6 (page 15) presents a list of all species found in the eight permanent plots during the first sampling, regardless of vegetation layer, and their frequencies. Excluding the two undetermined species in parentheses, the plots combined had a species richness of 71. However, the species richness of individual plots were about half this number (see bottom of Table 5, page 14). While about half of the species occurred in four or more of the plots, about one third were present in only one plot. More plots would be necessary to plot out a good species area curve. *Oryzopsis pungens*, *Lilium philadelphicum*, and *Asclepias exaltata* are three uncommon to rare species found in the plots.

3. Change in Plant Cover Over Time

Tables 7-10 (pages 16 - 19) present plant cover data from both 1993-1994 and 1998-1999 samplings of plots # 1-4, respectively. While more analysis is needed, a few observations are presented here based on the data in these tables. First, species' composition and cover can change dramatically over time, especially after disturbance events. In plot #1 (Table 7) 14 new species appeared in the ground layer after the patch cutting and spring burn. Many of these are ruderal, or weedy, species. Ten ground layer species could not be found on the second sampling. And blackberry (*Rubus allegheniensis*) overwhelmed the high shrub (S1) layer. Similar but less dramatic switches in species composition occurred in plots # 2 and 3 (Tables 8 and 9), both of which were subject to at least cutting disturbance. The appearance of low bindweed (*Calystegia spithamaea*), a state-threatened species, in plot #2 after the two ecological burns and cutting in that MU was of particular significance. Wood lily (*Lilium philadelphicum*), an uncommon plant in Vermont, similarly appeared in plot #2 after the disturbances. A dramatic shift in the abundance of bracken fern (*Pteridium aquilinum*) took place at plot #2, going from 18.7% cover

in 1993 to 95% cover in 1999. In contrast plot #4 (Table 10), which was not subject to the cutting and burns, had relatively little change in species composition or cover.

4. Soil Analysis Results

A copy of the nutrient analysis report on 13 soil samples from seven of the permanent plots is included as Appendix 1 (page 21). At plot # 3, 5, 6, and 8, samples were taken from at least 3 different soil horizons. At plot # 1, 2, and 7 they were taken in the A horizon. The availability of all nutrients dropped with soil depth. Soil acidity, measured as pH, however, rose slightly with depth. Surface layers were generally strongly acid, ranging from 3.8 to 4.96. Textural analysis was not done on these soils, but would be very useful. A comparison of this data with soils in other forested natural communities is needed.

Results of Grid Point Witness Tree Sampling

Included in Appendix 2 (pages 22 - 37) is all the data collected at the 244 grid points during mapping of the Restoration Area from 1995-1997. An explanation of abbreviations and protocol is found on page 22. Just as in land surveys of yore, nearest trees to the stake were recorded as "witness trees". In addition to species' names, diameter at breast height (dbh) of each witness tree was recorded. Landscape position and slope exposure can be useful locational information,

but also provide good ecological information about the Restoration Area. Data to the nearest path was recorded only at some points, so it is not available for analysis at this point.

Table 11 (page 20) presents an analysis of the witness tree data relative to landscape position. Of the 481 trees recorded over all landscape positions, 43% were red maple, 16 % black oak, then white oak, red oak and white pine at 6 - 8%. On the flats, black oak and red maple are the most common trees, with white oak and white pine of secondary importance. Red maple is clearly the dominant species in all slope and drainage bottom positions. While both white and red oaks are common on all three slope positions, black oak drops out going downslope. Sugar maple, such a ubiquitous tree throughout most of Vermont, occurs very sparingly in the Restoration Area, appearing only on the mid-lower slopes and drainage bottoms. Other species, such as musclewood, basswood, white ash, black ash, black cherry and mountain maple are similarly restricted to the lower slope positions and drainage bottoms. Not surprisingly all the birch species and the poplars become prevalent in the borrowpit. While a more thorough GIS analysis would be helpful, it is interesting to note that according to this grid point analysis 39% of the Restoration Area is flats, another 39% slope (upper,mid, and lower) 12% drainage bottom (dry, wet, and alluvial), 8% borrowpit, and 2% in some hillock top position.

An analysis of witness tree size (479 trees) show white pine the largest (97 cm dbh), a 19 cm white oak the median tree, and 23 cm the average diameter. Seventy-eight percent of the trees were 10 - 29.9 cm dbh, 18% 30 - 49.9 cm dbh, and 4% 50 cm dbh or greater.

PUBLIC NOTICE

Vermont Army National Guard

NOTICE OF AVAILABILITY

DRAFT ENVIRONMENTAL ASSESSMENT

The Vermont Army National Guard (VTARNG) proposes to implement an Integrated Natural Resource Management Plan (INRMP) for Camp Johnson training area, Colchester, Vermont. This Draft INRMP will guide natural resources management for the period 2002 through 2006, and will provide a foundation for planning beyond 2006.

Implementation of the management measures contained in this Draft INRMP and associated Environmental Assessment (EA) will maintain, protect, and enhance the ecological integrity on the training lands and the biological communities inhabiting them. In addition, the natural resource management measures described in this plan will protect Camp Johnson's ecosystems and their components from unacceptable damage or degradation and identify and restore previously degraded habitats.

The Vermont Army National Guard is currently conducting a 15-day public review and comment period on the Draft INRMP and combined Draft EA. The Draft EA evaluates potential environmental effects of the proposed action and the no action alternative.

The draft document is available from August 13 through August 28, 2001 for review at the following locations:

Burnam Memorial Library, Colchester, VT 05446. 802-879-7576.

Vermont State Library, 109 State St, Montpelier, VT 05602. 802-828-3261.

Bailey/Howe Library, University of Vermont, Burlington, VT 05403. 802-656-2022.

Public Affairs Office, Vermont National Guard, Green Mountain Armory, Camp Johnson, Colchester, VT. Monday through Friday, 7:30am-4:00pm.

Written substantive comments received on or before August XX, 2001 will be addressed. Send comments to The Adjutant General's Office, Attn: Public Affairs (1LT Johnson), Green Mountain Armory, Camp Johnson, Colchester, VT 05446-3004.

Additional information may be obtained through Lieutenant Johnson by calling (802) 338-3246 or writing to The Adjutant General's Office at the address listed above.

Glossary

Before Present (BP). A method used to describe years preceding the current year. Usually used when describing events which occurred before the arrival of man and used instead of the B.C. and A.D. acronyms. Could substitute 'years ago' for BP.

Best Management Practices. Resource management decisions that are based on the latest professional and technical standards for the protection, enhancement, and rehabilitation of natural and cultural resources.

Biodiversity. The variety of life forms and processes and the environment in which they occur. Biodiversity includes the number and variety of living organisms, the genetic differences among them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning, yet ever changing and adapting.

Conservation. Planned management, use, and protection of natural and cultural resources to provide sustainable use and continued benefit for present and future generations, and the prevention of exploitation, destruction, wasted and/or neglect.

Cultural Resources. Buildings, structures, sites, and objects eligible for r included in the National Register of Historic Places; "cultural items" as defined in 25 U.S.C. 3001 (reference (u)); American Indian, Eskimo, Aleut, or Native Hawaiian scared sites for which access is protected under 42 U.S.C. 1996 (reference(d)); "archeological resources" as defined by Section 470 aa-11 of 16 U.S.C. (reference h)); and :archeological artifact collections and associated records" defined under 36 CFR 79 (reference (e)).

Ecosystem. A dynamic and natural complex of living organisms interacting with each other and with their associated non-living environment.

