

Camp Edwards Training Site Integrated Natural Resources Management Plan

Revised 2009



Prepared by the Massachusetts Army National Guard Camp Edwards
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Camp Edwards

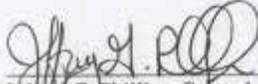
Integrated Natural Resources Management Plan

SIGNATURE PAGE

This Integrated Natural Resources Management Plan (INRMP) meets all requirements as described in The Sikes Act (16 U.S.C. 670a et seq.), Army Regulation 200-1 (Environmental Protection and Enhancement) and the Executive Summary of this document. Furthermore, the undersigned do hereby agree to cooperate in the implementation of the Camp Edwards INRMP.

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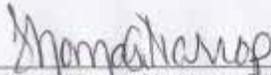
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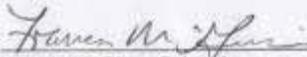
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Integrated Natural Resources Management Plan

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Preface

The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an Integrated Natural Resources Management Plan (INRMP) for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing natural communities and natural resources to support and be consistent with the military mission while protecting and enhancing those natural communities and resources for multiple use, sustainable yield, and biological integrity. "The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements" (US Army National Guard Bureau, 2000) and to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss in capability to fulfill the military training mission.

The Camp Edwards INRMP supports and guides the Massachusetts National Guard's Final Environmental Impact Report (2001). The Environmental Performance Standards (EPS) listed in the Massachusetts National Guard's Area Wide FEIR and as required by M.G.L. Chapter 47 Acts of 2002 serve as the guide by which MAARNG training and natural resources management is conducted on Camp Edwards. These EPS's are continuously incorporated with federal environmental and land management programs specified by military regulation and federal law. The INRMP, to the extent appropriate and applicable, integrates and aids in achieving the standards set forth within the EPS's. For a complete description of the EPS's, please refer to the Massachusetts National Guard's Area Wide FEIR (2001). Also, the INRMP integrates current environmental management practices incorporated in the Camp Edwards Regulations 385-63 (Range Safety) and the MAARNG's Natural Resources and Integrated Training Area Management (ITAM) Programs. In addition, the Environmental Readiness Center was formed to help guide and implement the aforementioned documents, laws, regulations, standards, and programs.

The MAARNG Natural Resource Office has and will continue to consult and cooperate with state and federal environmental agencies throughout the development and implementation of the INRMP, including U.S. Fish and Wildlife Service, the Environmental Management Commission (EMC), the Department of Conservation and Recreation, the Department of Environmental Protection (MASSDEP), the Division of Fisheries and Wildlife/Natural Heritage and Endangered Species Program (DFW/NHESP) are involved with INRMP creation and implementation.

Since the 1950s, and more frequently in the last 20 years, the MAARNG has received input and adopted management practices from several federal and state agencies and non-profit organizations in Massachusetts. The DFW has provided consultation and support on white tail deer (*Odocoileus virginiana*) hunting on Camp

Edwards since 1955 and was instrumental in reintroducing wild turkey (*Meleagris gallopavo*) in the 1980s which subsequently resulted in the first turkey harvest in the spring of 2000 and continues today. The NHESP conducted a grassland bird survey (White and Melvin 1985) of the cantonment area of the MMR. Within the report for the survey were recommendations for managing the grassland habitats on the MMR for rare bird species. These recommendations were in part adopted by the MAARNG and have been followed since the time of the initial survey. The NHESP has also been instrumental in conducting a comprehensive floristic survey of Camp Edwards (Jenkins 1994), as well as a moth survey that documented the 16 state-listed species of moths that inhabit the Camp Edwards Impact Area for at least part of their life cycle (Mello *et al.* 1999). The United States Department of Agriculture (USDA) has conducted research on the MMR since the 1980s. Throughout the course of this research, the USDA has focused on the gypsy moth (*Lymantria dispar*) caterpillar and the Asian longhorn beetle (*Anoplophora glabripennis*), which has not been recorded in Massachusetts, and has utilized various areas of Camp Edwards as study sites. The Environmental Management Commission created by "Chapter 47 of the Acts of 2002" was established to verify, through independent oversight, monitoring, and evaluation, the compatibility of training with environmental protection.

The MAARNG Natural Resource Office has also coordinated with multiple agencies on a single task. For instance, the Cape Cod National Seashore within the National Park Service (NPS), the MASSDEP, the University of Massachusetts at Amherst (UMASS), and The Nature Conservancy (TNC) have assisted in planning and conducting the prescribed burn program on Camp Edwards. UMASS completed a prescribed burn management plan in 2000 (revised by MAARNG in 2006) to provide direction on future prescribed burning on Camp Edwards.

An objective of the Camp Edwards INRMP is to compile and consolidate the management recommendations from the survey and study reports to provide a comprehensive management plan (i.e., INRMP) for the natural communities and natural resources on Camp Edwards. Input and comments from all agencies that have reviewed the Camp Edwards INRMP were taken into account and incorporated where appropriate. Ease of interpretation is the intent of this plan, so that the natural resources of Camp Edwards may be properly managed and protected while providing the most beneficial training experience for the MAARNG.

The Camp Edwards Natural Resource Office currently maintains a web site that describes in detail the natural resources of Camp Edwards, including the flora, fauna, and rare species, the ITAM Program, and other natural resources surveys and research. The site can be accessed at www.eandrc.org.

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LIST OF ACRONYMS

AIRFA-American Indian Religious Freedom Act of 1978
ANG-Air National Guard
AO-Administrative Order
APC-Armored Personnel Carrier
AR-Army Regulations
ARE-Army Environmental Division
ARI-Army Installations Division
ARNG-Army National Guard
ARO-Army Operations
ARPA-Archaeological Resource Protection Act of 1979
ART-Army Training Division
ASP-Ammunition Supply Point
ATV-All Terrain Vehicle
BMP-Best Management Plan
BOQ-Bachelor Officer's Quarters
CATS-Combined Arms Training Strategy
CCC-Cape Cod Commission
CFM-Custom Fuel Model
CFMO-Construction and Facilities Management Officer
COMSTA-United States Coast Guard Communication Station
CWA-Clean Water Act
CX-categorical exclusion
DA-Department of the Army
DCR-Department of Conservation and Recreation
DFP-Division of Forest and Parks
DFW-Division of Fisheries and Wildlife/
NHESP-Natural Heritage and Endangered Species Program
DoD-Department of Defense
DPW-Real Property Operation and Maintenance funds
DWM-Division of Watershed Management
EA-Environmental Awareness
E-Endangered
EIR-Environmental Impact Report
EIS-Environmental Impact Statement
EM-Environmental Monitoring
EMC-Environmental Management Commission
EO-Executive Order
EPA-Environmental Protection Agency
EPS-Environmental Performance Standards
FE-Facilities Engineer
FEIR-Final Environmental Impact Report

LIST OF ACRONYMS cont.

FMB-Fire Management Blocks
FMZ-Fire Management Zone
FT-Foot
FY-Fiscal Year
GIS-Geographical Information System
IAGWS-Impact Area Groundwater Study
ICRMP-Integrated Cultural Resource Management Plan
IDT-Inactive Duty Training
INRMP-Integrated Natural Resource Management Plan
IPM-Integrated Pest Management
IPMP-Integrated Pest Management Plan
ITAM-Integrated Training Area Management
JPO-Joint Programs Office
KM-Kilometer
RTLA-Range and Training Land Assessments
LRAM-Land Rehabilitation and Maintenance
LZ-Landing Zone
MAANG-Massachusetts Air National Guard
MAARNG-Massachusetts Army National Guard
MACOM-Major Army Command
MASSDEP -Department of Environmental Protection
MANG-Massachusetts National Guard
MCA-Master Cooperative Agreement
MEPA-Massachusetts Environmental Policy Act
MESA-Massachusetts Endangered Species Act
METL-Mission Essential Task List
MMR-Massachusetts Military Reservation
MOA-Memorandum of Agreement
MOU-Memorandum of Understanding
MS-Microsoft
MWPA-Massachusetts Wetland Protection Act
NAGPRA-Native American Graves Protection and Repatriation Act
NEPA-National Environmental Policy Act
NGB-National Guard Bureau
NHPA-National Historic Preservation Act
NPS-National Park Service
OP-Observation Point
Otis ANGB-Otis Air National Guard Base
PAB4-Palustrine Aquatic Bed
PACERS-Patriots Advocating Camp Edwards Restoration and Survival
PAVE-PAWS-Precision Acquisition Vehicle Entry – Phased Array Warning System
PEM-Palustrine Emergent

LIST OF ACRONYMS cont.

PFO1-Palustrine Forested
PLS-Planning Level Survey
POTO-Plans, Operations, and Training Officer
POW-Palustrine Open Water
PSS-Palustrine Scrub Shrub
REC-Record of Environmental Consideration
RFMSS-Range Facility Management Support System
RTI-Regional Training Institute
RTL-Range and Training Land Program
RUSLE-Revised Universal Soil Loss Equation
SC-Special Concern
SDWA-Safe Drinking Water Act
SDZ-Surface Danger Zones
SFM-Standard Fuel Model
SHPO-State Historic Preservation Officer
SMZ-Smoke Management Zone
SOP-Standard Operating Procedures
STEP-Status Tool for Environmental Programs
STRONG-Save The Reserve and Our National Guard
THPO-Tribal Historic Preservation Officer
TNC-The Nature Conservancy
TRI-Training Requirements Integration
T-Threatened
UMASS-University of Massachusetts
USCG-United States Coast Guard
USDA-United States Department of Agriculture
USFWS-United States Fish and Wildlife Service
UTES-Unit Training Equipment Site
UXO-Unexploded Ordinance
VA-Veteran's Affairs
WL-Unofficial Watch List
WUI-Wildland Urban Interface

EXECUTIVE SUMMARY

Camp Edwards is a 14,433-acre Massachusetts Army National Guard (MAARNG) training site located in southeastern Massachusetts approximately 50 miles southeast of Boston, at the base of Cape Cod (i.e., Barnstable County). The land use of Camp Edwards consists of military training activities, including assembly, tactical maneuvering, tactical bivouacking, small arms range firing, engineering, ammunition storage, support, maintenance, and aviation facilities, environmental management, as well as being designated the Upper Cape Water Supply Reserve, a drinking water recharge area. Consistent with the use of military installations to ensure the preparedness of the Armed Forces, the land and resources of Camp Edwards must be properly managed to minimize negative impacts from use, to preserve sensitive habitats and rare species, and to promote the sustainment of native natural communities.

Development and implementation of an Integrated Natural Resources Management Plan (INRMP) for Camp Edwards are required by the Sikes Act (16 USC § 670a *et seq.*) and the Sikes Act Improvement Amendments of 1997. The purpose of this plan is to guide natural resources management at Camp Edwards from Fiscal Year (FY) 2008 through 2013, and also review the previous five years for proper implementation. Chapter 11, Plan Implementation, includes a table listing goals and objectives with space for comments as to current level of implementation. The INRMP is renewed every five years, but may be amended as needed. This document represents a revision of the 2001 INRMP. Issues from the revised INRMP that drive NEPA documentation are as follows:

1. Environmental Oversight by the Environmental Management Commission as established by the Massachusetts General Law Chapter 47 the Acts of 2002.
2. Reclassification of the Natural Communities of Camp Edwards to be consistent with sister state agencies.
3. Adjusted goals, objectives, and management actions based upon reclassification of natural communities.
4. Expanded fire management goals, objectives, and proposed actions as exerted from the Camp Edwards Integrated Fire Management Plan.
5. The need to recognize a Federal Candidate Species, New England Cottontail (*Sylvilagus transitionalis*) and put forth proactive management actions to address this species.

In addition, The INRMP serves, in part, as a document by which the Environmental Performance Standards, as codified in Massachusetts General Law, Chapter 47, Acts of 2002, are achieved and implemented on Camp Edwards.

The goal of the Camp Edwards Integrated Natural Resources Management Plan (INRMP) is to support the training mission of the MAARNG through conservation and maintenance of the natural resources of Camp Edwards. Guidance from the INRMP aids in improving the training lands while benefiting the natural resources through reduced soil erosion, improvement to the flora, fauna, and their habitats, protection of wetlands, and conservation of rare species. Further objectives of the Camp Edwards INRMP are:

1. To outline the military mission and its effects on the natural resources of Camp Edwards.
2. To establish specific goals, objectives, and time frames for the management and protection of natural and cultural resources on Camp Edwards to maintain biological diversity and sustainability of the training site for mission use.
3. To suggest methods for increasing awareness of the Massachusetts Army National Guard and the general public on matters of natural resources protection and conservation and its integration with military training.
4. To provide specific management instructions so that the Environmental Performance Standards from the Massachusetts National Guard's Master Plan/Area-Wide Environmental Impact Report may be achieved on Camp Edwards with no net loss to the training mission.
5. To describe the physical characteristics of the Camp Edwards Training Site.
6. To describe the results and findings of the Range and Training Land Assessment Program and other natural resources inventories and studies on Camp Edwards. These results will serve as a baseline of information upon which management recommendations will be based.
7. To describe in detail the organization, personnel, funding, and support required for the implementation of the INRMP on the Camp Edwards Training Site.
8. To provide an avenue for public involvement in the implementation process of the INRMP as well as in the recommendations for use of the training site for recreational purposes.

9. Use experiences as lessons learned, positive and negative, for other military installations.

Benefits of the INRMP to the military mission include improved lands allowing for more realistic training, better distribution of military activities, and reduced conflicts between training requirements and environmental management resulting in minimized disruption to training exercises on Camp Edwards. The Camp Edwards INRMP supports the mission of the MAARNG by ensuring that the environmental conditions of the training lands continue to provide a variety of terrain that is necessary for realistic military training (missionscape) as well as providing natural resources data and information to benefit mission planning.

The Camp Edwards INRMP benefits the Massachusetts National Guard's Final Environmental Impact Report (2001). The INRMP integrates current environmental management practices incorporated in the Camp Edwards Regulations 385-63 (Range Safety) and the MAARNG's Natural Resources and Integrated Training Area Management (ITAM) Programs.

Benefits of the Camp Edwards INRMP to the environment include reduced soil erosion and vegetation loss, improvement to sensitive species habitats and subsequent enhancement of their populations, improvement of water-quality, and an increase in overall knowledge of the operation of the ecosystem of Camp Edwards through surveys, research, and monitoring. In addition, the natural resources management program described in this plan will protect natural communities and their components from unnecessary damage or degradation, and provide for restoration if needed, thereby protecting the Camp Edwards training mission.

SECTION I. TRAINING SITE OVERVIEW

CHAPTER 1. LOCATION AND ACREAGE

1.1 Location

The Camp Edwards Training Site (41° 42' 30" N, 70° 32' 30"W) is located in southeastern Massachusetts approximately 50 miles southeast of Boston, at the base of Cape Cod (i.e., Barnstable County) (Figure 1-1). Camp Edwards lies within the towns of Sandwich and Bourne. U.S. Route 6 and State Routes 28 and 130 border Camp Edwards to the north, west, and east, respectively. Camp Edwards comprises approximately 70% of the Massachusetts Military Reservation (MMR) of which the southern portion is occupied by the Veteran's Administration Cemetery, and land leased to the United States Coast Guard and to the United States Air Force.

Figure 1-1. Location of the MMR in Massachusetts

March 2006, MAARNG GIS, MassGIS, Michael Ciaranca, Natural Resource Manager

1.2 Acreage and Acquisition

The Camp Edwards Training Site is 14,433 acres in size (Mass. Army National Guard 1999). This excludes areas within the northern portion of the Massachusetts Military Reservation (MMR) that are leased to either the U.S. Air Force or the U.S. Coast Guard, including but not limited to the Cape Cod Air Force Station early warning radar site (PAVE PAWS) and the U.S. Coast Guard Communication Station (COMSTA) Boston (Figure 1-2).

While training and live firing by the Massachusetts Army National Guard occurred on Camp Sandwich, a site thought to have been somewhere in the northern portion of the MMR, as early as 1908, Camp Edwards was not established until 1933. The MMR was created in 1935 primarily from 12,600 acres of land acquired from the purchase of the Coonamesset Sheep Ranch. At the onset of World War II in 1941, 6,457 acres of Shawme-Crowell State Forest was added to the MMR. Eight years later, an additional 1,090 acres was added for military use. After World War II, the entirety of the MMR, then known as Otis Air Force Base, was transferred to the Massachusetts Air National Guard (MAANG) in the early 1970's. In 1976, The U.S. Air Force granted a permit to the U.S. Army for training Army Reserves on the northern portion of Otis AFB, which was the area presently known as Camp Edwards (Massachusetts National Guard 2001).

The land that currently comprises Camp Edwards is owned by the Commonwealth of Massachusetts and is custody of Massachusetts Division of Fisheries and Wildlife, which has leased the property to the Department of the Army. In turn, the U.S. Army licensed the land to the Massachusetts Army National Guard for training. The current lease held by the U.S. Army expires in the year 2051.

Figure 1-2. Massachusetts Military Reservation (MMR) and Camp Edwards.

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1.3 Installation History

The historic use of Camp Sandwich in 1908 and in 1913 arose from the need for an area at which the MAARNG could conduct live fire artillery training. Prior to this time period, the MAARNG was concentrated primarily in New Bedford and Fall River. Between 1920 and 1923, Fort Devens was used for much of the infantry training for the MAARNG. In 1933 the MAARNG sought another area of the state in which to conduct its training. The present site of Camp Edwards was chosen as the most suitable location for the new training site (Massachusetts National Guard 2001).

After its establishment in 1935, Camp Edwards was used intensively for training throughout World War II. Initial construction on Camp Edwards occurred between the years of 1935 and 1940 and consisted of 63 buildings and two runways. However, by 1941, the threat of war stimulated the construction of facilities to house 30,000 troops as well as a 1,722-bed hospital. Throughout the course of World War II, numerous Army Infantry Divisions and other major units trained on Camp Edwards prior to fighting in Europe and the Pacific (Massachusetts National Guard 2001).

After World War II, the U.S. Army deactivated Camp Edwards, which was then used for training the Army National Guard. However, at the start of the Korean War in 1950, Camp Edwards was reactivated to train U.S. Army troops. Otis Air Force Base, comprising Otis Field (the existing runways) and Camp Edwards, was established in 1958 through a transfer of land from the U.S. Army to the U.S. Air Force. In 1976 the U.S. Air Force granted a permit to the U.S. Army to use 14,433 acres, which was then licensed to the Massachusetts Army National Guard in 1979 for year-round training.

Throughout the course of training on Camp Edwards by the U.S. Army and the Massachusetts Army National Guard, ranges have been used for firing various weapons including pistols, rifles, machine guns, rocket launchers, long-range artillery, mortars, and anti-aircraft weapons. However, in May of 1997, the Environmental Protection Agency (EPA), citing potential groundwater contamination from actual or potential releases emanating from the Training Ranges and Impact Area, delivered Administrative Order 1 to the MAARNG. As a result, range firing on Camp Edwards has been limited to small arms firing of tungsten nylon "green" ammunition and plastic ammunition. However, tungsten nylon too has been abandoned due to leaching concerns. As a result, only plastic bullets are fired at the ranges. The cessation of actual artillery firing out of concerns for soil and groundwater contamination on Camp Edwards resulted in a loss of training. Soldiers currently travel to Fort Drum, New York, or Fort Dix, New Jersey, to conduct live artillery fire.

Historically, few people populated the area around the perimeter of Camp Edwards. However, between 1920 and 1990 the population of Cape Cod (i.e., Barnstable County) had the fastest growth rate of any county in Massachusetts,

resulting in a high demand for an adequate water supply (Massachusetts National Guard 2001). As a result of depletion and pollution of groundwater within residential areas, the surrounding Upper Cape towns of Falmouth, Sandwich, Bourne, and Mashpee required water supplies from Camp Edwards to meet their current and future demands.

In October of 1999, the Governor of Massachusetts, Argeo Paul Cellucci, drafted an executive order to establish an Upper Cape Water Supply Reserve and Commission to oversee the management of Camp Edwards Training Area as a water supply and for wildlife habitat. On October 2001, a Memorandum of Agreement (MOA) was signed establishing a management and oversight structure for the Reserve. In March of 2002, Chapter 47 of the Acts of 2002 codified into law the MOA and a set of Environmental Performance Standards ensuring the permanent protection of the drinking water supply and wildlife habitats in the Reserve, while allowing compatible military training. This legislation also created the Environmental Management Commission (EMC) to independently verify the compatibility of training with environmental protection.

1.4 Neighbors

Although the upper portion of Cape Cod was sparsely populated in the 1930's when Camp Edwards was first established, the residential population has exhibited one of the fastest rates of growth in the United States. Approximately 70% of the perimeter of Camp Edwards is surrounded by residential development. In these areas, residential development is within one half mile of the boundary of Camp Edwards and often directly adjacent to the fences.

The cantonment area in the southern portion of Camp Edwards adjoins the remainder of the MMR, which includes Otis Air National Guard Base, the Veteran's Administration Cemetery, Coast Guard Housing, and the Coast Guard Golf Course. The Coast Guard transmitter station is adjacent to Camp Edwards at its eastern border. The U.S. Air Force PAVE PAWS Radar station is located within the northern portion of Camp Edwards.

The only parts of Camp Edwards that are not directly bordered by development are at the northern and southern ends of the perimeter. The far northern end of Camp Edwards is adjacent to the Cape Cod Canal. Although no development currently exists in this area, the land is highly sought after for residential homes. The northeastern corner of Camp Edwards abuts Shawmee-Crowell State Forest. Although the state forest is only 742 acres in size, it is the most highly used state forest in southeastern Massachusetts (Massachusetts National Guard 2001). Furthermore, Shawmee-Crowell State Forest is so fragmented that within the forest, residential development is always less than one half mile from and often in contact with the boundary of Camp Edwards.

Crane Wildlife Management Area, which is managed by the Massachusetts DFW, is the only other relatively large public land in close proximity to Camp Edwards. It is located south of Otis Air National Guard Base and the Coast Guard Golf Course. Partnerships have been developed between Camp Edwards Natural Resource Office and the DFW on Crane WMA and the DCR on Shawme-Crowell State Forest.

1.5 Satellite Installations

The Camp Edwards Integrated Natural Resources Management Plan will directly affect no other installations occupied by the Massachusetts Army National Guard.

CHAPTER 2. MILITARY MISSION

2.1 Overview

2.1.1 Military Mission

The MAARNG on Camp Edwards serves the public interest in two primary areas. The federal mission of the MAARNG is to support the national military strategy of U.S. Army. As a result, the MAARNG must maintain a capable force of soldiers that have received high-quality realistic training. Achieving training objectives and overall force readiness depends, in part, upon the availability of adequate training lands.

The state mission of the MAARNG is to provide assistance to the Commonwealth of Massachusetts, under the direction of the Governor, during natural disasters or other emergencies under the ARNG's Innovative Readiness Training program. Furthermore, the MAARNG assists local communities with improvements to public properties such as athletic fields, landscaping, and playgrounds (Massachusetts National Guard 2001).

Headquarters at Camp Edwards "is committed to excellence in all aspects of environmental protection and management of the training site." The vision of Headquarters is "to constantly improve upon training practices that protect the future of our ecosystem" (Massachusetts Army National Guard 1999).

2.1.2 Types of Training

Army National Guard troops are trained on Camp Edwards in three basic categories: weapons systems, maneuvering, and support. As a result of Administrative Order 2 (AO 2) issued in May of 1997, weapons systems training is currently limited to small arms training and to simulators. The small arms training consists of firing pistols, rifles, and machine guns on 15 designated ranges throughout Camp Edwards.

Furthermore, the EPA mandated that any lead-based ammunition may not be fired on Camp Edwards. More recently, the firing of tungsten-nylon “green” ammunition was instituted on Camp Edwards at the early stages of its use by the Department of Defense. This ammunition too has been abandoned due to leaching concerns. As a result, only plastic bullets are fired at the ranges. Training simulators on Camp Edwards consist of the Fire Support Combined Arms Tactical Trainer, the Engagement Skills Trainer, and the Fire Arms Training System (Massachusetts National Guard 2001).

Maneuvering consists primarily of troop movement on foot through training areas. Vehicle maneuvering is limited to all existing roads, road shoulders, and power line right of ways on Camp Edwards. Training typically consists of either light or mechanized infantry training. Light Infantry Maneuver involves troops practicing patrolling, reacting to ambush, defense, movement to contact, and actions at the objective on foot throughout the training areas (Massachusetts National Guard 2001). Mechanized Infantry Maneuver may include troops mounted on armored personnel carriers (APCs) traveling along roads, road shoulders, and power line right of ways, or dismounted from the APCs to conduct light infantry maneuvers. Other maneuver and support unit training activities on Camp Edwards may include bivouac operations training, infantry battle course, land navigation training, individual chemical confidence training, engineering training, military police training, helicopter landing zones, and water storage and distribution training. For a more comprehensive list of training exercises and explanations, see Massachusetts Army National Guard (1999).

A notice of project change, in regards to Final Environmental Impact Report (FEIR) (2001), has been filed with Massachusetts Executive Office of Environmental Affairs MEPA office to resume the firing of lead ammunition on Camp Edwards. With this, the EMC will have to concur with changes to the Environmental Performance Standards and the EPA will be petitioned to “lift” AO 2.

2.1.3 Soldier Usage Data

The Massachusetts Army National Guard is currently authorized by the National Guard Bureau (NGB) and the Department of the Army to maintain an end strength of 9,000 soldiers. The actual number of soldiers fluctuates, but is at present approximately 5,552 troops.

Soldier training on Camp Edwards takes place during two-week increments concentrated between May and August and weekend inactive duty training (IDT) occurring throughout the year. Throughout summer months, approximately 2,500 to 3,000 soldiers train on Camp Edwards. At most 3,000 troops will train on Camp Edwards at one time (Massachusetts National Guard 2001). In the summer of 1999, 3,011 National Guard soldiers trained on Camp Edwards, of which 2,111 were from Massachusetts. A total of 3,153 soldiers trained on Camp Edwards between May and

August of 2000. The total number of personnel that used Camp Edwards throughout the year averaged 44,588 from 1994-1999, 29,946 of whom were MAARNG troops. Other military and law enforcement personnel and general civilians that used Camp Edwards during the same time period averaged 5,258, 1,620, and 7,763, respectively. After 11 September 2001, general civilian use including Boy Scouts, BMX racing, athletics, motorcycle training, and commercial drivers license training, are limited.

2.1.4 Types of Equipment Which Might Impact Natural Resources

Heavy mechanized equipment, such as tracked or wheeled vehicles, that is used and stored by the MAARNG on Camp Edwards has the potential to impact the natural resources in a negative manner. Wheeled vehicles, such as pickup trucks, Humvees, dump trucks, tractors, and dozers, are usually used on Camp Edwards on a daily basis. Tracked vehicles, which include armored personnel carriers, recovery vehicles, and self-propelled Howitzers, are utilized during weekend training and two-week annual training in the summer. However, all vehicle traffic is currently restricted to the established roads, road shoulders, and power line right of ways and does not present an evident threat to the natural resources on Camp Edwards. The only instance in which vehicles are used in areas other than established roads might include land rehabilitation projects.

Equipment used on Camp Edwards that has a noticeable negative impact on the natural resources are associated with well drilling, required by EPA under Administrative Order 1, and power line maintenance. The well-drilling rigs used in the Impact Area Ground Water Study typically require an area of area of 4000 ft² (.09 ac) clear of vegetation for drilling each well. Although preparation of monitoring well pads and access roads once involved removal of all vegetation and topsoil, and a concomitant decrease in soil stability and increase in soil erosion, negotiations between the IAGSWP and Natural/Cultural Resource Program Managers in 2002 led to the adoption of new policies. Current methods for preparation of well pads and access roads include flush-cutting of vegetation within the well pad and access road areas and limbing of overhanging branches. A layer of native woodchips is placed over the ground surface to provide a level surface for vehicle traffic; this layer protects the ground surface from disturbance during well construction activity and, unlike geotextile fabric, allows for gradual re-establishment of vegetation. In instances where wet conditions and/or steep slopes require the emplacement of fill or dense grade, geotextile fabric is placed over the layer of woodchips, and the fill or dense grade is placed on the fabric. Once the well has been constructed, the fabric and fill are removed. The woodchips remain in place to provide a surface for well monitoring.

2.1.5 Range Use Days

Table 2-1 provides a summary of the range use days for Camp Edwards 2002-2005. Ranges in which remediation is taking place (e.g., J-3, L, M Ranges) were not used for range firing. The ranges are divided into groups that exist on the north, south, east, and west of the Impact Area.

Table 2-1. Range use days for Camp Edwards, 2002-2005.

Range	Personnel			Ammunition Type							
	Training Days	Military	Civilian	5.56 TN	5.56 Plastic	.50 cal Plastic	.45 cal F	.40 cal F	9mm F	12 Gauge	40 mm TP
B	18	375	0	42,496	0	0	0	0	2,290	0	0
C	11	438	14	28,599	0	0	0	0	1,310	0	0
D	1	12	0	11,80	0	0	0	0	0	0	0
E	3	12	0	0	0	0	0	0	720	0	0
J	4	143	142	11,672	0	0	0	0	1,232	0	0
K	6	220	200	22,204	0	0	0	0	0	0	0
KD	4	296	0	8,280	0	0	0	0	0	0	475
SW	3	49	0	9,280	0	0	0	0	0	0	0
OFG	2	0	16	0	0	0	0	0	0	750	0
TY 2005	52	1,545	372	124,331	0	0	0	0	5,552	750	475
TY 2004	98	3,068	840	204,293	11,242	8,400	2,700	6,900	22,320	6,875	240
TY 2003	93	3,575	640	286,920	100	1,200	3,900	2,900	10,750	1,250	0
TY 2002	80	3,111	1,232	223,241	30,662	11,097	3,880	3,000	6,000	5,275	0

KD: Known Distance, OFG: Otis Fish and Game Club, SE: Sierra East, SW: Sierra West, TN: Tungsten Nylon, TP: Target Practice, F: Frangible

2.1.6 Ammunition Storage and Production

All ammunition that is fired on Camp Edwards by National Guard soldiers is stored and issued at the Ammunition Supply Point in the southwestern area of Camp Edwards. All ammunition that is not fired during training as well as the spent cartridge shells are returned to the Ammunition Supply Point at the end of the training period. Ammunition is not currently produced on Camp Edwards.

2.2 Natural Resources Needed to Support the Military Mission

Natural resources required to fulfill the training needs of the MAARNG and to support the military mission is referred to as the missionscape and includes all existing habitats on Camp Edwards. The diversity of habitats on Camp Edwards offer the vegetation types, density, and structure required for light infantry maneuvers and common task training, including map reading, terrain orientation, camouflage training, and ambush and defense training. Bivouac operations training requires bivouac sites with closed canopy and a relatively sparse under story for aerial and horizontal concealment. These areas are used for establishing command and control areas during training maneuvers as well as for tactical assembly areas. Open areas with little vegetation are used for engineering training, administrative assembly areas (3500 and 3600 areas in B10), and for establishing and maintaining helicopter landing zones. See the Camp Edwards Trainer's Guide for more information regarding training specific natural resource conditions.

2.3 Effects of the Military Mission on Natural Resources

All activities that are part of the military mission have the potential for impacting the natural resources of the Camp Edwards Training Site. However, all training practices are restricted to areas and schedules established in the Environmental Performance Standards and approved by the Natural Resource Office at Camp Edwards. Any training activities that are potentially destructive to natural resources are currently prohibited on Camp Edwards. These activities include firing lead ammunition, anti-tank missile fire, artillery or mortar fire, deforestation, burning gun powder, demolition, creation and use of open latrines, vehicle refueling in the field, as well as any training activity, with the exception of foot travel, within the following areas (Massachusetts National Guard 2001):

- 400 feet from a water supply well
- 100 foot wetland buffer
- grassland habitat
- cultural resource locations with high sensitivity
- the Impact Area
- any IRP remediation site
- any area not approved by Range Control and the Natural Resource Office

These restrictions effectively exclude approximately 2704 acres of land from most training activities. Most of this land, 2161 acres, consists of the Impact Area, which is currently restricted to all training activities due to the presence of unexploded ordinance. The impact area does have the potential to be used as training land (convoy training, vehicle maneuvers, etc.) if it is deemed appropriate by training and environmental staff. With no live fire training within the impact area there is the

absence of wildland fire from this fire adapted natural community (Scrub Oak Shrubland Community). Efforts are being made to introduce prescribed fire into the impact area to avoid the loss of this fire adapted natural community type. To achieve this end coordination among environmental agencies and the MAARNG in reference to range investigations and cleanup will have to be held to provide for safety and not to interfere with these efforts. Funding and other appropriate resources will have to be secured to provide for resources needed to undertake prescribed fire activities within the Camp Edwards impact area. The remaining 543 acres consists of wetland buffers (395 acres), cantonment area grasslands (113 acres), and water supply well buffers (135 acres), in which only foot travel is allowed for at least part of the year.

Bivouacking by soldiers during their annual training also has potential to negatively affect the natural resources of Camp Edwards. Bivouacking and heavy activity in disturbed areas often impact the natural resources in a negative manner, resulting in soil compaction, lower plant and mammal diversity. Results from analyzing the long-term environmental monitoring (i.e. Range and Training Lands Assessment- RTLA) data collected from 1994 through 1999 indicates that, in general, bivouacs and disturbed areas have the lowest plant diversity and animal diversity and abundance when compared to other habitats on Camp Edwards. However, a rotational schedule for bivouac site use to minimize the impacts of training and to restore bivouac sites to suitable environmental conditions is being developed. The objective of this is to prevent any net loss of capability to fulfill the training mission, namely bivouac areas, as a result of overuse.

Vehicle traffic within the bivouac areas and throughout the training area has the potential to cause mortality of flora and fauna. Animals such as deer, raccoons, squirrels, and toads have been documented as cases of vehicle mortality. Only two eastern box turtle road kills were documented between 1994 and 2006. The relatively frequent sightings and few road kills of eastern box turtles on the roads of Camp Edwards suggests that soldiers and other personnel are aware of eastern box turtles, and their status as a state-listed rare species, and avoid them.

Within the Camp Edwards Training Site, roads, road shoulders, and power line right of ways (areas between the wood lines of utility easements) are considered maneuver corridors by military training staff. Use of maneuver corridors is not permitted without an approved nonstandard training request, filed through Range Control, the Natural Resource Office, and notification to the Environmental and Readiness Center on Camp Edwards. All maneuver corridors used will be monitored for restoration (i.e. erosion, invasive plant species) if so needed.

See the Camp Edwards Trainer's Guide for additional information regarding the effects of the military mission on the natural resources.

2.4 Impacts of Natural Resources Management on the Mission

As a result of four Administrative Orders (AO) set in place by the United States Environmental Protection Agency under the Safe Drinking Water Act, all actual artillery and mortar fire have been banned on Camp Edwards. This was done to protect groundwater resources. However, it is not foreseen that the natural resources of Camp Edwards or their management should have any future impact on the military mission. An important part of the military's vision on Camp Edwards is to be committed to excellence in all aspects of environmental protection and management of the Camp Edwards Training Site. Furthermore, the MAARNG seeks to constantly improve upon training practices that protect the future of the ecosystem and training lands of Camp Edwards.

However, certain areas of the training site, such as bivouacs, may be closed for rehabilitation and maintenance. Such closures would temporarily restrict training from these areas, but would ultimately serve to improve the training lands as a whole.

2.5 Future Military Mission Impacts on Natural Resources

In the past, artillery fire often caused brush fires in the Impact Area of Camp Edwards. This disturbance maintained the rare scrub oak shrubland community of the Impact Area. Since artillery fire no longer occurs, the prescribed burn program on Camp Edwards will manage this sensitive natural community. Each section of the Impact Area is burned on a rotational basis to maintain the Impact Area as scrub oak shrubland and pitch pine scrub oak community. Burn prescriptions have also been developed for training areas outside of the Impact Area on Camp Edwards. These areas will be burned in the future pending permitting and funding approval.

CHAPTER 3. FACILITIES

3.1 Overview

The MMR is usually divided along Connery Avenue into two distinct areas: the training area to the north and the cantonment area to the south. Camp Edwards occupies approximately 90% of the northern training area, which translates to 14,433 of the 14,575 acres. Approximately one-half (55%) of the northern training area of Camp Edwards consists of 22 maneuver training areas, with another 40% of the area occupied by small arms ranges, the impact area and its buffers (Figure 3-2). The remainder of the northern training area includes two former demolition areas, the Otis Fish and Game Club, the Upper Cape Regional Water Cooperative, and an infiltration bed for wastewater each of which comprise 1% or less of Camp Edwards, as well as two utility easements: an electrical powerline (NStar), and a natural gas pipeline (Keyspan and Algonquin). The remaining 10% of the land in the northern training area of the MMR is occupied by US Coast Guard Transmitter Site and surrounding areas, US Air Force PAVE-PAWS Radar Site, US Air Force Right-of-Way (Connery Avenue) and the former landfill, which has been closed and capped, as well as other Off-limit Areas (Figure 3-1) (Massachusetts National Guard 2001).

In contrast to the northern training area, Camp Edwards occupies only 12%, or 697 of the 5,905 acres, of the cantonment area within the MMR. The Camp Edwards facilities within the cantonment area include the ARNG Maintenance Facility/UTES, ARNG Training Support Facilities, ARNG Aviation (helicopter) Facilities, Regional Training Institute (RTI), Bachelor Officer's Quarters (BOQ), Billeting (i.e., housing assignment office), and grassland management areas. The other 88% of the cantonment area is occupied by the ANG Airfield and its clear zones and associated facilities, ANG Combat Communications Squadron and Support Facilities, ANG Infrastructure Area, US Coast Guard Housing and Recreation Areas, Veteran's Affairs National Cemetery, Bourne School System, a portion of the Crane Wildlife Management Area, and the remainder of the grassland management area (Massachusetts National Guard 2001).