Ecosystem Management. A goal-driven approach to managing natural and cultural resources that supports present and future mission requirements; preserves ecosystem integrity; is at a scale compatible with natural processes; is cognizant of nature's timeframes; recognizes social and economic viability with functioning ecosystems; is adaptable to complex and changing environmental requirements; and is realize through effective partnerships among private, local, State, tribal, and Federal Interests. Ecosystem management is a process that considers the environment as a complex system functioning as a whole, not as a collection of parts, and recognizes that people and their social and economic needs are a part of the whole.

INRMP. Integrated Natural Resources Management Plan.

Natural Resources. All Elements of nature and their environments of soul, air, and water. Those consist of earth resources (non-living resources such as minerals and soil) and biological resources (living resources such as plants and animals).

Riparian Area. The vegetation that occurs along the moisture gradient on soils adjacent to watercourses, waterbodies and seeps. The closer the vegetation is to the water, the more flood-tolerant it must be.

Stewardship. The management of resources entrusted to one's care in a way that preserves and enhances the resources and their benefits for present and future generations.

Wetlands. Lands where saturation is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soiil and on its surface. Common terms used to describe various wetlands include; marshes, bogs, swamps, sloughs, potholes, vernal pools and wet meadows.

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Unpublished documents available on request at the Environmental Office of the Vermont Army National Guard, Camp Johnson, Colchester Vermont.

STATE OF VERMONT
OFFICE OF THE ADJUTANT GENERAL
CAMP JOHNSON
COLCHESTER
05446-3004

06 April 2001

(802)338-3300

Army Corps of Engineers
Vermont Field Office
ATTN: Ms. Marty Abair/Mr Mike Adams
8 Carmichael St., Suite 205
Essex Jct., VT 05452

Dear Ms. Abair and Mr. Adams:

To comply with current Army policies and with the Sikes Act (16 U.S.C. 670 et seq.), and the Sikes Improvement Act of 1997, The State of Vermont Military Department has completed a draft of the required Integrated Natural Resources Management Plan (INRMP) for Camp Johnson, in Chittenden County, Vermont

According to the National Environmental Policy Act (NEPA), the Vermont Army National Guard (VTARNG) must assess the potential environmental impacts of this proposed action. Base on a preliminary evaluation of the action, the VTARNG has prepared a draft Environmental Assessment (EA) to address this action to fulfill the NEPA requirements. This EA is combined with the INRMP and is designed as one document to avoid repetition of and to address both documents simultaneously.

The INRMP is a comprehensive plan to guide the natural resources management program at the 660 acre military installation from 2001 through 2005. This will ensure that natural resource conservation measures and Army activities on EAFR are integrated and are consistent with federal stewardship requirements. In addition, the INRMP will allow the Army to achieve its goal of maintaining military readiness, while maintaining and improving ecosystem viability.

In accordance with Executive Order 12372 (Intergovernmental Review of Federal Programs) and National Guard Policy, the VTARNG is requesting input from other federal, state and local agencies. Please provide comments or information within thirty (30) days of receipt of this package. Responses should be sent to:

Mr. Mike O'Hara
State of Vermont Military Department
Building #5, Camp Johnson
Colchester, VT 05446-3004

Your assistance in providing information is greatly appreciated and your continued support in the NEPA process is highly encouraged. Questions may be directed to Lieutenant Colonel Raymond Bouchard, the Environmental Chief, or Mike O'Hara, the Natural Resource Specialist, at (802)338-3306 or 3311.

Sincerely,

for ALAN L. NYE
Colonel, VT Army National Guard
Facilities Management Officer

Enclosure

STATE OF VERMONT
OFFICE OF THE ADJUTANT GENERAL
CAMP JOHNSON
COLCHESTER
05446-3004

(802)338-3300

06 April 2001

Agency of Natural Resources
ATTN: Ms. Gina Campoli (Environmental Project Reviews Coordinator)
103 South Main Street
Center Building
Waterbury, VT 05671-0301

Dear Ms Campoli:

To comply with current Army policies and with the Sikes Act (16 U.S.C. 670 et seq.), and the Sikes Improvement Act of 1997, The State of Vermont Military Department has completed a draft of the required Integrated Natural Resources Management Plan (INRMP) for Camp Johnson, in Chittenden County, Vermont

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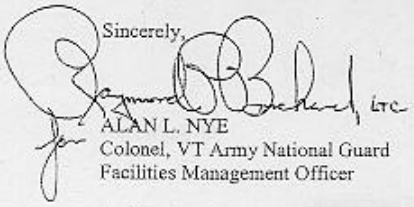
Mr. Mike O'Hara
State of Vermont Military Department
Building #5, Camp Johnson
Colchester, VT 05446-3004

Your assistance in providing information is greatly appreciated and your continued support in the NEPA process is highly encouraged.

J-3

Questions may be directed to Lieutenant Colonel Raymond Bouchard, the Environmental Chief, or Mike O'Hara, the Natural Resource Specialist, at (802)338-3306 or 3311.

Sincerely,



ALAN L. NYE
Colonel, VT Army National Guard
Facilities Management Officer

Enclosure

STATE OF VERMONT
OFFICE OF THE ADJUTANT GENERAL
CAMP JOHNSON
COLCHESTER
05446-3004

06 April 2001

(802)338-3300

State Division for Historic Preservation
ATTN: Ms G. Peebles/Ms. J. Erhlich
(Director: Ms. Emily Eadham)
National Life Building, Drawer 20
Montpelier, VT 05602-0501

Dear Ms. Peebles:

To comply with current Army policies and with the Sikes Act (16 U.S.C. 670 et seq.), and the Sikes Improvement Act of 1997, The State of Vermont Military Department has completed a draft of the required Integrated Natural Resources Management Plan (INRMP) for Camp Johnson, in Chittenden County, Vermont

According to the National Environmental Policy Act (NEPA), the Vermont Army National Guard (VTARNG) must assess the potential environmental impacts of this proposed action. Base on a preliminary evaluation of the action, the VTARNG has prepared a draft Environmental Assessment (EA) to address this action to fulfill the NEPA requirements. This EA is combined with the INRMP and is designed as one document to avoid repetition of and to address both documents simultaneously.

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In accordance with Executive Order 12372 (Intergovernmental Review of Federal Programs) and National Guard Policy, the VTARNG is requesting input from other federal, state and local agencies. Please provide comments or information within thirty (30) days of receipt of this package. Responses should be sent to:

Mr. Mike O'Hara
State of Vermont Military Department
Building #5, Camp Johnson
Colchester, VT 05446-3004

J-5

Your assistance in providing information is greatly appreciated and your continued support in the NEPA process is highly encouraged. Questions may be directed to Lieutenant Colonel Raymond Bouchard, the Environmental Chief, or Mike O'Hara, the Natural Resource Specialist, at (802)338-3306 or 3311.

Sincerely,

ALAN L. NYE
Colonel, VT Army National Guard
Facilities Management Officer

Enclosure

STATE OF VERMONT
OFFICE OF THE ADJUTANT GENERAL
CAMP JOHNSON
COLCHESTER
05446-3004

06 April 2001

(802)338-3300

U.S. Fish and Wildlife Service
New England Field Office
ATTN: Mr. Michael Amaral
22 Bridge Street, Unit 1
Concord, NH 03301-4986

Dear Mr. Amaral:

To comply with current Army policies and with the Sikes Act (16 U.S.C. 670 et seq.), and the Sikes Improvement Act of 1997, The State of Vermont Military Department has completed a draft of the required Integrated Natural Resources Management Plan (INRMP) for Camp Johnson, in Chittenden County, Vermont

According to the National Environmental Policy Act (NEPA), the Vermont Army National Guard (VTARNG) must assess the potential environmental impacts of this proposed action. Base on a preliminary evaluation of the action, the VTARNG has prepared a draft Environmental Assessment (EA) to address this action to fulfill the NEPA requirements. This EA is combined with the INRMP and is designed as one document to avoid repetition of and to address both documents simultaneously.

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In accordance with Executive Order 12372 (Intergovernmental Review of Federal Programs) and National Guard Policy, the VTARNG is requesting input from other federal, state and local agencies. Please provide comments or information within thirty (30) days of receipt of this package. Responses should be sent to:

Mr. Mike O'Hara
State of Vermont Military Department
Building #5, Camp Johnson
Colchester, VT 05446-3004

J-7

Your assistance in providing information is greatly appreciated and your continued support in the NEPA process is highly encouraged. Questions may be directed to Lieutenant Colonel Raymond Bouchard, the Environmental Chief, or Mike O'Hara, the Natural Resource Specialist, at (802)338-3306 or 3311.

Sincerely,

ALAN L. NYE
Colonel, VT Army National Guard
Facilities Management Officer

Enclosure

STATE OF VERMONT
OFFICE OF THE ADJUTANT GENERAL
CAMP JOHNSON
COLCHESTER
05446-3004

06 April 2001

(802)338-3300

Vermont SCS State Office (USDA)
ATTN: Mr. David G. Van Houten
69 Union Street
Winooski, VT 05404

Dear Mr. Van Houten:

To comply with current Army policies and with the Sikes Act (16 U.S.C. 670 et seq.), and the Sikes Improvement Act of 1997, The State of Vermont Military Department has completed a draft of the required Integrated Natural Resources Management Plan (INRMP) Camp Johnson , in Chittenden County, Vermont

According to the National Environmental Policy Act (NEPA), the Vermont Army National Guard (VTARNG) must assess the potential environmental impacts of this proposed action. Base on a preliminary evaluation of the action, the VTARNG has prepared a draft Environmental Assessment (EA) to address this action to fulfill the NEPA requirements. This EA is combined with the INRMP and is designed as one document to avoid repetition of and to address both documents simultaneously.

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In accordance with Executive Order 12372 (Intergovernmental Review of Federal Programs) and National Guard Policy, the VTARNG is requesting input from other federal, state and local agencies. Please provide comments or information within thirty (30) days of receipt of this package. Responses should be sent to:

Mr. Mike O'Hara
State of Vermont Military Department
Building #5, Camp Johnson
Colchester, VT 05446-3004

Your assistance in providing information is greatly appreciated and your continued support in the NEPA process is highly encouraged. Questions may be directed to Lieutenant Colonel Raymond

J-9

Bouchard, the Environmental Chief, or Mike O'Hara, the Natural Resource Specialist, at (802)338-3306 or 3311.

Sincerely,

ALAN L. NYE
Colonel, VT Army National Guard
Facilities Management Officer

Enclosure

STATE OF VERMONT
OFFICE OF THE ADJUTANT GENERAL
CAMP JOHNSON
COLCHESTER
05446-3004

06 April 2001

Mr. Ronald Regan
Commissioner
Vermont Fish and Wildlife Department
103 South Main Street, 10 South
Waterbury, VT 05671-0501

Dear Mr. Regan:

To comply with current Army policies and with the Sikes Act (16 U.S.C. 670 et seq.), and the Sikes Improvement Act of 1997, The State of Vermont Military Department has completed a required Integrated Natural Resources Management Plan (INRMP) for Camp Johnson, in Chittenden County, Vermont.

The INRMP is a comprehensive plan to guide the natural resources management program at the 660 acre military installation from 2001 through 2005. This will ensure that natural resource conservation measures and Army activities on EAFR are integrated and are consistent with federal stewardship requirements. In addition, the INRMP will allow the Army to achieve its goal of maintaining military readiness, while maintaining and improving ecosystem viability.

Potential habitat for federal and state-listed endangered species has been surveyed every year since 1989 by Natural Resource Program Staff. Independent surveys for federally listed species have been conducted on a contractual basis with the most recent occurring in 1999.

To date, no occurrence of federal or state- listed endangered species have been recorded in the EAFR. Monitoring of potential critical habitat for endangered species will continue as an annual activity to insure that any changes in the status of endangered species are detected.

In our judgment, the Natural Resources Management Plan for the EAFR meets standards imposed by the Endangered Species Act. Because no federal or state listed endangered species have been found on the EAFR, no action proposed by the INRMP may be construed as a taking of any listed species or their habitat. No action proposed by the revised Natural Resources Management Plan will jeopardize a listed species or work against the conservation of any listed species.

J-11

On behalf of the Vermont Army National Guard and the Vermont Military Department, request is made for review by the Fish and Wildlife Department of potential impacts to endangered plant or animal species caused by actions proposed in this Integrated Natural Resource Management Plan. Please contact Mr. Mike O'Hara or myself at 802-338-3311 if additional information is needed.

We have enjoyed working with members of your department in the past on natural resource issues affecting the Ethan Allen Firing Range, and look forward to continued cooperation in the future. Thank you.

Sincerely,

for COL Alan L. Nye
Facilities Management Officer
Vermont Military Department

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
696 VIRGINIA ROAD
CONCORD, MASSACHUSETTS 01742-2751

REPLY TO
ATTENTION OF

8 Carmichael Street, Suite 205
Essex Junction, Vermont 05452
May 9, 2001

Regulatory Division
CENAE-CO-R-61

Mr. Mike O'Hara
State of Vermont Military Department
Building #5, Camp Johnson
Colchester, Vermont 05446-3004

Dear Mr. O'Hara:

Thank you for the opportunity to review your "(Draft) Integrated Natural Resource Management Plan for 2001-2005 and (Draft) Environmental Assessment" for Camp Johnson. I apologize for the tardiness of my response. I did not receive the document until May 2, 2001.

For your information, let me first briefly describe Corps of Engineers jurisdiction. A Corps of Engineers permit is required [for all work beyond ordinary high water in or above navigable waters of the United States under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403). In New England, for the purposes of Section 10, navigable waters of the United States are those subject to the ebb and flow of the tide and a few major waterways, such as Lake Champlain and the major river systems, that were used in the past, are currently used, or are susceptible for use in the future to transport interstate or foreign commerce. Permits are required under Section 404 of the Clean Water Act for those activities involving the discharge of dredged or fill material in all waters of the United States, including not only navigable waters of the United States but also inland rivers, lakes, streams and wetlands. In inland waters Corps jurisdiction under the Clean Water Act extends landward to the ordinary high water mark or the landward limit of any wetlands. The term "discharge" in this context may include the redepositing of wetlands soils such as occurs during mechanized landclearing activities, including grubbing, grading and excavation.

The term "wetlands", used above, is defined by Federal regulations to mean "...those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions..." (33

C.F.R. Part 328.3 (b), as published in the November 13, 1986 Federal Register). Wetlands generally include swamps, marshes, bogs and similar areas.

Your proposed management measures for water resources are commendable. I do, however, have several comments:

1) All wetlands on Camp Johnson are subject to Federal jurisdiction under Section 404 of the Clean Water Act. Classification of a wetland as a Class I, II or III under the Vermont Wetland Rules has no effect on how an area is viewed under Federal regulations. The State's classification of wetlands is based on whether or not the wetland is mapped or contiguous to a wetland that is mapped on the National Wetland Inventory maps. Designation of a wetland as Class II or Class III is not necessarily indicative of its' value. I would recommend, therefore, that a 50' buffer be maintained around all of the wetlands on the facility.
2) Any activity to restore a degraded wetland or to mitigate impacts on habitats should be discussed with this office to determine and permit requirements prior to implementation.
3) Any development or training activity that may impact wetlands or waterways should be discussed with this office to determine and permit requirements prior to implementation.
4) Any operations and maintenance programs that may impact wetlands or waterways should be discussed with this office to determine and permit requirements prior to implementation.
5) Any proposed stream crossings will require prior authorization from the Corps of Engineers.
6) You note in your Figure 3.2 that there are Class I wetlands on the facility, yet on page 5-14 you note that there are no Class I wetlands on Camp Johnson.