Figure 3-1. Tenants of the Massachusetts Military Reservation.

March 2006, MAARNG GIS, MassGIS, Michael Ciaranca, Natural Resource Manager

Figure 3-2. Training area delineation on Camp Edwards, MA.

March 2006, MAARNG GIS, MassGIS, Michael Ciaranca, Natural Resource Manager

3.2 Land Use

The land use of Camp Edwards consists of certain training activities, including assembly, tactical maneuvering, tactical bivouacking, small arms range firing, engineering, ammunition storage, support, maintenance, and aviation facilities, and environmental management (Figure 3-2). Troop assembly occurs primarily in the 3600 Area or at the UTES Facility, but may occur in other areas. Tactical maneuvering, either on foot throughout the training area or in vehicles along roads, occurs as soldiers travel from the assembly area to their area of operation, which is one or more training areas. From the area of operation, soldiers engage in training missions specific to their mission requirements (e.g., engineering, infantry, medevac) throughout the training area. Small arms range firing and ammunition storage at the Ammunition Supply Point (ASP) also occur on the northern training area. The support, maintenance, and aviation facilities exist in a centralized region within the cantonment area.

Environmental management is not limited to a specific area, but rather occurs throughout Camp Edwards. For instance, maintenance of the scrub oak shrubland occurs in the northern training area, whereas grassland management takes place primarily within the cantonment area. See Chapter 8 for details on environmental management on Camp Edwards.

Natural Resource management activities should be reviewed to determine if they comply with Cultural Resources requirements. The compliance requirements of NEPA, NHPA (National Historic Preservation Act), ARPA (Archaeological Resource Protection Act of 1979), NAGPRA (Native American Graves Protection and Repatriation Act), AIRFA (American Indian Religious Freedom Act of 1978), EO (Executive Order) 13007 and 13175, and DoDI 4710.02 should be considered when undertaking any environmental management activity. For example, the following may trigger Section 106 consultation under the NHPA: (i) all ground disturbing activities associated with forest management (harvesting, plowing and planting for regeneration); (ii) habitat management (physical soil preparation for food plots, over plantings, pond and wetland construction, cantonment area management (historically appropriate landscaping may be an issue if the cantonment area is a historic district), soil surveys and land rehabilitation); (iii) maintenance (terrain modification for erosion control and restoration); and (iv) agricultural out leasing (plowing). See Chapter 8.11 for details on Cultural Resources Management.

3.3 Transportation System

Camp Edwards has an extensive transportation system including 120 miles of roads (Table 3-1), a railroad access point, and an ARNG Aviation facility with associated access points throughout the training area (Figure 3-3). Figure 3-3 also displays the conditions of the roads on Camp Edwards and accompanying Table 3-1

lists the total mileage and percent of the total roads for each road type. Paved roads are asphalt roads. Improved roads are those with an enhanced surface such as blue-stone, crushed concrete, gravel etc. All unimproved roads are single vehicle-width primitive dirt roads.

Table 3-1. Road system of Camp Edwards.

Road Condition	Miles	% Total
Paved	26.3	21.7
Improved	23.1	2.5
Unimproved	70.4	54.6
Total	119.8	

Figure 3-3. Transportation System on Camp Edwards, MA.

March 2006, MAARNG GIS, MassGIS, Michael Ciaranca, Natural Resource Manager

3.3.1 Cantonment Area Roads

Nearly all of the roads in the cantonment area of Camp Edwards are paved, with the exception of some older segments that have deteriorated. The paved roads are two-lane roads, with the exception of Connery Avenue, which is a four-lane road, constructed of bituminous concrete and lacking curbs. A storm water drainage system is lacking on most of the roads in the cantonment area, resulting in runoff draining into the shoulders of the roads.

3.3.2 Northern Training Area Roads

In contrast to the roads in the cantonment area, a relatively small percentage of roads in the northern training area of Camp Edwards are paved. The majority of the roads in the northern training area are unimproved single-vehicle trails that are utilized by wheeled vehicles for training and remediation purposes. A track vehicle trail exists on the western and northern portions of the training area and is used primarily by APCs, which may also utilize other unimproved (i.e., dirt) roads in the northern training area.

3.3.3 Railroad Access Point

A rail spur diverges from the Bourne-Falmouth railroad line and ends in the cantonment area of Camp Edwards. This rail line has historically served to transport large tracked vehicles (e.g., tanks and APCs) and other equipment that is typically too large for transporting on existing public roads.

3.3.4 ARNG Aviation Facility

The ARNG Aviation Facility exists adjacent to and utilizes the airfield on Otis ANGB that is also used by the USCG Air Station Cape Cod. The ARNG Aviation Facility primarily supports UH60 (Blackhawk) helicopters and a C26 fixed-wing airplane. Approximately 29 helicopter landing zones (LZs) are located throughout Camp Edwards to serve as locations to which soldiers may be transported by helicopter. These LZs are typically a 120'x111' area of cleared and smoothed land, with the actual landing pad measuring 23'x40'. However, many of the LZs are not used on a regular basis and are in need of maintenance. The restoration of LZs on Camp Edwards will be implemented as a Land Rehabilitation and Maintenance (LRAM) project (see Chapter 7.4).

3.4 Water Supply

There are two public water systems on the MMR located on land within the property licenses of the Massachusetts National Guard. The Upper Cape Regional

Water Supply Cooperative provides drinking water to the four surrounding communities, the Barnstable County Correctional Facility, and the MMR. The 102nd Fighter Wing water supply system provides water to base residents and to employees working in the general Cantonment Area.

The Cooperative has three wells in the northern area of the Camp Edwards Training Area. The locations of these wells are provided in Figure 6-5. The Cooperative serves as a water wholesaler, providing water to existing public water supply systems. It does not provide water directly to individual (service connection) customers. The Water Management Act Permit for the system was issued on December 26, 2002 and runs through November 30, 2010. The Cooperative's system is authorized to withdraw a daily average of 3.0 million gallons per day, for a total annual withdrawal of 1,095 million gallons per year.

The 102nd Fighter Wing draws water from J-Well, which is located in the Cantonment Area along Herbert Road on the north side of the Otis airfield. The Water Management Act Registration for this system was reissued by MassDEP in May 1999 and runs through May 2009. The system is authorized to withdraw an average volume of 540,000 gallons per day and a total annual volume of 197,100,000 gallons.

There are two additional water wells under Massachusetts National Guard control. These are located at Range Control in Training Area B-7 and at the ASP in Training Area A-4. The location of these facilities is provided in Figure 6-5. These wells, which are not metered and serve less than five full-time personnel each, do not serve enough people to be classified as public water supply system wells under the provisions of Massachusetts state regulation 310 CMR 22.00.

The Otis Fish and Game Club, located just north of Connery Avenue near the Otis Rotary, receive its water from the Bourne Water District.

3.5 Projected Changes in Facilities

Proposed changes in facilities on Camp Edwards within the cantonment area include a new Unit Training Equipment Site (UTES) and an upgraded Regional Training Institute by 2011. Within the training area of Camp Edwards a live fire convoy course, a forward operating base, and an upgrade to the Infantry Battle Course, upgrades to A, E, SE, SW, and T Ranges are proposed. As a result of the upgrade to the RTI, a 40 acre engineering dig site is planned.

A new Barnstable County Jail was constructed in 2004 in training area A-1. The construction and operation of the facility is not the responsibility of the MAARNG. The construction of the jail results in increased traffic on Connery Avenue which will not likely affect training, since convoys are required to Camp Edwards via the convoy gate

on the northeastern corner of the installation. Other environmental impacts include habitat destruction, increased noise, light pollution, runoff, and facilities construction (e.g., power lines, sewers, water supply).

SECTION II. MANAGEMENT RESPONSIBILITIES

CHAPTER 4. GOALS AND POLICIES

4.1 Goals

The goals of the Camp Edwards Integrated Natural Resources Management Plan (INRMP) are to maintain the natural resources of Camp Edwards consistent with the use of Camp Edwards to ensure the preparedness of the MAARNG. Guidance from the INRMP will aid in improving the training lands while benefiting natural resources through reduced soil erosion, improvement to the flora, fauna, and their habitats, protection of wetlands, and conservation of rare species. Further objectives of the Camp Edwards INRMP are:

1. To outline the military mission and its effects on the natural resources of Camp Edwards.
2. To recommend guidelines for the management and protection of natural and cultural resources on Camp Edwards to maintain biological diversity and sustainability of the training site for mission use.
3. To suggest methods for increasing awareness of the Massachusetts Army National Guard and the general public on matters of natural resources protection and conservation and its integration with military training.
4. To provide specific natural resources management guidelines and recommendations so that the Environmental Performance Standards from the Massachusetts National Guard's Master Plan/Area-Wide Environmental Impact Report, may be achieved on Camp Edwards with no net loss to the training mission.
5. To describe the physical characteristics of the Camp Edwards Training Site.
6. To describe the results and findings of the Range and Training Land Assessment Program and other natural resources inventories and studies on Camp Edwards. These results will serve as a baseline of information upon which management recommendations will be based.
7. To describe in detail the organization, personnel, funding, and support required for the implementation of the INRMP on the Camp Edwards Training Site.

8. To provide an avenue for public involvement in the implementation process of the INRMP as well as in the recommendations for use of the training site for recreational purposes.
9. The experiences are to be used as lessons learned, positive and negative, for other military installations.

4.2 Required and Relevant Environmental Regulations

Various policies, laws, regulations (both federal and state), and procedures apply to natural resources management at Camp Edwards. Of particular importance are the following regulations:

- Sikes Act (16 U.S.C. 670a et seq.); the Sikes Act Improvement Amendments of 1997 (SAIA) requires every Army installation to develop an INRMP by November 2001
- National Environmental Policy Act (NEPA) requires review of environmental consequences of federal actions
- Clean Water Act (CWA)
- Safe Drinking Water Act (SDWA) protects drinking water supplies
- Department of Defense (DoD) Instruction 4715.3 (Environmental Conservation Program) provides guidelines on developing environmental programs on military installations
- National Guard Bureau All States Memo (Log Number P00-0039)(NGB, 2000) provides instructions on developing and implementing the INRMP
- Army Assistant Chief of Staff for Installation Management Memo, dated 21 March 1997 (Army Goals and Implementing Guidance for Natural Resources Planning Level Surveys (PLS) and Integrated Natural Resources Management Plan (INRMP)) lists planning level surveys on installations
- Army Regulations (AR) 200-1 provides guidelines on protection and enhancement of the environment
- AR 200-2 discusses the review environmental effects of Army actions
- AR 200-4 addresses the protection of cultural resources on Army lands
- AR 200-5 discusses pest management principles and policies
- Chapter 47 of the Acts of 2002 as they pertain to the Massachusetts Military Reservation
- Massachusetts Endangered Species Act (MESA) prevents a loss or take of state-listed rare species
- Massachusetts Wetland Protection Act (MWPA) protects against loss or destruction of wetlands

- The Environmental Performance Standards (EPS) listed in the Massachusetts National Guard's Area Wide FEIR and as required by M.G.L. Chapter 47 Acts of 2002 serve as the guide by which MAARNG training and natural resources management will be conducted on Camp Edwards. These EPS's is incorporated with federal environmental and land management programs specified by military regulation and federal law. The INRMP, to the extent appropriate and applicable, will integrate and aid in achieving the standards set forth within the EPS's. For a complete description of the EPS's, please refer to the Massachusetts National Guard's Area Wide FEIR (2001).

The MAARNG will maintain copies of available laws and regulations for review.

4.3 Policies

Various policies established on the Camp Edwards Training Site will be used to attain each of the goals of the INRMP. The physical characteristics and some natural resources of Camp Edwards were described by planning level surveys (e.g., soils, water resources, forest resources) and using geographic information systems (e.g., topography, land uses, habitat types). Most of the natural resources of the training site (i.e., flora and fauna) were described during initial inventories and later through the Integrated Training Area Management (ITAM) Program, which was first established on Camp Edwards in 1994 (see Chapter 7).

Camp Edwards Training Site Regulation 385-63 (Range Safety) was written to provide guidance and direction relative to the safe and efficient use of Camp Edwards' training facilities for all users. A primary goal of the regulation was to ensure proper protection and management of hazardous wastes, wetlands and water resources, vegetation, cultural resources, wildlife and their habitat, and fire.

4.4 Environmental Review (NEPA Compliance)

The National Environmental Policy Act (NEPA) was created to identify environmental concerns with human activities and resolve them to the best degree possible at early stages of project development. The MAARNG uses NEPA analysis to ensure its activities are properly planned, coordinated, and documented. The MAARNG provides NEPA documentation for proposed projects (actions) at Camp Edwards that are beyond the existing required documentation developed by the MAARNG for the training site. This additional NEPA documentation can then be used for identification of potential problems or impacts on the natural resources of Camp Edwards.

NEPA is a three-stage process.

1. If the proposed action meets a categorical exclusion (CX) in Army Regulation 200-2, a Record of Environmental Consideration (REC) is prepared for the project, and the project may proceed as planned. These are the most commonly prepared documents.
2. An Environmental Assessment (EA) or Environmental Impact Statement (EIS) is required when an action does not qualify for Categorical Exclusion. EAs and EISs are comprehensive documents that describe a proposed action and the alternatives to the action. An EA is used for actions that will not have a significant environmental effect or where an action's environmental effects can be mitigated below a level of significance. An EA is often used when extensive new military exercises, major construction, or land acquisition is planned; when the planned action involves a large area, or when wetlands or endangered species may be involved. A Finding of No Significant Impact is required for the action to proceed as planned. A 30-day review period is provided for public comment.
3. An EIS is reserved for those actions with significant environmental effects that cannot be mitigated below a level of significance. If more study is needed or a Finding of No Significant Impact cannot be prepared, an Environmental Impact Statement (EIS) must be written. These can be lengthy documents that require significant time to prepare.

Implementation of this INRMP is the proposed action that must be reviewed in accordance with NEPA and AR 200-2 *Environmental Effects of Army Actions* before implementation of the projects, objectives and goals found within. An EA will be written to address the implementation of this plan. Topics to be addressed are related to the effects of implementing the proposed plan on natural resources. The details are discussed in the following chapters and include but are not limited to: ITAM, endangered species, wildlife, prescribed burning, routine maintenance activities, riparian zones, floodplains, wetlands, off-road vehicle use, sedimentation, erosion, and non-point source pollution.

4.5 Monitoring INRMP Implementation

Monitoring is a critical component of the INRMP implementation. Personnel from the Natural Resource Office on Camp Edwards will meet semi-annually with trainers and commanders from the Camp Edwards Training Site, the Environmental Management Commission (EMC), as well as with representatives from the Massachusetts Natural Heritage and Endangered Species Program (NHESP), to discuss the effectiveness of INRMP implementation. Meetings are held at least once annually to discuss management projects that will be or were carried out, respectively.

The INRMP will be renewed every five years (i.e., 2007, 2012, etc.), unless circumstances arise that would require the plan to be revised more frequently, to update the document with any changes in the military mission or the natural resources of the Camp Edwards Training Site.

CHAPTER 5. RESPONSIBLE AND INTERESTED PARTIES

5.1 Installation Organizations

The Commonwealth of Massachusetts, Military Division, as mandated in the license with the Department of Army, is responsible for the land that is Camp Edwards. Therefore, the Military Division is responsible for planning and managing activities to ensure compliance with an approved Integrated Natural Resources Management Plan (INRMP). The ultimate responsibility for operating and maintaining the installation and implementing the INRMP resides with the Adjutant General. However, the development and submission of the INRMP is the responsibility of the MAARNG Natural Resources Planner.

The development and implementation of the INRMP requires the cooperation and participation of the MAARNG Training Site Commander, the Construction and Facilities Management Officer (CFMO), the Plans, Operations, and Training Officer (POTO), and Camp Edwards Range Control. The CFMO provides a full range of financial, engineering and environmental services for all facilities including Camp Edwards, under the jurisdiction of the state Military Division. Specific responsibilities include: 1) procurement and contracting, 2) warehousing, 3) master planning, 4) construction, and 5) environmental funding. In addition, all Commanders, trainers, and soldiers must abide by the management guidelines detailed in this document for successful implementation of the INRMP.

The Camp Edwards Operations and Training Office is primarily responsible for the scheduling of military training and for the safety of all personnel while training exercises are conducted. In addition, personnel are in charge of maintaining an adequate training environment, which is accomplished through monitoring usage and enforcement of natural resource and land management regulations.

The Camp Edwards Natural Resource Office is responsible for coordinating activities that affect the installation's natural resources. This involves, but is not limited to, preparing plans, developing projects, conducting field studies, securing permits, GIS support and analysis, preparing reports, and facilitating cooperation between military operations and other natural resource agencies at the local, state and federal levels.

The responsibility of the Facility Engineers Office on Camp Edwards is to develop and maintain training site land and facilities. This office supports the Camp Edwards Natural Resource Office by providing equipment and personnel to aid in conducting natural resource and remediation projects.

5.2 Federal Defense Organizations

Implementing the Camp Edwards INRMP is ultimately the responsibility of the Adjutant General of the MA ARNG, and the day-to-day coordination and implementation of the management proposed in the INRMP will be the responsibility of the Camp Edwards Natural Resource Office. The NGB is responsible for providing Army funds for natural resources management as programmed and budgeted by MA ARNG, and submitted to NGB for funding by the MA ARNG.

5.3 Other Federal Agencies

Coordination with the U.S. Fish and Wildlife Service (USFWS) on the development and implementation of the Camp Edwards INRMP is required under the Sikes Act. Therefore, upon the approval of the INRMP by the agency, the USFWS will serve as a signatory partner on the INRMP. Although no federally threatened or endangered species have been found on Camp Edwards, the USFWS is greatly interested in the management of wildlife and habitats of the training site and will provide input throughout the implementation process. Other federal agencies that might have an interest in the management of natural resources on Camp Edwards may include the U.S. Army Corps of Engineers, the Natural Resources Conservation Service, the Environmental Protection Agency, the National Park Service, and the U.S. Coast Guard.

5.4 State Agencies

Under the direction of the Executive Office of Environmental Affairs of the Commonwealth of Massachusetts, several environmental agencies have been asked to provide assistance in developing and implementing the INRMP. These agencies include the Environmental Management Commission, as required by Chapter 47 the acts of 2002, the Division of Fisheries and Wildlife, as required by the Sikes Act, and subsequently the Natural Heritage and Endangered Species Program, the Department of Conservation and Recreation and the Department of Environmental Protection through the Environmental Management Commission.

The purpose of the EMC is to ensure the permanent protection of the drinking water supply and wildlife habitat of the northern 15,000 acres of the MMR. The EMC ensures, by independent oversight, monitoring, and evaluation, that all military and other activities on the northern 15,000 acres are consistent with this purpose. The EMC oversees compliance with, and enforcement of, the Environmental Performance Standards (EPS); coordinate the actions of state environmental agencies in the enforcement of laws and regulations, as appropriate; and facilitate open and public review of all activities on the northern 15,000 acres of the MMR.

5.4.1 Memorandum of Agreement 2001 and Chapter 47 of the Acts of 2002 (see Appendix G)

On October 4, 2001, a Memorandum of Agreement (MOA) was signed establishing a management structure for the Camp Edwards Training Area and the Upper Cape Water Supply Reserve. It also created the oversight structure for the area as outlined in the CWG Master Plan Final Report. The MOA was signed by the Governor of Massachusetts for the Commonwealth of Massachusetts and by the Deputy Assistant Secretary of the Army (Environment, Safety & Occupational Health) for the Department of the Army. Other signatories were the Secretary of EOEA, NGB, the Adjutant General of the Massachusetts National Guard, the Commissioner of the Massachusetts Department of Fisheries, Department of Fish and Game, the Commissioner of the Massachusetts Department of Conservation and Recreation (DCR), and the Commissioner of the Massachusetts Department of Environmental Protection (DEP).

On March 5, 2002, acting Governor Jane Swift signed legislation (Chapter 47 of the Acts of 2002) codifying into law the MOA (Appendix G) ensuring the permanent protection of the drinking water supply and wildlife habitats in the Camp Edwards Training Area and the Upper Cape Water Supply Reserve, while allowing compatible military training. Under the law, the compatibility of training with environmental protection would be verified through independent oversight, monitoring, and evaluation. For this purpose, the legislation created the Environmental Management Commission (EMC), consisting of the Commissioner of MDFWELE, the Commissioner of MassDEP, and the Commissioner of DCR. The EMC oversees compliance with and enforcement of the Environmental Performance Standards and coordinates the actions of environmental agencies of the Commonwealth in the enforcement of environmental laws and regulations within the Reserve.

The legislation further directed that the EMC be assisted by two advisory councils. The Community Advisory Council (CAC), consisting of 15 members and The Science Advisory Council (SAC), consisting of 5 to 9 members, both of which assist the EMC by providing advice on issues related to the protection of the water supply and wildlife habitat within the Camp Edwards Training Area and the Upper Cape Water Supply Reserve

Finally, the legislation established a full-time Environmental Officer (EO) for the MMR. This position acts as a liaison between the EMC, SAC, CAC, military, general public, and various state agencies, identifies and monitors ongoing issues regarding training procedures and the environment and keeps the EMC, SAC and CAC apprised of the progress of these issues, in addition to bringing issues to the Environmental and Readiness Center (E&RC) for resolution and participates in community outreach activities with the E&RC and facilitates the EMC, SAC and CAC public meetings under the legislation

5.5 Universities

The University of Massachusetts at Amherst has provided input and advice to the MAARNG regarding natural resources management since the early 1980s. Recent cooperation with the MAARNG includes assistance in implementing the prescribed burn program and planning, conducting various GIS work, and graduate student research projects on Camp Edwards.

5.6 Contractors

Contractors have been and will continue to be employed for large-scale environmental rehabilitation and remediation projects that exceed in-house asset capability. The Camp Edwards Facilities Engineers Roads and Grounds Crew is comprised of three individuals whom are responsible for maintaining all of the roads and grounds of Camp Edwards. Therefore, the apparent shortage of personnel results in the need for hiring contractors to complete larger projects.

5.7 Native American Tribes

The Wampanoag Tribe of Gay Head (Aquinnah) is one of two federally recognized tribes of Native Americans that consider Camp Edwards to be within their ancestral lands. All actions, including those associated with the implementation of the INRMP, that have the potential for impacting tribal cultural resources must be reviewed by the tribe under the Section 106 process of the National Historic Preservation Act. Failure to consult with the Wampanoag Tribe prior to a federal undertaking could result in a foreclosure of the activity to prevent any potential impacts to cultural resources (SEE Appendix G for MOU). The other federally recognized tribe is the The Wampanoag Tribe of Mashpee that was federally recognized May 2007. Consultation with this tribe will occur according two all guidances, policies, regulations, and laws; the consultation process will be initiated fall 2007.

5.8 Other Interested Parties

Assistance in developing and implementing the INRMP may also be received from local agencies of the surrounding towns of Bourne, Falmouth, Mashpee, and Sandwich. These could include town selectmen, conservation agents, conservation commissions, and natural resources departments.

Non-profit organizations that contribute technical advice have included The Nature Conservancy (see Appendix G for Cooperative Agreement), the Massachusetts Audubon Society, and the Lloyd Center for Environmental Studies. Other

organizations that would likely be interested in reviewing the INRMP include, but are certainly not limited to, the following:

- Environmental Protection Agency
- National Park Service – Cape Cod National Seashore
- Cape Cod Commission
- Friends of the MMR (FMMR)
- Massachusetts Audobon Society
- Association for the Preservation of Cape Cod
- Trustees of Reservations
- Senior Environmental Corps. (RSVP) Of Cape Cod
- Patriots Advocating Camp Edwards Restoration and Survival (PACERS)
- Save The Reserve and Our National Guard (STRONG)

5.9 Signatory Agencies

The signatory partners of the INRMP include members of the National Guard as well as a representative from the U.S. Fish and Wildlife Service and the Massachusetts Division of Fisheries and Wildlife. National Guard signatories are the Chief of Environmental Programs at the National Guard Bureau, The Adjutant General, the Construction and Facilities Management Officer, the Director, Plans, Operations, Training, and Military Support, and the Training Site Commander of the Massachusetts Army National Guard. Signatory partners from federal and state agencies include an appointee of the Director of the New England Field Office of the US Fish and Wildlife Service and the Director of the Massachusetts Division of Fisheries and Wildlife.

SECTION III. NATURAL RESOURCES OF CAMP EDWARDS

CHAPTER 6. NATURAL RESOURCES AND CLIMATE

6.1 Setting

The Camp Edwards Training Site is located on the western end of Cape Cod, within the Cape Cod and Islands Ecoregion of the Northeastern Coastal Zone (Barbour *et al.* 1999). The predominant geologic characteristics of the Cape Cod Ecoregion include glacial moraines with associated outwash plains and kettle holes, all of which are present on Camp Edwards.

Camp Edwards contains a unique diversity of natural communities that support 36 state-listed rare species. The predominant natural community of Camp Edwards is pitch pine-oak forest woodland. Pine and oak dominate this natural community, with pitch pine scrub oak community and black oak scarlet oak forests comprising less of the total acreage. Native grassland communities comprise a relatively small portion of Camp Edwards, but are one of the primary habitats for state-listed rare species. The wetland communities that exist on Camp Edwards are all classified as palustrine in that they are well-vegetated and most often lacking open water.

Camp Edwards represents an island of natural resources surrounded by a sea of development. It is one of the largest undeveloped tracts of land over 10,000 acres, along the coast, from Maine to New Jersey. The MMR as a whole is a “massive wooded area on the Upper Cape that is largely undeveloped, but fringed with highways, homes, and other development” (Cape Cod Commission 1998). The predominant land use surrounding Camp Edwards is residential or commercial development. The cantonment area of Camp Edwards borders Otis Air National Guard Base (Otis ANGB), United States Coast Guard (USCG) Air Station Cape Cod, USCG Housing, and the Veteran’s Affairs (VA) Cemetery. Although the MMR is situated within four towns, Bourne, Sandwich, Falmouth, and Mashpee, Camp Edwards lies only within the boundaries of Bourne and Sandwich. Within the town of Sandwich is the most densely populated area surrounding Camp Edwards. Shawmee-Crowell State Forest, an undeveloped yet fragmented area of land, that borders Camp Edwards to the north and is used for recreational purposes. The land uses in the Town of Bourne that border Camp Edwards are primarily residential, but also includes the Bourne Integrated Solid Waste Management Facility.

6.2 Topography

The surface topography of Camp Edwards varies greatly between northern and western portion and the southern portion of the training area (Figure 6-1). The northern and western portion of Camp Edwards is part of the Sandwich and Buzzards Bay glacial moraines, respectively. Large glacial deposits dominate this area with high topographic relief of rolling hills and deep kettle holes (Figure 6-1). Slopes range from 0-15%, with a mean slope of 3.4%. The greatest change in topographic relief in this area of Camp Edwards is approximately 90 feet. The highest point on Cape Cod, Pine Hill (318 feet above sea level), is situated in this western portion of Camp Edwards, atop the Buzzards Bay Moraine.

In contrast, the southern portion of Camp Edwards, which resides entirely within the Mashpee pitted outwash plain, has relatively low elevation (approximately 100 feet above sea level) and little topographic relief. Although slopes range from 0-15% in the outwash plain, the mean slope of 1.5% is considerably less in the moraine. The majority of the outwash plain has a slope of 0-2%, with the exception of the approximately 20 kettle-holes within the area.

Figure 6-1. Geology and Topography of Camp Edwards

March 2006, MAARNG GIS, MassGIS, Michael Ciaranca, Natural Resource Manager

6.3 Geology

The geologic origin of Cape Cod dates back to approximately 12,000 years ago at the end of the Wisconsin Period of glaciation. During the retreat of the Laurentide ice sheet, moraines of glacial till were deposited by the Cape Cod Bay Lobe to form the Sandwich moraine, the main peninsula of the Cape, and by the Buzzards Bay Lobe, which formed the Buzzards Bay Moraine, the western edge of the Cape and the Elizabeth Islands (Strahler 1966). Camp Edwards is situated on the northwest corner of Cape Cod where these two moraines converge. Approximately 40% of Camp Edwards resides on the glacial moraines. As a result, much of the geologic material with which much of Camp Edwards and Cape Cod was formed is an amalgam of well-scoured rock fragments that originated in northern New England.

As the Laurentide Ice Sheet melted and retreated over the course of hundreds or thousands of years, rivers and streams of melt water deposited material from the moraines southward to the ocean. Much of the loam and clay washed into the Atlantic Ocean while the sand, gravel, and cobble was deposited closer to the moraines, forming the Mashpee pitted outwash plain (Strahler 1966) (Figure 6-2). This outwash plain is broad sloping land that forms the southern side of Cape Cod, extending from the terminal moraines to the Atlantic Ocean. The southeastern portion of Camp Edwards, approximately 60% of the land, is situated on the Mashpee pitted outwash plain. As a result, much of the soil in the area is a loose sand material.

Prior to the development of the Sandwich and Buzzards Bay moraines, the Laurentide ice sheet had advanced further south, creating the islands of Martha's Vineyard and Nantucket (Strahler 1966). During the period when the glacier retreated northward across what is now Cape Cod, large blocks of ice were left scattered throughout what would become the Mashpee pitted outwash plain. As the outwash plain was formed, soil was deposited around the blocks of glacial ice. The glacial ice eventually melted leaving deep, steep-sided cavities that are referred to as kettle-holes. Some of these kettle-holes filled with water, creating kettle-hole ponds or lakes, which are present throughout Camp Edwards.

6.4 Climate

The climate of the region in which Camp Edwards is situated is rather temperate due to the influence of the Atlantic Ocean. Winters are generally cold, with an average daily temperature of 31°F, and summers are generally warm, averaging 68°F. Average annual precipitation is 45 inches, 21 inches of which fall between April and September. The average annual snowfall is about 24 inches. Mean relative humidity is 70% in mid-afternoon and 80% at dawn (Soil Conservation Service 1993).

6.5 Petroleum and Minerals

There are no known mineral or petroleum resources of commercial value on Camp Edwards.

6.6 Soils

In general, the soil of Camp Edwards is well-drained sand or sandy loam often containing stones or boulders (Figure 6-2) (Appendix A). As a result, most of the soils have a high susceptibility to erosion, especially at steeper slopes (US Department of Agriculture Soil Conservation Service 1993) and along roads (Figure 6-3). The soil erosion potential data represented in Figure 6-3 were generated using the Revised Universal Soil Loss Equation (RUSLE) (Renard et al., 1996) which is an empirical model that predicts the amount of annual soil loss for a specified set of conditions.

For the sake of description, the soils of Camp Edwards can be classified in two categories- soils of the Sandwich and Buzzards Bay terminal moraines and soils of the outwash plain.

6.6.1 Soils of the Sandwich and Buzzards Bay Terminal Moraines

The soils of the Sandwich and Buzzards Bay terminal moraines are classified as rolling or hilly, and containing many boulders. These excessively drained or well-drained soils are typically found on slopes ranging from 3-15% and on hills of glacial moraine areas. Plymouth-Barnstable complex soils and Plymouth loamy coarse sand (7,066 Ac), and Barnstable-Plymouth complex soils (791 Ac) comprise the entirety of the terminal moraine soils on Camp Edwards. The Plymouth-Barnstable and Barnstable-Plymouth complex soils are mixtures of Plymouth, Barnstable, and other soils in varying proportions. These soils are typically covered with an inch of organic matter above the highly permeable soil. The relatively high susceptibility of these soils to erosion is a management concern (US Department of Agriculture Soil Conservation Service 1993).

6.6.2 Soils of the Outwash Plains

The soils of the outwash plains on Camp Edwards are primarily Enfield silt loams and Merrimac sandy loams. Both of the Enfield and Merrimac loams have been classified as very deep well-drained soil commonly found in broad areas on outwash plains. These soils have been described at a range of slopes between 0 and 15% throughout outwash plains. Erosion is a management concern where these soils exist on moderate to steep slopes (Soil Conservation Service 1993).

Other soil types that have been described on the outwash plain of Camp Edwards include Plymouth loamy coarse sand, Carver coarse sand, Hinckley gravelly sandy loam and gravelly sandy loam. These soils are often found on moderate or steep slopes of swales on outwash plains. Like the Enfield and Merrimac loams, these soils are described as excessively drained, often resulting in high erodability, especially at steeper slopes (Soil Conservation Service 1993).

Soil types associated with development on the outwash plain include sand and gravel pits from which sand or gravel have been removed, Udipsamments, smoothed, which are areas that have been leveled or smoothed during construction, and urban land that includes buildings and pavement (Soil Conservation Service 1993).

Figure 6-2. Soil classification of Camp Edwards, MA.

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Figure 6-3. Erosion potential of soils on Camp Edwards, MA.

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6.7 Water Resources

The water resources of Camp Edwards are scarce on the surface of the land, but plentiful beneath. The excessively drained sandy soils of Camp Edwards are not conducive to surface water retention. As a result, 45% of the annual rainfall on Camp Edwards infiltrates the soil and contributes to the groundwater supply.

6.7.1 Surface Water Resources

Surface water resources are sparse on Camp Edwards. Although there are 31 wetlands on the training site, they comprise only 55 of the 14,433 Acres, or .39%, of land (Table 6-1). No large lakes, rivers, or streams exist on the property, only small palustrine (i.e., marshy) wetlands and ponds (Gravatt *et al.* 1999). As determined using the National Wetlands Inventory classification system, there are 17 palustrine emergent, 8 palustrine open water, 6 palustrine scrub-shrub, 5 palustrine forested, 2 Palustrine emergent/scrub shrub, 1 palustrine forested/scrub shrub, 1 palustrine emergent/open water, and 1 palustrine aquatic bed wetlands on Camp Edwards. By definition, these palustrine wetlands are well-vegetated nontidal wetlands that are dominated by trees, shrubs, or emergent plants and have salinity below 0.5 ppt. If vegetation is not present, then the wetlands must be less than 8 hectares, lacking in wave-formed or bedrock shores, and have a maximum water depth less than 2 meters at low water (Cowardin *et al.* 1979). Most of the wetlands and surface waters in the Sandwich and Buzzards Bay Moraines on Camp Edwards are considered to be perched (US Army Corps of Engineers 2000). The wetlands presented in Table 6-1 are also classified by community type per MA NHESP community classification scheme. It also states whether a given wetland is certified as a vernal pool.

Table 6-1. Wetlands and Ponds of Camp Edwards, MA.

Name	Acres	NWI	MA NHESP	Certified Vernal Pool
A-2 Pond	0.2	Palustrine Emergent / Scrub Shrub	Shrub Swamp	Yes
Bailey's Pond	0.9	Palustrine Emergent	Coastal Plain Pondshore	No
Beaman Street Wetland	0.0	Palustrine Emergent / Open Water	Shrub Swamp	No
Bypass Bog	0.9	Palustrine Emergent / Scrub Shrub	Coastal Plain Pondshore	No
Cranberry Bog	2.3	Palustrine Emergent	Kettlehole Level Bog	Yes
Deep Bottom Pond	1.3	Palustrine Open Water	Coastal Plain Pondshore	Yes
Donnelly Pond	2.1	Palustrine Open Water	Coastal Plain Pondshore	No
Gibbs Pond	0.6	Palustrine Emergent	Basin Depression	Yes
GP-3 Pond	0.5	Palustrine Emergent	Kettlehole Wet Meadow	No
Grassy Pond	0.5	Palustrine Emergent	Shrub Swamp	Yes
Little Halfway Pond	0.7	Palustrine Scrub Shrub	Coastal Plain Pondshore	Yes
Monument Swamp	2.3	Palustrine Emergent	Kettlehole Level Bog	Yes
Monument Swamp Cistern	0.1	Palustrine Open Water	Woodland Vernal Pool	No
Monument Swamp Red Maple	0.8	Palustrine Forested	Forest Seep Community	No
Opening Pond	1.0	Palustrine Open Water	Coastal Plain Pondshore	Yes
Ox Pond	1.0	Palustrine Forested / Scrub Shrub	High Bush Blueberry Thicket / Red Maple Swamp	No
Raccoon Swamp A	0.1	Palustrine Open Water	Woodland Vernal Pool	Yes
Raccoon Swamp B	0.0	Palustrine Emergent	Shrub Swamp	Yes
Raccoon Swamp C	0.0	Palustrine Emergent	Shrub Swamp	No
Raccoon Swamp D	0.4	Palustrine Emergent	Woodland Vernal Pool	No
Raccoon Swamp E	0.5	Palustrine Emergent	Kettlehole Level Bog	No

Table 6-1. continued.

Name	Acres	NWI	MA NHESP	Certified Vernal Pool
Red Maple Swamp	0.6	Palustrine Forested	Red Maple Swamp	No
Rod & Gun Club Red Maple Swamp	0.6	Palustrine Forested	Red Maple Swamp	No
Rod & Gun Club Red Maple Swamp	0.8	Palustrine Forested	Red Maple Swamp	No
Rod & Gun Club S Shrub Swamp	1.7	Palustrine Scrub Shrub	Shrub Swamp	No
Rod & Gun Club S Shrub Swamp	1.5	Palustrine Scrub Shrub	Shrub Swamp	No
Rod and Gun Club 3	0.2	Palustrine Emergent	Coastal Plain Pondshore	No
Rod and Gun Club North	6.7	Palustrine Open Water	Coastal Plain Pondshore	No
Rod and Gun Club Shrub Swamp	2.1	Palustrine Scrub Shrub	Shrub Swamp	No
Rod and Gun Club Shrub Swamp	2.7	Palustrine Scrub Shrub	Shrub Swamp	No
Rod and Gun Club South	8.3	Palustrine Open Water	Coastal Plain Pondshore	No
Rod and Gun Club West	0.9	Palustrine Open Water	Coastal Plain Pondshore	No
Round Swamp	0.5	Palustrine Scrub Shrub	High Bush Blueberry Thicket / Red Maple Swamp	No
Spruce Swamp	0.0	Palustrine Emergent	Shrub Swamp / Coastal Atlantic White Cedar Swamp	No
Succonsett Pond	1.3	Palustrine Aquatic Bed	Coastal Plain Pondshore	Yes
Tank Trail Wetland	0.0	Palustrine Emergent	Woodland Vernal Pool	No
USDA East	0.2	Palustrine Forested	Shrub Swamp	No
USDA West	0.2	Palustrine Emergent	Shrub Swamp	No
UTES Pond	0.2	Palustrine Emergent	Shrub Swamp	No
Washrack Wetland	0.2	Palustrine Emergent	Shrub Swamp	No
Wood Road Wetland	0.1	Palustrine Emergent	Shrub Swamp	No

6.7.2 Groundwater Resources

Camp Edwards sits atop the Sagamore Lens of the Cape Cod Aquifer (Figure 6-4). This aquifer has been designated as a “sole-source” aquifer by the Environmental Protection Agency, since it meets the definition of supplying greater than 50 percent of the drinking water. With the exception of bottled water, it supplies 100% of the drinking water to the residents of Upper Cape Cod.

The Camp Edwards Training Site is also known as the Upper Cape Water Supply Reserve and is providing up to 3 million gallons of clean drinking water per day to the MMR and the four Upper Cape Cod towns of Sandwich, Bourne, Falmouth, and Mashpee (Figure 6-4, see also section 3.4 Water Supply).

Figure 6-4. Sagamore Lens of the Cape Cod Aquifer with Groundwater Contours and Central Monitoring Well.

25 December 2005, USGS, AEC, MassGIS, AMEC

Figure 6-5. Upper Cape Water Supply Wells on Camp Edwards, MA.
March 2006, MAARNG GIS, MassGIS, Michael Ciaranca, Natural Resource Manager

6.8 Natural Communities of Camp Edwards

An initial floristic survey of the MMR identified 433 species of vascular plants (Jenkins 1994). The annual RTLA and rare plant surveys have identified an additional 124 specimens since 1994, increasing the total number of known plant species on Camp Edwards to 557 (Appendix B). Data from the RTLA plant surveys originally indicated seven major plant communities on Camp Edwards. These communities were classified according to The Nature Conservancy's Albany Pine Bush Reserve Classification System: mixed woods forest, pitch pine-scrub oak forest, hardwood forest, scrub oak barrens, grasslands, wetlands, and disturbed communities. The natural communities of Camp Edwards and the MMR in 2004 were reclassified using the Massachusetts Natural Heritage and Endangered Species Program's Natural Communities Classification (Swain and Keasley 2001). Some smaller undescribed plant communities, such as aspen (*Populus* spp.) depressions also exist within the predominant natural communities.

The plant communities of Camp Edwards are generally classified as mid to late successional forest with intermittent early successional disturbed areas and kettle-hole ponds and wetlands. The climax plant community on Camp Edwards is likely an oak-pine forest with gray birch (*Betula populifolia*), American beech (*Fagus grandifolia*), and bitternut hickory (*Carya cordiformis*) (Foster and Motzkin 1999). Many of the plant communities at Camp Edwards have been influenced by several different factors including fire, ice storms, frost, drought, insect outbreaks, hurricanes, tropical storms, and historic logging and grazing. Natural or human induced fires have played an important role in creating and maintaining the plant communities on Camp Edwards.

The species diversity of the forests of Camp Edwards is generally quite low. On average, 53 species of plants were documented in each plant community of Camp Edwards, which when compared to most fertile woods of western New England that typically have up to 200 plant species, is relatively low (Jenkins 1994).

The following are brief descriptions of the Natural Communities of Camp Edwards as per the Classification of Natural Communities (Swain and Keasley 2001) (see Figure 6.7):

6.8.1 Plantations

Prior to the creation of the MMR in the 1935, the area north of Wood Road was managed as pine, spruce, and fir plantations as part of Shawme State Forest. Areas were frequently burned over and planted with Austrian pine (*Pinus sylverstris*), white pine (*Pinus strobus*), red pine (*Pinus resinosa*), Spanish pine (*Pinus sp.?*), Douglas fir (*Pseudotsuga menziesii*), balsam fir (*Abies balsamea*), Norway spruce (*Picea abies*), and

larch (*Larix sp.*) between 1925 and 1934 (Figure 6-6) (US Department of Agriculture 1932).

Figure 6-6. Portion of 1932 Shawme State Forest Map indicating historic burning, access roads, and exotic pine and spruce plantations.

March 2006, MAARNG GIS, Michael Ciaranca, Natural Resource Manager

Figure 6-7. Natural Communities of Camp Edwards, MA.

March 2006, MAARNG GIS, MassGIS, Michael Ciaranca, Natural Resource Manager

6.8.2 Pitch Pine-Oak Forest Woodland

The Pitch pine-oak forest woodland of Camp Edwards varies with degree of maturity. The structure of the forest ranges from a low canopy with a dense shrub layer to a taller canopy with a sparser shrub layer. In general, the plant community is in a mid-successional state where trees and shrubs are increasing in number, while forbs and grasses are becoming less abundant. The woodlands in the northern area of Camp Edwards tend to have a higher and denser canopy than the other forest communities. This may be due to less historic disturbance, resulting in a more mature forest.

The Pitch pine-oak forest woodland of Camp Edwards has a low canopy of pitch pine (*Pinus rigida*) and tree oaks (black oak (*Quercus velutina*), scarlet oak (*Q. coccinea*), and white oak (*Q. alba*) and a moderately continuous shrub layer of blueberry (*Vaccinium* spp.), black huckleberry (*Gaylussacia baccata*), sheep laurel (*Kalmia angustifolia*), and scrub oak (*Q. ilicifolia*). The sparse forb layer consists of bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), and Pennsylvania sedge (*Carex pensylvanica*). The low forest canopy, about 10-15 m tall, indicates a relatively young forest of no more than 100 years old.

The following table (6-2) contains species of Pitch Pine-Oak Forest Woodland with the plants and birds in order of abundance.

Table 6-2: Species of the Pitch Pine-Oak Forest Woodland

Common Name	Scientific Name	Status in MA
PLANTS		
<u>Trees</u>		
Black oak	<i>Quercus velutina</i>	-
Pitch pine	<i>Pinus rigida</i>	-
White oak	<i>Quercus alba</i>	-
Scrub-oak	<i>Quercus ilicifolia</i>	-
Scarlet oak	<i>Quercus coccinea</i>	-
Red maple	<i>Acer rubrum</i>	-
<u>Shrubs</u>		
Black huckleberry	<i>Gaylussacia baccata</i>	-
Late lowbush blueberry	<i>Vaccinium pallidum</i>	-
Early lowbush blueberry	<i>Vaccinium angustifolium</i>	-
Sheep-laurel	<i>Kalmia angustifolia</i>	-
Beaked hazel-nut	<i>Corylus cornuta</i>	-
Sweet pepper-bush	<i>Clethra alnifolia</i>	-
<u>Forbes</u>		
Wintergreen; Teaberry	<i>Gaultheria procumbens</i>	-
Bracken fern	<i>Pteridium aquilinum</i>	-

Prairie three-awn	<i>Aristata oligantha</i>	-
Pennsylvania sedge	<i>Carex pensylvanica</i>	-
Poverty grass	<i>Danthonia spicata</i>	-
Withe-rod	<i>Viburnum cassinoides</i>	-
Hispid swamp dewberry	<i>Rubus hispidus</i>	-
Ground pine	<i>Lycopodium obscurum</i>	-
Common greenbrier	<i>Smilax rotundifolia</i>	-
Oblong-leaf Juneberry	<i>Amelanchier canadensis</i>	-

INVERTEBRATES

Barrens Daggermoth	<i>Acronictan albarufa</i>	T
Spiny Oakwoarm	<i>Anisota stigma</i>	-
Blueberry Sallow	<i>Apharetra dentata</i>	SC
Straight Lined Mallow Moth	<i>Bagisara rectifascia</i>	SC
Gerhard's Underwing	<i>Catocala herodius gerhardi</i>	T
Melsheimer's Sack Bearer	<i>Cicinnus melsheimeri</i>	T
Coastal Barrens Buck Moth	<i>Hemileuca maia maia</i>	T
Pine Barrens Itame	<i>Itame sp.</i>	SC
Coastal Swamp Metarranthis	<i>Metarranthis pilosaria</i>	SC
Water-willow Stem Borer	<i>Papaipema sulphurata</i>	T
Pine Barrens Zale	<i>Zale sp.</i>	SC

AMPHIBIANS

Spotted salamander	<i>Ambystoma maculatum</i>	-
American toad	<i>Bufo americanus</i>	-
Fowler's toad	<i>Bufo woodhousei fowleri</i>	-
Red-backed salamander	<i>Plethodon cinereus</i>	-
Spring peeper	<i>Pseudacris crucifer</i>	-
Wood frog	<i>Rana sylvatica</i>	-

REPTILES

Eastern box turtle	<i>Terrapene c. carolina</i>	SC
Black racer	<i>Coluber constrictor</i>	-
Ringneck snake	<i>Diadophis punctatus</i>	-
Garter snake	<i>Thamnophis sirtalis</i>	-

BIRDS

Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>	-
Pine warbler	<i>Dendroica pinus</i>	-
Common yellowthroat	<i>Geothlypis trichas</i>	-

Black-capped chickadee	<i>Parus atricapillus</i>	-
Hermit thrush	<i>Catharus guttatus</i>	-
Ovenbird	<i>Seiurus aurocapillus</i>	-
Northern oriole	<i>Icterus galbula</i>	-
Blue jay	<i>Cyanocitta cristata</i>	-
American goldfinch	<i>Carduelis tristis</i>	-
American robin	<i>Turdus migratorius</i>	-
Eastern wood-pewee	<i>Contopus virens</i>	-
Mourning dove	<i>Zenaida macroura</i>	-
Chipping sparrow	<i>Spizella macroura</i>	-
Brown-headed cowbird	<i>Molothrus ater</i>	-
Gray catbird	<i>Dumetella carolinensis</i>	-
Tufted titmouse	<i>Parus bicolor</i>	-
American crow	<i>Corvus brachyrhynchos</i>	-
Prairie warbler	<i>Dendroica discolor</i>	-
Northern flicker	<i>Colaptes auratus</i>	-
Scarlet tanager	<i>Piranga olivacea</i>	-

MAMMALS

Coyote	<i>Canis latrans</i>	-
Red Fox	<i>Vulpes vulpes</i>	-
Southern Flying Squirrel	<i>Glaucomys volans</i>	-
Ground Hog	<i>Marmota monax</i>	-
Meadow Vole	<i>Microtus pennsylvanicus</i>	-
White Tailed Deer	<i>Odocoileus virginianus</i>	-
Shorttailed Shrew	<i>Blarina brevicauda</i>	-
White Footed Mouse	<i>Peromyscus leucopus</i>	-
Southern Red-backed Vole	<i>Clethrionomys gapperi</i>	-
Raccoon	<i>Procyon lotor</i>	-
Eastern Cottontail	<i>Sylvilagus floridanus</i>	-
Eastern Chipmunk	<i>Tamias striatus</i>	-

6.8.3 Pitch Pine-Scrub Oak Community

In areas of forest from which hardwood trees were historically cleared, the plant community is almost entirely pitch pine (*Pinus rigida*) with an understory of sometimes very dense scrub oak (*Quercus ilicifolia*) (Jenkins 1994). Other tree species that are present but not common to the community are scotch pine (*Pinus sylvestris*), white oak, and scarlet oak. Scotch pine was likely introduced to Camp Edwards in the late 1920's and the early 1930's as plantations in Shawme State Forest (US Department of Agriculture 1932). The prevalent shrub species of Camp Edwards, black huckleberry (*Gaylussacia baccata*), blueberry (*Vaccinium* spp.) are commonly interspersed among scrub oak.

The structure of the pitch pine-scrub oak communities varies greatly with age. Younger stands are short, dense thickets of immature pitch pine. Immature pitch pine is relatively low in plant diversity and often occurs along roads, old firebreaks, or other previously disturbed areas, and comprises a total of 1% of Camp Edwards. The primary value of the immature pitch pine is habitat for prairie warblers. As the pitch pine matures, the forest has a more closed canopy, which ultimately out competes scrub oak for sunlight. However, in areas where pitch pine has been cleared, scrub oak often grows in extremely dense patches. In the pitch pine-scrub oak community, trees and shrubs in general are growing at a rate greater than in any other plant community, indicating a somewhat young, but rapidly maturing forest.

The diversity of the pitch pine-scrub oak community, 51 plant species, is about average for the plant communities of Camp Edwards. However, pitch pine and scrub oak are the dominant and most productive species in the community.

The following table (6-3) contains the species of Pitch Pine-Scrub Oak Community with the plants and birds in order of abundance.

Table 6-3: Species of the Pitch Pine Scrub Oak Community

Common Name	Scientific Name	Status in MA
PLANTS		
<u>Trees</u>		
Pitch pine	<i>Pinus rigida</i>	-
Scrub-oak	<i>Quercus ilicifolia</i>	-
Black oak	<i>Quercus velutina</i>	-
White oak	<i>Quercus alba</i>	-
Black cherry; Wild cherry	<i>Prunus serotina</i>	-
Dwarf Chinkapin oak	<i>Quercus prinoides</i>	-

Shrubs

Black huckleberry	<i>Gaylussacia baccata</i>	-
Late lowbush blueberry	<i>Vaccinium pallidum</i>	-
Early lowbush blueberry	<i>Vaccinium angustifolium</i>	-
Beaked hazel-nut	<i>Corylus cornuta</i>	-
Sheep-laurel	<i>Kalmia angustifolia</i>	-
Arrow-wood	<i>Viburnum recognitum</i>	-

Forbes

Wintergreen; Teaberry	<i>Gaultheria procumbens</i>	-
Cat brier	<i>Smilax glauca</i>	-
Pennsylvania sedge	<i>Carex pensylvanica</i>	-
Ticklegrass	<i>Agrostis hyemalis</i>	-
Poverty grass	<i>Danthonia spicata</i>	-
Bracken fern	<i>Pteridium aquilinum</i>	-
Hispid swamp dewberry	<i>Rubus hispidus</i>	-
Redtop; black bentgrass	<i>Agrostis gigantea</i>	-
Northern dewberry	<i>Rubus flagellaris</i>	-
Common greenbrier	<i>Smilax rotundifolia</i>	-

INVERTEBRATES

Barrens Daggermoth	<i>Acronictus albarufa</i>	T
Spiny Oakwoarm	<i>Anisota stigma</i>	-
Blueberry Sallow	<i>Apharetra dentata</i>	SC
Straight Lined Mallow Moth	<i>Bagiscara rectifascia</i>	SC
Gerhard's Underwing	<i>Catocala herodius gerhardi</i>	T
Melsheimer's Sack Bearer	<i>Cicinnus melsheimeri</i>	T
Coastal Barrens Buck Moth	<i>Hemileuca maia maia</i>	T
Pine Barrens Itame	<i>Itame sp.</i>	SC
Coastal Swamp Metarranthis	<i>Metarranthis pilosaria</i>	SC
Pine Barrens Zale	<i>Zale sp.</i>	SC

AMPHIBIANS

Spotted salamander	<i>Ambystoma maculatum</i>	-
American toad	<i>Bufo americanus</i>	-
Fowler's toad	<i>Bufo woodhousei fowleri</i>	-
Red-backed salamander	<i>Plethodon cinereus</i>	-
Spring Peeper	<i>Pseudacris crucifer</i>	-
Green frog	<i>Rana clamitans</i>	-
Wood frog	<i>Rana sylvatica</i>	-

REPTILES

Spotted turtle	<i>Clemmys guttata</i>	-
Black racer	<i>Coluber constrictor</i>	-
Ringneck snake	<i>Diadophis punctatus</i>	-
Eastern box turtle	<i>Terrapene c. carolina</i>	SC
Garter snake	<i>Thamnophis sirtalis</i>	-

BIRDS

Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>	-
Pine warbler	<i>Dendroica pinus</i>	-
Common yellowthroat	<i>Geothlypis trichas</i>	-
Chipping sparrow	<i>Spizella passerina</i>	-
American robin	<i>Turdus migratorius</i>	-
Black-capped chickadee	<i>Parus atricapillus</i>	-
American goldfinch	<i>Carduelis tristis</i>	-
Blue jay	<i>Cyanocitta cristata</i>	-
Mourning dove	<i>Zenaida macroura</i>	-
Gray catbird	<i>Dumetella carolinensis</i>	-
Brown-headed cowbird	<i>Molothrus ater</i>	-
Prairie warbler	<i>Dendroica discolor</i>	-
Northern oriole	<i>Icterus galbula</i>	-
House finch	<i>Carpodacus mexicanus</i>	-
Northern mockingbird	<i>Mimus polyglottos</i>	-
Song sparrow	<i>Melospiza melodia</i>	-
Northern cardinal	<i>Cardinalis cardinalis</i>	-
Hermit thrush	<i>Catharus guttatus</i>	-
House wren	<i>Troglodytes aedon</i>	-
American crow	<i>Corvus brachyrhynchos</i>	-

MAMMALS

Coyote	<i>Canis latrans</i>	-
White Tailed Deer	<i>Odocoileus virginianus</i>	-
Red Fox	<i>Vulpes vulpes</i>	-
Ground Hog	<i>Marmota monax</i>	-
Raccoon	<i>Procyon lotor</i>	-
Eastern Cottontail	<i>Sylvilagus floridanus</i>	-
Southern Flying Squirrel	<i>Glaucomys volans</i>	-
Meadow Vole	<i>Microtus pennsylvanicus</i>	-
White Footed Mouse	<i>Peromyscus leucopus</i>	-
Southern Red-backed Vole	<i>Clethrionomys gapperi</i>	-

Shorttailed Shrew	<i>Blarina brevicauda</i>	-
Eastern Chipmunk	<i>Tamias striatus</i>	-

6.8.4 Black Oak-Scarlet Oak Forest/Woodland

Although pitch pine is the dominant tree species on Camp Edwards, some small stands of hardwood trees exist in the northeastern corner of the training area. Although the community comprises approximately 2% of Camp Edwards, it represents the most advanced state of succession of all of the plant communities. Oaks dominate the tree canopy of these stands and the shrub layer is similar to the pitch pine-mixed oak forest. The structure of the community varies with age from stands of immature hardwoods to more mature forest with a closed canopy and sparse understory.

The following table (6-4) contains the species of Black Oak-Scarlet Oak Forest Woodland with the plants and birds in order of abundance.

Table 6-4: Species of the Black Oak Scarlet Oak Forest

Common Name	Scientific Name	Status in MA
PLANTS		
<u>Trees</u>		
Black oak	<i>Quercus velutina</i>	-
White oak	<i>Quercus alba</i>	-
Pitch pine	<i>Pinus rigida</i>	-
White pine	<i>Pinus strobus</i>	-
Scarlet oak	<i>Quercus coccinea</i>	-
Norway spruce	<i>Picea abies</i>	-
<u>Shrubs</u>		
Black huckleberry	<i>Gaylussacia baccata</i>	-
Late lowbush blueberry	<i>Vaccinium pallidum</i>	-
Sweet pepper-bush	<i>Clethra alnifolia</i>	-
Early lowbush blueberry	<i>Vaccinium angustifolium</i>	-
Sheep-laurel	<i>Kalmia angustifolia</i>	-
Black cherry; Wild cherry	<i>Prunus serotina</i>	-
<u>Forbes</u>		
Wintergreen; Teaberry	<i>Gaultheria procumbens</i>	-
Pennsylvania sedge	<i>Carex pensylvanica</i>	-
Little bluestem	<i>Schizachyrium scoparium</i>	-
Northern dewberry	<i>Rubus flagellaris</i>	-
Bracken fern	<i>Pteridium aquilinum</i>	-
Common greenbrier	<i>Smilax rotundifolia</i>	-
Sweet fern	<i>Myrica asplenifolia</i>	-

Meadow beauty	<i>Rhexia virginica</i>	-
Hispid swamp dewberry	<i>Rubus hispidus</i>	-
Oblong-leaf Juneberry	<i>Amelanchier canadensis</i>	-

INVERTEBRATES

Barrens Daggermoth	<i>Acronictan albarufa</i>	T
Spiny Oakwoarm	<i>Anisota stigma</i>	-
Blueberry Sallow	<i>Apharetra dentata</i>	SC
Gerhard's Underwing	<i>Catocala herodius gerhardi</i>	T
Coastal Barrens Buck Moth	<i>Hemileuca maia maia</i>	T
Pine Barrens Itame	<i>Itame sp.</i>	SC
Pine Barrens Zale	<i>Zale sp.</i>	SC

AMPHIBIANS

American toad	<i>Bufo americanus</i>	-
Fowler's toad	<i>Bufo woodhousei fowleri</i>	-
Spring Peeper	<i>Pseudacris crucifer</i>	-
Wood frog	<i>Rana sylvatica</i>	-
Spotted salamander	<i>Ambystoma maculatum</i>	-
Red-backed salamander	<i>Plethodon cinereus</i>	-

REPTILES

Eastern Box Turtle	<i>Terrapene c. carolina</i>	SC
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BIRDS

Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>	-
Ovenbird	<i>Seiurus aurocapillus</i>	-
Pine warbler	<i>Dendroica pinus</i>	-
Northern oriole	<i>Icterus galbula</i>	-
Black-capped chickadee	<i>Parus atricapillus</i>	-
Common yellowthroat	<i>Geothlypis trichas</i>	-
Hermit thrush	<i>Catharus guttatus</i>	-
American goldfinch	<i>Carduelis tristis</i>	-
Blue jay	<i>Cyanocitta cristata</i>	-
American robin	<i>Turdus migratorius</i>	-
Chipping sparrow	<i>Spizella passerina</i>	-
Scarlet tanager	<i>Piranga olivacea</i>	-
Eastern wood-pewee	<i>Contopus virens</i>	-
Gray catbird	<i>Dumetella carolinensis</i>	-
Brown-headed cowbird	<i>Molothrus ater</i>	-

Mourning dove	<i>Zenaida macroura</i>	-
Tufted titmouse	<i>Parus bicolor</i>	-
Black-and-white warbler	<i>Mniotilta varia</i>	-
Cedar waxwing	<i>Bombycilla cedrorum</i>	-
American crow	<i>Corvus brachyrhynchos</i>	-

MAMMALS

Coyote	<i>Canis latrans</i>	-
White Tailed Deer	<i>Odocoileus virginianus</i>	-
Red Fox	<i>Vulpes vulpes</i>	-
Raccoon	<i>Procyon lotor</i>	-
Southern Flying Squirrel	<i>Glaucomys volans</i>	-
Ground Hog	<i>Marmota monax</i>	-
Eastern Cottontail	<i>Sylvilagus floridanus</i>	-
Meadow Vole	<i>Microtus pennsylvanicus</i>	-
White Footed Mouse	<i>Peromyscus leucopus</i>	-
Shorttailed Shrew	<i>Blarina brevicauda</i>	-
Southern Red-backed Vole	<i>Clethrionomys gapperi</i>	-
Eastern Chipmunk	<i>Tamias striatus</i>	-

6.8.5 Scrub Oak Shrubland

Much of Upper Cape Cod has been dominated by pitch pine and scrub oak barrens since the period of colonial settlement (Ruffner and Patterson 2000a). Thomas Bourne stated in 1769 that “a large barren wilderness of small pitch pines and scrub oaks make up the space between the settlements [of Sandwich] and indeed the center and for the greater part of the township” (Lovell 1984). The area was maintained in an early successional state as a result of timber harvesting and a catastrophic fire that occurred in 1772 (Sawyer 1988). Fire and frost effects typically suppress the growth of pitch pine and other tree species while promoting the growth of scrub oak. Fire scarring causes scrub oak acorns to germinate more readily and terminal buds to die, resulting in the growth of lateral branches. While frequent late spring frosts result in chronic dieback of developing leaves, slow growth rates, and reduced stem height which promotes shrub growth. Eventually, large herds of sheep were grazed throughout the Upper Cape, which limited tree growth and promoted the establishment of the scrub oak barren habitats.

The scrub oak shrubland covers 2,107 acres, or 15% of Camp Edwards, mostly within the Impact Area, but also in training areas C-13 and C-14, the firing ranges on the northern edge of the Impact Area, as well as surrounding Demo Area 1. This plant community represents one of the earliest states of vegetative succession on Camp Edwards and consists primarily of scrub oak (*Quercus ilicifolia*) with essentially no pitch pine (*Pinus rigida*). Other common plants in the scrub oak barrens include black huckleberry (*Gaylussacia baccata*), blueberry (*Vaccinium* spp.), cat brier (*Smilax glauca*), and wintergreen (*Gaultheria procumbens*).

The following table (6-5) contains the species of Scrub Oak Shrubland with the plants and birds in order of abundance.

Table 6-5: Species of the Scrub Oak Shrubland

Common Name	Scientific Name	Status in MA
PLANTS		
<u>Trees</u>		
Scrub-oak	<i>Quercus ilicifolia</i>	-
White oak	<i>Quercus alba</i>	-
Pitch pine	<i>Pinus rigida</i>	-
Dwarf Chinkapin oak	<i>Quercus prinoides</i>	-
Black cherry; Wild cherry	<i>Prunus serotina</i>	-
Gray birch	<i>Betula populifolia</i>	-
<u>Shrubs</u>		
Black huckleberry	<i>Gaylussacia baccata</i>	-
Late lowbush blueberry	<i>Vaccinium pallidum</i>	-

Beaked hazel-nut	<i>Corylus cornuta</i>	-
Early lowbush blueberry	<i>Vaccinium angustifolium</i>	-
Sheep-laurel	<i>Kalmia angustifolia</i>	-
Highbush blueberry	<i>Vaccinium corymbosum</i>	-
Forbes		-
Kentucky bluegrass	<i>Poa pratensis</i>	-
Wintergreen; Teaberry	<i>Gaultheria procumbens</i>	-
Bracken fern	<i>Pteridium aquilinum</i>	-
Sweet fern	<i>Myrica asplenifolia</i>	-
Hispid swamp dewberry	<i>Rubus hispidus</i>	-
Cat brier	<i>Smilax glauca</i>	-
Red chokeberry	<i>Aronia arbutifolia</i>	-
Northern dewberry	<i>Rubus flagellaris</i>	-
Rough-stemmed goldenrod	<i>Solidago rugosa</i>	-
Wild indigo	<i>Baptisia tinctoria</i>	-

INVERTEBRATES

Barrens Daggermoth	<i>Acronicta albarufa</i>	T
Spiny Oakwoarm	<i>Anisota stigma</i>	-
Blueberry Sallow	<i>Aphraretra dentata</i>	-
Straight Lined Mallow Moth	<i>Bagisara rectifascia</i>	SC
Gerhard's Underwing	<i>Catocala herodius gerhardi</i>	T
Melsheimer's Sack Bearer	<i>Cicinnus melsheimeri</i>	T
Coastal Barrens Buck Moth	<i>Hemileuca maia maia</i>	T
Pine Barrens Itame	<i>Itame sp.</i>	SC
Coastal Swamp Metarranthis	<i>Metarranthis pilosaria</i>	SC
Pine Barrens Zale	<i>Zale sp.</i>	SC

AMPHIBIANS

Spotted salamander	<i>Ambystoma maculatum</i>	-
American toad	<i>Bufo americanus</i>	-
Fowler's toad	<i>Bufo woodhousei fowleri</i>	-
Red-backed salamander	<i>Plethodon cinereus</i>	-
Spring peeper	<i>Pseudacris crucifer</i>	-
Green frog	<i>Rana clamitans</i>	-
Pickerel frog	<i>Rana palustris</i>	-
Wood frog	<i>Rana sylvatica</i>	-

REPTILES

Spotted turtle	<i>Clemmys guttata</i>	-
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Black racer	<i>Coluber constrictor</i>	-
Ringneck snake	<i>Diadophis punctatus</i>	-
Eastern box turtle	<i>Terrapene c. carolina</i>	SC
Garter snake	<i>Thamnophis sirtalis</i>	-

BIRDS

Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>	-
Common yellowthroat	<i>Geothlypis trichas</i>	-
Black-capped chickadee	<i>Parus atricapillus</i>	-
Prairie warbler	<i>Dendroica discolor</i>	-
Gray catbird	<i>Dumetella carolinensis</i>	-
Pine warbler	<i>Dendroica pinus</i>	-
Northern oriole	<i>Icterus galbula</i>	-
American goldfinch	<i>Carduelis tristis</i>	-
House wren	<i>Troglodytes aedon</i>	-
Chipping sparrow	<i>Spizella passerina</i>	-
Blue jay	<i>Cyanocitta cristata</i>	-
Mourning dove	<i>Zenaida macroura</i>	-
American robin	<i>Turdus migratorius</i>	-
Black-and-white warbler	<i>Mniotilta varia</i>	-
Hermit thrush	<i>Catharus guttatus</i>	-
Field sparrow	<i>Spizella pusilla</i>	-
Brown-headed cowbird	<i>Molothrus ater</i>	-
Northern flicker	<i>Colaptes auratus</i>	-
American crow	<i>Corvus brachyrhynchos</i>	-
Tree swallow	<i>Tachycineta bicolor</i>	-

MAMMALS

Shorttailed Shrew	<i>Blarina brevicauda</i>	-
Southern Red-backed Vole	<i>Clethrionomys gapperi</i>	-
Eastern Chipmunk	<i>Tamias striatus</i>	-
Meadow Vole	<i>Microtus pennsylvanicus</i>	-
White Tailed Deer	<i>Odocoileus virginianus</i>	-
White Footed Mouse	<i>Peromyscus leucopus</i>	-
Ground Hog	<i>Marmota monax</i>	-
Raccoon	<i>Procyon lotor</i>	-
Eastern Cottontail	<i>Sylvilagus floridanus</i>	-
New England Cottontail	<i>Sylvilagus transitionalis</i>	-
Red Fox	<i>Vulpes vulpes</i>	-
Coyote	<i>Canis latrans</i>	-

6.8.6 Cultural Grasslands

These are human created and maintained open communities dominated by grasses. Mowing is the typical maintenance, however on Camp Edwards; fire has played and is playing a more important role.

There is a total of 1658 acres of cultural grasslands on the MMR, only 175 acres of which are located on Camp Edwards (Figure 6-8). The remainder of the grasslands of the MMR is located in the former parade grounds and the airfield on Otis ANG Base. Most of the grasslands of Camp Edwards are located in the cantonment area and were historically cleared for use as parade grounds during World War II. Other smaller patches of cultural grasslands exist in the 3600 Assembly Area north of Connery Avenue, adjacent to the wastewater treatment facility in the northwestern corner of the MMR and the small arms firing ranges, although the afore mentioned areas are not managed grasslands.

The cultural grasslands are one of the least diverse plant communities on Camp Edwards, with only 37 identified species. The community is dominated by grass species including filiform fescue (*Festuca tenuifolia*), little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*), hairgrass (*Deschampsia flexuosa*), redtop (*Agrostis gigantea*), poverty grass (*Danthonia spiccata*), and Pennsylvania sedge (*Carex pensylvanica*). The only common tree species is immature pitch pine and red cedar. Sweetfern (*Comptonia peregrina*) was found in dense thickets less than a meter in height, whereas bayberry (*Myrica pensylvanica*), blueberry, and scrub oak were present, but less common. Many non native species such as honeysuckle (*Lonicera* spp.), Asiatic bittersweet (*Celastrus orbiculata*), autumn olive (*Elaeagnus umbellata*), and spotted knapweed (*Centaurea maculosa*) occur in the cultural grasslands of Camp Edwards and the MMR. There are ongoing management efforts to to remove these exotic, invasive plant species.

The following table (6-6) contains the species of Cultural Grasslands with the plant and bird species in order of abundance.

Table 6-6: Species of the Cultural Grassland

Common Name	Scientific Name	Status in MA
PLANTS		
<u>Trees</u>		
Red cedar	<i>Juniperus virginiana</i>	-
<u>Shrubs</u>		
Early lowbush blueberry	<i>Vaccinium angustifolium</i>	-
Morrow's honeysuckle	<i>Lonicera morrowii</i>	-

Forbes

Filiform fescue	<i>Festuca tenuifolia</i>	-
Poverty grass	<i>Danthonia spicata</i>	-
Purple Lovegrass	<i>Eragrostis spectabilis</i>	-
Little bluestem	<i>Schizachyrium scoparium</i>	-
Bead-grass	<i>Paspalum setaceum</i>	-
Swith-grass	<i>Panicum virgatum</i>	-
Star-thistle; Knapweed	<i>Centaurea maculosa</i>	-
Ticklegrass	<i>Agrostis hyemalis</i>	-
Northern dewberry	<i>Rubus flagellaris</i>	-
Hispid swamp dewberry	<i>Rubus hispidus</i>	-

INVERTEBRATES

Pink Streak	<i>Faronta rubripennis</i>	T
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AMPHIBIANS

American toad	<i>Bufo americanus</i>	-
Fowler's toad	<i>Bufo woodhousei fowleri</i>	-
Green frog	<i>Rana clamitans</i>	-
Pickerel frog	<i>Rana palustris</i>	-

REPTILES

Black racer	<i>Coluber constrictor</i>	-
Easten box turtle	<i>Terrapene c. carolina</i>	-
Smooth green snake	<i>Opheodrys vernalis</i>	-
Garter snake	<i>Thamnophis sirtalis</i>	-

BIRDS

Chipping Sparrow	<i>Spizella passerina</i>	-
Savannah Sparrow	<i>Passerculus sandwichensis</i>	-
American Goldfinch	<i>Carduelis tristis</i>	-
American Robin	<i>Turdus migratorius</i>	-
Northern Mockingbird	<i>Mimus polyglottos</i>	-
Song Sparrow	<i>Melospiza melodia</i>	-
Tree Swallow	<i>Tachycineta bicolor</i>	-
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	T
Mourning Dove	<i>Zenaida macroura</i>	-
Cedar Waxwing	<i>Bombycilla cedrorum</i>	-
House Finch	<i>Carpodacus mexicanus</i>	-
European Starling	<i>Sturnus vulgaris</i>	-

Gray Catbird	<i>Dumetella carolinensis</i>	-
Black-capped Chickadee	<i>Parus atricapillus</i>	-
Field Sparrow	<i>Spizella pusilla</i>	-
Pine Warbler	<i>Dendroica pinus</i>	-
Prairie Warbler	<i>Dendroica discolor</i>	-
American Crow	<i>Corvus brachyrhynchos</i>	-
Horned Lark	<i>Eremophila alpestris</i>	-
Brown-headed Cowbird	<i>Molothrus ater</i>	-

MAMMALS

Short-tailed Shrew	<i>Blarina brevicauda</i>	-
Coyote	<i>Canis latrans</i>	-
Southern Red-backed Vole	<i>Clethrionomys gapperi</i>	-
Ground Hog	<i>Marmota monax</i>	-
Meadow Vole	<i>Microtus pennsylvanicus</i>	-
White Tailed Deer	<i>Odocoileus virginianus</i>	-
White Footed Mouse	<i>Peromyscus leucopus</i>	-
Raccoon	<i>Procyon lotor</i>	-
Eastern Cottontail	<i>Sylvilagus floridanus</i>	-
Eastern Chipmunk	<i>Tamias striatus</i>	-
Red Fox	<i>Vulpes vulpes</i>	-
Meadow Jumping Mouse	<i>Zapus hudsonicus</i>	-

Figure 6-8. Grasslands Management Area of Camp Edwards, MA

March 2006, MAARNG GIS, MassGIS, Michael Ciaranca, Natural Resource Manager

6.8.7 Wetlands

The ponds and wetlands, which comprise only 55 acres, or .39%, of Camp Edwards, are the most diverse plant community (Figure 6-9). A total of 67 plant species were documented in the wetlands. There are six different types of wetlands based on the "Classification of Natural Communities in Massachusetts" (MA NHESP, 2001). They are Ponds, Coastal Plain Pond Shore, Kettlehole Level Bogs, Red Maple Swamps, Highbush Blueberry Thickets, and Woodland Vernal Pools. The following is a description of each.

6.8.7a Ponds

The Coastal Plain Ponds of Camp Edwards are referred to as kettle ponds. Kettle ponds are typically deep ponds formed during the last Ice Age by large chunks of ice breaking off retreating glaciers resulting in depressions in the ground called "kettle holes." When the hole is deep enough to reach groundwater, it is then filled with water and is called a kettle pond. Seasonal changes in groundwater level are mirrored by changes in the level of these ponds. The fluctuating water levels alternately flood and expose the shore like a slow moving tide. This rates and depth of fluctuation is a main determinant of the plant types that can live in Coastal plain pond shore.

6.8.7b Coastal Plain Pond Shore

These are herbaceous communities of exposed pond shore. The ponds consist of shallow, acidic, exposed groundwater in the glacial outwash plain, with no inlet or outlet. Water levels rise and fall with changes in the water table. These changes can be quite dramatic and result in distinct Coastal Plain Pond flora.