Please feel free to contact me if you have any questions at 802 872-2893. Again, thank you for the opportunity to comment.

Sincerely,

Martha Abair

Martha Abair
Senior Project Manager
Regulatory Division

J-184

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Lake Champlain Fish and Wildlife Resources Office
11 Lincoln Street
Essex Junction, Vermont 05452

In Reply Refer To:
FWS/Region 5/LCFWRO

MAY 30 2001

Mr. Mike O'Hara
State of Vermont Military Department
Building #5, Camp Johnson
Colchester, Vermont 05446-3004

Dear Mr. O'Hara:

We have reviewed the Draft Integrated Natural Resources Management Plan for the Vermont Army National Guard, Camp Johnson. The report identifies several unique habitat types found in Camp Johnson and makes prudent suggestions to improve or maintain current conditions.

Based on information currently available to us, no federally listed or proposed threatened or endangered species under the jurisdiction of the U.S. Fish and Wildlife Service are known to occur in the project area.

If, in the future, you need any biological assessment or would like to confer regarding opportunities for habitat restoration, please don't hesitate to contact me at 802/872-0629.

Sincerely,

David A. Tilton

David A. Tilton
Project Leader

cc: Michael Amaral, New England Field Office
David Perkins, Region 5 Division of Fish and Wildlife Assessment
David Linck, Military Coordinator, Lake Champlain Complex

J-15

STATE OF VERMONT
OFFICE OF THE ADJUTANT GENERAL
CAMP JOHNSON
COLCHESTER
05446-3004

I, Colonel Alan L. Nye, Director of Facilities, request that the public comment period for both the Draft Environmental Assessment (EA) and the Final EA with FNSI involving the Integrated Natural Resource Management Plan for Camp Johnson be reduced from thirty (30) to fifteen (15) days.

I certify the two separate 30-day waiting periods may jeopardize the meeting of DOD's suspense in November 2001. The two thirty-day comment periods plus the staffing time will not allow all work to be completed as necessary.

The two full thirty-day comment periods is not thought to provide public benefit. The proposed Management Plan does not have new activities but merely discusses and consolidates existing practices that have occurred for several years. These practices are compatible to the existing surrounding structures and land use and are not likely to illicit any public comments (based on experience from past EAs completed by the VTARNG). Furthermore, the proposed action in its self does not pose national concern, is not unprecedented, and is not likely to require an EIS.

Colonel Alan L. Nye, Director of Facilities — Date: 3 Aug 01

Signature of Reviewing Official at NGB-ARE — Date: 3 Aug 01

☒ Approved
☐ Disapproved

16
J-09

State of Vermont

AGENCY OF NATURAL RESOURCES

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation

DEPARTMENT OF FISH AND WILDLIFE
103 South Main Street, 10 South
Waterbury, Vermont 05671-0501

Tel.: (802) 241-3700
TDD: 1-800-253-0191

June 15, 2001

RAM
MIKE

Colonel Alan L. Nye
Facilities Management Officer
Camp Johnson
Colchester, VT 05446 – 3004

RE: Draft Integrated Natural Resource Management Plan for Camp Johnson

Dear Colonel Nye:

I apologize for the extensive delay in responding to your request for comments on the Camp Johnson management plan. Circulating the draft plan among the staff of the Nongame and Natural Heritage Program, Fisheries, and Wildlife divisions in both the central and district offices can take time. I hope that these comments do not come too late to be incorporated into the final management plan.

Overall, the Integrated Natural Resource Management Plan and Environmental Assessment are very comprehensive. The Department offers the following specific comments that, if incorporated, will fully address our interests. They are:

Pg. 3-17 Line 25. Although it is not incorrect to refer to the predominant vegetation type as a pine-oak-heath sandplain habitat, it is more correct to refer to it as a natural community type. Perhaps this term could be defined if there is potential for confusion among the intended audience. Same comment for Pg. 3-23 Line 30.

Pg. 3-18 Table 3-4. Isotria verticillata is ranked S2 and the common name is large whorled pogonia. The green adder's mouth is ranked S2. Tuckerman's panic grass is ranked S2. Slender knotweed is ranked S1. Many leaved sedge is ranked S2.

Pg. 3-19 Line 5. We question the distribution of sandplains as occurring in a linear network of interwoven patches on the landscape. They are better described as occurring in large patches of flat terrain incised by small streams.

Pg. 3-19 Line 7. Here, the pitch pine restoration area is said to comprise 126 acres, but on Pg. 5-16 Line 23 it is listed as 196 acres. We also suggest referring to this area as the sandplain restoration area rather than the pitch pine restoration area. You are attempting to restore more than just pitch pine here, and future users may think that we're trying to ultimately create a pine plantation.

Page 5-7 Line 22. We applaud your mention of and share your concern about erosional problems caused by mountain biking on the base. We agree that a long term solution is necessary, and suggest adding natural resource concerns to those of the mountain biking public and the military mission.

Page 5-16 Line 21. Although pitch pine stands are declining throughout the state, the species is by no means rare or even uncommon. Our principal concern remains with the pine-oak-heath natural community of which pitch pine is a primary constituent.

Page 5-17 Line 14. A prescribed burn is being considered either for the summer of 2001 or the spring of 2002.

Page 5-22 Line 5. The total acreage of known sandplain in the state is approximately 265 ha or 665 acres.

Page 5-22 Line 24. We heartily applaud your management suggestion to develop signs for soldiers and community members explaining the fragile nature of the restoration area and the rare species it contains.

Page 5-26 Line 25. We very much appreciate and endorse your management strategy for the state threatened grasshopper sparrow. Prohibiting mowing in the area used by the sparrows until after August 1st while continuing to monitor their success on an annual basis should help maintain the present population at the base.

General Comment. On Pg. 5-16 Line 23 it is mentioned that pitch pine habitat extends beyond the restoration area by probably twice that amount. It would be great to mention that some good sandplain also occurs to the north of Sunderland Brook, and that some restoration may be appropriate here in the future.

Thank you for the opportunity to comment.

Sincerely,

Scott R. Darling
Director of Wildlife

SRD/lh

State of Vermont

AGENCY OF NATURAL RESOURCES

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation

DEPARTMENT OF FISH AND WILDLIFE
103 South Main Street, 10 South
Waterbury, Vermont 05671-0501

Tel.: (802) 241-3700
TDD: 1-800-253-0191

Office of the Secretary
28 June, 1999

Major General Martha T. Rainville
The Adjutant General
Green Mountain Armory
Camp Johnson
Colchester, VT 05446-3004

Dear General Rainville:

I am pleased to write you about the very positive interactions and results the Agency of Natural Resources has had with the Vermont Military Department. Colonel Alan Nye recently hosted a conference on "Sandplain Forests: Vermont's Most Endangered Natural Community" at your Lafayette Training Building at Camp Johnson. I had the honor of welcoming participants to this conference and truly believe that the Sandplain Forest natural community at Camp Johnson is an important statewide asset. The cooperative management of Sandplain Forest at Camp Johnson is a model of how agencies can work successfully together and develop "win-win" situations.

The staff of the Fish and Wildlife Department's Nongame and Natural Heritage Program work closely with Colonel Nye and others at Camp Johnson and together they have protected and enhanced a part of our natural heritage that has otherwise been largely lost in Vermont. Camp Johnson retains the largest viable example of Sandplain Forest in Vermont. Proactive management, using such tools as prescribed burning, is restoring the natural Sandplain Forest community at Camp Johnson. We are grateful to the Vermont Military Department for funding and assistance with management of the Sandplain Forest. Restoration and management of Sandplain Forest at Camp Johnson along with its constituent rare, threatened, and endangered species are the subject of the 1992 Memorandum of Agreement between the Vermont Fish and Wildlife Department and the Vermont Military Department.