In general, the Coastal Plain Pond Shore communities of Camp Edwards can be classified as having four concentric circular zones of vegetation. The first zone is the deepest area of the wetland where open water is present. This zone is often vegetated by floating plants including spotted bladderwort (*Utricularia purpurea*), water shield (*Brasenia schreberi*), and water-lily (*Nymphaea odorata*). The presence of this vegetation depends entirely upon the water levels in these wetland communities.

The zone of emergent vegetation surrounds the open water zone and is located in the more shallow water of the wetlands. Common emergent plant species are usually grasses, including bur-reed (*Sparganium americanum*), wool grass (*Scirpus cyperinus*), and three-way sedge (*Dulichium arundinaceum*).

Beyond the shoreline of the wetlands lies a transitional zone that is occupied by many emergent species but is dominated by forbs. Lance-leaf violet (*Viola lanceolata*), northern bugleweed (*Lycopus uniflorus*), swamp candles (*Lysimachia terrestris*), beggar

ticks (*Bidens frondosa*), hyssop-hedge-nettle (*Stachys hyssopifolia*), rush (*Juncus* spp.), and sedges (*Carex* spp.) are common throughout the forb zone.

As the wetland transitions into the surrounding forest community, a distinct shrub zone including highbush blueberry (*Vaccinium* spp.), swamp azalea (*Rhododendron viscosum*), hardhack (*Spirea tomentosa*), inkberry (*Ilex verticillata*), leatherleaf (*Chamaedaphne calyculata*), swamp dewberry (*Rubus hispidus*), and goldenrod (*Solidago* spp.) is present. Common tree species in this zone include red maple (*Acer rubrum*), pitch pine, and various oaks.

Although the four zones of vegetation can describe most wetlands of Camp Edwards, there are some exceptions. Monument Swamp, a Kettlehole Level Bog, is primarily a bog of sphagnum moss (*Sphagnum* spp.) and cranberry (*Vaccinium macrocarpon*). In addition, many of the Woodland Vernal Pools, and Highbush Blueberry Thickets that lack standing water for much of the year do not have the distinct vegetation zones described above.

6.8.7c Kettle Hole Level Bogs

These bogs occur in kettle depressions, and have zoned vegetation. They are typically small, round, and lack inlets and outlets. Often the outermost ring is a wet moat that acts as a vernal pool when water remains for 2-3 months. They are surrounded by highbush blueberry (*Vaccinium corymbosum*) and swamp azalea (*Rhododendron viscosum*). The central mat has a mixture of members of the heath family.

6.8.7d Red Maple Swamps

Red Maple Swamps consist of 5% of the total wetlands on Camp Edwards.

The hydrogeologic setting is the primary determinant of water regime and plant community in Red Maple Swamps. On Camp Edwards, they are seasonally flooded, fed by groundwater seepage, and overland flow. The Red Maple itself typically provides 90% of the canopy cover. The shrub layer is often dense and well developed and consist of Sweet pepperbush (*Clethra alnifolia*), swamp azalea (*Rhododendron viscosum*), and highbush blueberry (*Vaccinium corymbosum*). The herbaceous layer is highly variable with abundant ferns.

6.8.7e Highbush Blueberry Thicket

This natural community is characterized by acidic peat lands dominated by dense highbush blueberry (*Vaccinium corymbosum*) bushes and sphagnum hummocks. These tall thickets are generally flooded in the spring and early summer with water levels dropping below surface levels by late summer. Many examples are located in kettle holes.

6.8.7f Woodland Vernal Pools

Woodland vernal pools are small, shallow depressions with little or no vegetation within upland forests. They are temporally flooded, provide important breeding habitat for amphibians, and are typically isolated from other surface waters and are typically dry in the summer. They do not support fish populations. Vernal pools support diverse invertebrate and amphibian fauna that is not adapted to fish predation. Most wetlands on Camp Edwards are either vernal pools or function as one.

The following table (6-7) contains the species of the Wetlands of Camp Edwards with the plant and bird species in order of abundance.

Table 6-7: Species of the Wetlands

Common Name	Scientific Name	Status in MA
PLANTS		
<u>Trees</u>		
Red maple	<i>Acer rubrum</i>	-
Pitch pine	<i>Pinus rigida</i>	-
Scarlet oak	<i>Quercus coccinea</i>	-
<u>Shrubs</u>		
Bayberry	<i>Myrica pensylvanica</i>	-
Highbush blueberry	<i>Vaccinium corymbosum</i>	-
<u>Forbes</u>		
Wool grass	<i>Scirpus cyperinus</i>	-
Large cranberry	<i>Vaccinium macrocarpon</i>	-
Common rush	<i>Juncus effusus</i>	-
Three-way sedge	<i>Dulichium arundinaceum</i>	-
Ticklegrass	<i>Agrostis hyemalis</i>	-
Little bluestem	<i>Schizachyrium scoparium</i>	-
Panic grass	<i>Dichanthelium acuminatum</i>	-
Lance-leaved violet	<i>Viola lanceolata</i>	-
Northern bugleweed	<i>Lycopus uniflorus</i>	-
Hardhack	<i>Spiraea tomentosa</i>	-
INVERTEBRATES		
Moths		
Water-willow Stem Borer	<i>Papaipema sulphurata</i>	T
Odonates		
Amberwings	<i>Perithemis tenera</i>	-
Blue Pirate	<i>Pachydiplax longipennis</i>	-
Calico Pennant	<i>Celithemis elisa</i>	-

Comet Darner	<i>Anax longipes</i>	SC
Common Forktail	<i>Ischnura verticalis</i>	-
Common Green Darner	<i>Anax junius</i>	-
Tule Bluet	<i>Enallagma carunculatum</i>	SC
Fragile Forktail	<i>Ischnura posita</i>	-
Goldenwings	<i>Libellula auripennis</i>	-
Green Jacket	<i>Erythemis simplicicollis</i>	-
Halloween Pennant	<i>Celithemis eponina</i>	-
New England Bluet	<i>Enallagma laterale</i>	SC
Pine Barrens Bluet	<i>Enallagma recurvatum</i>	T
Slaty Skimmer	<i>Libellula incesta</i>	-
Spatterdock Darner	<i>Aeshna mutata</i>	SC
Swamp Spreadwing	<i>Lestes vigilax</i>	-

Crustacea

Clam Shrimp	<i>Eulimnadia agassizi</i>	E
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VERTEBRATES

Amphibians

American toad	<i>Bufo americanus</i>	-
Fowler's toad	<i>Bufo woodhousei fowleri</i>	-
Gray treefrog	<i>Hyla versicolor</i>	-
Spring peeper	<i>Pseudacris crucifer</i>	-
Wood frog	<i>Rana sylvatica</i>	-
Bullfrog	<i>Rana catesbeiana</i>	-
Green frog	<i>Rana clamitans</i>	-
Pickerel frog	<i>Rana palustris</i>	-
Spotted salamander	<i>Ambystoma maculatum</i>	-
Red spotted newt	<i>Notopthalmus viridescens</i>	-

Reptiles

Eastern box turtle	<i>Terrapene c. carolina</i>	SC
Spotted turtle	<i>Clemmys guttata</i>	-
Snapping turtle	<i>Chelydra serpentina</i>	-
Musk turtle	<i>Sternotherus odoratus</i>	-
Eastern painted turtle	<i>Chrysemys picta picta</i>	-
Eastern ribbon snake	<i>Thamnophis sauritus sauritus</i>	-

Birds

Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>	-
Pine warbler	<i>Dendroica pinus</i>	-

American robin	<i>Turdus migratorius</i>	-
Common grackle	<i>Quiscalus quiscula</i>	-
Common yellowthroat	<i>Geothlypis trichas</i>	-
Black-capped chickadee	<i>Parus atricapillus</i>	-
Hermit thrush	<i>Catharus guttatus</i>	-
Northern oriole	<i>Icterus galbula</i>	-
American goldfinch	<i>Carduelis tristis</i>	-
Chipping sparrow	<i>Spizella passerina</i>	-
Red-winged blackbird	<i>Agelaius phoeniceus</i>	-
Gray catbird	<i>Dumetella carolinensis</i>	-
Eastern wood-pewee	<i>Contopus virens</i>	-
Blue jay	<i>Cyanocitta cristata</i>	-
Mourning dove	<i>Zenaida macroura</i>	-
Brown-headed cowbird	<i>Molothrus ater</i>	-
Ovenbird	<i>Seiurus aurocapillus</i>	-
Eastern kingbird	<i>Tyrannus tyrannus</i>	-
Northern flicker	<i>Colaptes auratus</i>	-
Prairie warbler	<i>Dendroica discolor</i>	-

Mammals

Short-tailed shrew	<i>Blarina brevicauda</i>	-
Masked shrew	<i>Sorex cinereus</i>	-
Muskrat	<i>Ondatra zibethicus</i>	-
Meadow vole	<i>Microtus pennsylvanicus</i>	-
Raccoon	<i>Procyon lotor</i>	-

Figure 6-9. Wetlands of Camp Edwards and the MMR.

March 2006, MAARNG GIS, MassGIS, Michael Ciaranca, Natural Resource Manager

6.8.8 Disturbed Natural Communities

A major objective of the ITAM Program is to monitor and assess the effects of ARNG training on the natural resources of Camp Edwards. In order to achieve this objective, disturbed plant communities were surveyed to compare results to the native communities to determine the effect of land use on the flora of Camp Edwards. The disturbed plant communities of Camp Edwards were further divided into three subsets: bivouacs, burns, and other disturbed (e.g., areas mowed or subject to vehicle traffic).

The flora of bivouac sites, which total 395 acres or 2.7% of Camp Edwards, appear less diverse and more sparsely vegetated than the plant communities that surround them. In fact, bivouac sites have been found to have significantly fewer trees ($P < 0.01$), lower shrub density ($P < 0.01$), and less leaf litter ($P < 0.01$) than the surrounding habitats (Stokes and Griffin 1997). A P-value is a “probability value” relating to the probability that the groups being measured are statistically different from one another. A P-value of less than 0.05 indicates that there is less than a 5% chance that the differences observed are false. However, the plant diversity in the bivouacs, 52 species, was near average for the plant communities on Camp Edwards. The tree canopy in the bivouac sites is dominated by scarlet oak, black oak, and pitch pine. The under story in the bivouac sites is predominantly grasses, such as autumn bentgrass (*Agrostis perenans*), barnyard-grass (*Echinochloa crusgalli*), and redtop, with interspersed shrubs, including black cherry (*Prunus serotina*), arrow wood (*Viburnum recognitum*), huckleberry (*Gaylussacia baccata*), and blueberry (*Vaccinium spp.*). Within the bivouac sites, trees and forbs are decreasing in abundance, revealing a gradual trend of vegetative loss likely due to overuse of the areas.

Areas that were burned were one of the least diverse plant communities, with 40 documented species. The purpose of prescribed burning on Camp Edwards is to manage for a particular community of plants, usually scrub oak barrens. The fast, low burning fires usually consume much of the forb layer and some of the shrub layer, but do not usually impact the tree canopy. As a result, many of the shrub and forb species of plants that recolonize the areas are not only early successional species, but also must be somewhat shade tolerant. Scarlet oak, black oak, white oak, and pitch pine are common tree species in the burn communities, with huckleberry, blueberry, and scrub oak dominating the shrub layer. Many of the early successional plant species such as winged sumac (*Rhus copallina*), wild indigo (*Baptista tinctoria*), sheep sorrel (*Rumex acetosella*), northern dewberry (*Rubus flagellaris*), sweetfern, gray birch, and poverty grass are generally more abundant in the burned plant communities than in any other community on Camp Edwards.

Although the other disturbed plant communities are considered negatively impacted, they are one of the most diverse communities on Camp Edwards with 63 documented species. Disturbance often prevents certain plant species from out

competing other species, thereby promoting competition between species and increasing overall plant diversity. Grasses, including poverty grass, Pennsylvania sedge, little bluestem, cypress witchgrass (*Dichanthelium dichotomum*), hairgrass, panic grass (*Dichanthelium acuminatum*), and starved panic grass (*Dichanthelium depauperatum*), were the most prevalent plant form in the disturbed sites. However, pitch pine was abundant, with scarlet oak, black oak, white oak, and chinquapin oak (*Quercus prinoides*) being less common. The shrub layer, which included huckleberry, scrub oak, blueberry, and sweetfern, was typical of other plant communities on Camp Edwards. All plant forms, grasses, forbs, shrubs, and trees, have increased in abundance within the disturbed sites, indicating a gradual recolonization or succession of vegetation in these areas.

The plant communities that have been disturbed on Camp Edwards, either from training (e.g., bivouacs, vehicle traffic) or through land management (e.g., prescribed burning), often have characteristics that differ from the surrounding communities. Bivouacs are typically less diverse due to regular use, whereas the other disturbed areas were impacted over a shorter period of time, resulting in an increase in plant diversity. Bivouac restoration will serve to increase plant diversity and abundance within the bivouac sites on Camp Edwards. The burned areas are typically one of the least diverse plant communities, since prescribed fires promote growth of the shrubs and trees, but not the grass and forb layers. Therefore, disturbance may serve to maintain a particular natural community (i.e., prescribed burning in scrub oak shrublands) or increase plant diversity. However, where plant diversity is decreased as a direct result of training activities, such as in the bivouacs, land management activities (e.g., Bivouac Restoration) will be employed to restore plant diversity and abundance while maintaining the land for military training.

Some exotic and invasive plant species benefit from disturbance. They typically outcompete native species and proliferate in disturbed systems. One example of such a proliferation is that of Knapweed (*Centaurea maculosa*) in the Cantonment area. This species takes over areas where pipelines are put into the ground. The disturbance leaves the ground bare. The Knapweed quickly establishes and outcompetes native species. It should be noted however, that the Knapweed is slowly displaced by native bluestem grasses over a period of several years. Exotic invasives will be discussed further in Chapter 8 (8.10.3).

6.9 Fauna

Extensive surveys have been conducted to inventory the fauna of Camp Edwards. Annual RTLA surveys have monitored the long-term trends in bird and small mammal populations since 1993 while other projects have surveyed faunal populations for 1 to 8 years. These surveys and inventories have provided an enormous database of the fauna of Camp Edwards and their associated habitats.

6.9.1 Invertebrates

Due to their high diversity compared to other groups of fauna, invertebrates are one of the least studied groups of animals on Camp Edwards. Past surveys and inventories have concentrated on three groups of invertebrates: moths, dragonflies, and aquatic invertebrates.

Historically, 10 state-listed rare moth species dependent upon the pitch pine/scrub oak plant communities and 5 other state-listed rare moth species had been documented at locations near Camp Edwards. As a result of these reports as well as the relative abundance of pitch pine scrub oak communities on Camp Edwards, the training site was surveyed for state-listed rare moths from 1996-1998 (Mello *et al.* 1999). A range of plant communities on Camp Edwards were surveyed, primarily within the scrub oak shrublands, but also within pitch pine scrub oak community, pitch pine-oak forest woodland, and grasslands. Portions of the cantonment area and the PAVE PAWS radar station were also included in the survey. A total of 528 species of macrolepidoptera (i.e., moths and butterflies) were identified during the study (Appendix C), including 17 state-listed rare species (Table 6-8). The open scrub oak shrublands and partially closed pitch pine scrub oak communities provide significant habitat for 7 of the 17 species, which feed upon the scrub oak. The host plants for most of the other state-listed rare moths were members of the plant family Ericaceae, which includes blueberries, huckleberry, and cranberry- shrub species common to Camp Edwards.

Table 6-8. State-Listed rare moths, their associated habitat, and host plant on Camp Edwards, MA.

Common Name*	Associated Habitat on Camp Edwards	Host Plant
Barrens Daggermoth	Scrub Oak Shrubland	Scrub Oak
Coastal Barren's Buckmoth	Scrub Oak Shrubland	Scrub Oak
Gerhard's Underwing	Scrub Oak Shrubland	Scrub Oak
Melsheimer's Sack Bearer	Scrub Oak Shrubland	Scrub Oak
Pink Streak	Grassland/Wet Meadow	Panic Grass
Water-Willow Stem Borer	Wetlands	Water Willow
Chain-dotted Geometer	Scrub Oak Shrubland	Ericaceae & bayberry
Coastal Heathland Cutworm	???	Ericaceae/Grasses?
Coastal Swamp Metarranthis	Pine/Oak Barrens Swamps	Cranberry
Ostrich Fern Borer	???	Ostrich Fern
Pine Barrens Itame	Scrub Oak Shrubland	Ericaceae?
Pine Barrens Zale	Scrub Oak Shrubland	Scrub Oak
Pink Swallow Moth	Pine/Oak Barrens	Ericaceae
Straight Lined Mallow Moth	???	Hazelnut?
Sandplain Euchlaena	Scrub Oak Shrubland	???

*for scientific names and status in MA, see Table 6-14.

The most significant plant communities for state-listed rare moth species on Camp Edwards are the scrub oak shrubland and the cultural grasslands. Since both of these habitats are early successional fire-adapted habitats, active management will be required to ensure their existence on Camp Edwards.

Although not systematically, dragonflies and damselflies (i.e., odonates) have been surveyed during the past 11 years on Camp Edwards. Mello *et al.* (1999) noted 20 species of odonates throughout the course of the moth surveys. In addition, some of the ponds and wetlands of Camp Edwards were surveyed for dragonflies during the summers of 1995-2005. A list of documented odonates was compiled, but should by no means be considered a complete inventory of Camp Edwards (Appendix D). Five state-listed rare species of dragonflies were documented during the surveys: the comet darner (*Anax longipes*), the spatterdock darner (*Aeshna mutata*), the Tule Bluet (*Enallagma carunculatum*), the New England bluet (*Enallagma laterale*), and the pine barrens bluet (*Enallagma recurvatum*).

An aquatic invertebrate survey was conducted in the ponds and wetlands of Camp Edwards during the summer of 1997, during which 153 distinct taxa were identified (Wojtowicz 2000). The majority of the taxa were in the orders Diptera (flies), Odonata (dragonflies and damselflies), Coleoptera (beetles), and Hemiptera (true bugs). Other less common insect orders included Megaloptera (dobsonflies, fishflies, and alderflies), Trichoptera (caddisflies), and Ephemeroptera (mayflies). Two species from the study are state-listed rare species: the clam shrimp *Eulimnadia agassizi* (endangered) and the damselfly *Enallagma carunculatum* (special concern). Non-insect invertebrates were rather diverse and included Collembola (springtails), Nematoda (roundworms), Hydracarina (water mites), Hydra, Oligochaeta (aquatic earthworms), Isopoda (aquatic sow bugs), Hirudinea (Leeches), Conchostraca (clam shrimp), Gastropoda (snails), Amphipoda (scuds and sideswimmers), Copepoda, and Cladocera (water fleas).

6.9.2 Birds

A total of 105 bird species have been documented on Camp Edwards since 1994 during annual RTLA bird surveys as well as during surveys of grasslands, the Impact Area, and other areas of Camp Edwards (Appendix E). The RTLA bird surveys are conducted along the same transects as the RTLA plant surveys. The data from the bird surveys are used to determine abundance and species richness of birds throughout the natural communities of Camp Edwards. Camp Edwards supports a relatively large amount of habitat for bird species that are characteristic of oak and pitch-pine scrub oak habitats. Many of these species, including the eastern towhee, field sparrow, song sparrow, prairie warbler, whip-poor-will, and gray catbird that have exhibited significant regional declines (Scott Melvin, personal communication), are relatively abundant on Camp Edwards.

There were distinct differences between the avifauna of bivouac sites and their surrounding habitats. The most noticeable difference was that ovenbirds (*Seiurus aurocapillus*) and common yellowthroats (*Geothlypis trichas*), two scrubland nesting bird species that typically require deep leaf litter and dense, low vegetation, respectively, were significantly less abundant in bivouac sites on Camp Edwards ($P=0.024$, 0.019 , respectively) (Stokes and Griffin 1997). A P-value is a “probability value” relating to the probability that the groups being measured are statistically different from one another. In this case, a P-value of less than 0.05 indicates that there is less than a 5 % chance that the differences in abundance observed at bivouac sites were false. In contrast, the American robin (*Turdus migratorius*), chipping sparrow (*Spizella passerina*), and Baltimore oriole (*Icterus galbula*), three species that are often associated with suburban park-like habitats or open woodlands, were significantly more abundant in the bivouac sites ($P=0.001$, 0.001 , 0.033 , respectively).

The grasslands of Camp Edwards and Otis ANG Base cantonment area are critical habitat for four state-listed rare bird species. These species include the upland sandpiper (*Bartramia longicauda* - endangered), the grasshopper sparrow (*Ammodramus savannarum* - threatened), the vesper sparrow (*Pooecetes graminus* - threatened), and the northern harrier (*Circus cyaneus* - threatened). The largest population of upland sandpipers, 14 pairs, observed by White and Melvin (1985) in Massachusetts occurred in the cantonment area grasslands. The sandpipers used mowed and unmowed areas of the grasslands for feeding, loafing, courtship, nesting, and brood-rearing. However, the numbers of upland sandpipers have declined since the initial survey (White and Melvin 1985), perhaps due to the gradual succession of the grasslands, including recolonization of pitch pine (Table 6-9).

The second largest population of grasshopper sparrows in Massachusetts, 22 pairs, was observed in the unmowed portions of the cantonment area grasslands. The population of grasshopper sparrows has also declined from 22 pairs in 1985 to 10 individuals in 1998. Numbers currently are on the increase, 54 individuals were reported in 2004, and 60 in 2005. This increase reflects the mowing schedule of the runway. The later in spring that it is mowed, the larger the number of grasshopper sparrows.

Northern harriers have been observed in the grasslands and scrub oak shrublands of Camp Edwards. One pair of northern harriers is observed hunting in the grasslands most years; however a nest has not been located. A female northern harrier was observed with three recently fledged young in the Impact Area during a 1998 survey. Although a nest was not located, the presence of the young suggests that the female may have nested nearby.

Although the vesper sparrow was not observed during the White and Melvin (1985) survey, it has been documented within the cantonment area grasslands several times since in 1995, 2004, and 2005.

A new arrival to the grasslands was discovered during the RTLA surveys in 2004, 2005, and 2006. The Clay-colored Sparrow (*Spizella pallida*) has been observed several times utilizing previously burned areas of the cantonment area grasslands.

Table 6-9. Numbers of state-listed rare bird species observed in Camp Edwards grasslands.

Species	1985	1995	2001	2005
Upland sandpiper	14*	16	2	23
Grasshopper sparrow	22*	11	7	60
Vesper sparrow	0*	1	0	3
Northern harrier	1*	1	1	3*

*recorded as number of pairs

The wetlands of Camp Edwards were surveyed in 1995 for secretive waterbirds, some species of which are declining in or have disappeared from the Commonwealth of Massachusetts (Veit and Petersen 1993). Only one species of secretive waterbird, the green heron (*Butorides striatus*), was observed during the study (Wilson and Cavanaugh 1996). Other documented wetland bird species were the great blue heron (*Ardea herodias*), the Canada goose (*Branta canadensis*), the wood duck (*Aix sponsa*), the mallard (*Anas platyrhynchos*), and the mute swan (*Cygnus olor*). None of the bird species observed were state-listed rare species in Massachusetts.

The Massachusetts Division of Fisheries and Wildlife (DFW) developed and implemented a wild turkey (*Meleagris gallopavo*) reintroduction program beginning in 1972. Between 1979 and 1996, 561 turkeys were released throughout the Commonwealth. The DFW successfully reintroduced wild turkey to the forests of Camp Edwards, one of the two locations on Cape Cod where turkeys were released. Eighteen turkeys, 6 males and 12 females, were released during the winter months of 1989. Since this time, wild turkeys have been a common sight on Camp Edwards. The first organized wild turkey harvest was held in the spring 2000, during which a total of 121 hunters shot 11 turkeys. The harvest has since been conducted in spring 2004 (105 hunters, 4 turkeys), spring 2005 (44 hunters, 1 turkey), and spring 2006 (90 hunters, 4 turkeys). Techniques used when hunting wild turkey in the spring favors the harvest of males over females, thereby minimizing the long-term impact to the overall population (J. Cardoza pers. comm.).

6.9.3 Mammals

Camp Edwards is inhabited by at least 30 species of mammals (Appendix F). The most common of these mammals is likely the white-footed mouse (*Peromyscus leucopus*). Nine other small mammals have been captured on Camp Edwards. Ten species of medium-sized small mammals have been documented from visual observations. The only mammals that have been observed on Camp Edwards that could be classified as large mammals are the coyote and the white-tailed deer. Four species of bats have been captured throughout the training area during chiropteran surveys.

Populations of small mammals on Camp Edwards have been monitored since 1994 during annual RTLA surveys. The most abundant small mammal species encountered during the surveys were the white-footed mouse and the southern red-backed vole (*Clethrionomys gapperi*) ($P=.0001$). The white-footed mouse was captured in every plant community on Camp Edwards, whereas the southern red-backed vole was found mostly within communities dominated by pitch pine. In the relatively small grasslands that were surveyed, the meadow vole (*Microtus pennsylvanicus*) was common. Other species that were uncommon or rarely captured included, in order of relative abundance, short-tailed shrew (*Blarina brevicauda*), southern flying squirrel (*Glaucomys volans*), masked shrew (*Sorex cinereus*), long-tailed weasel (*Mustela frenata*), eastern chipmunk (*Tamias striatus*), and red squirrel (*Tamiasciurus hudsonicus*). The only other species of small mammals observed on Camp Edwards not documented during the RTLA surveys were the eastern mole (*Scalopus aquaticus*), grey squirrel (*Sciurus carolinensis*) and meadow jumping mouse (*Zapus hudsonius*).

Among the plant communities, or habitats, of Camp Edwards, the number of small mammal species (i.e., richness) did not vary significantly ($P = .6062$). However, a significantly greater number of small mammals was captured in the mixed woods north plant community than in any other ($P = .0001$). The burn, pitch pine scrub oak, and grassland communities produced a relatively moderate number of individuals. The fewest number of small mammals was captured within the disturbed, wetland, and bivuac communities.

Most of the medium-sized small mammals on Camp Edwards are species that are common to Southeastern Massachusetts, with the exception of the fisher (*Martes pennanti*) and the New England cottontail (*Sylvilagus transitionalis*). The geographic range of the fisher usually does not extend as far south as Cape Cod (Burt and Grossenheider 1980), the southernmost observation of the species was Middleborough, Massachusetts. Sightings of fisher by field crews, soldiers etc. was confirmed in 2005 with a road kill discovery on SR 130, by the convoy gate. Also discovered by the convoy gate in 2005 was the first recorded specimen of a Porcupine (*Erethizon dorsatum*) on Cape Cod. The New England Cottontail is recognized by the USFWS as a candidate

species for listing. Thus, it is not yet listed as endangered and no regulations to their protection are imposed. However, Camp Edwards hosts a population of this species and it will be protected through the early successional patch pine scrub oak community and scrub oak shrublands management.

Beginning in the 1950s, an annual white tail deer hunt has taken place on Camp Edwards. However, records from only 1992-2005 were available (Table 6-10). On average, 102 deer were shot each year during this time period. Although the harvest data do not provide an accurate estimation of the abundance of the deer on Camp Edwards, the consistent success rate of 4-6% suggests that the population size has not fluctuated greatly. However, this is assuming that the effort and skill of the hunters does not vary much between years. Personal accounts from hunters indicate that they often return to the same location each year, which contributed to a consistent hunting effort. No hunt occurred in 2001 due to the terrorist attacks of 11 September. This caused a spike in the take, and thus hunter success due to the increase in deer population. Two years later, the numbers returned to pre 11 September 2001 levels. This emphasizes the importance of holding the annual hunt to maintain a healthy deer herd on Camp Edwards.

Table 6-10. Deer harvest data for Camp Edwards, MA, 1992-2005.

Year	Hunters	Bucks	Does	Sex Ratio	Total	Deer/Hunter
1992	2516	68	32	2.1	100	0.04
1993	2364	41	51	0.8	92	0.04
1994	2177	61	34	1.8	95	0.04
1995	2290	53	39	1.4	92	0.04
1996	1919	58	49	1.2	107	0.06
1997	1352	50	32	1.6	82	0.06
1998	2139	62	33	1.9	95	0.04
1999	1778	50	39	1.3	89	0.05
2000	1624	48	43	1.12	91	0.06
2002	1272	105	64	1.64	169	0.13
2003	1291	79	50	1.58	129	0.10
2004	1658	49	56	0.88	105	0.06
2005	1573	38	37	1.03	75	0.05

A survey of the bat species on Camp Edwards was conducted during 1999 and 2000. Four species were documented during the preliminary survey: the big brown bat (*Eptesicus fuscus*), the red bat (*Lasiurus borealis*), the northern myotis (*Myotis septentrionalis*), and the eastern pipistrelle (*Pipistrellus subflavus*). In 2002 Bat/Duck boxes have been placed in the wetlands of Camp Edwards. Bats (northern myotis?) have been recorded in two houses located in Donnelly Pond and the Rod and Gun Club South Pond.

Domesticated cats are not common to Camp Edwards, but have been observed in the housing and cantonment areas of the MMR. Domestic cats may pose a threat to ground nesting grassland birds. In the event that feral cats are observed in the grasslands, consultation with MA DFW will occur to determine the appropriate method of removal.

6.9.4 Reptiles

The reptile species that are found on Camp Edwards have been documented as a result of surveys for the Massachusetts Herpetological Atlas Project or from incidental sightings. Twelve species of reptiles, 5 turtles and 7 snakes, have been observed on Camp Edwards, including one species of special concern, the eastern box turtle (Table 6-11).

Table 6-11. Reptile species observed on Camp Edwards*.

Common Name	Scientific Name	Status in MA
Eastern box turtle	<i>Terrapene c. carolina</i>	SC
Spotted turtle	<i>Clemmys guttata</i>	-
Snapping turtle	<i>Chelydra serpentina</i>	-
Musk turtle	<i>Sternotherus odoratus</i>	-
Eastern painted turtle	<i>Chrysemys p. picta</i>	-
Black racer	<i>Coluber constrictor</i>	-
Smooth green snake	<i>Opheodrys vernalis</i>	-
Garter snake	<i>Thamnophis sirtalis sirtalis</i>	-
Eastern ribbon snake	<i>Thamnophis sauritus sauritus</i>	-
Northern ring-necked snake	<i>Diadophis punctatus edwardsii</i>	-
Milk snake	<i>Lampropeltis triangulum</i>	-
Eastern hog-nosed snake	<i>Heterodon platirhinos</i>	-

*SC = Special Concern

The sightings of eastern box turtles have been of particular interest to the Camp Edwards Natural Resource Office and the Massachusetts NHESP. Personnel from the Camp Edwards Natural Resource Office and Range Control as well as MAARNG soldiers have recorded eastern box turtle sightings during the past eight years on Camp Edwards. Approximately 170 individuals have been recorded, 46 of which were marked. Each individual that was marked was also measured (i.e., carapace length and width), weighed, sexed, and aged.

As a result of the relatively high incidence of eastern box turtle sightings, the Camp Edwards Natural Resource Office attached transmitters to 10 individuals to monitor their movements and habitat use each year for five years. Preliminary analysis of the data indicates that, in general, eastern box turtles are ubiquitous within the ecosystem of Camp Edwards. Home ranges of eastern box turtles vary in size from 3.2-84.4 acres (mean=20.4 acres) and do not vary much between years. One individual was

observed moving over one kilometer within one week. Further analysis of these data will be summarized in a following report.

6.9.5 Amphibians

A survey of the reptiles and amphibians of Camp Edwards was conducted in 1995 as part of the Massachusetts Herpetological Atlas Project. Every wetland, drainage ditch, or area of standing water on Camp Edwards was visually inspected and sampled for eggs, larvae, and adults using a dipnet. In addition, most wetlands were surveyed for calling amphibians in the evening. Although the survey was qualitative in nature, it resulted in approximately 200 reptile and amphibian records for Camp Edwards.

A total of 11 species of amphibians have been observed on Camp Edwards. The ponds and wetlands of Camp Edwards were surveyed for amphibians as part of the Massachusetts Herpetological Atlas Project as well as periodically during the breeding season since 1994. Observations of breeding amphibians have included 7 species. The most commonly observed amphibians include bullfrogs (*Rana catesbeiana*), green frogs (*Rana clamitans*), grey treefrogs (*Hyla versicolor*), wood frog (*Rana sylvatica*), and spring peepers (*Pseudacris crucifer*), however, American toads (*Bufo americanus*) spotted salamanders (*Ambystoma maculatum*) and eastern newts (*Notophthalmus viridescens*) were also frequently observed. The redback salamander (*Plethodon cinereus*), pickerel frog (*Rana palustris*), and American toad (*Bufo americanus*) have been observed at areas of Camp Edwards not necessarily associated with delineated wetlands.

6.9.6 Fish

The following fish have been documented within wetlands of Camp Edwards: Golden shiner (*Notemigonus crysoleucas*), Bluegill (*Lepomis macrochirus*), Pumpkinseed (*Lepomis gibbosus*), Brown bullhead (*Ameiurus nebulosus*), and Largemouth bass (*Micropterus salmoides*). Additional surveys are planned to complete the inventory of fish species on Camp Edwards.

6.10 Endangered, Threatened, and Special Concern Species

The Cape Cod Ecoregion has the highest number and one of the highest densities of state-listed rare plant and animal species within the 13 ecoregions in Massachusetts (Barbour *et al.* 1999). Within the Cape Cod Ecoregion, the greatest number of state-listed rare species can be found at the MMR. 41 state-listed (i.e., endangered (E), threatened (T), and special concern (SC)) and 6 species on the unofficial watch-list (WL) have been observed on Camp Edwards (Table 6-12).

Along with the 41 state listed species there is one candidate for federal listing-the New England cottontail (*Sylvilagus transitionalis*) that occurs on Camp Edwards. As it is

not yet federally listed, no regulatory actions are required. However, this management plan outlines further studies of this species (see 8.8.3) and habitat management of its required habitat of early successional scrub oak shrublands and pitch pine scrub oak community (see 8.2 and 8.5).

Table 6-12. State-listed and watch-listed species observed on Camp Edwards, MA.

group	Endangered	Threatened	Special concern	State-Listed Total	Watch-Listed
plants	4	1	0	5	6
odonates	1	1	3	5	0
butterflies	0	0	1	1	0
moths	0	4	12	16	0
reptiles	0	0	1	1	0
amphibians	0	1	0	1	0
birds	1	4	1	6	0
total	6	11	18	35	6

6.10.1 Threatened and Endangered Flora

Only one species of state-listed plants, broad tinker's-weed (*Triosteum perfoliatum*), was documented during the initial floristic survey of Camp Edwards (Jenkins 1994). As a result of annual surveys to update the list of flora on Camp Edwards, 4 more state-listed and 6 watch-listed plant species have been identified on Camp Edwards (Table 6-13). Conservation of the state-listed rare plant species is discussed in Chapter 9.2.

Table 6-13 State Listed Plant Species of Camp Edwards

Scientific Name	Common Name	Status in MA	National Status
<i>Rhynchospora torreyana</i>	Torrey's Beak Rush	*E	G5
<i>Thuja occidentalis</i>	Northern White Cedar	E	G5
<i>Triosteum perfoliatum</i>	Broad Tinker's Weed	E	G5
<i>Ophioglossum pusillum</i>	Adder's Tongue Fern	T	G5
<i>Asclepias tuberosa</i>	Butterflyweed	WL	G5
<i>Fuirena pumila</i>	Umbrella Grass	WL	G5
<i>Lechea minor</i>	Least Pinweed	WL	G5
<i>Lupinus perennis</i>	Lupine	WL	G5
<i>Polygala nuttallii</i>	Nuttall's Milkwort	WL	G5
<i>Stachys hyssopifolia</i>	Hyssop Hedge Nettle	WL	G5
<i>Eleocharis ovata</i>	Ovate Spike-sedge	E	G5

6.10.2 Threatened and Endangered Fauna

A total of 30 state-listed animals have been observed on Camp Edwards (Table 6-14). These species include 17 species of lepidoptera, 5 species of odonates, 6 species of birds, 1 species of turtle, and 1 amphibian.

Table 6-14 State Listed Fauna of Camp Edwards

Scientific Name	Common Name	Status in MA	Heritage Status
BIRDS (6)			
<i>Bartramia longicauda</i>	Upland Sandpiper	E	G5
<i>Ammodramus savannarum</i>	Grasshopper Sparrow	T	G5
<i>Circus cyaneus</i>	Northern Harrier	T	G5
<i>Parula americana</i>	Northern Parula	T	G5
<i>Pooecetes gramineus</i>	Vesper Sparrow	T	G5
<i>Accipiter striatus</i>	Sharp-shinned Hawk	SC	G5
REPTILES and AMPHIBIANS (2)			
<i>Scaphiopus holbrookii</i>	Eastern Spadefoot	T	G5T5
<i>Terrapene carolina carolina</i>	Eastern Box Turtle	SC	G5T5
ODONATES (5)			
<i>Anax longipes</i>	Comet Darner	SC	G5
<i>Aeshna mutata</i>	Spatterdock Darner	E	G3G4
<i>Enallagma carunculatum</i>	Tule Bluet	SC	G5
<i>Enallagma recurvatum</i>	Pine Barrens Bluet	T	G3
<i>Enallagma laterale</i>	New England Bluet	SC	G3
MOTHS (16)			
<i>Acronicta albarufa</i>	Barrens Daggermoth	T	G3G4
<i>Hemileuca maia</i>	Coastal Barren's Buckmoth	SC	G5T3T4
<i>Catocala herodias gerhardi</i>	Gerhard's Underwing	SC	G3T3
<i>Cicinnius melsheimeri</i>	Melsheimer's Sack Bearer	T	G4
<i>Faronta rubripennis</i>	Pink Streak	T	G3G4
<i>Papaipema sulphurata</i>	Water-Willow Stem Borer	T	G2
<i>Cingilia catenaria</i>	Chain-dotted Geometer	SC	G4
<i>Abagrotis nefascia benjamini</i>	Coastal Heathland Cutworm	SC	G4T3
<i>Metarrhantthis pilosaria</i>	Coastal Swamp Metarranththis	SC	G3G4
<i>Papaipema sp.</i>	Ostrich Fern Borer	SC	G3G4
<i>Itame sp.</i>	Pine Barrens Itame	SC	G3
<i>Zale sp.</i>	Pine Barrens Zale	SC	G3Q
<i>Psectraglaea carnosa</i>	Pink Swallow Moth	SC	G3
<i>Oncocnemis riparia</i>	<i>noctuid moth</i>	SC	G4
<i>Bagisara rectifascia</i>	Straight Lined Mallow Moth	SC	G4
<i>Euchlaena madusaria</i>	Sandplain Euchlaena	SC	G5S1
BUTTERFLYS (1)			
<i>Callophrys irus</i>	Frosted elfin	SC	G3

The Massachusetts NHESP lists sixteen species of moths and one butterfly that inhabit Camp Edwards as either threatened or special concern. At least ten of these species depend upon the scrub oak barrens of Camp Edwards for at least part of their life cycle (see Chapter 6.9.1). Mello *et al.* (1999) identified the habitats on Camp Edwards that contain scrub oak and an open forest canopy as critical habitat for state-listed rare moths. The Massachusetts NHESP has requested that the MAARNG maintain approximately 4000 acres of scrub oak barrens as rare wildlife habitat. The other species of state-listed rare moths have been documented in either grasslands, wetlands, or forested habitats on Camp Edwards. The conservation of state-listed rare moth species is discussed in Chapter 9.4 of this document.

Five state-listed rare species of odonates (i.e., dragonflies and damselflies) have been documented in or near the ponds on the western edge of Camp Edwards (Table 6-14). The Rod and Gun Club Ponds, Donnelly Pond, and Deep Bottom Pond are critical habitat for these species. The occurrence of the state-listed rare odonates in these ponds suggests that the land along the western edge of Camp Edwards, which includes an open path along the powerline easements, serves as a migration corridor between the ponds. The emphasis in protecting these species should be placed not only on the aquatic habitats used for feeding and larval development, but also the upland habitats that are used by the adults. The conservation of state-listed rare odonate species is discussed in Chapter 9.3 of this document.

Six species of state-listed rare birds have been documented on Camp Edwards. Four of these species, the upland sandpiper, grasshopper sparrow, vesper sparrow, and northern harrier, inhabit the grasslands of the Camp Edwards cantonment area. Their habitat requirements and management are discussed in Chapters 8.6 and 9.5 of this document. Migratory records exist for the sharp-shinned hawk and northern parula in the forests of Camp Edwards. The common tern has been observed flying over Camp Edwards. The conservation of state-listed rare birds will be described in Chapter 9.5 of this document.

One species of state-listed rare turtle, the eastern box turtle, has been documented on Camp Edwards. The eastern box turtle has been observed in nearly every natural community on Camp Edwards, including grasslands, forests, and disturbed areas (e.g., bivouacs and powerline easements). The conservation of state-listed rare turtle species will be discussed in Chapter 9.6 of this document.

Along with the 41 state listed species there is one candidate for federal listing-the New England cottontail (*Sylvilagus transitionalis*) that occurs on Camp Edwards. As it is not yet federally listed, no regulatory actions are required. However, this management plan outlines further studies of this species (see 8.8.3) and habitat management of it required habitat of early successional scrub oak shrublands and pitch pine scrub oak community (see .8.2 and 8.5).

SECTION IV. NATURAL RESOURCES MANAGEMENT AT CAMP EDWARDS

CHAPTER 7. INTEGRATED TRAINING AREA MANAGEMENT (ITAM) PROGRAM

7.1 Overview of ITAM and Relationship to Natural Resource Management

The Integrated Training Area Management (ITAM) program is responsible for maintaining the land to help the Army to meet its training requirements. This requires understanding and balancing Army Training requirements and land management practices. The Integrated Training Area Management Program (ITAM) is the U.S. Army standard for sustaining the capability of installation land units to support their military training missions by achieving the following goals:

- to integrate environmental planning procedures into all operations
- to protect natural and cultural resources
- to ensure compliance with existing statutory regulations (See Chapter 4)
- to prevent future pollution and reduce hazardous waste and toxic releases (This final goal is coordinated thru the Camp Edwards Environmental Manger and Hazardous Waste Coordinator. References: MMR Groundwater Protection Policy, October 1, 2003, Camp Edwards Integrated Contingency Plan and the Hazardous Materials and Waste Management Plans)

The ITAM Program relies on its four components and an integrated management from HQDA, MACOM, and installations to accomplish its mission. The four components are Training Requirements Integration (TRI); Range and Training Land Assessment (RTLA); Land Rehabilitation and Maintenance (LRAM); and Sustainable Range Awareness (SRA). These components combine to provide the means to understand how the Army's training requirements impact land management practices, what the impact of training is on the land, how to mitigate and repair the impact, and communicate the ITAM message to soldiers and the public. Geographic Information Systems (GIS) is a foundational support element that provides locational information that assists land managers in making their decisions.

- 1) **Range and Training Land Assessments (RTLA):** The RTLA program inventories and monitors natural resource conditions and manages and analyzes natural resource information. Results are pertinent to management of training and testing lands from training area to installation scales and provides input to decisions that promote sustained and multiple uses on military lands. The RTLA program evaluates relationships between land use and condition through the collection of physical and biological resource

data. Some RTLA projects are long term, while others are relatively short. Key to RTLA success is the evaluation and analysis of collected data.

- 2) **Training Requirements Integration (TRI):** TRI is the component of the ITAM Program that provides a decision support procedure that integrates training requirements with land management, training management, and natural and cultural resources management processes and data derived from RTLA and Army Conservation Program components.
- 3) **Land Rehabilitation and Maintenance (LRAM):** LRAM is the component of the ITAM Program that provides a preventive and corrective land rehabilitation and maintenance procedure to reduce the long-term impacts of training and testing on an installation. It includes training area redesign and/or reconfiguration to meet training requirements.
- 4) **Sustainable Range Awareness (SRA):** Sustainable Range Awareness is the component of the ITAM Program that provides a proactive means to develop and distribute educational materials to users of range and training land assets. Materials relate procedures that reduce the potential for inflicting avoidable impacts on range and training land assets, including the local natural and cultural resources. ITAM SRA addresses specific environmental sensitivities at the installation level, to inform land users of restrictions and activities to avoid so as to prevent damage to natural and cultural resources.

In 1994, the Office of the Under Secretary of Defense for Environmental Security issued a memorandum to all forces in the Department of Defense (DoD) to implement Ecosystem Management on DoD lands. In addition to being a smart way of doing business, ecosystem management blends multiple-use needs, provides a consistent framework to manage installations, and ensures that the integrity of the system of DoD lands remains intact.

DoD Instruction 4715.3 "Environmental Conservation Programs", implements policy, assigns responsibilities, and prescribes procedures for the integrated management of natural and cultural resources on property under DoD control. The guidelines issued by the Department of Defense in both documents were incorporated into the goals and objectives of this plan (see Chapter 8 for detailed information about Ecosystem Management at Camp Edwards).

Together, the ITAM Program and Natural Resource Management ensure sustainable use of training lands as well as taking into consideration the surrounding environment and public concern.

7.1.1 ITAM Coordination

National Guard Bureau ITAM program proponenty resides in the Army Training Division (NGB-ART), while the Army Environmental Programs Division (NGB-ARE) and Army Installations Division (NGB-ARI) provide technical expertise to support ITAM (see Chapter 4 for responsibilities). In Massachusetts, the Office of The Adjutant General has proponenty of the ITAM program for the MAARNG.

7.1.2 ITAM Program on Camp Edwards

The National Guard Bureau (NGB) and Commonwealth of Massachusetts, State Military Department (MAARNG) have made a commitment to implement the ITAM program at Camp Edwards. ITAM at Camp Edwards was formally initiated with the start of the Land Condition Trend Analysis (LCTA) Program in 1993. The LCTA program is now called the RTLA program.

The ITAM Program at Camp Edwards is administered by the Camp Edwards Natural Resource Office with cooperation and support from Operations and Range Control at Camp Edwards. The RTLA portion of the ITAM Program is carried out by the seasonal and permanent staff of the Camp Edwards Natural Resource Office. LRAM Projects are initiated by the Camp Edwards Natural Resource Office, with most of the work conducted by the Roads and Grounds crew within the Camp Edwards Division of Facilities Engineering. TRI initiatives are coordinated between the Camp Edwards Natural Resource Office, The Environmental and Readiness Center, Range Control, and trainers. The EA portion of the ITAM Program is conducted by the Camp Edwards Natural Resource Office with an emphasis not only on the soldiers that train at Camp Edwards, but also people and organizations outside the MAARNG (e.g., the public, local school groups).

7.2 Range and Training Land Assessments (RTLA)

7.2.1 Introduction

RTLA is the natural resources data collection and analysis component of the ITAM Program and is used as a standard base for inventory and monitoring on Department of Defense owned or managed properties (US Army Construction Engineering Research Laboratories 1995). The intent of RTLA is to acquire essential natural resource baseline information that is needed to effectively manage training lands.

RTLA surveys inventory plants, animals, and describe the condition of the land. The information obtained from RTLA surveys may be integrated with standard data elements from ancillary components of ITAM (for example, cultural resources surveys, wetlands surveys, endangered species surveys, water quality monitoring), as well as satellite imagery and aerial photography to portray a total picture of the natural and cultural resources of the training site. A Geographic Information System (GIS) is used to integrate all natural and cultural resources data and graphically display the relationships between individual resource components.

LCTA was initiated in the mid-1980's by the Department of Army as a top-down program emphasizing uniform data collection methodologies to provide regional, MACOM, or national-level assessments of land condition. With the adoption of ITAM by the Training & Operations community, the LCTA program has evolved to RTLA, a decentralized, installation-level management of objectives to document the status and trends in natural resources, examine the relationships between disturbance and condition, and support training and testing area land use decisions. Current policies allow installation-level managers (land managers and range operations staff) to determine how they can best collect and use resource data to support short and long-term land management decisions such as training area allocation, training area use, and land rehabilitation.

A successful RTLA program provides scientifically valid baseline and long-term monitoring data. Monitoring is a critical component of the adaptive management cycle, especially in the context of ecosystem management, but can only be successful if it is objective-based. Limited resources dictate that qualitative methods sometimes be coupled with quantitative methods to address short- and long-term objectives.

Long-term monitoring plots, in addition to non-permanent plots and other sampling sites, reduce the "noise" caused by annual variability and facilitates detection of condition trends over time. This information supports stationing decisions, mission change analysis, and natural resource management activities. It is important to note that RTLA encompasses the collection and analysis of both field-scale (plot/transect/area) and spatial (i.e., GIS) data.

RTLA has changed in recent years in response to needs and constraints coming from installations and Major Army Command (MACOMs- i.e., NGB) as well as changes in organizational responsibilities and funding. There is a need for core elements that will remain important over time and flexible regardless of most policy changes. Decision-making at the installation level is also essential to ensure site-specific issues can be addressed effectively (Center for Ecological Management of Military Lands, 1999).

7.2.2 History of RTLA at Camp Edwards

The RTLA component of the ITAM program at Camp Edwards was launched during the spring of 1993, when 30 core plots were installed and monitored (then called the LCTA program). The number of plots increased with the addition of 30 special use plots to a total of 60 plots by 1994 (Figure 7-1). Some smaller plant communities (e.g., wetlands) were underrepresented within the 30 core plots but were sampled using special use plots. The special use plots were also established in sites that were visibly impacted or disturbed by military activities. The purpose of establishing these plots was to examine the direct impacts of certain activities associated with military training (e.g., bivouacking, establishing a helicopter landing zone, driving in assembly areas) on the natural resources of Camp Edwards. This was accomplished by comparing the data from the disturbed areas to those from the core plots. The core plots are distributed on Camp Edwards in a stratified random fashion. Within the stratified random sampling, the number of plots in each of the plant communities on Camp Edwards was directly proportionate to the percentage of the area of Camp Edwards that is occupied by that natural community. Within each natural community, the plots were distributed in a random fashion. In 2003, a Forest Resource Inventory was conducted. At that time it was decided to add all of the Forest Inventory plots to the RTLA database, for better plot coverage, and call them Environmental Monitoring (EM) Plots. There are currently 224 EM plots located on Camp Edwards. All EM plots are included in the Camp Edwards GIS database.

Bird surveys began at Camp Edwards in 1993. Surveys for birds have occurred yearly since 1993 on Camp Edwards. Incidental sightings of the less commonly observed faunal species have been recorded, and the presence of rare or protected species has also been documented.

The data entered into the training site's database has many different uses. Of primary interest to the training staff is the application of data to produce overlays of particular areas of the training site to get a snap-shot of what is happening within that portion of the site. Satellite imagery and aerial photography can be viewed within Arcview along with a map of the site's training areas and training facilities. Trainers can use GIS generated maps to plan maneuvers, since terrain, topography, and vegetation can be portrayed on each map at or above the original scale of the input data.

Figure 7-1. RTLA (EM) plot locations within natural communities on Camp Edwards.

March 2006, MAARNG GIS, MassGIS, Michael Ciaranca, Natural Resource Manager

7.2.3 RTLA Goals and Objectives

GOAL 1. Maintain the RTLA monitoring system on Camp Edwards that will serve as a measure of the integrity of the training site's ecosystem and defend mission activities. This system also provides for the early detection of any adverse environmental impacts by the yearly monitoring of RTLA study plots.

Objectives:

- a. Document existing conditions through standardized inventories to evaluate the capability of the land to meet multiple-use objectives on a sustained basis and to match land capabilities with land use.
- b. Conduct inventories of vegetation, wildlife, and effects of training on the landscape by monitoring EM plots.
- c. Establish additional plots as necessary on Camp Edwards.
- d. Monitor change and detect trends, thereby providing a basis for altering land use and amending land management plans to ensure long-term resource availability.

GOAL 2. Maintain a comprehensive RTLA database with sufficient completeness, consistency, and accuracy, so that reliable and useful analysis can be achieved.

Objectives:

- a. Establish consistent data entry protocols for use by all RTLA database users and field crews.
- b. Train Camp Edwards Natural Resource Office staff in RTLA database development and maintenance.

GOAL 3. Maintain a Geographic Information System (GIS) that will provide efficient data storage, retrieval, and presentation to facilitate fully informed and integrated management decisions on Camp Edwards.

Objectives:

- a. Support environmental, facilities, and training GIS needs.
- b. Develop and implement written standards and procedures for GIS administration.
- c. Define how GIS should be used within Camp Edwards Natural Resource Office, Facilities, and Training staffs.
- d. Use the Federal Geographic Data Committee Metadata Standard to document geo-spatial data sets as required by Executive Order 12906.

7.2.4 Plot Inventory and Monitoring

RTLA data collection can be divided into three phases: initial plot inventory, long-term monitoring, and data interpretation. Establishing and inventorying permanent core field plots are the first and second phases in measuring changes to soil, vegetation, and wildlife on the entire training site. The initial inventory and monitoring consist of three major elements: land use assessment, line intercept sampling, and belt transect sampling. All the data are entered on handheld computers while in the field doing the actual inventory.

The RTLA plot surveys are conducted each year during the peak of the growing season for plants, which at Camp Edwards is from June to August. However, the peak in bird and small mammal breeding typically occurred in the spring, just prior to or at the beginning of the surveys. Long-term monitoring techniques are used to monitor all plots. Details of RTLA monitoring can be found in US Army Construction Engineering Research Laboratories (1992) and U.S. Army Environmental Center (1997a). Results of 10 years of RTLA data gathering at Camp Edwards are represented in Section III - Natural Resources of Camp Edwards and in the State of the Reservation Report produced yearly for the Upper Cape Water Supply Reserve, Massachusetts Army National Guard, Camp Edwards, MA.

The second type of plot is the special use plot. As the name implies, special use plots are for use in special situations. They are not necessarily permanent and may only be as long lived as required to collect enough data to monitor and assess potential impacts. Special use plots are used to address issues that cannot be addressed by core plots. Data collected from special use plots can be used to evaluate land rehabilitation efforts (i.e., LRAM projects), document the effects of prescribed or accidental fires, assess natural recovery of degraded lands, or to characterize and monitor relatively small habitats, including those of sensitive species or wetlands. Special use plots at Camp Edwards have been established to monitor the effects of training activities.

7.2.5 Data Management and Analysis

The RTLA plant data are summarized using Microsoft Excel and Access and analyzed using a variety of statistical software. The RTLA plots serve as replicates for each of the habitat types in which they are located. Hence, data is analyzed by comparing habitats, rather than plots.

The RTLA data from 1994-1999 indicated that the plots were sampled in a somewhat haphazard fashion. Therefore, a permanent plot rotation was established starting in 2000 in order to facilitate data analysis in the future. Plots were sampled for birds and small mammals every other year, and sampled for plants every three years. As a result, one-half of the plots from each habitat and one-half of the core plots were surveyed for birds and small mammals each year whereas one-third of the plots were surveyed for plants. These plot rotations were repeated every two (birds and small

mammals) or three (plant) years. The objective in establishing this plot rotation was to create a sampling regime in which habitats could better be compared. Since 2004, when we created the EM plots, a 1-7 year rotation is in effect. This is due not only to the increased number of plots, but for reasons of flexibility. For example, core habitat plots need only be visited every 5-7 years. This is the amount of time most habitats on Camp Edwards need to exhibit change of any kind. However, if there is a disturbance present on any one plot such as fire or training damage, a 1-2 year rotation may be necessary to monitor its recovery, and avoid establishment of invasives on the disturbed soil.

The RTLA plant data are analyzed for species frequency, diversity, stem density, canopy structure, and rates of succession. The RTLA mammal data are analyzed for species richness, diversity, abundance, sex ratio, population size, trap success, and capture success. The RTLA bird data are analyzed for species abundance and diversity.

7.2.6 Geographic Information Systems (GIS)

A GIS is an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information. A simpler definition of a GIS is a computer system capable of holding and using data describing places on the Earth's surface. The power of a GIS is its ability to identify spatial relationships between geographic features. A GIS is an analytical tool used not only for making maps but also for performing complex spatial analysis and modeling.

Over the past several years, the Massachusetts Army National Guard (MA-ARNG) has developed and maintained a GIS database for Camp Edwards, the Massachusetts Military Reservation (MMR), and other MA-ARNG facilities. Until recently, only a few individuals had direct contact with this database, but with more workstations (faster PCs) and better-trained personnel, GIS is becoming available to other individuals and groups. Standards have been implemented to educate users, improve communication, maintain consistency, assure data compatibility, reduce duplication of efforts, and provide a medium to transfer the most current information.

In addition to applying standards, a plan to create an Enterprise GIS is being developed. An Enterprise GIS uses a Relational Database Management System (RDBMS) and ArcSDE to distribute a GIS to multiple clients over a network. ArcSDE is an application server and acts as a GIS gateway that facilitates managing and storing spatial data in a RDBMS like Microsoft SQL Server. An Enterprise GIS is the key component in managing a multi-user GIS and creates the possibility of integrating GIS data with other relational databases. A central repository for spatial and non-spatial data optimizes information accessibility, eliminates the duplication of data, and increases an organization's efficiency.

The GIS database is dynamic. The MAARNG is always obtaining and creating new layers, updating existing layers, accumulating additional data, and performing new and more complex analysis in GIS. This GIS is moving towards compliance with Federal and National Guard Bureau standards. GIS is now a significant part of facilitating the National Guard mission in environmental stewardship, facility management, and training.

7.3 Training Requirements Integration (TRI)

7.3.1 TRI Introduction

Training Requirements Integration (TRI) supports the integration of land use requirements with natural and cultural resources management processes. Siting military missions (and other land uses) in areas best capable of supporting the activities is the main goal of TRI. TRI relies heavily on GIS and RTLA to determine land capabilities and includes rotation of training lands as well as scheduling lands according to their “carrying capacity” to support specific missions. TRI also includes those restrictions required to maintain high-quality training lands, provide a safe training environment, and protect significant natural resources. When areas cannot be placed “off-limits” or signage cannot be used, the Sustainable Range Awareness program will serve to educate the training site users about site limitations. Sustainable Range Awareness also instructs units about the best means to accomplish the missions with minimal damage.

Training land and range requirements are derived from the Range and Training Land Program (RTLTP), using the installation’s assigned units’ Mission Essential Task List (METL) and Combined Arms Training Strategy (CATS). Procedures for the day-to-day management of range and training lands are also outlined by the RTLTP. Using RTLTP information, TRI integrates the training requirements with the capabilities of the natural resources to support those requirements.

Range Control at Camp Edwards has fielded the Range Facility Management Support System (RFMSS) since 1998. RFMSS, which was developed by the USACE, is a collection of microcomputer-based software programs designed to automate the training facility management functions at an installation. RFMSS consists of components that can be customized to a particular installation, scheduling of ranges and training areas, collection and analysis of range and training area usage data, and generation of various administrative reports.

RFMSS is used extensively by Range Control and using units in scheduling training areas, ensuring that planned training activities do not overlap with other units scheduled to train or affect sensitive areas within the training site. Range control personnel enter the training site utilization data into dBase compatible tables in the

RFMSS program. These tables, in particular, the UPROCESS.DBF table can be added to ARCVIEW and queried by programs that summarize the data. In so doing, training site utilization data can be correlated with any information loaded into the GIS system, for example, ground cover types, wildlife abundance, tree mortality, and bivouac site usage tracking.

7.3.2 TRI Goals and Objectives

GOAL 1. Ensure that there is no net loss in the capability of training site lands to support existing and projected military missions on Camp Edwards.

Objectives:

- a. Maximize training opportunities while minimizing impacts to training lands.
- b. Distribute activities and minimize conflicts.

GOAL 2. Maintain quality training lands by minimizing, rehabilitating, and mitigating damage.

Objectives:

- a. Site military missions (and other land uses) in the areas best capable of supporting them.
- c. Provide command elements with the information needed to make decisions that include natural resource-related values.
- d. Aid in coordinating development of the five-year Range Training Land Program (RTLTP) Development Plan

GOAL 3. Provide guidance to users of Camp Edwards regarding their conduct while on the installation.

Objectives:

- a. Update the Camp Edwards Regulation 385-63 as needed.
- b. Provide adequate boundary signage and boundary fencing to deter trespassing

GOAL 4. Aid in establishing consistent RFMSS data entry protocols for use by Range Control.

Objectives:

- a. Continue RFMSS coordination between Range Control and Natural Resource Office.

7.3.3 Training Siting

Engineer and special types of engineer training projects that involve grading, filling, or excavation activities must be coordinated with and approved by Camp Edwards Operations and Natural Resource Office. Prior to the start of any such action,

the commander of the using unit must coordinate with Range Control and the Natural Resource Office to find a location for the action that would limit or prevent the impact to the natural resources.

Timing and scheduling of activities is important as well; for example, an activity that might impact the habitat of a breeding bird or flowering plant during a particular season might not do so in a different season. As a consequence, site-specific determinations must be made when assessing the possible consequence(s) of an activity.

The Camp Edwards trainer's manual that is being developed by the Natural Resource Office will describe the characteristics and restrictions associated with each of the training areas on Camp Edwards. This will assist trainers in selecting training areas that best suit their mission requirements while protecting sensitive areas from disturbance. See Chapter 7.5.5 for a more detailed description of the trainer's manual.

7.3.4 Guidelines for Protection of Natural Resources During Training

Training restrictions are a form of ecosystem protection, since not all locations within the training area boundaries are always compatible with military training. Training Site operations will be conducted in accordance with Camp Edwards Training Site Regulation 385-63 and the Environmental Performance Standards as outlined in MA General Law Chapter 47 the Acts of 2002 and in the Massachusetts National Guard's Master Plan/Area-Wide Environmental Impact Report.

Examples of natural communities that are protected by training restrictions include wetlands and grasslands. Placing troop-oriented signs or marking trees in a buffer zone around them can prevent training use in these areas. By delineating wetland buffer zones and grasslands as "off-limits" not only improves the quality of training, but also improves the quality of the natural communities on Camp Edwards.

Other off-limits areas, such as cultural resources sites or sensitive species locations are marked or fenced in addition to placing them on Range Control maps. It is important that commanders planning training activities incorporate environmental concerns and hazardous areas during initial planning. Restrictions associated with these areas are passed on to the soldiers taking part in the training exercise. Each soldier that trains on Camp Edwards is issued a Soldier's/Leader's Field Card (Figure 7-2), which outlines the environmental restrictions on activities associated with training.

Figure 7-2. The Soldier's/Leader's Field Card from Camp Edwards.

Camp Edwards is an important training center for National Guard and Reserve Units throughout Northeastern United States. Located on Cape Cod, an environmentally sensitive region, Camp Edwards contains a number of threatened and endangered wildlife species, culturally sensitive sites, and wetland areas. Moreover Camp Edwards sits on top of a sole source aquifer for Cape Cod that is recharged by rainfall alone and the Northern 15,000 acres of Camp Edwards have been designated as the Upper Cape Water Supply Reserve. Materials left on the ground can eventually reach and contaminate this vital water source.

All users of Camp Edwards are strictly responsible for ensuring that Army, National Guard, and Camp Edwards Range Regulations are followed along with the environmental laws of the Federal, State, and Local governments. Users are to minimize environmental disturbance to protect the eco-system thus preserving the long-term training value of the Camp.

VISION

The Adjutant General for the MANG and Headquarters, Camp Edwards are committed to excellence in all aspects of management and environmental protection of the training site. We will seek to constantly improve upon training practices that protect the future of our eco-system and allow for trained and ready soldiers.

TRAINING AREAS

- Currently **NO LEAD can be fired at Camp Edwards.**
- Do not limb trees above seven (7) feet.
- Complete trees will not be cut without permission of Range Control and the Natural Resource Office.
- Mechanical excavations require advance approval by Camp Edwards Range Control and the Natural Resource Office.
- Portable latrine units will be used at all times.
- The following will be performed prior to requesting clearance inspection from Range Control:
 - Fill and mound approved excavations.
 - Report damaged facilities to Range Control
 - Collect casings, brass, wire, etc. for turn in to Range Control
 - Remove all packing material and trash
- DO NOT BURY ANY WASTE

VEHICLE MOVEMENT

- Speed limit 25mph on range roads
- Obey all posted speed limits and traffic control signs.
- Stay on established roads, unless otherwise approved by Range Control and the Natural Resource Office
- Do not create roads, this is strictly prohibited.
- Stay clear at least 100 feet of Off Limit Areas such as: Impact Areas, Wetlands, Land Rehab, and other posted sites.
- Track Vehicles will not make pivot or neutral steer turns except on concrete turning pads or where otherwise designated.
- Any unauthorized vehicles (ATVs, Motorcycles) must be immediately reported to Range Control

POL AND HAZARDOUS MATERIALS

- Accidents happen: Immediately report the type, size and location of any POL or hazardous waste to Range Control.
- Stop the spill, if it can be done safely.
- Contain spill or incident to the smallest possible area.

- Clean up spill and remove contaminated soil to polyethylene bags or hazardous waste drums (available at DOL) at the time of the spill, **Do Not Wait!**
- Refueling vehicles may only be conducted at the Turpentine Rd. fuel point or in the 3600 area on **secondary containment.**
- Generators may be refueled in the field, (5 gallon fuel cans only) on **secondary containment.**

WILDLIFE

- Harassment of wildlife or destruction of their habitat (nests, dens, burrows etc.) is strictly prohibited.
- Because of rabies and other animal born diseases; animals exhibiting odd behaviors should be avoided and immediately reported to Camp Edwards Range Control.
- Tick awareness and precautions should be followed. Lyme disease is prevalent in Cape Cod. All tick bites should be reported to Range Control on a DA Form 285, by the end of the day of the incident.

CULTURAL RESOURCES

- **Disturbance or removal** of cultural resources (e.g., Native American artifacts, old stone foundations) is strictly prohibited and will result in penalties including fines and/or imprisonment.
- Report all discoveries of cultural resources, artifacts, or any suspected human remains, to the Camp Edwards Range Control. Range control will then notify the Natural Resource Office or EandRC representative

FIRE

- Open fires are prohibited.
- Immediately report any fire to Range Control.
- Be observant of, and adhere to, pyrotechnic suspensions
- Units near a fire are expected to aid in extinguishing or to provide assistance to fire crews, as directed by Range Control.

UNEXPLODED ORDINANCE (UXO)

- Do not approach, pick up, or touch UXO or any item not identifiable. Mark the location, not the item, and notify Range Control.

IMPORTANT PHONE NUMBERS

Range Control	508-968-5925 or 5926
Range Control frequency	FM 38.50 or 52.95MHz
Force Protection (24hrs)	508-968-5997
Environmental Office	508-968-5148
	cell 508-294-2243
Natural Resource Office	508-968-5121
	cell 508-294-2244

COMMENTS

Any suggestions for improvement, as well as comments or questions concerning Camp Edwards' Environmental programs should be provided to the Environmental & Readiness Center at (508) 968-5152.

Figure 7-2. The Soldier's/Leader's Field Card from Camp Edwards cont.

7.3.5 Rotational Use of Training Areas

The goal of this plan is to minimize loss of training acreage by implementing training standard operating procedures for protection of the environment and implementing adaptive management on the site; however, if training area use results in detectable damage, training areas will be rotated, giving specific areas a “rest and rehabilitation” time, during which any LRAM projects or sensitive species habitat management activities could occur.

Rotational training may be implemented at the site if a training area is not able to recover from training activities (for example, if no ground cover can be established, unacceptable erosion is occurring, gullies are forming, or woody vegetation has become damaged and susceptible to disease). Specifically, any of the activities associated with training that cause significant effects will be excluded from that particular area until the area has recovered enough to support training again. Conversely, activities with negligible effects will be scheduled in that training area. Camp Edwards Range Control and Environmental Staffs have up-to-date knowledge of the conditions on each training area. Therefore, these offices must routinely inform the training site commander of natural resources conditions that indicate that some change in training types or levels must be made.

7.3.6 Restricted Areas

Training areas or portions of training areas are set aside when significant natural resources that are incompatible with training activities have been identified on those areas. These areas are usually associated with wetlands and grasslands or are areas that pose a threat to human safety. The wetlands of Camp Edwards and their 100-ft buffer zones are generally closed to all training activities. The Rod and Gun Club, including the wetlands, in the southwestern portion of Camp Edwards is also off-limits to training. The cantonment area grasslands are off-limits to training from 1 May to 31 July due to the presence of nesting state-listed grassland birds. Another temporal closure is from 1 March-15 June on roads within the 500 foot wetland buffers to allow for amphibian migration. Areas of Camp Edwards that pose a threat to human safety include the Impact Area, the former J Ranges, and the Ammunition Supply Point. Training is not permitted in these areas.

7.4 Land Rehabilitation and Maintenance (LRAM)

7.4.1 LRAM Introduction

LRAM is an active component of the ITAM program that is designed to restore and maintain soil, vegetation, and water resources for long-term sustainable use and training realism. The program uses cost-effective technologies such as revegetation and erosion control techniques to reduce soil loss, control water runoff, and protect soil productivity and riparian areas (adjacent to water and wetlands). A key element in the LRAM program is the watershed or drainage basin approach to land rehabilitation. This approach ensures that land rehabilitation projects address actual land degradation problems, not just the symptoms.

There are four types of rehabilitation activities: (1) reducing activities that result in negative environmental impacts, (2) adding materials, (3) accelerating or decelerating environmental processes, and (4) changing site conditions. The simplest and least costly rehabilitation activity is to reduce or control an activity such as cutting of live vegetation. A second and more costly activity involves adding species (by planting or seeding), water, fertilizers, or soil to the site. Accelerating or decelerating environmental processes might involve introducing prescribed fire to reduce woody species and provide nutrients to the soil, mowing or shredding to slow successional processes, or attracting seed vectors such as birds to accelerate seed input to a site. In severely damaged sites, changing site conditions would be accomplished by changing drainage, slope, or vegetation to improve environmental conditions.

LRAM efforts are specifically designed to minimize long-term costs associated with land rehabilitation and reduce the need for additional land purchase due to unusable existing training site conditions. The success of the Camp Edwards LRAM program will ensure compliance with environmental laws and regulations, in particular the Clean Water Act.

7.4.2 LRAM Goals and Objectives

GOAL 1. Protect, maintain, and improve soil integrity, water quality, and air quality by providing adequate vegetative cover on all soils and maintaining appropriate drainage structures. Provide improved troop training environments that can sustain training indefinitely.

Objectives:

- a. Comply with all federal, state, and local laws and regulations pertaining to soil stabilization and water/air quality.
- b. Provide protection of natural resources (i.e. native communities and species) by implementing best management practices (BMP's) for routine maintenance/repair projects and LRAM projects.

- c. Improve surface water quality by reducing sediment loading in drainages on Camp Edwards.
- d. Rehabilitate damaged training areas with native species.
- e. Protect soil integrity and enhance soil productivity.

7.4.3 LRAM Project Planning

Project planning is essential for successful execution of LRAM projects. All interested parties must communicate with each other frequently to maximize efficient use of resources and ensure successful project execution.

Planning for LRAM projects has been the responsibility of the Camp Edwards Natural Resource Office. In coordination with the Division of Facilities, the Camp Edwards Natural Resource Office has successfully identified important erosion problems, designed projects to resolve problems (with estimated costs), and prioritized activities for implementation.

Project planning, coordination, and design will include the following:

- Construction/rehabilitation designs for all projects
- Cost estimates
- Resource requirements (e.g., labor, materials, equipment, monitoring)
- Impacts to training
- Project timelines
- Support preparation of applicable permits and approvals from affected state and federal agencies (e.g., storm water, 404 permits, air permits, biological opinions, cultural resources, and NEPA documentation).
- Maintenance requirements
- Applicable schedules
- Coordination procedures and points-of-contact
- Notifications

Important considerations affecting project plans include: soil properties, topography, accessibility, sensitive species, cultural resources, training realism, vegetation, wetlands, water quality, and environmentally sensitive areas.

Projects will be designed in accordance with current Erosion Control Best Management Practices. The design process will be followed by requests for funding. Funding for projects will come from three sources: ITAM, Status Tool for Environmental Programming (STEP), and Real Property Operation and Maintenance funds (DPW).

Execution of projects may be accomplished by engineering units, private contractors, in-house personnel, universities, LRAM field crews, volunteer groups, or state/federal governmental agencies.

7.4.4 LRAM Projects

All LRAM Projects that are carried out on Camp Edwards will consider the established guidelines at each stage of their development and implementation.

Guidelines for LRAM projects:

- Schedule and perform land rehabilitation projects during optimum seeding periods. If projects cannot be performed within those time frames, complete them as soon as possible.
- After heavy training exercises are conducted on the site, identify areas needing rehabilitation and schedule them to receive soil amendments or reseeded.
- Use temporary erosion control methods (such as silt fences or hay bale diversions) during periods of heavy troop training and inclement weather to avoid excessive siltation to watercourses and water bodies and other sensitive areas.
- Include soil capabilities, water management, landscaping, erosion control, and conservation of natural resources in all site feasibility studies and in project planning, design, and construction.
- Contact the Tribal Historic Preservation Officer of the Wampanoag Tribe of Aquinnah and Mashpee in the event that any ground disturbing activities are scheduled to occur. Consultation with the tribe is mandated under Section 106 of the National Historic Preservation Act.
- Include all necessary rehabilitation work and associated costs in project proposals and construction contracts and specifications.
- Use native grasses to revegetate disturbed soils when feasible, effective, and economical.
- When planting native grasses, include non-persistent grasses that act as a cover crop for the first two or three years to minimize erosion before native species become established; for example, red top, timothy, or annual rye.
- Areas that fail to establish vegetative cover adequate to prevent erosion will be re-seeded as soon as such areas are identified and weather permits.

7.4.5 LRAM Project Monitoring

LRAM projects are, in some instances, monitored using RTLA special use plots. Through the integration of LRAM and RTLA, the vegetation, birds, and small mammals that exist at LRAM project sites may be monitored during and after the implementation of the project.

All LRAM projects will be assessed on at least a monthly basis for the first year after completion. After this time period, the sites will be revisited on an annual basis to determine the effectiveness of the rehabilitation. A plan will be developed to continue work at the site if the initial rehabilitation was not successful or requires maintenance.

7.5 Sustainable Range Awareness (SRA)

7.5.1 SRA Introduction

Sustainable Range Awareness is an education and consciousness-raising program to encourage environmental stewardship and responsible use of the natural resources of Camp Edwards. The purpose of Sustainable Range Awareness is to provide information to all site users with the ultimate goal of preventing unnecessary damage to the environment and in particular, training lands.

The Sustainable Range Awareness Program focuses on primarily two groups of land users: military and non-military training site users (e.g., police, local population, and school and community groups). It is designed to improve their understanding of the effects of their mission, training, or activity on the natural resources of the Camp Edwards.