The Vermont Military Department is to be commended for being responsible stewards of their land while maintaining the uses needed to fulfill their mission. I know there has

been, and continues to be, pressure to develop the land at Camp Johnson for commercial purposes. The Vermont Agency of Natural Resources is willing to stand alongside the Vermont Military Department and prevent further impacts to Camp Johnson. The natural heritage value of military land holdings nationwide is becoming more widely appreciated and Camp Johnson is Vermont's shining example. Grasshopper sparrows were recently reported at Camp Johnson and our agency was immediately contacted. Nongame and Natural Heritage staff verified the presence of this state-threatened grassland bird, provided management guidelines to Colonel Nye, and offered direct assistance with developing a management plan that is compatible with Vermont Military Department uses of the area. We look forward to continuing to work together with the Vermont Military Department and believe the current use of camp Johnson as a military base is more compatible with its high natural heritage values than other proposed uses.

Sincerely,

John Kassel, Secretary
Vermont Agency of Natural Resources

cc: Colonel Alan Nye
Commissioner Ronald J. Regan

STATE OF VERMONT
OFFICE OF THE ADJUTANT GENERAL
CAMP JOHNSON
COLCHESTER
05446-3004
(802) 338-3306

VT-FE-EV

11 April 2000

Memorandum For: The Record

Subject: Government to Government Consultation, E.O. 13084 and Programmatic MLRS Environmental Assessment

1. References:

   a) Telecon w/ Mr. Eric Anderson, Conservation Branch Chief, NGB-ARE on 07 1530 April 2000, Subject: Same as above.
   b) Telecon w/ Major Brian Rogers, National Environmental Policy Act Chief, NGB-ARE on 11 1210 April 2000, Subject: Same as above.
   c) Telecons w/ Mr. Scott Dillon, State of Vermont Historic Preservation Office, on 24 0830 March 2000 and 07 1200 April 2000, Subject: Listing of Native American Tribes.

2. Per the conversation with Mr. Eric Anderson, I have since checked the Bureau of Indian Affairs' (BIA) website at http://www.doi.gov/bureau-indian-affairs.html. I've checked both the Northeastern Maps and the Federally Recognized Tribe Lists. The Map does not show such tribes within Vermont (see attachment). I did crosscheck the known Native American Tribes who reside in Vermont - - The ~~Eastern~~ Abenakis - - but they are not federally listed on the BIA listing either. Also, the St. Francis/Sokoki band was

3. I've also confirmed via telephone with Mr. Scott Dillon, of the Vermont State Historic and Preservation Office, that Vermont has neither federally- nor state-listed Native American Tribes.

4. Consequently, it is my belief that further work to comply with E.O. 13084 and to evaluate additional impacts to Native American Tribes (outside of the traditional archaeological considerations) is unnecessary and the initial intent is met.

5. Questions should be directed to the undersigned by calling (802) 338-3306 or by email rbouchard@mil.state.vt.us.

Att:
as

RAYMOND P. BOUCHARD
Major, VT Army National Guard
Environmental Chief

c.c. Home Engineering
NGB-ARE (Attn: CPT M. Williams)

Encl # 1

STATE OF VERMONT
OFFICE OF THE ADJUTANT GENERAL
CAMP JOHNSON
COLCHESTER
05446-3004

April 30, 2001

Mr. Jeff Benay
Chair of Governor's Commission of Native American Affairs
Suite 5, 14 First St.
Swanton, VT 05488

Dear Mr. Benay:

The Vermont Army National Guard is working on a number of initiatives as responsible stewards of lands that we manage. The initiatives include the writing of two Integrated Natural Resource Management Plans for the largest two training sites and a Cultural Resource Management Plan that incorporates all our facilities that associated with federal support. We are also in the process of conducting an environmental review for proposed construction of a maintenance shop in Fair Haven.

As a federal agency, we must comply with Section 106 of the National Historic Preservation Act, Executive Order 13175 "Consultation and Coordination with Indian Tribal Governments" and 36 CFR 800 Advisory Council on Historic Preservation (ACHP) regulations "Protection of Historic Properties."

I am hoping that your office can provide guidance and assist in our efforts to comply with Government to Governmental Consultations with Native American requirements. I recognize that Vermont's Native American history is somewhat poorly understood. I do know that neither Federally nor State Recognized Native American Tribes reside within Vermont.

I am hoping that consultation with the commission would in part satisfy these requirements. I have conferred with a State Archaeologist from the VT Agency of Transportation. He has forwarded me a list with eighteen different Native American groups that he has identified through his personal research and that he believes have some sort of historical tie with Vermont at one time or another. His notes show some may have migrated to Vermont with a presence as little as a few years and as late as the Seventeenth Century.

As a novice who has read "The Original Vermonter's—Native Inhabitants, Past and Present by William A. Haviland and Marjory W. Powers, 1994 and other historic references, I am a bit hesitant in blindly sending letters to each of the eighteen different

Encl. #2, pg #1

Native Americans groups. As I look at the attached list, I see members whom I associate as warring nations who had little if any presence here in Vermont due to the indigenous presence. At the same time, I do not feel qualified to pare this list down. Consequently, I am looking to you and the commission for guidance and direction.

Enclosed is an abbreviated location description of the Army National Guard Facilities and a map denoting the towns located. With these locations and your resources concerning Indian Affairs, I am hoping the Commission can help us meet the intent of Executive Order 13175 as it applies to Vermont's unique history.

I understand that the St. Francis/Sokoki Band has yet to obtain "federal recognition," in the prerequisite to Section 101(*d*)(2). However, the local Abenaki band has a close relationship and has had constant presence in Vermont. Consequently, I see them as a resource that might help us to identify religious or cultural significance to properties that we may manage. Their input shall be sought as an interested party as allowed per the National Environmental Policy Act.

I, respectfully, request that your office respond within the next thirty days after receiving this letter. A written list narrowing the number of federal recognized Native Americans with respect to our facility locations or a request to review the mentioned Management Plans/Environmental Assessments will move this effort in a forward direction.

Please direct comments to The Vermont Army National Guard, Attn: VT-FE-EV (LTC R. Bouchard), Building #5, Camp Johnson, Colchester, VT 05446-3004. If you have questions, you may reach me at (802) 338-3306 or via e-mail: raymond.bouchard@vt.ngb.army.mil.

I thank you for your anticipated cooperation and patience with our latest efforts.

Sincerely,

Encl.

RAYMOND P. BOUCHARD
Lieutenant Colonel, VT Army National Guard
Senior Environmental Officer

Encl #2, pg 2

ABBREVIATED DESCRIPTION OF VERMONT ARMY NATIONAL GUARD FACILITY LOCATIONS

ARMORIES: Most of these sites are simply armories on a couple of acres. Twenty of these sole armory sites are located throughout the state.

MAINTENANCE SHOPS: The maintenance shops are on five to ten acres plots. The outlying maintenance shops are located in St. Albans Town, Lyndonville, and Rutland City.

TRAINING SITES: In addition, the Vermont Army National Guard has three larger facilities where administrative support, maintenance of equipment and training occurs. These three facilities are Camp Johnson, Ethan Allen Firing Range, and Westminster Training Site.

1. Camp Johnson is a 660 installation in Colchester, VT. Camp Johnson is north of Saint Michael's College and sandwiched between Routes 15 and 7.

2. Ethan Allen Firing Range is an 11,218 acre site that incorporates parts of three different town—Jericho, Underhill, and Bolton.

3. The Westminster Training Site consists of thirty-six acres. The Westminster site is located on Town Road #30 and is within two miles of the Interstate 89 exit.