Sustainable Range Awareness also serves to educate the public and garner their support by effectively communicating the nature of the military mission at Camp Edwards and the level of success of natural resources management at the site. Military users and the public are informed and educated about “easily understood” management practices (such as wildlife food plots, reseeding, tree plantings) as well as “misunderstood” management practices (such as restrictions on field operations or hunting, prescribed burning, or reduced grounds maintenance).

7.5.2 SRA Goals and Objectives

GOAL 1. Create a conservation ethic in those who use Camp Edwards’ lands to minimize damage to lands and natural resources.

Objectives:

- a. Design, produce and update soldier education materials that identify environmental considerations and guidelines for military tenants utilizing the facilities and resources on Camp Edwards (posters, ITAM video,

trainer's handbook, educational displays, signs, and a website regarding natural resources on Camp Edwards)

- b. Provide decision makers with information needed to make sound natural resources judgments
- c. Enhance the professional skills of the Camp Edwards Environmental staff.

GOAL 2. Develop and implement a public education program to increase public awareness and acceptance of natural resource management.

Objectives:

- a. Provide an understanding of the Camp Edwards natural resources program to training site and surrounding communities.
- b. Provide general conservation education to the Camp Edwards community.
- c. Support community and youth groups with educational tours.
- d. Use available media effectively in public education.

7.5.3 Environmental Stewardship

Environmental Stewardship at Camp Edwards is a moral and legal obligation for all users to carefully and responsibly use and manage the land and resources of the training site. As leaders and soldiers alike adopt a sense of environmental stewardship of the training site, the natural resources will be more effectively conserved and sustained for future training use. True environmental stewardship and awareness must originate from The Adjutant General through the Training Directorate to each Commander and soldier within the MAARNG.

7.5.4 Soldier Awareness

Camp Edwards Training Site Regulation 385-63 was designed in part to educate soldiers training at Camp Edwards about proper protection and management of hazardous wastes, wetlands and water resources, vegetation, cultural resources, wildlife and their habitat, and fire. Range Control staff conduct advance party environmental briefings and post-training reviews to ensure that soldiers training at Camp Edwards adhere to the training site regulation and avoid sensitive or restricted areas. Each unit commander will be involved in incorporating this information into training plans to minimize effects of soldier activities on natural resources.

From reports of other military installations, most accidents, injuries, loss of life, and damage to natural resources occur during administrative duties. It is, therefore, important to emphasize that the training site regulation applies to all activities (for example, construction, surveys, public hunting periods, and contractor labor) conducted at the training site, not just training activities. Also an effective

environmental awareness program that stresses the importance of personal responsibility and accountability can minimize the kinds of accidents and losses experienced at other installations.

7.5.5 Educational Training Tools

Sustainable Range Awareness will be used to promote different aspects of the Environmental Program such as the protection of sensitive species and their habitats; hazardous materials spill prevention, cultural resources protection, and soil erosion control. An effective Sustainable Range Awareness effort is essential to the implementation of a range-oriented environmental program.

Soldier's/Leader's Field Card

In 2006, the Camp Edwards Environmental and Readiness Center updated the 1994 version of the *Soldier's/Leader's Field Card* for use by trainers in the field (Figure 7-2). The field card consists of condensed information contained in other awareness materials such as the Training Site Regulation and the Sustainable Range Awareness goals. Following a brief introduction, it describes environmental stewardship guidelines with an emphasis on training area uses, the protection of wildlife and their habitats, vehicle movement, erosion control, cultural resources protection, hazardous waste management, and fire prevention.

Environmental Management Systems and Awareness Training

An Environmental Management Systems and Awareness Training DVD was produced in 2005. MAARNG personnel will view the DVD during meetings prior to annual training and upon arrival at Camp Edwards. The DVD will also be made available to community groups. It focuses on taking a proactive approach to protecting and maintaining sustainable natural resources. The DVD provides soldiers with information about the environment while training on the Camp Edwards and addresses the following topics:

- Natural resources protection
- Wildlife protection
- Hazardous material and waste management
- Land rehabilitation
- Soil erosion
- Vehicle maneuvers
- Fire prevention
- Restricted areas
- Deer ticks and Lyme disease

Trainer's Guide

The Camp Edwards Natural Resource Office developed a Trainer's Guide in 2002 that describes the characteristics and restrictions associated with each training area on the installation. This is accomplished by combining GIS and RTLA from the Natural Resource Office with land use data from Range Control. The Trainer's Guide is designed to be used by range control, headquarters, and MAARNG units that train at Camp Edwards.

The description of each training area includes a detailed map and a list of relevant land use data. The map will display forest types, roads and their surface conditions, topographic contours, existing bivouacs, latrines, firing points, and RTLA plots, as well as other important land features of each training area.

The land use data includes a description and relevant data for each training area. Land use data will include the following information:

- Total acreage of the training area
- Roads within the area and their mileage
- Area occupied by the natural communities within the training area
- Training use (as a measure of the number of soldiers times the number of days used) data from previous years
- Soil erosion risks (high, medium, or low)
- Types of training that may occur in the area
- Presence of state-listed rare species and sensitive habitats
- Cultural Resources Sensitivity
- LRAM activities
- Notification of the Camp Edwards Natural Resource Office and Range Control for permission to conduct activities that were not previously authorized

The Trainer's Guide will be available on the website of the Camp Edwards Natural Resource Office and is distributed to MAARNG Headquarters, Camp Edwards Headquarters, Billeting, and Range Control. The Trainer's Guide is being updated by the MAARNG GIS Office as an intranet based interactive guide to better serve the units in the field and at their home station to allow for more efficient planning and more time for training and readiness.

7.5.6 Community Environmental Awareness

The Camp Edwards Natural Resource Office and the Environmental and Readiness Center use several educational tools to inform the public about the natural

resources, natural communities, and environmental protection on Camp Edwards. The most common methods include presentations, tours, pamphlets, a web site, and participation in science fairs.

Presentations

Presentations describing the natural resources of Camp Edwards and the activities of the Natural Resource Office are often the most effective method of raising community awareness. Since the early 1990s, presentations have been given to public groups including the following:

- Town selectmen
- General public
- State environmental agencies
- Federal and State Representatives
- Public service organizations
- Chambers of Commerce
- DoD officials
- Local school groups
- Non profit conservation organizations

Tours

Guided tours of Camp Edwards are offered through the Camp Edwards Natural Resource Office, the Environmental and Readiness Center, and Range Control. Members of the public as well as representatives from state agencies are often taken on tours of Camp Edwards to describe the management efforts under the ITAM Program and other natural resources surveys and studies undertaken by the Natural Resource Office. Tours of remediation sites are also available for those who are interested in learning about the Impact Area Groundwater Study Program.

Web Site

The Camp Edwards Environmental and Readiness Center currently maintains a web site that describes the natural resources of Camp Edwards, including the flora, fauna, rare species, the ITAM Program, and other natural resources surveys and research. The site can be accessed at <http://www.mass.gov/guard/E&RC/index.htm> and is updated as new information becomes available.

Pamphlet

A pamphlet was designed and produced by the Camp Edwards Natural Resource Office to convey the same information as the web site, but in an abbreviated

form. Pamphlets are usually handed out at meetings, poster sessions, tours, or science fairs; they also contain the web site address and phone numbers of the Camp Edwards Natural Resource Office.

7.5.7 Professional Education

The staff of the Camp Edwards Natural Resource Office is encouraged to attend classes, seminars, and professional meetings to further their education as it pertains to their duties and expertise. The National Guard Bureau (NGB) often funds developmental seminars such as the Cultural Resources Management Seminar, the NEPA Writer's Course at Duke University, or the System Architecture and Design for GIS Seminar. These NGB-sponsored seminars are always beneficial and usually are at no cost to the installation.

The Department of the Army's (DA) ITAM Program hosts several annual conferences and Workshops that should be attended by the Camp Edwards Natural Resource Office staff as well as by trainers. The ITAM Workshop is held each year in a different part of the country to showcase new ITAM programs and the results of ITAM related research at U.S. Army installations throughout the world. The DA also hosts annual RTLA Workshops and GIS Defense User Group Conferences. It is encouraged that research and survey results be presented to the ITAM community at these conferences.

Participation in professional societies may further the education of the Natural Resource Office staff as well as to contribute to the scientific community. Staff of the Camp Edwards Natural Resource Office should participate in regional societies such as the regional section of The Wildlife Society, the Northeastern Association of Fish and Wildlife Agencies, or the Northeast Arc Users Group (GIS). National societies may include the American Society of Ichthyologists and Herpetologists, American Society of Mammalogists, American Ornithologists' Union, or Torrey Botanical Society.

7.5.8 Research Opportunities

As one of the largest undeveloped parcels of land on Cape Cod, Camp Edwards may be considered an ideal site for conducting field research. Researchers affiliated with state universities, non-profit organizations, and state and federal environmental agencies have conducted surveys and research projects on Camp Edwards, either as contractors or independently. Any person that is affiliated with the aforementioned organizations and is interested in conducting research on Camp Edwards should submit a research proposal to the Camp Edwards Natural Resource Office for review.

CHAPTER 8. NATURAL RESOURCE MANAGEMENT

8.1 Introduction

8.1.1 Philosophy of Natural Community Management at Camp Edwards

Management of natural communities is “driven by explicit goals, executed by policies, protocols, and practices, and made adaptable by monitoring and research based on our best understanding of the ecological interactions and processes necessary to sustain ecosystem structure and function” (Ecological Society of America, 1996). For example, the goals, objectives, and projects defined in this management plan will be accomplished by following the guidelines in the plan; all management actions will be monitored through the RTLA program and other monitoring programs; and management will be adapted according to monitoring results; thus, an endless feedback loop.

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

Natural Community management is based on a holistic, systems-oriented approach, and not predicated on single species management or maximizing the prevalence of a small group of organisms. However, rare species management should absolutely complement the conservation of a healthy, biologically diverse system. It is important to note that, although this plan takes an ecosystem approach to managing the lands of Camp Edwards, the Massachusetts Endangered Species Act still protects against a “take”, or loss, of state-listed rare species and their habitats. Combining both management objectives will ensure that the natural communities maintain their integrity, their constituent species and dynamics, and continue to support those species that are most vulnerable to ecosystem change- state-listed rare species.

8.1.2 Natural Community Management Goals and Objectives

GOAL 1. Follow DoD guidelines on Ecosystem Management to enhance natural community integrity and MAARNG training on a sustainable basis.

Objectives:

- a. Implement an adaptive management strategy through updating management recommendations in the Camp Edwards INRMP along with

the change or succession of natural communities and resources, best management practices, or scientific knowledge.

- b. Emphasize protection, restoration, and management of state-listed rare species, native plants and animals, and sensitive natural communities, such as wetlands and grasslands.
- c. Monitor and manage soils, vegetation, and wildlife on Camp Edwards considering all biological communities and the human values associated with these resources.
- d. Take a proactive approach to managing sensitive species before federal or state listing.
- e. Maintain natural communities in such a way that does not result in a net loss of training area.

GOAL 2. Maintain the ecosystems of Camp Edwards with variation in vegetation structure resulting from disturbance and recovery, not only to benefit the natural communities, but also to provide training opportunities in terrain with a variety of landscape structure.

Objectives:

- a. Meet with MADFW yearly to coordinate ecosystem maintenance
- b. Meet with Camp Edwards Training staff to determine needed landscape structure for training

GOAL 3. Prevent conflicts between training operations and rare species management.

Objectives:

- a. Research rare species to minimize potential impacts on training
- b. Research training to reduce potential impacts on rare species

GOAL 4. Restore and maintain native wildlife populations and habitats through the use of integrated ecosystem management principles when compatible with the military mission.

Objectives:

- a. Improve the quality of wildlife habitat for game and nongame species.
- b. Protect and conserve natural communities.

GOAL 5. Prevent the spread and further introduction of invasive exotic plant and animal species to the training site.

Objectives:

- a. Inventory invasive and exotic plants on an ongoing basis
- a. Reduce numbers of exotics / invasive through accepted best management practices

GOAL 6. Provide research, special projects, and other studies to support natural resources management on Camp Edwards

Objectives:

- a. Reach out to appropriate state agencies, local universities, and non-profits to provide natural resource research and management opportunities on Camp Edwards
- b. Acquire funding to conduct research, special projects, and other studies to support natural resources management through seasonal staff or outside agencies on Camp Edwards

GOAL 7. Inventory the natural resources of Camp Edwards and monitor resources that are important indicators of ecosystem integrity, water quality, capability of lands to support military missions, renewable product surpluses, imperiled species or communities, and other special interests.

Objectives:

- a. Conduct RTLA surveys every year

GOAL 8. Provide continuing education for Environmental staff.

Objectives:

- a. Natural Resource staff will attend at least one professional workshop per year
- b. Natural Resource staff to renew INRMP every five years

GOAL 9. Continually monitor and inventory existing natural communities to identify previously unclassified subsystems (e.g., hemlock stands within the mixed woods forest, red maple swamps within wetlands).

Objectives:

- a. Monitor and inventory natural communities by using environmental monitoring plots.
- b. Acquire funding to hire seasonal crews to conduct monitoring and inventorying of environmental monitoring plots.

8.1.3 Natural Resource Management Units

Within natural community management, goals and objectives are developed for each natural community and decisions made based upon a predetermined desired future condition for the landscape. The MAARNG believes that future condition for Camp Edwards is a mosaic of interacting natural communities linked by hydrologic flow, nutrient cycling, fire, animal movement, and transitions between natural communities.

8.2 Pitch Pine Scrub Oak Community Management

8.2.1 Pitch Pine Scrub Oak Community Introduction

Pitch pine scrub oak communities are well-adapted to fire, which is a critical component of the natural community's ecology. Mature pitch pine can survive regular low intensity ground fires; and most saplings have the ability to sprout after being top-killed by fire. Fire also contributes to the health of pitch pine scrub oak community by recycling plant nutrients and removing substances of plant origin that accumulate in the duff and litter and are toxic to some plants and other organisms. Without fire, the character of vegetation would change, and the health of plant communities would decline. Many of the plant species in the pitch pine scrub oak community are maintained and perpetuated by fire, which stimulates seed germination in some brush species and creates the necessary conditions of disturbance that promote seedling establishment of others.

The pitch pine scrub oak community share many of the similar characteristic species with the scrub oak shrublands natural community on Camp Edwards. Some of these species, such as the moths and the eastern box turtle, are state-listed rare species in Massachusetts. As a result, the pitch pine scrub oak community will be managed in conjunction with the scrub oak shrublands to improve the quality of habitat for the state-listed rare species as well as for wildlife in general.

8.2.2 Pitch Pine Scrub Oak Community Goals and Objectives

GOAL 1. Maintain the pitch pine-scrub oak community of Camp Edwards in multiple states of succession for the purposes of protection of sensitive species, soil stabilization, wildlife food and cover, and military training.

Objectives:

- a. Monitor the effects of training on pitch pine scrub oak communities and their characteristic species using RTLA methods.
- b. Use prescribed burning to maintain pitch pine scrub oak communities in a variety of age classes and structure.
- c. Prevent the spread and further introduction of invasive exotic plant and animal species to the pitch pine scrub oak community.
- d. Preserve snags and dead logs as wildlife habitat.
- e. Provide management that leads to recovery of rare species and protects other sensitive species through maintenance of their required habitat.
- f. Maintain or improve wildlife species richness, productivity, and survivorship.
- g. Inventory and manage game wildlife (i.e., white-tailed deer and wild turkey) populations through surveys and annual hunts.

8.2.3 Pitch Pine Scrub Oak Community Management

The pitch pine-scrub oak community will be maintained in a range of successional states using periodic prescribed burning and selective cutting of hardwood tree species and specific age classes of pitch pine depending upon the desired successional state. Specific burn prescriptions have been written for the pitch pine-scrub oak community and will be employed within the training areas of Camp Edwards. The successional state of the pitch pine scrub oak community will be monitored using the established RTLA survey plots (see Figure 7-1). As the composition of the forest begins to change from that of pitch pine and scrub oak community to a pitch pine-oak forest woodland or black oak scarlet oak forest, an assessment will be made as to the desired successional state for each particular area. After an assessment is performed and consultation with specialists from USFWS, DFW, and NHESP, the appropriate management techniques (i.e., prescribed burning, selective cutting) will be selected and employed on Camp Edwards. The ever-changing successional state of the pitch pine scrub oak community on Camp Edwards renders selecting specific areas for burning or selective cutting up to five years in advance rather difficult. As a result, an assessment will be made each year as to the priority of each portion of the natural community to be managed in the appropriate season. The effectiveness of techniques used will be evaluated using RTLA.

Standing dead trees (i.e., snags) and fallen logs will be left where they lie except when they pose a threat to human safety. Snags and logs serve several important ecological functions. They provide structural habitat characteristics for various plant and animal species, are potentially important in long-term nutrient cycling, and help minimize effects to soil and water resources caused by erosion. An average percent basal area of snags is 4.5% throughout Camp Edwards. Snags may be created through tree thinning to remove unwanted species.

8.3 Pitch Pine-Oak Forest Woodland Management

8.3.1 Pitch Pine-Oak Forest Woodland Introduction

The Pitch Pine-Oak Forest Woodland on Camp Edwards represents an intermediate successional state between the pitch pine scrub oak community and black oak scarlet oak forest natural communities. As a result, the characteristic species of the pitch pine-oak forest woodland is essentially a composite of those from the pitch pine scrub oak community and the black oak scarlet oak forest. However, the sparse understory of the pitch pine-oak forest woodland results in a relatively lower abundance of scrub oak, a plant essential to several state-listed rare species. Furthermore, the pitch pine-oak forest woodland comprises 40% of Camp Edwards, the greatest proportion of any natural community.

8.3.2 Pitch Pine-Oak Forest Woodland Goals and Objectives

GOAL 1. Maintain the pitch pine-oak forest woodland on Camp Edwards for the purposes of sensitive species and natural community protection, soil stabilization, wildlife food and cover, and military training.

Objectives:

- a. Monitor the pitch pine-oak forest woodland using RTLA methods.
- b. Decrease the presence of aggressive exotic plants (e.g., Japanese barberry).
- c. Preserve snags and logs as wildlife habitat
- d. Provide special protection to state-listed rare species and their habitats.
- e. Maintain or improve wildlife species richness, productivity, and survivorship.
- f. Manage game wildlife (i.e., white tailed deer and wild turkey) populations with annual hunts.
- g. Use prescribed burning to maintain pitch pine-oak forest woodland in a variety of age classes and structure.

8.3.2 Pitch Pine-Oak Forest Woodland Management

It is proposed that active management to promote pitch pine-oak forest woodland will not necessarily occur on Camp Edwards. However, portions of the pitch pine-oak forest woodland will instead be utilized in the creation of larger, more contiguous tracts of other natural communities such as scrub oak shrublands and black oak scarlet oak forest.

8.4 Black Oak Scarlet Oak Forest

8.4.1 Black Oak Scarlet Oak Forest Introduction

The black oak scarlet oak forest community currently comprises only 2% of the habitats on Camp Edwards. Hardwood forests are valuable in that they provide a larger, more contiguous tract of hardwood forest, with a low understory that provides valuable training for MAARNG soldiers. Training in a greater diversity of habitats, from scrub oak shrublands to mature hardwood forest, would prepare soldiers in a wide variety of missionscapes.

Aside from enhancing training, a larger tract of black oak scarlet oak forest would provide habitat and diverse mast crop that is beneficial to a diverse array of wildlife. Aside from oak acorns, hardwood mast may include fruits from American beech, hickories, American hazelnut, and black cherry. Hardwood trees also often provide nest or den cavities for wildlife including woodpeckers, squirrels, raccoons, and fishers. Several unconfirmed sightings of fishers (*Martes pennanti*) have occurred on Camp Edwards in 1998, 1999, and 2005. The black oak scarlet oak forest community on Camp Edwards may provide the required extensive mixed hardwood forest habitat for the species.

8.4.2 Black Oak Scarlet Oak Forest Goals and Objectives

GOAL 1. Maintain the black oak scarlet oak forest natural community on Camp Edwards for the purposes of sensitive species and natural community protection, soil stabilization, wildlife food and cover, and military training.

Objectives:

- a. Monitor the pitch pine-oak forest woodland natural community using RTLA methods.
- b. Decrease the presence of aggressive exotic plants (e.g., Japanese barberry).
- c. Preserve snags and logs as wildlife habitat
- d. Provide special protection to state-listed rare species and their habitats.
- e. Maintain or improve wildlife species richness, productivity, and survivorship.
- f. Manage game wildlife (i.e., white tailed deer and wild turkey) populations with annual hunts.
- g. Use prescribed burning to maintain black oak scarlet oak forests in a variety of age classes and structure.

GOAL 2. Increase the amount of black oak scarlet oak forest on Camp Edwards by converting pitch pine-oak forest woodland to black oak scarlet oak forest to create a larger, more contiguous tract of hardwood forest on the Camp Edwards training site.

Objectives:

- a. Delineate area in which black oak scarlet oak forest succession will be promoted.
- b. Promote succession to black oak scarlet oak forest by selectively cutting coniferous trees.
- c. Enhance wildlife habitat by leaving cut trees.

8.4.3 Black Oak Scarlet Oak Forest Management

It is proposed to increase the size of the black oak scarlet oak forest in the northeastern portion of Camp Edwards to create a larger, more contiguous tract of wildlife habitat. This will be accomplished by mechanical cutting (thinning) of pitch pine within the proposed black oak scarlet oak forest management area. Trees will either be cut down and left on the ground or girdled creating standing snags to promote wildlife habitat. Prescribed fire will also be used to maintain black oak scarlet oak forests in a variety of age classes and structure, and to promote germination compositional and structural heterogeneity.

8.5 Scrub Oak Shrubland Management

8.5.1 Scrub Oak Shrubland Introduction

The scrub oak shrublands habitat on Camp Edwards has been traditionally been maintained from live artillery fire into the Impact Area over the past 60-70 years. Since live artillery fire no longer occurs on Camp Edwards, it is necessary to maintain the scrub oak habitat using prescribed burning. A fire management plan has been developed for and accepted by the MAARNG that describes the methods for burning each unit of the Impact Area as well as other land management units of Camp Edwards (Ruffner and Patterson 2000a, 2005). Although the main purpose of the fire management plan is to reduce accumulated fuels and therefore reduce the risk of catastrophic forest fires, it also serves to maintain the Impact Area as scrub oak habitat, a critical refuge for several state-listed rare species.

8.5.2 Scrub Oak Shrubland Goals and Objectives

GOAL 1. Maintain and increase the amount of scrub oak shrubland on Camp Edwards for the purposes of state-listed rare species and natural community protection, soil stabilization, wildlife food and cover, and military training.

Objectives:

- a. Monitor the scrub oak shrubland using RTLA methods, to include the impact area where feasible.
- b. Decrease the presence of aggressive exotic plants (e.g., Japanese barberry).
- c. Preserve snags and logs as wildlife habitat.
- d. Provide protection to state-listed rare species and their habitats.
- e. Maintain or improve wildlife species richness, productivity, and survivorship.
- f. Delineate other areas in which scrub oak shrubland will be maintained and promoted.
- g. Use prescribed burning to maintain scrub oak shrubland in a variety of age classes and structure.
- h. Enhance wildlife habitat by leaving dead snags and logs where they lie.

8.5.3 Scrub Oak Shrubland Management

Controlled burning of the scrub oak habitats will occur every 8 years. The scrub oak habitat of the Impact Area is divided into eight burn units by roads. A burning rotation of these units every 8 years would require the burning of one of the eight units on an annual basis. Such a rotation would reduce dead standing fuel (i.e., snags) and regeneration of large woody tree species. The burns should be of low or moderate intensity to burn the finer fuels (i.e., litter and duff) that have accumulated on the

ground, while reducing the chances of widespread indiscriminate mortality that inevitably occurs during wildfires of high heat intensity. All prescribed burns on Camp Edwards should occur during the period of dormancy in order to minimize the mortality to wildlife. Furthermore, the relatively low rates of movement by the low-to-moderate intensity burns would allow the few animals active during this period (e.g., small mammals, rabbits, deer) to escape the fire. The only foreseeable wildlife mortality as a result of prescribed burning might be that of larval moths, small mammals, and other wildlife that may be active during this period (Ruffner and Patterson 2000a). However, the benefit to the critical Lepidopteran habitat is considered to outweigh that of the possibility of mortality to vulnerable fauna (Drake et al. 1988, Mello et al. 1999).

The MAARNG proposes to increase the size of the scrub oak shrubland to create a larger, more contiguous tract on Camp Edwards. This will be accomplished using prescribed burns and mechanical removal as the primary management techniques. A relatively large percentage of the area that will be converted to scrub oak shrubland is presently pitch pine scrub oak community. These areas will be burned to reduce the presence of immature tree species (e.g., pitch pine) and to promote the growth of scrub oak. The larger trees that may survive the cooler fires will be removed by mechanical means (i.e., cutting with chainsaws). Any trees that are cut will be left in place to provide cover for ground dwelling wildlife. Some of the larger trees should be girdled to provide dead snags as habitat for wildlife such as insects and cavity nesting birds. Periodic prescribed burns will serve to reduce the accumulation of woody plant debris on the ground and to discourage the growth of larger tree species.

8.6 Grasslands Management

8.6.1 Grasslands Management Introduction

Grassland-dwelling birds are suffering the most precipitous population declines of any habitat-specific group in the eastern United States. Annual Christmas Bird Counts going back in some cases 50 years, the Breeding Bird Survey, and various local studies have all documented decreases as great as 90 percent for such species as Upland Sandpiper, Northern Bobwhite, Grasshopper Sparrow, and Eastern Meadowlark.

Common to nearly all grassland birds is the extent of grassland required. Fields must be as large as a few hundred acres to support a population of these birds. It is important to note that this is not a territorial requirement; for example Grasshopper Sparrows will readily nest in a small, uncultivated strip in a large working farm field.

Setting aside enough habitats to preserve grassland birds poses a difficult challenge in Massachusetts and most areas of the northeast. At Camp Edwards, opportunity exists to manage large tracts of grassland. Many of the natural processes that once maintained this type of habitat, no longer occur. Development and agricultural practices are mostly incompatible with breeding habitat and nesting success, while such old fields, as do occur, eventually succeed to forest, or get sold for development. Large tracts of land used for military bases such as Camp Edwards, airports, and landfills are often compatible with the needs of grassland birds being in many cases the last refuge for grassland species (Jones, A. and P. Vickery 1997 and Maryland Partners in Flight 1999).

The grasslands of Camp Edwards are inhabited by four state-listed species of birds: the upland sandpiper (*Bartramia longicauda* - endangered), the grasshopper sparrow (*Ammodramus savannarum* - special concern), the vesper sparrow (*Poocetes graminus* - threatened), and the northern harrier (*Circus cyaneus* - threatened). In conjunction with those of Otis ANG Base, the grasslands of Camp Edwards, in 1985, supported the largest known population of upland sandpipers in Massachusetts and were therefore critical habitats for the species' survival (White and Melvin 1985). Since the 1985 survey, grassland areas on the MMR have ebbed and flowed with regards to natural succession (or restoration) and the number of grassland birds has reflected this. As of 2005 numbers of grassland bird species of concern are at or exceeding historic numbers. Four of the seven locations at which breeding pairs of upland sandpipers were observed by White and Melvin in 1984 and 1985 were military installations. This illustrates not only the importance of habitat management on military installations, but also that military installations often provide large amounts of unfragmented habitats that are crucial to rare and endangered wildlife species as a result of activities directly related to military training.

White and Melvin (1985) indicated that different bird species may prefer grasslands with differing characteristics. For instance, they stated that upland sandpipers would feed, nest, and raise young in short-grass fields that were recently mowed. However, taller vegetation often served as protective cover for young. In contrast, grasshopper sparrows preferred unmowed fields with scattered taller vegetation that were used for song perches. Furthermore, grasslands preferred by grasshopper sparrows tended to have relatively low stem densities and amounts of ground litter (Whitmore 1979, Whitmore 1981).

8.6.2 Grasslands Goals and Objectives

GOAL 1. Maintain and restore grassland communities on Camp Edwards for the purposes of rare species protection, wildlife habitat, and, at times, military training.

Objectives:

- a. Monitor grassland communities using RTLA methods.
- b. Provide special protection and habitat management that leads to the recovery of state-listed rare species including upland sandpiper and grasshopper sparrows.
- c. Decrease the presence of aggressive exotic plants (e.g., knapweed, honeysuckle, autumn olive.) using mowing, prescribed burning, or mechanical removal.
- d. Increase the presence of native grassland vegetation.
- e. Prevent conflicts between training site operations and rare species management.
- f. Monitor effects of training activities on animal and plant populations dependent on the grassland communities.
- g. Maintain or improve grassland bird species richness, productivity, and survivorship.

GOAL 2. Use prescribed fire and at times mowing as the primary means of grassland management while protecting and conserving natural and cultural resources.

Objectives:

- a. Apply the Camp Edwards Training Site, Integrated Fire Management Plan (2006) to maintain certain areas of the grasslands on Camp Edwards, remove accumulated litter, and control exotic invasive species.
- b. Using mowing regimes when appropriate to create short grass areas needed for some grassland bird species (e.g. upland sandpipers)
- c. Minimize the threat to human safety when conducting prescribed burns in the grasslands within the cantonment area of Camp Edwards.
- d. Set a precedent for grassland management to provide guidance to other branches of the military that manage grasslands on the MMR.

GOAL 3. Increase the acreage of grasslands on Camp Edwards as existing structures and facilities are demolished.

Objectives:

- a. Remove all structures associated with the facility.
- b. Plant only native grass and tree species.
- c. Maintain grasslands using prescribed fire and mowing regimes.

8.6.3 Grasslands Management

All activities and land uses are restricted from the grasslands in the Cantonment Area of Camp Edwards between 1 May and 31 July of each year. This time period should accommodate the period of nesting and brood-rearing by the state-listed grassland birds. Restricted activities include the following:

- mowing
- vehicle traffic in areas other than the established roads
- foot traffic in areas other than the established roads
- camping or bivouacking

Major grassland management activities such as large tree removal should be conducted either before or after 1 May to 31 July, the breeding season of the grassland birds. Other management activities such as small area burning must be conducted to ensure that effects on nesting grassland birds are minimized.

Grassland areas (Fig. 6-8), are currently being restored. Restoration has been successful if the basis for success is the number of grassland bird species surveyed (Table 6-9). Also, species of grassland-like birds that have not been previously recorded are now being documented such as the Clay-colored sparrow (*Spizella pallida*). These areas have been treated by removing trees, late spring prescribed burning, and when necessary, mowing. Mowing of 10-20 ft wide strips along roads and around buildings of the grassland units may occur throughout the summer.

Burning and mowing schedules should accommodate the annual use of grasslands by state-listed grassland birds while enhancing the habitats by removing large tree species. The periodic burning and mowing of the grasslands will serve to maintain the natural community, by preventing colonization of trees and shrubs. The following are further specific management recommendations for the grasslands of Camp Edwards (adapted from Jones, A. and P. Vickery 1997 and Maryland Partners in Flight 1999):

1. On Camp Edwards, grassland bird conservation efforts will be aimed at benefiting grassland breeding birds and target existing grasslands that are at least 100 acres (40 ha) or larger. These large tracts offer the best opportunity to

provide suitable habitat for entire grassland bird communities. A tract that is large enough to accommodate the area-sensitive species also benefits less sensitive species. Where there are management opportunities in smaller areas, efforts will focus on existing grasslands that are at least 25 acres (10 ha) in size.

2. When possible, grasslands on Camp Edwards will be adjacent or close to each other (less than 1/2 mile, or 1 km, apart), particularly if the areas are relatively small (25-100 acres, or 10-40 ha). Connecting strips, when feasible, will be developed and maintained between adjacent patches.

3. Grasslands on Camp Edwards will be managed to provide a diversity of grassland habitats and structure.

4. On Camp Edwards, grassland edge-to-area ratio will be minimized where possible.

5. Circular tracts are preferred, and square plots are better than rectangular ones. However, on Camp Edwards historic configuration of post structures and roadways has left square and rectangular grassland areas for management. Long, thin (less than 600 ft, or 185 m, wide), linear tracts and areas with highly convoluted or irregular borders will be avoided as these areas provide little or no benefit to most grassland breeding birds.

6. Non-native plants (e.g., Asiatic bittersweet, multiflora rose, Autumn olive, Japanese honeysuckle) within grasslands, and all other communities, will be eradicated, when possible, by current best management practices including but not limited to stump and paint application of herbicide and mechanical removal.

7. Fragmentation is a major concern for all habitats on Camp Edwards and regionally throughout the northeast. Fragmentation reduces the probability of attracting grassland birds, particularly highly area-sensitive species such as the Upland Sandpiper. With fragmentation, it is likely that nest predation will increase. Also, trees or shrubs that fragment grasslands can increase brood parasitism by providing cowbirds with perches close to nesting areas. Fragmentation of grasslands on Camp Edwards will be avoided, and when possible, sources of fragmentation (e.g. roads, groves of trees, hedgerows) will be removed. Hedgerows dominated by woody vegetation taller than 10 ft (3 m) or wider than 16 feet (5 m) will be cut or removed when practical.

8. Sharply contrasting edges between forest and grassland have higher nest predation rates as opposed to edges that are feathered. One benefit of such a practice is that these edges present longer lines-of-sight for cowbirds scanning for nests to parasitize. Where grassland habitats, on Camp Edwards, border forested habitats, a more natural, open or "feathered" edge between grassland

and forest will be encouraged rather than maintaining sharp, straight, contrasting walls of woody vegetation.

9. Native warm-season grasses, which grow during the summer rather than during the cooler spring and fall months, grow in clumps. Each clump is surrounded by relatively open areas that provide a network of travel lanes for birds. Tall fescue and other cold-season grasses, in contrast, form more uniformly dense stands, leaving little room for birds to move about and should not be used in grassland areas. On Camp Edwards, management efforts will be aimed at establishing native warm-season grasses as the dominant cover type. Use of cold-season grasses (e.g., Kentucky 31 tall fescue, bluegrass, and timothy) will be discouraged. The following are recommendations regarding management for native warm-season grasses:

a. Monotypic stands do not provide adequate habitat for birds, especially in the form of vegetative structure. It is more beneficial to plant a mixture of tall and short grasses, which result in a mosaic of vegetative heights. Recommended tall grasses include big bluestem, Indian grass, switch grass, and side-oats grama. Recommended short grasses include little bluestem and broomsedge. Because native warm-season grasses vary in soil and moisture requirements, some of the grasses will become dominant in some fields, or parts of larger fields, and other grasses in other fields or parts of fields, depending on soil moisture and fertility. As a result, the habitat will become more diverse and of greater benefit to birds. To further increase the diversity of the vegetation, native forbs can be encouraged (e.g. Butterfly Weed). These will help attract insects, which are a vital protein source for growing nestlings.

b. Maintain native warm-season grasses through prescribed burning.

i. Prescribed burns generally provide the most benefit to grassland bird communities. Burns should be conducted in late spring (May-early June) or late fall (October-November). In grasslands larger than 100 acres (40 ha), prescribed burns should be conducted on an annual rotation in which 20-30 percent of the total grassland area is burned during a single year. On smaller grasslands, annual burn areas may represent a larger percentage of the total grassland area, but should not exceed 50-60 percent.

c. Although mowing is often necessary for maintaining grasslands and preventing succession to forest, mowing should not be done during May-July, the breeding season for most grassland birds in Massachusetts. When mowing needs to be done during this period, the following should be followed to provide benefit to nesting birds:

- a. Concentrate mowing outside of mid-May to mid-July, the peak nesting period for the majority of grassland breeding birds.
 - b. During the breeding season, mow on a rotational basis, allowing some large (greater than 10 acres, or 4 ha) blocks or wide (greater than 300 ft, or 90 m) strips to remain unmowed for at least a 6-week period. Stagger the location of mowed sections so that the amount of contiguous unmowed area is maximized.
 - c. Use an annual rotational mowing system in which some sections are left unmowed each year; a mowing cycle of 3 to 5 years (depending on site conditions) is beneficial especially for species that need bushes or short trees for perches.
 - d. Use a cutting height of at least 10 inches (25 cm).
 - e. Favor early spring (March-early April) mowing over late summer-fall (August-October) mowing to provide winter habitat for grassland birds (e.g., Northern Bobwhite, Northern Harrier, Short-eared Owl). This will allow time for regrowth and seed production.
 - f. Mowed areas must be treated with prescribed fire every two to three years to remove the thatch layer and expose interstitial spaces among native bunch grasses.
10. Tall (more than 10 ft, or 3 m, in height) trees and snags will be removed from the parts of grasslands that are more than 300 feet (90 m) from the grassland edge. If not removed these structures may provide observation perches for avian nest predators or for Brown-headed Cowbirds scouting for host-species' nests to parasitize. However, a few small trees scattered throughout the area can improve habitat for species such as Field Sparrows, and American Kestrels. Within a regional context, it is probably best to protect and manage enough sites to provide a diversity of grassland habitats, ranging from prairie-like areas free of woody vegetation to lightly treed, savannah-like grasslands.
11. Current nest boxes for Eastern Bluebirds, wood ducks, American Kestrels, and bats will be maintained and others can be added for other species.
12. Human disturbance to grasslands will be minimized, especially during the nesting season.
13. Garbage and trash collection facilities and containers will be locked and or kept away from grassland areas as they can attract unwanted concentrations of predators.

14. Modifications or amendments to grassland management will be made as needed and that are appropriate and beneficial.

8.7 Wetland Resource Management

8.7.1 Wetland Resource Management Introduction

8.7.2 Wetland Resource Management Goals and Objectives

GOAL 1. Protect and maintain wetland communities on Camp Edwards for the purposes of rare species protection, water quality, and wildlife habitat.