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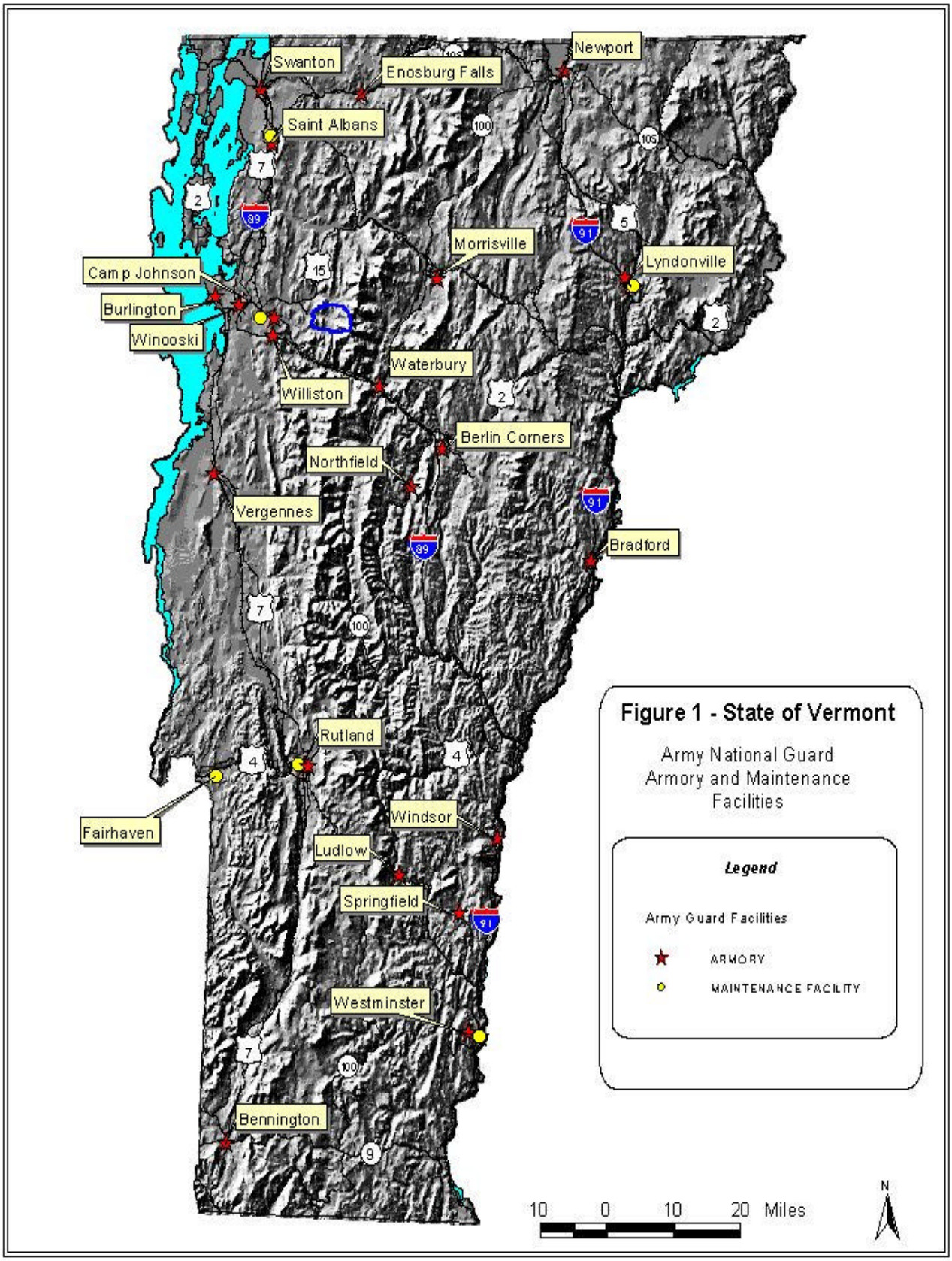
Swanton
Enosburg Falls
Newport
Saint Albans
Morrisville
Lyndonville
Camp Johnson
Burlington
Winooski
Waterbury
Williston
Berlin Corners
Northfield
Vergennes
Bradford
Rutland
Fairhaven
Windsor
Ludlow
Springfield
Westminster
Bennington
Figure 1 - State of Vermont
Army National Guard
Armory and Maintenance
Facilities
Legend
Army Guard Facilities
ARMORY
MAINTENANCE FACILITY
10 0 10 20 Miles
N

LIST OF EIGHTEEN NATIVE AMERICAN COMMUNITIES WITH POSSIBLE TIES TO VERMONT

Western Abenaki Tribes

Ron Silliboy, Interim Chief, Aroostook Band of Micmacs, P.O. Box 772, Presque Isle, ME 04769

Brenda Commander, Chairperson, Houlton Band of Maliseet Indians, Rte. 3, Box 450, Houlton, ME 04730

Richard Doyle, Governor, Passamaquoddy Tribe – Pleasant Point Reservation, P.O. Box 343, Perry, ME 04667

Richard Stevens, Governor, Passamaquoddy Tribe – Indian Township Reservation, P.O. Box 301, Princeton, ME 04668

Richard H. Hamilton, Governor, Penobscot Indian Nation, Community Bldg. – Indian Island, Old Town, ME 04468

Iroquois Tribes – Some supposedly lived in certain parts of western VT

Vernon Isaac, Chief, Cayuga Nation of Indians, P.O. Box 11, Versailles, NY 14168

Irving Powless, Jr., Chief, Onondaga Indian Nation, RR #1, Box 319-B, Nedrow, NY 13120

Ray Halbritter, Reresentative, Oneida Indian Nation, Genesee Street, Ames Plaza, Oneida, NY 13421

Edward Smoke, Chief, St. Regis Mohawk Tribe, Route 37, Box 8A, Hogansburg, NY 13655

Emerson Webster, Chief, Tonawanda Band of Seneca, 7027 Meadville Road, Basom, NY 14013

Leo Henry, Chief, Tuscarora Nation, 5616 Walmore Road, Lewistown, NY 14092

Duane J. Ray, President, Seneca Nation of Indians, P.O. Box 231, Salamanca, NY 14779

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Deborah J Doxtator, Chariperson, Oneida Tribe of Indians of Wisconsin, P.O. Box 365, Oneida, WI 54155-0365

NEW ENGLAND TRIBES – in 1640's to 1680's forced out, some re-established in Vermont for a time.

Kenneth Reels, Chairman, Mashantucket Pequot Tribe, 1 Matts Path, P.O. Box 3060, Mashantucket, CT 06339

Matthew Thomas, Chief Sachem, Narrangansett Indian Tribe, P.O. Box 268, Charlestown, RI 02813

Roland Harris, Chairman, Mohegan Indian Tribe, 67 Sandy Desert Road, Uncasville, CT 06382

Beverly Wright, Chairperson, Wampanoag, Tribe of Gay Head (Aquinnah), State Road RR1, Box 137, Gay Head, MA 02535

Robert Chicks, President, Stockbridge Munsee Community of Wisconsin, N8476 Mo He Con Nuck Road, Bowler, WI 54416

Governor's Advisory
Commission on
Native American
Affairs

c/o Jeff Benay, Chairman
14 First Street, Suite 5
Swanton, VT 05488
(802) 868-4033

May 22, 2001

Lt. Colonel Raymond Bouchard
The Vermont Army National Guard
Building #5, Camp Johnson
Colchester, VT 05446

Dear Lt. Colonel Bouchard:

As per our conversation, I discussed your letter (April 30, 2001) with Commission members at our meeting on May 17th. Members were pleased with your thoughtfulness in our inclusion; however, the overall feeling was that you should be dealing directly with the Abenaki Tribal Council as you have already initiated contact with Acting Chief April Rushlow.

Furthermore, the consensus of Commission members was that "interested parties" rest with the Abenaki alone and the other tribes on your list do not have a current presence in Vermont other than alliance and friendship with the Abenaki. Therefore, their participation is superfluous.

If you have any further questions, do not hesitate to contact me.

Sincerely,

Jeff Benay, Ed.D.
Chair

Encl #3

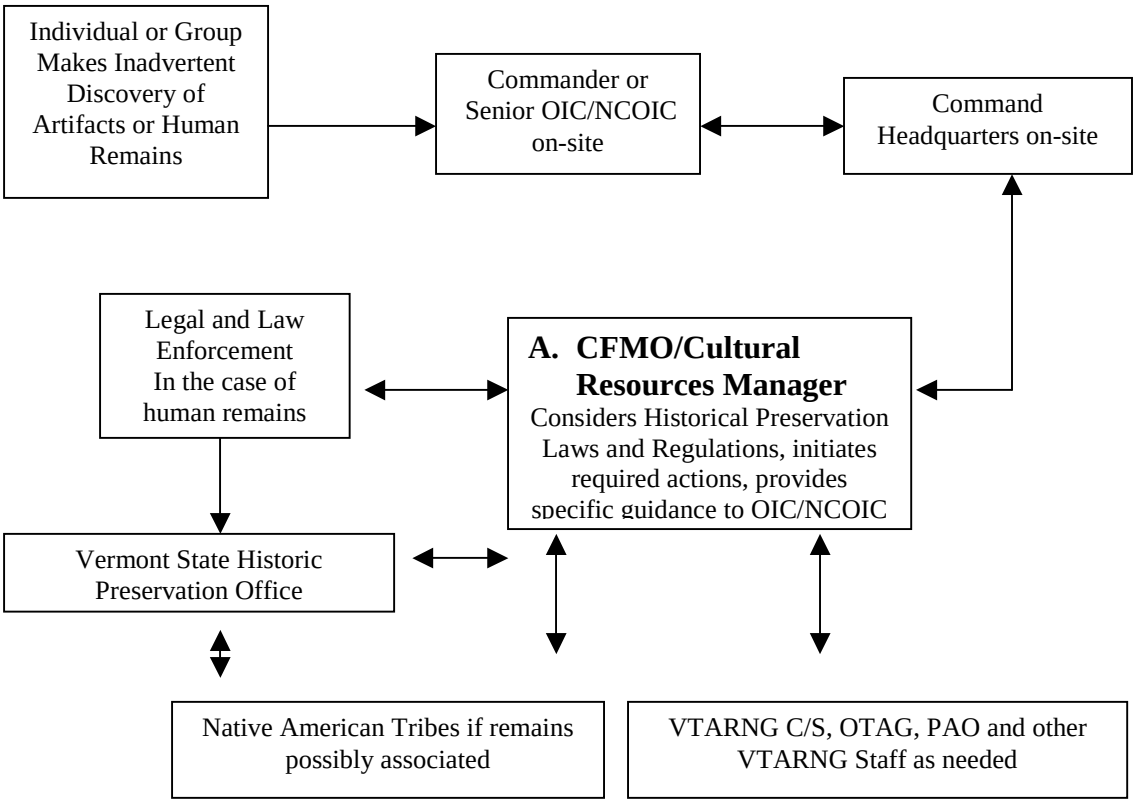
CULTURAL RESOURCES PROTOCOL

The following are the minimum procedures for reporting on archaeological and historical resources encountered in the course of operations on this facility:

Inadvertent discovery of **artifacts** (arrowheads, pottery, old glass items, coins, and similar objects), **features** (old foundations and walls, cellar pits, old wells, old gravestones, and similar remains), and **human remains** (burials, unmarked graves, pieces of human bone).

1) Report the find as soon as possible to your immediate superior.
2) Do not move or remove the find and, whenever possible, avoid the find and make sure of its location.
3) The location and type of find should then be reported as soon as possible to the CFMO

Special Note In the case of the inadvertent discovery of **human remains** it is extremely important that the area be avoided and left undisturbed. At a minimum and whenever possible an avoidance perimeter of 50 feet around the remains should be maintained and enforced until the CFMO has been notified. As per the Vermont Attorney General's Office, the VTARNG shall not assume remains are Native American and the discovery shall, initially, be treated as a crime scene. The CFMO or CRM shall work closely with the JAG. The State Police (and if federal site, the FBI) shall be notified through the JAG. VTARNG will comply with NAGPRA requirements. Detailed notification procedures for inadvertent discovery of cultural resources and human remains are outlined below:



Legal notice **The Archaeological Resources Protection Act of 1979 (16 U.S.C 470ee)** states that any person who knowingly excavates, removes, damages, alters or otherwise defaces archaeological resources may be subject to a fine of up to $20,000 or imprisoned not more than two years, or both. (21 SEP 01).

Appendix M – List of Preparers

Mr. Mike O'Hara
Natural Resource Administrator
State of Vermont Military Department

LTC Raymond Bouchard
Vermont Army National Guard
Environmental Program Manager

COL Alan Nye
Vermont Army National Guard
Facilities Management Officer

Appendix N – Addendum Addressing Aviation Training and Grassland Bird Management

1) Need and Purpose for Training VT Army National Guard Helicopter Units (applicable to Sections 2.1 and 3.12.1)

The Vermont Army National Guard (VTARNG) Aviators have a need for specific training that is limited to type and size training areas. These aviators are part of a Black Hawk Helicopter (UH-60) Company or a small two-passenger helicopter (OH 58). The Black Hawk Company is an Air Ambulance Medical Evacuation Unit. The pilots and crew must train to land in a number of weather conditions, to land on bare sand or snow without losing visibility, and to land at night. The pilots must also practice slope landings and low level hovering. Hovering is a perishable skill that requires the pilots to stabilize the aircraft as reasonably possible while the aircrew operates the hoist. Hoist operations include the delivery of (medical) supplies in a remote area, plucking a stranded hiker off a mountainside or lift an injured individual.

Due to the low level flights and amount of time needed to practice the hovering techniques / hoist operations, the limited areas to practice this are becoming less and less each year. Most private residences consider the extended time near their homes to be a nuisance and undesired. The public does not like to hear the sound of the helicopters in their warm weather recreation areas; so the State Forests and the Green Mountain National Forest are, also, less permissible each year. Consequently, VTARNG Aviators are relying more and more on the use of the Training Areas available at Camp Johnson, Ethan Allen Firing Range, or the Airport.

When the army aviators use the Burlington Airport for slope landings or hovering, it causes use restrictions for other operators at the airport and increases concern for safety for everyone. The Ethan Allen Firing Range in Jericho, VT is the VTARNG Training Area for artillery and mortar (indirect) fires, the M-1 Abrams Tank main gun (sub-caliber) firing and the firing of both small arms and crew serve weapons. Such activity forces the FAA to implement airspace restrictions over the 11,218+ acres. This same air space restriction prohibits the low level flying that the army aviators need and seek.

Consequently, Camp Johnson is a critical training area for the army aviators to maintain their readiness skills if needed in time of war, natural disasters, or medical evacuations.

2) Description of Necessary Training Conducted at Camp Johnson (applicable to Section 3.12.1).

The Army Aviation elements primarily use helicopters (UH 60s and OH 58s) at Camp Johnson. The post maintenance flight checks and training consists mostly of low level flights. The flight routes outside the Camp Johnson property are flown at 300-600 feet above ground level (AGL) and stay to the industrial zones as much as possible. The larger training zone (Zones C, D-1, and D-2 of the attached map) is used for the nap-of-

the-earth (NOE) and night vision goggle training. The above ground altitude is approximately 50 feet, and the periphery of the outlined area is where most of this training occurs.