Objectives:

- a. Prohibit activities except those associated with natural community management or restoration and travel along existing roads within the wetlands and their buffers.
- b. Monitor wetland communities using RTLA methods.
- c. Prevent the introduction of or colonization by invasive exotic species (e.g., *Phragmites sp.*, purple loosestrife) within the wetlands communities.
- d. Prevent the removal or draw-down of water from wetlands as a result of any activity, including the Upper Cape Water Supply Reserve Cooperative.
- e. Identify vernal pools on Camp Edwards and submit completed applications to NHESP for vernal pool certification.

GOAL 2. Restore disturbed wetland communities when necessary to their historic conditions to enhance rare species habitat, water quality, and biodiversity.

Objectives:

- a. Survey wetlands for visible signs of disturbance (e.g., erosion).
- b. Review historic aerial photographs of Camp Edwards to determine the changes, if any, to the size, shape, or condition of each wetland and its buffer
- c. Control and eliminate runoff and sedimentation within wetlands and their buffers using sound vegetative and land management practices.
- d. Conduct restoration activities, when practical and feasible, during periods of hibernation or inactivity (i.e., late fall and winter months).
- e. Abide by laws and regulations governing water resources, including, but not necessarily limited to the Massachusetts Wetland Protection Act, Massachusetts Endangered Species Act, and those pertaining to local conservation commissions.
- f. Monitor the success of restoration and rehabilitation of wetlands on at least an annual basis.

GOAL 3. Preserve and maintain water quality and quantity and recharge areas to existing water supply wells.

Objectives:

- a. Abide by and accommodate existing state and federal laws and regulations pertaining to water supply, the MMR Groundwater Protection Policy Plan, the CCC Regional Policy Plan's Water Quality Improvement sections, the Camp Edwards Spill Prevention Control and Countermeasures Plan, and MMR groundwater remediation and restoration programs.
- b. Allow only activities that are associated with the Upper Cape Water Supply Reserve Cooperative and the Camp Edwards Training Site within established wellhead protection zones.

8.7.3 Wetland Resource Management

A relatively small proportion, .39%, of Camp Edwards is covered by surface water. As a result, it is especially important to protect the wetlands and surrounding buffers throughout the training site. As mentioned in Chapter 2.3, any training activities that are potentially destructive to surface water resources of Camp Edwards are prohibited within the wetland habitats and their 100-foot buffers (Massachusetts General Law c. 131 § 40, 310 CMR 10)(Massachusetts National Guard 2001). Any land use that is proposed to occur within wetlands or their buffers must be reviewed by Camp Edwards Operations and Natural Resource Office (Camp Edwards Regulation 385-63, Range Safety), the Massachusetts Department of Environmental Protection's Wetlands Unit, and the Massachusetts Division of Fisheries and Wildlife, including the Natural Heritage and Endangered Species Program, at least 45 days before the activity is scheduled to take place.

Although Massachusetts General Law defines a 100-foot buffer to protect wetlands and vernal pools, certain species of wildlife, such as amphibians or odonates, might require a greater area of upland habitat surrounding wetlands. For instance, adult state-listed rare damselflies and dragonflies that inhabit Camp Edwards may roost in trees up to 250 or 1000 meters (825 or 3300 feet), respectively, from a wetland (J. Hull, pers. comm.). Therefore, aside from protecting the wetland that is inhabited by the odonate larvae, it is also necessary to consider the upland habitat requirements of the adults. Establishing a buffer that exceeds 100 feet around a particular wetland to protect the natural community or even a single species of plant or animal does not necessarily restrict all activities from taking place. Rather, the apparent threats to the wetland or species should be identified and minimized either altogether or during important activity periods. Activity near most wetlands on Camp Edwards, with the exception of vehicle travel on existing roads and remediation projects, usually does not occur within areas that often exceed the required 100 foot buffer. Please see Chapter 9.3

for a more complete discussion of the conservation of state-listed rare odonates on Camp Edwards.

A 500-foot seasonal buffer has been established for all wetlands per the MANG FEIR (2001). This buffer restriction is in place from 1 March through 15 June.

Although Army Regulation 200-3 requires no net loss of wetlands on Camp Edwards, any loss of wetlands is unacceptable to the MAARNG. In the event that a portion of a wetland or its buffer is negatively impacted due to an activity, it must be restored to the condition prior to the disturbance. An assessment will be made to determine whether natural recovery will be sufficient or if a greater effort is required. For instance, if a vehicle accidentally travels on the edge of a road within a wetland buffer and impacts the vegetation, natural recovery may be appropriate. However, if past activities such as the construction of roads or a land bridge has resulted in erosion and sedimentation of a wetland, a restoration plan will be created as a LRAM project to restore the site to its historic condition. The recovery of the wetland will be monitored using RTLA and other survey methods to determine if the efforts were successful. If recovery was not successful, restoration efforts will continue until the site has fully recovered.

8.7.4 Groundwater Management

All land uses on the Camp Edwards Training Site must conform to MAARNG, Camp Edwards, Department of Defense, local town, and Massachusetts State regulations pertaining to groundwater resources and wellhead protection. These regulations include, but are not necessarily limited to the following:

- Safe Drinking Water Act (40 CFR 141, 144-147)
- Clean Water Act (40 CFR 61, 33 USC 1251-1387)
- State Drinking Water Regulations (310 CMR 22.00)
- State Wellhead Protection Act (310 CMR 22.21)
- Water Management Act (310 CMR 36.00)

Land uses on Camp Edwards must not interfere with current or future restoration or remediation projects or with the distribution of water supplies to the surrounding Upper Cape towns. Furthermore, the extraction, use, and transfer of groundwater resources must not degrade or impact natural resources, aquatic or terrestrial habitats on Camp Edwards.

Water quality management on Camp Edwards, as pertaining to public water supply, is based upon compliance with the Groundwater Protection Policy Plan. All land uses on Camp Edwards must adhere to the requirements and regulatory

restrictions of the Groundwater Protection Policy Plan. In addition, water quality management on Camp Edwards includes the following regulations:

- Federal water supply regulations
- State water supply regulations
- Spill Prevention Control and Countermeasures Plan

For further information regarding groundwater management, consult the current annual State of the Reservation Report.

8.8 Research and Monitoring

8.8.1 Research and Monitoring Introduction

The primary method for monitoring the natural communities of Camp Edwards will be the RTLA Program (see Chapter 7.2). However, other monitoring methods may be employed when the RTLA methods do not meet the requirements for a specific monitoring goal. For instance, the Camp Edwards Natural Resource Office has developed methods for monitoring the restoration and revegetation of monitoring well pads on Camp Edwards. After a new well is created, the excavated pad is photographed and its area is measured. The well pad is described and photographed and percent ground covered by vegetation is estimated every three months after the initial description. In addition to these monitoring programs, the populations of state-listed rare species that have been documented on Camp Edwards are monitored each year. The site where a particular species was documented is visited each summer and the state of the population is assessed to determine the relative size of the population and changes, if any, since the previous year.

8.8.2 Research and Monitoring Goals and Objectives

GOAL 1. Conduct long-term monitoring to determine the effects of training and management practices on the natural resources of Camp Edwards to preserve training.

Objectives:

- a. Continue the Camp Edwards RTLA monitoring program on an annual basis.
- b. Implement other monitoring programs in conjunction with the RTLA Program when additional information is required.

GOAL 2. Design and implement research projects to address specific resource or natural community concerns or interests on Camp Edwards.

Objectives:

- a. Determine a purpose or need for conducting each research project.
- b. Research projects funded by the MAARNG should focus on continuing inventories of flora and fauna as well as projects addressing the status and requirements of rare species that inhabit Camp Edwards.
- c. Describe the results of each project in a final report including the benefits to training and readiness.

8.8.3 Projects, Research, and Surveys

In addition to implementing the ITAM Program on Camp Edwards, the Natural Resource Office also conducts research, projects, and surveys. A proposal will be developed and reviewed for each project.

As one of the largest undeveloped parcels of land on Cape Cod, Camp Edwards may be considered an ideal site for conducting field research. In the past, researchers affiliated with state universities, non-profit organizations, as well as state and federal environmental agencies have conducted surveys or research projects on Camp Edwards, either as contractors or independently. Any person that is affiliated with the aforementioned organizations, and is interested in conducting research on Camp Edwards, should submit a research proposal to the Camp Edwards Natural Resource Office for review.

The projects, research, and surveys that have been proposed for FY 2008-2013 include, but are not necessarily limited to, the following:

Groundwater Studies

At the MMR there are two major clean-up programs that are investigating soil and groundwater contamination caused by past activities. They are, the Installation Restoration Program (IRP) managed by the Air Force Center for Environmental Excellence and the Impact Area Groundwater Study Program (IAGWSP) managed by the Army Environmental Center. The IRP is a Comprehensive Environmental Response, Compensation, and Recovery Act (CERCLA) based investigation and remediation program and the IAGWSP investigation and remediation decisions are based on the Safe Drinking Water Act (SDWA). The IAGWSP area of investigation is in the Camp Edwards training area with the sources of contamination linked to some military training and government contract weapons testing; the significant contaminants to groundwater include RDX and perchlorate, both of which are explosive by-products. More information on the specifics of these programs can be found on their respect web sites; www.mmr.org and <http://groundwaterprogram.army.mil>.

Additionally, the US Geological Survey (USGS) has conducted a variety of studies on the aquifer to provide information to the two clean up programs, the EPA and the Massachusetts Department of Environmental Protection as well as stand alone research on the water resources of Massachusetts. The USGS has installed a monitoring well near the mound of the aquifer's Sagamore Lens, which is in the training area, to measure the height of the water table based on annual precipitation. For further information of the USGS visit their website at <http://ma.water.usgs.gov>.

Due to the efforts of the two clean-up programs and with only minimal surface water bodies at Camp Edwards, the Natural Resource Office has focused their efforts, with respect to groundwater monitoring, on ecosystem management as identified in section 8.8.2 Research and Monitoring Introduction. Plus, the MAARNG will be exploring options to assess the need to conduct periodic surface water monitoring to support the ecosystem management venues in section 8.2.2. However, the MAARNG has initiated two programs that will increase its assessment of how training may be affecting the groundwater. The first program, started in 2006, is to create a Small Arms Management Plan/Pollution Prevention Plan that will incorporate best management practices in monitoring the activities of small arms training and reduces the footprint on the environment. A component of this program will be to install lysimeters and groundwater wells to measure pore water and groundwater. The second program was initiated in 2004, which was to start an investigation based on its current use of the tungsten-nylon small arms ammunition.

Fate and Transport of Tungsten at Camp Edward's Small Arms Ranges

In response to the EMC, the MAARNG requested that the Army Environmental Center conduct a feasibility study on the mobility of tungsten that is left on the small arms ranges as a result of firing tungsten-nylon ammunition on the ranges at Camp Edwards. Due to the issue of the Administrative Orders by EPA in 1997, which stopped the firing of lead based ammunition, the MAARNG switched to the recently released "green" ammunition issued by the Army; the MAARNG began firing this new tungsten-nylon bullet in October 1999. When the MAARNG starting using this ammunition for small arms training it was considered a safe and environmentally friendly ammunition that could stay on the range after training; however by 2004 there was sufficient scientific information for the MAARNG to assess whether the use of this ammunition, specifically tungsten, could affect the environment, whether soil or groundwater.

The feasibility field work for the mobility study began in June 2005 and samples were collected in the soil, in pour water, and in the groundwater. Sampling results have shown tungsten is reaching the groundwater, and while tungsten is not currently regulated by the MassDEP or EPA, the values were significant enough to temporarily suspend firing and try to determine whether tungsten does represent a threat to the

environment. The report for the field work is due in the fall of 2006; and, AEC has decided to expand its' initial study and will be conducting a Phase II by installing additional monitoring wells on other ranges to further understand the possible extent of the tungsten and possible impact to the groundwater.

Wetlands Rehabilitation (1999-present)

The wetlands rehabilitation will serve to reduce or eliminate soil erosion into wetlands or their buffers and to restore ponds to their historic conditions, if deemed beneficial to the natural resources of the wetlands. Activities include: removing soil that was deposited by erosion or filling, implementing erosion control techniques, revegetating wetland buffers, and closing roads adjacent to the wetlands. Prior to any disturbance in or near the wetlands of Camp Edwards, the Natural Resource Office will consult and coordinate with the Massachusetts DEP, NHESP, and appropriate local conservation commission. Notification of, and consultation with, the Wampanoag Tribe is required under Section 106 of the NHPA prior to excavation or earth-moving activities near all wetlands. Inadvertent discovery of cultural resources should be reported to the Camp Edwards Natural Resource Office. All necessary consultation and permitting procedures will be conducted prior to disturbing wetlands or regulated wetland buffers.

Road Closures (1999-present)

Roads that pose a threat to sensitive habitat areas have been seasonally or permanently closed as long as there is no net loss to maneuver areas (Table 8-1). These roads are most often associated with wetland buffers. Seasonal closures are from 1 March through 15 June and occur at designated roads through out the training area that are within the 500 ft regulatory buffer of a wetland.

Table 8-1. Seasonal and permanent road closures on Camp Edwards

Road	Training Area	Seasonal Closure	Permanent Closure
Deep Bottom Pond Road	Bravo 9		X
Orchard Road	Bravo 10	X	
Spruce Swamp Road	Charly 14	X	
Unnamed road between Spruce Swamp and Sandwich Roads	Charly 15		X
Jefferson Road between Burgoyne and Orchard	Bravo 10	X	

Avery Road at Wood Road	Bravo 9	X	
Tank Trail	Bravo 8	X	
Canal View Road at the Rod and Gun Club	Rod and Gun Club	X	

Erosion Control (1997-present)

All roads, improved (i.e., paved or gravel) or unimproved (i.e., dirt), are and will be maintained to prevent erosion. Roads will be graded and stabilized and proper drainage will be constructed or maintained to prevent soil erosion. The Roads and Grounds Crew of the Division of Facilities and Engineers or other MAARNG engineering units will conduct work that requires heavy machinery; however contractors may be used when funds are available.

MAARNG personnel and contractors should be aware of the potential for impacting cultural resources during any ground disturbing activity associated with erosion control. Any erosion control project that results in ground disturbance off of established roads must be reviewed by the Wampanoag Tribe, as mandated by Section 106 of NHPA.

In areas where road erosion might occur, hay bales and silt fences will be installed as a temporary means of erosion control, with the ultimate goal of stabilizing roads to eliminate soil erosion. The condition of the roads on Camp Edwards will be monitored on a regular basis and erosion control measures will be implemented where necessary.

Bivouac Restoration (2000-present)

The purpose of bivouac sites is to assemble or camp in an area that provides tactical concealment, both horizontal and vertical, which depends directly upon existing vegetation. Some of the bivouac sites on Camp Edwards have been negatively impacted by overuse, which has resulted in vegetation loss, soil compaction, and erosion. In some cases, numerous access points to a bivouac have been created.

Bivouac site restoration includes closing any unnecessary access points and stabilizes others, as well as to restore the soil and vegetation to promote growth and concealment for troops. Compacted soil will be aerated and protected from erosion using wood chips, hay bales, and silt fences until native vegetation can be established. Wood chips will also be used to protect the root stock of existing trees and shrubs. New trees and shrubs will be planted or transplanted from other areas of Camp Edwards to stabilize soil and provide additional concealment within the bivouac sites. All plantings in the bivouac sites will be native species.

Ground disturbing activities (e.g., planting vegetation, grading the soil surface) associated with bivouac restoration have the potential to impact cultural resources on Camp Edwards. Consultation with the Wampanoag Tribe prior to these activities is required under Section 106 of NHPA

Landing Zone Restoration (2000-present)

Most of the helicopter landing zones (LZs) on Camp Edwards are obsolete and in disrepair. This is due to the change in air frame from the Huey to the Blackhawk, woody vegetation encroachment, well drilling practices, etc. Thus, many of these LZs are no longer safe for landing. This has resulted in a loss of training area for MAARNG Aviation personnel. Coordination with MAARNG aviation has been initiated to determine needs and restore the existing LZs on Camp Edwards to a useable condition by removing trees, debris, and regrading the ground surface. Any ground disturbing activities require prior consultation with the Wampanoag Tribe.

Bat Survey

Mist-netting was conducted throughout the training areas of Camp Edwards during the summers of 1999, 2000, and 2001. This survey will be continued to determine the species distribution among the different natural communities of Camp Edwards and to aid in the habitat use and home range study.

Whip-poor-will Survey and Habitat Use and Home Range Research Project

The Caprimulginae (Aves: Caprimulgiformes: Caprimulgidae) are crepuscular/nocturnal insectivores that occur virtually worldwide (Cleere 1998). In the Nearctic, the subfamily is represented by several species including; the Whip-poor-will (*Caprimulgus vociferus*). Due to its nocturnal habits the Whip-poor-will is one of the most poorly known species in North America. This species is a ground-nester that inhabits oak-pine forests (Cleere 1998); laying two eggs on bare ground (Bent 1940). The Whip-poor-will is double brooded (Cleere 1998). Young are incubated and reared by both sexes, however diurnal incubation is usually by the female (Bent 1940). Males are territorial and will give their characteristic song from song posts within their territories (Bent 1940). Singing activity varies with moonlight (Bent 1940). Feeding is done low, over the ground. Insects are consumed during short sallies from the ground or from perches (Bent 1940). Typical foods include; moths, beetles, crickets, grasshoppers and mosquitoes (Cleere 1998).

A regional decline in population has been documented over the last several years. The lack of information on this species makes developing management strategies nearly impossible. The study will provide data on Whip-poor-will density, micro-

habitat (nesting), spatial and overall habitat use and requirements. Data derived from this study is essential for developing Whip-poor-will conservation and management strategies on Camp Edwards (MMR) and other suitable habitats throughout the region.

Areas of highest Whip-poor-will density on Camp Edwards are determined by point counts, and abundance will be determined by the presence of singing males. Ten individuals are captured per year in mist nets and given USFWS leg bands. Tape-playback is used to lure the birds to the nets (Mengel et al. 1972, Mills 1986). The nest site will be found by scanning the area near where each bird is captured for eye shine with hand-held spotlights, and by random encounters. Nests will be monitored periodically throughout the season to determine nesting success. Microhabitat of each nesting site will be examined. The nest sites will be marked. Marking will allow for diurnal determination of vegetative composition of all territories, according to the methods of Dueser and Shugart (1978).

This study focuses on the habitat use by the species and their home range. The relatively large tracts of undisturbed forest on Camp Edwards most likely provide desirable habitat for whip-poor-wills, a species that has declined in abundance due to habitat loss from forest fragmentation, urban development, and lack of wildland fire.

Ten Whip-poor-wills are fitted with radio transmitters per year. Transmitters are affixed using elastic harnesses according to the methods of Brigham (1988) and are retrieved before fall migration. Individuals are tracked three times per week. Observation periods alternate. These periods will be 6:00am to 8:00pm, 8:00pm to 1:00am, and 1:00am to 6:00am. These periods allow for the determination of nesting, roosting, and feeding habitats used on Camp Edwards. This information will also be used to determine individual and overall home ranges of Whip-poor-wills on Camp Edwards.

Management efforts are focused on maintaining large un-fragmented tracts of land here on Camp Edwards, and when possible increasing the size of these tracts. Also, through a proactive fire management program habitat diversities will be maintained which is found to be beneficial for this species.

Eastern Box Turtle Habitat Selection and Hibernation Thermal Ecology Research Project

The purpose of the eastern box turtle research project on Camp Edwards, Massachusetts, was to: (1) determine the characteristics of the microhabitats in which the turtles are located and whether or not the turtles select a microhabitat with particular resources or conditions; (2) to quantify the daily movements and home ranges of the turtles; (3) to attempt to determine the abundance of eastern box turtles throughout the various habitats of Camp Edwards. Two important objectives for this project were to standardize the methods of the study so that they may be repeated each

year in the future and to successfully monitor the movements and habitat selection of the same ten individual box turtles over the course of multiple (5) years.

Eastern box turtles were fitted with radio transmitters during 1998-2004 (n=10) to monitor their movements on Camp Edwards. Turtles were located throughout the summer to determine habitat preferences and the relation of microhabitat characteristics to those of the home range used by the turtle.

Management efforts are focused on maintaining large un-fragmented tracts of land here on Camp Edwards and when possible increasing the size of these tracts. Also, through a proactive fire management program habitat diversities will be maintained which appears to be essential to maintaining healthy populations of box turtles.

Finally, a proactive educational plan has been implemented at Camp Edwards beginning in 1998 to educate Camp Edwards land users to the importance of this species and so that notification is made to the Camp Edwards Natural Resource Office when Box Turtles are found on site. Wanted posters asking to report all box turtle sightings have been placed throughout the MMR-buildings and kiosks. All reports are filed with the Natural Heritage and Endangered Species Program of the Division of Fisheries and Wildlife at the end of the field season.

Amphibian Survey

A comprehensive amphibian survey has not been conducted for most wetlands on Camp Edwards. Monument Swamp and Raccoon Swamp were surveyed for three years during spring amphibian migrations, and vernal pool surveys are conducted each year on as many wetlands as feasible. To date (spring 2006), 12 vernal pools have been certified by MA NHESP. A quantitative survey should be conducted on the rest of the major wetland communities to determine the species diversity and abundance throughout Camp Edwards. Surveys will be conducted for the remaining ponds and wetlands as well as the terrestrial communities of Camp Edwards. The surveys should be conducted for at least one year, between March and July during the height of the activity (e.g., breeding) period.

Reptile Survey

Little effort has been made to systematically document all reptiles that occur on Camp Edwards. Therefore, a comprehensive survey of the reptiles of Camp Edwards is necessary. A survey of the ponds and wetlands Camp Edwards for aquatic turtles has been conducted sporadically in the past. The presence of the spotted turtle in two of the wetlands (Monument and Raccoon Swamp) of Camp Edwards warrants a more comprehensive survey. The survey will involve live trapping throughout the summer

to assess the species diversity and abundance within each of the ponds and wetlands on Camp Edwards. The survey should be conducted for at least one year, between May and July, the height of the active season of the turtles. A survey of terrestrial reptiles may be conducted using pitfall traps with drift fences, plywood boards placed in open, sunny areas, or other appropriate techniques

Grassland Bird Survey

A grassland bird survey was conducted in the cantonment area of the MMR in 1985, during which one of the largest populations of upland sandpipers in Massachusetts was documented. Since that time, trees and shrubs have colonized much of the grasslands on Camp Edwards. Grassland birds were also surveyed in 1995, 1997, 1998, and 2001-2006. The increase in abundance of upland sandpipers and grasshopper sparrows (Table 6-9) can likely be attributed to a change in mowing schedules and subsequent restoration of the cantonment area grasslands. Grassland bird surveys assist in the management of the grasslands by documenting the population sizes and distribution. Surveys are conducted between April and August, the breeding season for most grassland birds.

Odonate Survey

Surveys for dragonflies and damselflies have been conducted since 1995. The presence of five state-listed rare odonate species on Camp Edwards justify the necessity to conduct a comprehensive survey to determine species distribution and to identify not only the aquatic habitats, but also the upland habitats used by the species. A comprehensive survey should be conducted for at least one year, between May and August to encompass all of the flight periods of the state-listed rare odonates on Camp Edwards.

American Burying Beetle Survey

The American burying beetle (*Nicrophorus americanus*) is a federally-listed rare insect species; the geographic range of which has historically included Massachusetts. The relatively close proximity of an identified population in Rhode Island and large tracts of undisturbed open woodland forest on Camp Edwards provide a likely possibility of the species occurring on Camp Edwards. A survey for American burying beetles on Camp Edwards would be conducted under the guidance of NHESP.

New England Cottontail Survey

On August 30th, 2000, the US Fish and Wildlife Service received a petition requesting the need to list the New England Cottontail (*Sylvilagus transitionalis*) as a threatened or endangered species. Findings indicated that the petitioned action may be

warranted and that a full status review is needed. Consequently, the New England Cottontail is officially acknowledged as a species in need of conservation attention (as a candidate species).

The New England Cottontail is a medium sized cottontail rabbit, weighing approximately 2.2 lbs. It can be distinguished from its counterpart, the Eastern Cottontail by several features including pelage color, body size, and skull characteristics. The external characteristics of pelage and body size are not 100% reliable; however, the skull characteristics are very trustworthy. This lagomorph is considered an early successional forest species with suitable habitat comprising both of forested and shrub lands with dense understory growth.

With the introduction of the Eastern Cottontail in 1930's, fragmentation of habitat as the human population grows, and higher predation and hunting rates as the habitat is more and more fragmented, have all contributed to the decline of this species. It has been found that large patches of habitat, like that of Camp Edwards, are essential for sustaining populations of this species.

Camp Edwards is considered, by some, to be the stronghold for this species on Cape Cod. A baseline survey was conducted on Camp Edwards in 2006. The study will be carried out for at least two additional years to provide information on population status and habitat requirements on Camp Edwards.

Camp Edwards Box Project

Camp Edwards, with the aid of the Senior Environmental Corps (SEC), maintains a bluebird trail in the cantonment area. In addition to bluebird boxes, bat/duck boxes were built and placed into the wetlands of the training area. These boxes provide nesting habitat for up to two wood duck pairs and additional space for 1000's of roosting bats. To date, there are several bats in four of the boxes located on Donnelly Pond, Baileys Pond, Little Halfway Pond, and Rod and Gun Club South Pond. These boxes will be maintained and monitored yearly for species use and success with the aid of the SEC.

8.9 Fire Management

This section is derived from the Integrated Fire Management Plan (2006) for the Camp Edwards Training Site.

8.9.1 Fire Management Introduction

The natural communities found on the Camp Edwards Training Site (CETS) are fire dependant systems resulting from the interaction with fire through time. With

Euro-American influence, the natural fire regime has mostly been suppressed and replaced with infrequent human induced catastrophic fires. Further anthropogenic changes to the environment surrounding Camp Edwards has greatly accelerated in recent times with home building and population growth, creating a severe Wildland Urban Interface (WUI). Given this scenario, the MAARNG aims to proactively address and plan for wildland fire using a landscape-scale approach outlined in an Integrated Fire Management Plan (IFMP). The goal of the IFMP is to support the military mission of the Camp Edwards Training Site, while promoting the sustainment of native biological systems and their inherent processes by encouraging sound fire management planning, policy, and procedure.

It is the intent of the MAARNG and other stake holders that fire be reintroduced to this system by taking a landscape scale approach. It is critical to the success of this undertaking that wildland and prescribed fire planning is in place to ensure the most ecologically sound and safest approach to this endeavor.

The overriding goal of fire management on Camp Edwards is to support the mission of the training site (combat readiness), while promoting a diverse ecosystem, public safety, and protection of the surrounding community from wildland fire.

General program direction for Fire Management on Camp Edwards is:

- To guide the decision making process-where safety, social, political, and resource values are evaluated with appropriate management.
- To provide a framework for fuels management through the use of prescribed fire.
- To provide a platform to cooperate in planning and implementing a fire program within and across agency boundaries.

Program operations include preparedness, prevention, fuels management, and suppression. Current scientific knowledge (at the local and international scale), historical background, and operational standards have been incorporated to accomplish resource and fire management goals and objectives. Also fire management on Camp Edwards will evolve with the scientific knowledge domain and as new operational protocols are developed. On-going review and updates for fire management will consequently be prepared by the Massachusetts Army National Guard, Natural Resource Office, Camp Edwards.

8.9.2 Fire Management Goals and Objectives

GOAL 1. Prevent wildfires from resulting in a threat to life and property on Camp Edwards and to surrounding towns.

Objectives:

- a. Restore and maintain existing and historical firebreaks that would be beneficial and enhance the effectiveness of wildfire suppression and wildland fuel reduction activities.
- b. Reduce wildland fuel loads with the use of prescribed fire and other fuel treatment techniques.
- c. Provide wildland fire prevention education to the users of Camp Edwards.

GOAL 2. Restore and maintain the ecological processes that have occurred historically across the Camp Edwards landscape in such a manner so as to promote viable plant and animal populations and communities.

Objectives:

- a. Revert and restore plant and animal communities to varied stages of early ecological succession with the use of prescribed fire and other vegetation management techniques.
- b. Maintain these varied stages of ecological succession on the Camp Edwards landscape with the use of prescribed fire and other vegetation management techniques.
- c. Ensure that specific plant and animal community targets complement the overall ecological health and diversity of the southeastern Massachusetts region.
- d. Ensure that prescribed fire and vegetation management techniques are conducted in such a manner that a healthy and varied suite of plant and animal population is maintained.
- e. When possible conduct large scale landscape level treatments (greater than 300 acres in size) in such a manner that the ecological results of historical large scale natural disturbances are reintroduced to the southeastern Massachusetts' region.

GOAL 3. Establish an informed and effective fire management program that will facilitate the accomplishment of Fire Management Goals 1 and 2.

Objectives:

- a. Establish and maintain a cadre of staff that has experience and training in fire management techniques and practices.
- b. Conduct fire management planning that uses best available information to refine fire management goals and objectives over time.

- c. Monitor the success of fire management activities using the Land Condition Trend Analysis Method in addition to other methods as needed.
- d. Ensure that the users of Camp Edwards and surrounding towns are kept informed on the fire management activities at Camp Edwards and of the benefits associated with these activities.
- e. Ensure that the capacity to execute fire management goals and objectives is established and maintained through a combination of direct action and partnering with other organizations.

8.9.3 Fire Management

Much of the vegetation of Camp Edwards is characterized as pitch pine and scrub oak barrens. Comprised of various combinations of tree and scrub oaks and pitch pine, the vegetation is the product of wildfires and human disturbance activities including timber cutting, grazing, and military training exercises. Many of the largest fires occurring in Massachusetts in the last 50 years have originated within Camp Edwards. Some have threatened surrounding developments and communities, all of which are expanding rapidly along the installation boundary.

Long viewed by foresters and the public as "wastelands" to be converted to other uses (e.g. planting to more valuable timber species, conversion to agriculture, or as sites for industrial and residential development), "barrens" are now seen as unique landscapes which serve as habitat for a number of rare plant, insect and animal species. Almost without exception, they also serve to protect aquifers that are becoming increasingly important to the rapidly developing population.

Land managers recognize that the management of pine barrens systems requires the use of prescribed fires, which has the advantage of duplicating the natural role of fire in regenerating barrens vegetation and retarding succession to more tolerant species. Many areas in the northeast are now too fragmented by development to employ prescribed fire at a cost-efficient level in terms of acres treated per year. Camp Edwards is one of the few remaining barrens north of New Jersey for which the use of prescribed fire to reduce wildfire hazard and maintain valued landscape features is still a viable alternative. In the IFMP, the history of fire on the land that is Camp Edwards, the ecological importance fire-adapted communities, and options that exist to reduce the threat of wildfire while maintaining the ecological integrity are discussed and evaluated.

Fire management options include continuation of past policies of suppressing wildfires, a continuation and expansion of efforts to implement a prescribed fire program, which began in the early 1980s, and the mechanical manipulation of fuels to reduce fire hazard.

Suppression alone will not eliminate the risk for wildfires. Although fires may occur less frequently, they will, inevitably occur, and at intensities that will defy control and threaten human resources, both on Camp Edwards and on adjacent public and private property. Prevention, detection and suppression of wildfires should remain a priority for local fire control organizations, but resource managers must, at the same time, actively work to reduce fuel loads in areas where flammable fuels have accumulated as a result of past management. Mechanical reduction of fuel loads can be employed effectively on high priority areas, but the cost of mechanically treating large areas, and the hazard of unexploded ordinance in some portions of the installation, preclude relying solely on mechanical measures for reducing hazardous fuel accumulations. The ecological effects on sensitive species of mechanically “chopping” or “shredding” fuels are unknown.

Camp Edwards environmental management staff, and Massachusetts Military Reservation staff in cooperation with the MADFW, MA Bureau of Fire Control, the University of Massachusetts, the Nature Conservancy and other non-profits, have learned much from past efforts to employ prescribed fire at Camp Edwards. The program has resulted in the burning of more than 3,955 acres since 1983 (Table 8-2) and has the support of local fire chiefs, conservation, and land management agencies/organizations.

Table 8-2. Historic prescribed fire activity for Camp Edwards, 1983-2005.

Date	Location	Area Burned (acres)
1983	—	370
1984	—	126
1985	—	494
1989	—	600
1990	—	404
1991	—	10
1993	—	400
1994	—	45
2000	—	88
3/1/2000	NW corner of IA	40
3/23/2000	NW corner of IA	40
3/28/2003	MMR Cantonment, Area 1, Sub-Unit A & B	40
5/15/2003	MMR Camp Edwards, Training Area Buffer	20
5/16/2003	MMR Camp Edwards, A2	223
11/10/2003	MMR Cantonment, Area 1, Sub-Unit D, E, & F	50
11/10/2003	Cantonment 1	50
5/14/2004	A-4	186
5/18/2004	Cantonment 1	1
5/19/2004	Cantonment 1	1
5/20/2004	Cantonment 1	3
6/3/2004	A-3/1 East	5
6/4/2004	A-3/1 East	1
6/8/2004	A-3/1 East	58
6/9/2004	A-3/1 East	222
6/24/2004	A-1/3 West	200
10/7/2004	BA-3 East	40
10/8/2004	BA-3 East	40
5/10/2005	Cantonment Area	1
5/11/2005	Cantonment Area	3
5/12/2005	Cantonment Area	3
5/19/2005	Cantonment Area	15
5/20/2005	Cantonment Area	5
6/8/2005	BA-3	20
6/9/2005	BA-3	149
6/24/2005	B Range	2
Total:		3955

8.9.4 Fire Management Blocks

Delineation of Fire Management Blocks (FMB) at Camp Edwards is based upon numerous influences including vegetation composition/fuel type, topographic features, training area configurations, reservation boundaries, desired ecological effects, safety for people and property, common management objectives at the local scale and other management constraints (Figure 8-1). Burn unit boundaries within a given FMB, in general, reflect present training subsections (i.e. A-1 through A-6, B-7 through B-12, and C-13 through C-16; Figure 8-2). Site specific burn plans will reflect the training unit organization in most cases. In most instances, management objective for a given unit will be dictated by the FMB it falls within. Specific planning for those areas outside of the current training ground configuration will be considered when required. Block descriptions, dominant management objectives, and pre-selected strategies to accomplish zone specific targets are as follows:

Fire Management Block A:

Description - FMB A is 2230 acres in size and located along the western side of Camp Edwards along route 28 in the Town of Bourne (Figure 8-1). FMB-A lies in glacial moraine deposits, with pitch pine - oak forest found as the dominant vegetation community in the block (83 % of the block). Pitch pine - scrub oak community, immature pitch pine, and some small disturbed and developed areas make up a very minor portion of the vegetation cover in the block. The dominant fuel models in the block include custom fuel model (CFM) 1, 2, and 3. Alternatively, past prescribed burn plans have used standard fuel model (SFM) 8, 4, 6, and 9 to model fire spread and flame height. Training Areas A-1 through A-6, unit BA-3, and unit BA-4 are located with FMB-A.

Management Objective - General management objectives for this block are to, initially, conduct growing season burns to develop a patch work of early successional habitat within, to conduct dormant season burns to reduce fuel loads, the duff layer, and for overall maintenance. Growing season burns will enable the relief of the canopy that will in turn aid in the creation of an early successional patch work dynamic. These burns will create standing dead wood, which is distinctly lacking in this system, and snags that provides habitat for a variety of flora and fauna. Site specific objectives will be addressed in unit specific burn plans.

Fire Management Block B:

Description – FMB B, 3119 acres in size, is found in the northwest corner of Camp Edwards, in the Town of Bourne, closest to Cape Cod Canal (Figure 8-1). The most complex topography on Camp Edwards is found in this block, which is part of the Sandwich and Buzzards Bay terminal moraines. Pitch pine – oak forest is the prevailing block vegetation cover (68 %), though pitch pine – scrub oak community, black oak – scarlet oak forest, scrub oak shrubland, and Scotch pine dominated stands make-up minor components. The main fuel models for this block include CFM 1, 2, and 3. The Training Areas B-7 through B-12 structures the block.

Management Objective - General management objectives for this block are to, initially, conduct growing season burns to maintain the patch work dynamic of early successional habitat that already exist, to conduct dormant season burns to reduce fuel loads, the duff layer, and for overall maintenance. Growing season burns will maintain the canopy openings that will provide for early successional patch dynamics. These burns will create standing dead wood, which is distinctly lacking in this system, and snags that provides habitat for a variety of flora and fauna. Dormant season burns will provide for the maintenance of the hardwood component of this management block. Site specific objectives will be addressed in unit specific burn plans

Fire Management Block C:

Description – FMB C is 2023 acres, and lies in the northeastern portion of Camp Edwards in the Town of Sandwich, with its northern border adjacent to Route 6, the mid-Cape Highway (Figure 8-1). Glacial moraine constitutes the accumulated soils in the block. Pitch pine – oak forest form the primary vegetation cover in the block (62 % of the block); however, pitch pine – scrub oak communities, black oak – scarlet oak forests, scrub oak shrublands, and disturbed areas are also observed. Important fuel models include CFM 2, 3, and SFM 6. The Training Areas C-13 through C16 builds the block.