The smaller training zone is the stage field(includes B-2, & B-3 in Figure 3-6 of the INRMP) and is the busiest of the two aviation training zones. This training involves flight approaches, slope landings, and decelerated NOE work, and simulated power failures. The slope landings require the pilot to hover three feet AGL and then land. The deceleration work involves flying fifteen feet AGL along the length of the stage field, and the pilot eventually slows to a stationary hover. The simulated power failures involve an initial altitude of 1,000 feet, and the autorotation of several hundred feet before the engine re-engages the rotor. The approach on the southeast end involves altitudes of approximately 950 feet AGL.

3) Impacts and Description of Permissible Training in Vicinity of Grassland Song Birds (applicable to Section 5.9 and 5.9.1).

Although the landings would be limited to Zone B-3 from May through August 15th each year, the pilots still have a need to hover over B-2 as part of the approach for slope landings and practicing hoist lifts as part of the military and civil support roles for medical evacuations. Although landings on the open stage field would be restricted to B-3 due to wind directions, location of power lines, and distance to trees or buildings, landings can not always happen on B-3. Pilots will consider and use of other zones at Camp Johnson when available or as safety requirements allow before using B-2 to land from May to August 15th time period.

As an effort to minimize additional training restrictions on military preparedness and protect the current songbird population, all parties within the VTARNG are working to find an adequate solution. The songbird population is on a serious decline nationally and the grasshopper sparrow is specifically State Listed.

By limiting the activity over Zone B-2 to hovering at $\geq$15 ft AGL, it is believed the lack of actual physical contact of landing gear and the concentrated rotor wash experienced during landings and take-offs will mitigate harm to the nests, eggs or fledglings. The birds have managed to brood and survive with the presence of helicopters thus far. It is thought the population will continue under these conditions, also.

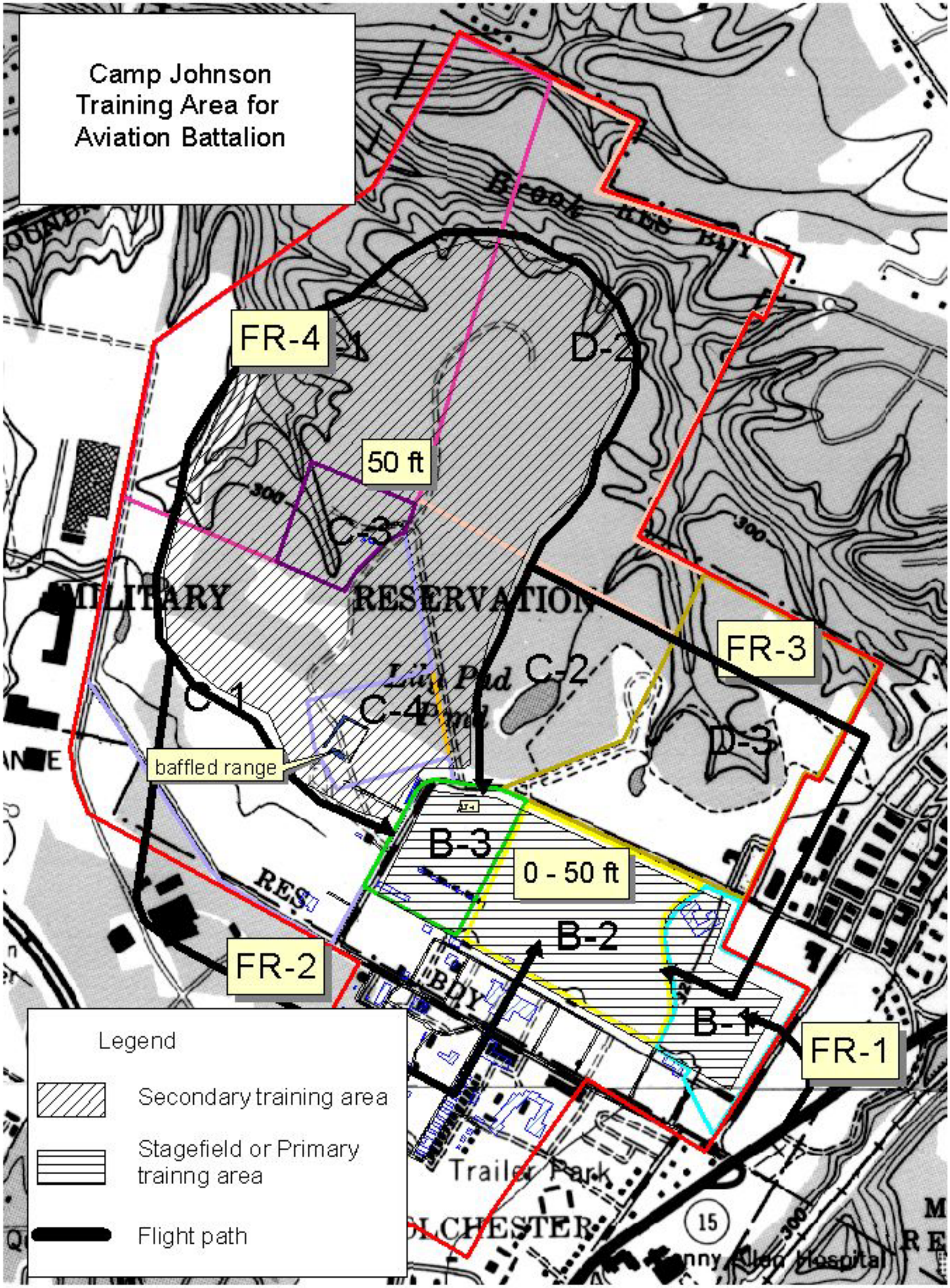
As far as landings and hoisting objects, this activity can occur year around in Zone B-3 and in Zone B-2 from August 15th to May 1st.

To delineate the B-3 Training Zone and persuade the grassland birds to brood in the designated regions (B-2), the B-3 Zone will be moved in early June. Prior to mowing the B-3 Zone can be distinguished as a straight line from the most eastern end of the most eastern field latrine to the utility pole on the eastern side of the driveway to the small chain-linked fenced compound. The only zones that will be mowed within B-2 is one

mower width pass on either side of the running track and a walking path from the Green Mountain Armory to the running track. All other portions of the B-2 Zone will remain unmowed and unused each year until August 15th.

Aviation Training Area Use and Mowing Summary Table

Training Zone Designation	Limitations	Permissive Activities	Mowing Schedule
B-1 (RTI and NATO Obstacle Course)	Not Applicable	Not Applicable	closely mowed lawn on weekly basis
B-2 Stage field	No touchdown or land & no hovering $\underline{<}$ 15 ft. AGL from May 1st through Aug 15th	--Unrestricted use from Aug 15th thru May 1st. --Yr Around hovering > 15 ft AGL	--5/1 to 8/15 only the footpath and along running track. --After 15 Aug, on monthly or bimonthly basis
B-3 NW end of Stage field	Unrestricted year around	Unrestricted year around	First mowing to occur early June and plans include mowing every two weeks thereafter during the growing season
C	Unrestricted except C-4 (Baffle Range) and C-3 (Area 5000 compound)	None except for C-3 and C-4	Some mowing limited in C-3 and C-4
D	Unrestricted		Open areas vicinity of ROPES course and within Area 2400 compound


Camp Johnson
Training Area for
Aviation Battalion
FR-4
D-2
50 ft
C-3
MILITARY
RESERVATION
C-1
C-2
C-4
FR-3
D-3
baffled range
B-3
0 - 50 ft
B-2
FR-2
B-1
FR-1
Legend
Secondary training area
Stagefield or Primary trainng area
Flight path