Management Objective - General management objectives for this block are to, initially, conduct growing season burns to maintain the patch work dynamic of early successional habitat that already exist, to conduct dormant season burns to reduce fuel loads, the duff layer, and for overall maintenance. Growing season burns will maintain the canopy openings that will provide for early successional patch dynamics. These burns will create standing dead wood, which is distinctly lacking in this system, and

snags that provides habitat for a variety of flora and fauna. Dormant season burns will also provide for the maintenance of the hardwood component of this management block. Site specific objectives will be addressed in unit specific burn plans

Fire Management Block D:

Description – FMB D is a 2546 acre, narrow, horseshoe shaped section wrapping around to the northern, southern, and western margins of the Impact Area (Figure 8-1). The block rests within the towns of Bourne and Sandwich. Its main vegetation cover is pitch pine – oak forest (42 %), though pitch pine scrub oak community (31 %), scrub oak shrubland, black oak – scarlet oak forest (10 %), cultural grassland (.4 %), and sandplain heathland (9 %) are also important cover types. Fuel models linked to this block include CFM 2, 3, and 4, but SFM 5 and 6 should also be considered. The small arms range areas and the BA-5 training areas are situated in this management block.

Management Objective - General management objectives for this block are to conduct growing season burns to maintain the patch work dynamic of early successional habitats that exist, to conduct dormant season burns to reduce fuel loads, the duff layer, and for overall maintenance. Several areas within this block will need management similar to the objectives stated for the previously mentioned blocks. These objectives will be addressed in unit specific burn plans.

Fire Management Block E:

Description – FMB E rests on the eastern side of Camp Edwards in the Town of Sandwich along Route 130 (Figure 8-1). Its total area is 1037 acres. The major vegetation types include pitch pine – oak forest (43 %), sandplain heathland (18 %), and pitch pine – scrub oak community (28 %), while pitch pine community, cultural grassland, and disturbed areas function as minor vegetative components. Custom Fuel Models 2, and 3 are the dominant models for describing this block. Standard Fuel Models 5 and 6 also are significant. Several small arms ranges, a Coast Guard facility, and two antenna farms one subsurface and one above ground occur within this management block.

Management Objective - General management objectives for this block are to conduct growing season burns to maintain the patch work dynamic of early successional habitats that exist, to conduct dormant season burns

to reduce fuel loads, the duff layer, and for overall maintenance. Site specific objectives will be addressed in unit specific burn plans.

Fire Management Block F:

Description – FMB F is located in the southeast corner of Camp Edwards, Sandwich, Massachusetts and measures 1734 acres. Soils in the management block are classified of the outwash plain. The major vegetation types are pitch pine – scrub oak community (48 %), pitch pine – oak forest (23 %), and developed areas (12.5 %). Minor vegetation classes in the block include cultural grassland, scrub oak shrubland, black oak – scarlet oak forest, and disturbed areas. Custom Fuel Models 2, 3, and 4 prove most important. Training areas BA-1, BA-2, BA-6, and the 1800 area are found in this FMB.

Management Objective - General management objectives for this block are to conduct dormant season burns to top kill pitch pine – scrub oak community flora, primarily scruboak. Other objectives are to conduct growing season burns to maintain patch work dynamics of early successional habitats, to conduct dormant season burns to reduce fuel loads, the duff layer, and for overall maintenance. Site specific objectives will be addressed in unit specific burn plans, for example hardwood areas of this block will be burned during the dormant season for the purpose of maintenance.

Fire Management Block G:

Description – FMB G is a disjunct management area measuring 572 acres and abuts Otis Airfield in the Mashpee outwash plains. The major vegetation classes include cultural grassland (47 % of the block), sandplain heathland (23 %) , pitch pine – scrub oak community (8%), and developed areas (22 % of the block); significant fuel models being SFM 1, 2, 5 and 6, and CFM 2 and 3. Training areas 1100, 1200, 1300, 1500, 1600, 1700, and 2800 are within FMB- G.

Management Objective - General management objectives for this block are to conduct growing season burns, late May to early June, to stimulate grassland species growth, remove thatch layer, to kill small woody vegetation, and for overall maintenance. Site specific objectives will be addressed in unit specific burn plans.

Fire Management Block IA:

Description – FMB IA, 2197 acres in dimension, encompasses the Impact Area of Camp Edwards and is located approximately in the center of the base and within the towns of Bourne and Sandwich (Figure 8-1). Vegetation is mainly composed of scrub oak shrubland (67 % of the block), though pitch pine – oak forest, pitch pine – scrub oak community, immature pitch pine and disturbed areas are observed. Custom Fuel Model 4 is the most important in the management block.

Management Objective - General management objectives for this block are to conduct dormant or early season burns to top kill scrub oak (90%) and to kill pitch pine saplings. Other objectives are to conduct growing season burns to maintain patch work dynamics of early successional species, to conduct dormant season burns to reduce fuel loads, the duff layer, and for overall maintenance. Site specific objectives will be addressed in unit specific burn plans.

Figure 8-1. Prescribed Fire Management Blocks on Camp Edwards, MA.

March 2006, MAARNG GIS, MassGIS, Michael Ciaranca, Natural Resource Manager

Figure 8-2. Burn Units on Camp Edwards, MA

March 2006, MAARNG GIS, MassGIS, Michael Ciaranca, Natural Resource Manager

8.9.5 Smoke Management Zones

Awareness of smoke production, transport, and effects in conjunction with knowledge and implementation of control strategies maximizes the effectiveness of using fire as a tool. The purpose of smoke management on Camp Edwards is to prevent health and safety hazards by minimizing the amount of smoke entering sensitive areas (i.e., populated areas, hospitals, nursing homes, etc...), to avoid significant deterioration of air quality, and to eliminate visibility impacts on roadways or runways. Compliance with laws and regulations set by the U.S. EPA (i.e., the Federal Clean Air Act) and the state of MADEP (i.e., the Massachusetts Clean Air Act) is foremost in all fire management planning and implementation. Over-arching control strategies include:

- Avoidance – using meteorological conditions when planning burns to avoid impingement of smoke into smoke sensitive area.
- Dilution – controlling the amount of emissions for dispersion to assure tolerable concentrations of smoke in designated areas.
- Emissions reduction - using techniques to minimize the smoke output per unit area and decrease the contribution to regional haze as well as intrusions into smoke sensitive areas.

To aid in the success of smoke management on Camp Edwards, Smoke Management Zones (SMZ) were created that identify preferred wind direction when planning prescribed fire for a given area (Figure 8-3). These parameters serve as a guide to fire planners and managers when identifying the proper control strategies necessary for local scale management realization.

Figure 8-3. Smoke Management Zones for Camp Edwards, MA.

March 2006, MAARNG GIS, MassGIS, Michael Ciaranca, Natural Resource Manager

8.10 Integrated Pest Management

8.10.1 Integrated Pest Management Introduction

The purpose of the Integrated Pest Management Plan (IPMP) is to describe pest management activities performed by and for the MAARNG. The contents of the plan apply to all activities and individuals working, residing or otherwise doing business on MAARNG installations, and are implemented to the maximum extent possible. Pest management operations are conducted in a manner respectful to the health and safety of personnel and the environment.

Pest management responsibility begins with those individuals who occupy or maintain buildings or open space on the installation. Non-chemical control efforts are used to the maximum extent possible before pesticides are used. This is done using Integrated Pest Management (IPM) principles that consist of the judicious use of both chemical and non-chemical control techniques to achieve effective pest management with minimal environmental contamination. The plan is a working document and will be updated in an ongoing basis to reflect actual pest management practices.

The MAARNG IPMP describes the organization's pest management requirements, outlines the resources necessary for surveillance and control, and the administrative, safety and environmental requirements of the program. The program requires state-certified contract pest management technicians to control pests.

Pests that are discussed in the plan include cockroaches and other crawling insects (e.g., crickets, earwigs, and ants), medically important pests such as ticks, mosquitoes, rodents, other vertebrate pests, and various plant pests. Without control, these pests could interfere with the military mission, damage real property, increase maintenance costs, and expose installation personnel to diseases.

8.10.2 Integrated Pest Management Goals and Objectives

GOAL 1. Ensure that the Camp Edwards INRMP is consistent with and supports the principles of the MAARNG Integrated Pest Management Plan to maximize safety and minimize pesticide use.

Objectives:

- a. Control invasive exotic plants and pest animals in a manner that supports the military mission, promotes sustained ecosystem functionality, and favors native species.
- b. Update the MAARNG Integrated Pest Management Plan on a regular basis.

- c. Conduct a comprehensive pest plant inventory and supply information regarding areas on Camp Edwards needing invasive pest plant removal.
- d. Apply the most effective strategies when managing pest populations.

8.10.3. Invasive Plant Species

Non-native invasive plant species are relatively uncommon throughout Camp Edwards. A roadside survey of the training area, conducted by the Senior Environment Corps, was conducted from 2003-2004. The Impact Area Groundwater Study Program and the annual RTLA surveys also report occurrences of invasive plants through their annual floristic surveys. The results showed that although certain species may be abundant in small, localized areas, they are generally not widely dispersed throughout the installation. Ten exotic invasive plant species have been documented as potentially posing a threat to native plant communities. Plans for removal of exotic or invasive species from Camp Edwards are coordinated with appropriate representatives from the MA NHESP to reduce risk to state-listed rare plant species. Prescribed fire and fire break maintenance will play an important role in control and management of invasive plant species on Camp Edwards. The following is the list of the 10 exotic invasive plant species documented on Camp Edwards that potentially pose a threat to native plant communities.

Japanease knotweed (*Polygonum cuspidatum*) has been found on a few well pads as well as in the cantonment area. These plants are destroyed immediately upon verification to avoid this quickly spreading invasive from getting a foothold on Camp Edwards. These occurrences are associated with fill.

Scotch broom (*Cytisus scoparius*), a popular ornamental, is known to occur on a few monitoring well pads in the impact area of Camp Edwards. These individuals were likely introduced in the fill used to create the pads. As they are detected, they are removed by mechanical methods.

Asiatic bittersweet (*Celastrus orbiculatus*) has been documented along the fenceline at Greeway Rd. and Canal View near housing, as well as several individuals throughout the training and cantonment area. This quickly spreading vine is being treated with the stump and paint method of herbicide application.

Japanese barberry (*Berberus thunbergii*) has been found in dense thickets in the C-16 area of Camp Edwards. The species readily propagates through seeds that drop from the plant or are dispersed by birds. Japanese barberry outcompetes other shrubs and herbaceous vegetation, creating dense, thorny thickets that pose a threat to wildlife. The species is managed through mechanical removal, and the stump and paint method of herbicide application.

Phragmites australis, otherwise called common reed, has been observed in disturbed grassland areas of Camp Edwards as well as wetlands associated with the Rod and Gun Club. The propagation of *Phragmites* occurs at a relatively high rate through underground rhizomes or wind-dispersed seeds. The establishment of *Phragmites* in the wetlands of Camp Edwards can result in a lower diversity of aquatic vegetation as *Phragmites* outcompetes the other species. Mechanical removal of the plant, including the roots, is likely the most effective method of control.

Knapweed (*Centaurea maculosa*) exists throughout the grasslands in the southern portion of Camp Edwards. The species is considered to be highly invasive in previously disturbed grassland areas. The management of knapweed in the grasslands may be achieved through periodic prescribed burning during the summer to create hot fires to consume fine debris. Although mowing temporarily controls knapweed, it likely serves to disperse seeds from the plant, resulting in a greater distribution of the species. It has been observed that the knotweed densities on Camp Edwards decrease as native plants increase in number.

Black locust (*Robinia pseudoacacia*) is relatively common in northern portion of the base along the gas pipeline. Although black locust may have been present on Cape Cod since the 18th Century, it is still an exotic invasive species. A management strategy will be developed to control black locust in the event that the species dominates a particular area of Camp Edwards in the future.

Scotch pine (*Pinus sylvestris*) was introduced to Shawme State Forest, which eventually became Camp Edwards north of Wood Road, as plantations between 1925 and 1934 (US Department of Agriculture 1932). Other planted species include Austrian pine, white pine, red pine, Spanish pine, Douglas fir, balsam fir, Norway spruce, and larch. Relatively small, isolated stands of scotch pine remain in the northern areas of Camp Edwards. Removal of these stands would provide land for native forest communities to increase in size. The scotch pine stands on Camp Edwards will be delineated and proposed for removal.

Autumn olive (*Eleagnus umbellata*) has been documented in previously disturbed sites within the cantonment area and along roadsides of the training areas of Camp Edwards. Although autumn olive is often considered a food source for wildlife, it is questionable as to its value as such. Nonetheless, the species is a non-native invasive plant that has the potential to outcompete native plant species. The most effective method for control of autumn olive is likely mechanical removal.

Japanese honeysuckle (*Lonicera japonica*) is a highly invasive plant that is often associated with the habitat of broad tinker's weed (*Triosteum perfoliatum*), a state-listed rare plant. In order to protect the habitat of broad-tinker's weed, Japanese honeysuckle are removed from areas in which they pose a threat to state-listed rare plants. All

known populations of state-listed rare plants are surveyed each year to assess the size and health of the population.

8.10.4 Common Pests of Camp Edwards

Other potential pests at Camp Edwards are ubiquitous pests that have the potential to create problems. Examples of these can be seen in Table 8-3.

Table 8-3. Common pests and their potential locations on Camp Edwards, MA.

Pest	Location
German Cockroaches	Housing, Food Service Facilities, Barracks, Offices
American Cockroaches	Crawl Spaces, Steam Tunnels, Sewers
Filth Flies	Food Service Facilities
Stored Product Insects	Food Handling Facilities
Mosquitoes	Training Sites - Bivouac Areas
Ants	Family Housing
Ants (Carpenter)	Wooden Buildings and Structures
Spiders	Buildings and Other Structures
Minor Nuisance Crawling Pests	Family Housing, Administrative Buildings, etc.
Bees and Wasps	Occupied Buildings
Subterranean Termites	Building and Other Structures
Fleas	Family Housing and Other Buildings
Mites	In or Around Buildings or Residences
Tent Caterpillars	Shade and Ornamental Trees
Gypsy Moths	Shade and Ornamental Trees
Rodents	Food Service and Storage Facilities
Rodents (Mice)	Housing, Offices, Barracks
Raccoons	Housing, Offices, Barracks
Birds (Pigeons, Starlings)	Warehouses, Loading Docks, Other Buildings
Birds (Geese)	Lawns, Mowed Grasslands
Feral House Cats	Cantonment Area, in Abandoned Buildings
Incidental Vertebrate Pests	In, Under, and Around Post Buildings
Ornamental Shrub Insect Pests	Common Areas
Turf Insect Pests	Lawns, Grassy Areas
Ticks	Wood and Shrub Margins, Overgrown Areas
Common Reed (<i>Phragmites sp.</i>)	Grasslands, disturbed areas
Knapweed	Grasslands
Japanese Barberry	Forested areas, grasslands

8.10.5 Integrated Pest Management Principles

The four basic principles described below are the emphasis of Integrated Pest Management (IPM), and are indicative of the philosophy of the MAARNG. While any one of these methods may solve a pest problem, often several methods are used concurrently, particularly if long-term control is needed. For example, screens may be used to prevent mosquitoes from entering buildings, eliminating artificial breeding sites will control larval mosquito habitat, and pesticides may be used to kill adult mosquitoes. Screens will protect people inside, but do little to keep people from being bitten outdoors. Larval control may eliminate mosquito breeding on the installation, but will not prevent adult insects from flying to the installation from surrounding areas. Chemicals will kill most flying mosquitoes. Although chemical control is an integral part of IPM, non-chemical control is stressed. Chemical control is almost always a temporary measure and, in the long run, more expensive. Non-chemical control, which may initially be more expensive than chemicals, will usually be more cost effective in the long run. Non-chemical controls also have the added advantage of being nontoxic, thereby reducing potential risk to human health and the environment.

Mechanical and Physical Control

Mechanical and physical control alters the environment in which a pest lives, traps and removes pests where they are not wanted, or excludes pests. Examples of this type control include: harborage elimination in structures through caulking or filling voids, screening, mechanical traps or glue boards, and nets and other barriers to prevent entry into buildings.

Cultural Control

Strategies in this method involve manipulating environmental conditions to suppress or eliminate pests. For example, planting or replacing ornamental trees and shrubbery with native plants would be less attractive to defoliating pests and would therefore reduce their occurrence.

Biological Control

Biological control involves using predators, parasites, or disease organisms to control pest populations. For example, parasitic wasps and highly specific bacteria, viruses, and fungi have been used to control gypsy moth. Biological control may be effective by itself, but is often used in conjunction with other types of control. All forms of biological control must be reviewed by the DFW before implementation for potential impacts to state-listed rare species.

Chemical Control

Chemicals were once considered to be the most effective control available, but pests have developed a resistance, rendering many pesticides ineffective. In recent years, the trend has been to use pesticides that have limited residual action. While this has reduced human exposure and lessened environmental impact, the cost of chemical control has risen due to requirements for more frequent application. Since personal protection and special handling and storage requirements are necessary with the use of chemicals, the overall cost of using chemicals as a sole means of control can be relatively expensive when compared with non-chemical control methods. When applied to plants, chemical control, especially when integrated with mechanical methods, may be the most effective and ecologically sound method of controlling invasive exotic species.

8.11 Cultural Resources Management

8.11.1 Cultural Resources Goals and Objectives

GOAL 1. Preserve and protect cultural resources on Camp Edwards in accordance with state and federal laws and regulations.

Objectives:

- a. Comply with all federal, state, and local laws and regulations pertaining to cultural resources found on the training site.

GOAL 2. Consult with applicable federally recognized American Indian Tribes to receive their guidance on preservation of cultural resources on Camp Edwards.

Objectives:

- a. Determine with which federally recognized American Indian Tribes consultation should occur.
- b. Encourage the creation of a memorandum of agreement (MOA) between the MAARNG and the tribes.
- c. Develop standard operating procedures (SOPs) for addressing the protection of cultural resources during specific activities (e.g., excavation) that may potentially impact those resources.

GOAL 3. Continue to develop and implement an Integrated Cultural Resources Management Plan (ICRMP) for all MAARNG properties.

8.11.2 Cultural Resources Management Policies

Activities or management practices undertaken by the MAARNG that involve ground disturbance of any kind have the potential to impact cultural resources on Camp Edwards. These activities may include brush removal, grading, revegetation, and excavation. Any of these activities that are federally funded are considered a

federal undertaking and would require consultation under Section 106 of the National Historic Preservation Act.

The natural resource management practices that are proposed to occur during the implementation of the Camp Edwards INRMP must comply with the following statutes:

- NEPA- National Environmental Policy Act
- NHPA- National Historic Preservation Act
- AIRFA- American Indian Religious Freedom Act
- NAGPRA- Native American Grave Protection and Repatriation Act
- AIRFA- American Indian Religious Freedom Act
- Executive Order 13007- requires the protection and preservation of American Indian Sacred Sites and practices.

To ensure compliance with the aforementioned statutes, the following policies have been established:

- MAARNG units and environmental personnel shall not remove or disturb, or cause or permit to be removed or disturbed, any historical, archaeological, architectural or other cultural artifacts, relics, vestiges, remains or objects of antiquity. In order to avoid disturbance of cultural resources, units should coordinate with the Camp Edwards Range Control and Natural Resource Office when planning training and other activities to ensure that potentially disruptive activities are located away from sensitive areas.
- If buried cultural resources, such as chipped or ground stone, historic debris, building foundations, or human bone, are inadvertently discovered during ground-disturbing activities, work will stop in that area and within 100 feet of the find until a qualified archaeologist can assess the significance of the find and, if necessary, develop appropriate treatment measures in consultation with the Wampanoag Tribe of Gay Head Aquinnah, the Wampanoag Tribe of Mashpee, THPO(Tribal Historic Preservation Officer) and any other appropriate federally recognized tribes, the SHPO(State Historic Preservation Officer) and other appropriate agencies.
- If human remains of Native American origin are discovered during construction or other activities, it is necessary to comply with state laws relating to the

disposition of Native American burials, which fall within the jurisdiction of the Native American Heritage Commission (Pub. Res. Code Sec. 5097). If any human remains are discovered or recognized in any location other than a dedicated cemetery, there will be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains the procedures outlined in the ICRMP have been followed. If human remains are discovered during a unit activity or any other time, contact the Camp Edwards Natural Resource Office immediately.

- Government-to-government consultation with federally recognized American Indian Tribes is required by the following Army Regulations, Federal laws, and Executive Orders:
 - AR 200-4 requires that an ICRMP be developed and implemented by the end of FY01 and revised every five years thereafter.
 - Section 106 of the NHPA requires that, in relation to properties eligible or listed in the National Register of Historic Places, portions of the ICRMP be developed from the beginning stages with the recommendations of the respective American Indian Tribes as well as the SHPO
 - Executive Order 13175, Consultation and Coordination with Indian Tribal Governments (05 Jan 01)-The Primary goal is to strengthen the unique legal relationships as one domestic independent government interacting with another. It confirms the sovereign rights of the Indian tribes. This impacts those federally recognized Indian tribes listed on the Federally recognized Indian Tribe List Act of 1994.
 - 14 Sept 2006, DoDI4710.02-DoD Interactions with federally-recognized Tribes
 - NEPA requires public participation and input as well as the development of an EA in conjunction with the ICRMP
- Government-to-government consultation with recognized American Indian Tribes is required by the following Army Regulations, laws, and Executive Orders:
 - DA PAM 200-4 - This pamphlet provides guidance for implementation of the cultural resources requirement in AR 200-4.

- DoDI 4715.3 - Implements policy, assigns responsibilities, and establishes procedures for the integrated management of cultural and natural resources on properties under DoD control.
- National Historic Preservation Act (NHPA) - Establishes historic preservation as a national policy and defines it as the protection, rehabilitation, restoration, and reconstruction of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, or engineering.
- ARPA - Archaeological Resources Protection Act-Prohibits the removal, sale, receipt, and interstate transportation of archeological resources obtained illegally (without permits) from public or Indian lands and authorizes agency permit procedures for investigations of archaeological resources on public lands under the agency's control.

8.11.3 Cultural Resources Contributions to Natural Community Management

Cultural resources investigations on Camp Edwards have the potential for contributing to natural community management decisions. Data that are recovered from archaeological site investigations on Camp Edwards pertaining to floral and faunal remains as well as pollen analysis can provide insight as to the historic composition of the surrounding natural communities. Such information would enable the natural resources managers to determine the native plant and animal species and communities and their changes throughout time and therefore which species, and natural communities, should be sustained.

8.11.4 Sacred Site Protection

Under AIRFA and EO 13007, federal agencies or agencies that receive federal funds are required to allow Native Americans reasonable access to lands that contain sacred sites. In addition, MAARNG activities should be conducted to avoid adverse effects to the integrity of sacred sites on Camp Edwards and to provide reasonable notice to American Indian Tribes when management activities might restrict future access or when adverse impacts to the sites may occur.

Sacred sites may include topographical features of the natural environment, past occupation sites, burial sites, building ruins, plant, animal, and mineral gathering areas, and geologic features that may be indistinguishable from the surrounding environment. American Indian tribes are in no way required to divulge the location of sacred sites on an installation or the reason for their classification as a sacred site.

In the event that sacred sites are located on Camp Edwards, they will be protected from adverse impacts. The modification to the terrain and changes to the species composition of a sacred site could significantly impact the sacredness of the site and therefore affect Native American cultural practices. Such an occurrence would result in non-compliance with EO 13007 and NHPA. Management of natural communities that are associated with sacred sites or locations that are utilized in traditional Native American practices should focus on the preservation and enhancement of the sites or practices and their integration into the overall natural resources management plan.

8.11.5 Cultural Resources Management at Camp Edwards

Cultural resources management at Camp Edwards was initiated in 2000. Two federally recognized tribes exist in eastern Massachusetts- the Wampanoag Tribe of Gay Head (Aquinnah) and the Wampanoag Tribe of Mashpee. However, in the future it may be determined that other tribes may claim ancestral rights to lands occupied by the MAARNG. Formal consultation with the Wampanoag Tribe has included site visits and exchanges of information (e.g., environmental assessments and cultural resources survey reports from Camp Edwards). A formal consultation process between the MAARNG and the Wampanoag Tribe has been completed for the Wampanoag Tribe of Gay Head (Aquinnah) and will be initiated with the Wampanoag Tribe of Mashpee during the fall of 2007 to address the ongoing activities at Camp Edwards. Topics for discussion during the initial consultation meeting include, but are not necessarily limited to, the following:

- Existence of any sacred places and historic sites on Camp Edwards.
- Establishing SOPs for preserving cultural resources on Camp Edwards.
- Future comprehensive cultural resources survey of Camp Edwards.
- Collection of flora and fauna for cultural use. The following have been identified as a sampling of species that are culturally significant to the Wampanoag Tribe of Gayhead Aquinnah once the consultation process is completed those significant to the Wampanoag Tribe of Mashpee will be include in the next revision of this document:

Alternate Leaf Dogwood
American Hazelnut
Bayberry
Black Gum
Black Huckleberry
Brown-fruit Rush
Canada St. John's-wort
Common Rush
Early Goldenrod

Grass Leaved Goldenrod
Hispid Swamp Dewberry
Large Cranberry
Pignut Hickory
Purple St. John's-wort
Rough-stemmed Goldenrod
Sassafras
Sweet Pepper Bush
Sweet Vernal Grass
Wintergreen
Witch Hazel
Eastern box turtle
Eastern painted turtle
Musk turtle
Redtailed Hawk
Snapping turtle
Spotted turtle

- Activities occurring on Camp Edwards that have the potential for impacting cultural resources, including, but not limited to, training, the Upper Cape Water Supply Project and the Impact Area Groundwater Study.

As a result of formal consultation, the MAARNG has fostered a secure and friendly cooperative working relationship with the Wampanoag Tribe. Through this relationship, the MAARNG developed an Integrated Cultural Resources Management Plan (ICRMP) for Camp Edwards and all other MAARNG properties that will serve to identify the cultural resources on Camp Edwards, address the potential impacts to the resources, and protect all cultural resources from degradation or loss.

8.12 Outdoor Recreation Management

8.12.1 Outdoor Recreation Introduction

DoD Directive 4700.4, Natural Resources Management Program (24 January 1989), states, "DoD lands shall be available to the public and DoD employees for enjoyment and use of natural resources, except when a specific determination has been made that a military mission prevents such access for safety or security reasons or that the natural resources will not support such usage."

8.12.2 Outdoor Recreation Goals and Objectives

GOAL 1. Provide opportunities for outdoor recreation to members of the public and the military while maintaining ecosystem integrity and function as well as no net loss to military training on Camp Edwards.

Objectives:

- a. Continue the hunting programs on Camp Edwards.
- b. Maintain sports fields within the cantonment area.
- c. Provide public access upon request when consistent with the military mission.
- d. Continue the collection of flora and fauna for cultural use

8.12.3 Outdoor Recreation Opportunities on Camp Edwards

Camp Edwards has been a limited access facility since September 11, 2001. Persons interested in utilizing Camp Edwards for recreational or other purposes must request access from Camp Edwards Headquarters, Range Control, and the Environmental and Readiness Center. Consistent with this, an SOP for hunting on Camp Edwards was created by the Natural Resource Office in conjunction with Camp Edwards HQ, Facilities Engineers, Range Control, MADFW, The Senior Environmental Corps., and the Otis Rod and Gun Club. The basis of this SOP, is to plan each hunt in an open format with all interested parties present to avoid confusion as to dates, off limit areas and staffing.

Camp Edwards has extensive outdoor recreation opportunities such as:

- Hunting
- Wildlife viewing (e.g., grassland birds)
- Sports fields (e.g., baseball, soccer, lacrosse)
- Camping and training opportunities for scouting groups (e.g., Boy Scouts, Sea Cadets)
- Running races, triathlons, and bicycle races
- Collection of flora and fauna for cultural use

The following limitations on public access have been set in certain areas and for certain activities:

Due to the presence of hazards related to training activities, the Impact Area is always closed to public access. Some possible threats to public safety related to training activities include: live firing, training residue (e.g., unexploded ordnance, training “fox” holes), and training mechanisms (for example, moving targets). All of these are potential hazards within and surrounding the Impact Area. For this reason, public access to the Impact Area is strictly prohibited, without exception.

Certain recreational activities are prohibited on Camp Edwards, due to potential risks and conflicts with military training activities and potential damage to natural resources. These activities may include, but not necessarily be limited to, motorcycle, ATV, mountain bike, and horseback riding, camping, and building fires. Any person entering the training site for any purpose prohibited by law or lawful regulation is trespassing. It may endanger the life of the person entering the training site as well as potentially endangering lives of the MAARNG and interfering with training.

8.13 Natural Resources Law Enforcement

8.13.1 Natural Resource Law Enforcement Introduction

To ensure the success of natural resources management, effective enforcement is essential. Hunting harvest controls, wetlands protection, water pollution prevention, and rare species protection, for example, are dependant upon law enforcement. Range Control and Natural Resource Office personnel conduct patrols on a regular basis to assess the condition of the natural resources and to monitor all activities at the Camp Edwards Training Site. Camp Edwards Range Control personnel patrol sites that are used for training purposes before, during, and after each activity to ensure that neither range safety nor environmental regulations have been violated. If a violation has occurred, the users are held responsible and required to correct the violation. For instance, if a MAARNG unit uses a bivouac site for training purposes, Camp Edwards Range Control inspects it prior to their departure to ensure compliance with applicable regulations (e.g., garbage is picked up, foxholes are filled in, vegetation has not been damaged).

During the hunting season, Environmental Police Officers enforce state hunting regulations on Camp Edwards. For purposes of enforcing state hunting regulations, Camp Edwards falls under the jurisdiction of the Commonwealth of Massachusetts.

The Wampanoag Tribe of Gay Head Aquinnah and Mashpee, once cosulation is completed (initiated fall 2007), as well as other appropriate federally recognized tribes are allowed cultural-hunting and gathering rights year round. Range Control and Natural Resource Office personnel must be notified and proper tribal identification carried and displayed.

Illegal ATV use in and around Camp Edwards has been on the rise. Natural resources (wetlands), cultural resources (certain kettle deprerssions), and military resources (range complexes) are being affected as more, and larger, vehicles illegally utilize Camp Edwards. As a result of this, a task force has been set up consisting of Army National Guard, Coast Guard, Environmental police, and State and local police. The purpose of this force is to monitor and conduct "sting" operations to ticket illegal

users, and seize unregistered vehicles. It is hoped that if conducted seasonally, illegal use will be reduced.

8.13.2 Natural Resource Law Enforcement Goals and Objectives

GOAL 1. Minimize illegal ATV, motorcycle, and mountain bike use in the training area of Camp Edwards

Objectives:

- a. Identify and report to Range Control illegal access points
- b. Request Facilities Engineers to sign and block off identified illegal access points
- c. Coordinate law enforcement efforts for ATV, motorcycle, and mountain bike illegal use with the state and surrounding communities.

CHAPTER 9. CONSERVATION OF LISTED RARE SPECIES

9.1 Introduction

An objective of the Camp Edwards INRMP is to protect and conserve listed rare species while continually achieving the training requirements of the MAARNG. Identifying the distribution, abundance, and requirements of these species is essential in conservation. The general requirements of the state-listed rare species on Camp Edwards will be determined from field investigations as well as from consultation with experts, Massachusetts NHESP Fact Sheets found at <http://www.mass.gov/dfwele/dfw/nhesp/nhfact.htm>, and other scientific literature.

Any management activities that are proposed for conserving listed rare species will be coordinated with recommendations and advice from the appropriate federal and/or state environmental agencies, including, but not necessarily limited to, the United States Fish and Wildlife Service, the Massachusetts NHESP of DFW. Maps will be created to display the general vicinity of state-listed rare species and distributed only to Camp Edwards Range Control and Natural Resource Office personnel to aid in the protection of the species.

Federally listed species are protected under the Endangered Species Act of 1973 as amended through the 108th Congress, while State listed rare species are protected under the Massachusetts Endangered Species Act (MESA) (G.L. c. 131A) and its implementing regulations (321 CMR 10.00). MESA prohibits a “take” of state-listed rare species. “Take,” in reference to animals means to harass, harm, pursue, hunt, shoot, hound, kill, trap, capture, collect, process, disrupt, the nesting, breeding, feeding, or migratory activity, or attempt to engage in any such conduct, or to assist such conduct, and in reference to plants means to collect, pick, kill, transplant, cut, or process or attempt to engage or assist in any such conduct. Management activities proposed for Camp Edwards that have the potential to affect rare species will follow regulations set forth within 321 CMR 10.00 and the agreement stated on Appendix F of this document.

9.2 Plants

Five state-listed rare species of plants have been documented on Camp Edwards- northern white cedar (*Thuja occidentalis*), ovate Spike Sedge (*Eleocharis ovata*), Torrey’s beak rush (*Rhynchospora torreyana*), broad tinker’s weed (*Triosteum perfoliatum*), and Adder’s tongue fern (*Ophioglossum pusillum*). In most cases, the state-listed rare plant species exist in relatively small, localized populations on Camp Edwards. Each of these species was first documented during the initial floristic survey, site inspections, or annual RTLA plant surveys.

The sites at which these species were observed are revisited each year to reassess the size and relative health of the populations. Rare plant observation forms are completed and submitted to the MA NHESP at the end of each field season. The successional state of the habitat in which the plants occur and prefer will also be documented to benefit the long-term management of the species. If the habitat in which a state-listed rare plant species occurs is gradually succeeding toward a less desirable state, then management strategies will be implemented to benefit the species. Prior to being conducted, all activities within the vicinity of these species must be reviewed and approved by Camp Edwards Range Control Officer and the Natural Resource Office.

9.3 Odonates

Five species of state-listed rare odonates, 2 dragonflies (i.e., comet darner - *Anax longipes*, spatterdock darner - *Aeshna mutata*) and 3 damselflies (i.e., New England bluet - *Enallagma laterale*, Pine Barrens bluet - *Enallagma recurvatum*, and tule bluet - *Enallagma carunculatum*) have been documented on Camp Edwards. The conservation of these species is complex in that the habitat requirements of the species include not only wetland communities, but also upland forest communities for roosting, reproductive development, and traveling between aquatic habitats. Threats to odonate survival include, but are not necessarily limited to, the following:

Aquatic larvae

- Lowering of water level by draining, extraction, or diversion.
- Destruction of habitat by filling, removal of substrate, construction work, or earth moving.
- Direct effects of insecticides used in mosquito control.
- Water acidification by monotypic forestation with conifers.
- Increase of predation on larvae by stocking or propagation of fish, or by introduction of domestic ducks.

Adults

- Destruction of uplands, forests, and meadows in which adults feed and finish reproductive development before returning to the aquatic habitat to mate and lay eggs.
- Degradation of egg laying sites within the emergent vegetation along the wetland margins.
- Direct and indirect effects of insecticide application.
- Road mortality of adult dragonflies and damselflies.

The conservation of state-listed rare odonates on Camp Edwards depends upon reducing or eliminating these threats within the habitats used by these species. Wetlands restrictions prevent any of the threats to aquatic larvae from occurring, however, activities within the upland habitats beyond the regulated 100-foot wetland

buffer are somewhat less restricted. Surveys have documented the existence of the four state-listed rare odonates on Camp Edwards as occurring in the Rod and Gun Club Ponds, Donnelly Pond, and Deep Bottom Pond. Adult dragonflies and damselflies often utilize upland forest habitat up to 1000 meters and 250 meters, respectively, from the aquatic habitats (J. Hull, pers. comm.). Furthermore, the powerlines that run north to south along the western edge of Camp Edwards most likely serve as a travel corridor between the ponds for adult odonates, since they often travel between ponds along forested roads (J. Hull, pers. comm.).

Land uses within the areas encompassed by the 1000 and 250 meter distances from the Rod and Gun Club Ponds, Donnelly Pond, and Deep Bottom Pond should accommodate the likely presence of adult odonates between May and August, the general flight periods for these species. Activities that could, but may not necessarily occur within these flight areas on Camp Edwards include, land clearing and vehicle traffic. It is not necessarily proposed that these two activities should never occur within the flight areas between May and August, but rather that vehicle traffic should occur with caution and that any land clearing be approved by the Camp Edwards Natural Resource Office and reviewed by the Massachusetts NHESP. By reducing or eliminating threats to larval and adult state-listed rare odonates, the MAARNG can provide essential habitat for these species while resulting in no net loss of training land.

9.4 Moths

At least 10 of the 16 state-listed rare moth species on Camp Edwards are dependent upon the scrub oak shrubland for part or all of their life cycle (Table 6-8). The conservation of these species will be achieved primarily through the maintenance and enlargement of the scrub oak shrubland on Camp Edwards. Prescribed burning will be the preferred management technique within the scrub oak barrens (see Chapter 8.5). Although prescribed burning may result in short-term negative impacts to a portion of the populations, the populations as a whole will benefit through the maintenance of their required natural community. If it is determined that the prescribed burn units are too large, they may be reduced so that more smaller units spaced apart from each other are burned each year to minimize the local impacts to a population.

Two species that do not directly depend upon the scrub oak barrens are the water-willow stem borer and the pink streak. Wetlands and grassland management encompass the conservation of these two species, respectively.

9.5 Birds

More than half of the 6 state-listed rare bird species on Camp Edwards, the upland sandpiper, vesper sparrow, grasshopper sparrow, and northern harrier, inhabit

the grasslands of the cantonment area. The conservation of these species was the primary objective in designing management goals for the grassland community on Camp Edwards. The management recommendations discussed in Chapter 8.6 not only accommodates the requirements of the state-listed rare grassland birds, but also preserves and enhances the habitat for the species.

State-listed rare bird species that inhabit the grasslands of Camp Edwards will be surveyed on an annual basis on EM plots and by spot mapping. Surveys will be conducted during June and July at the height of the breeding season. The populations will be monitored to determine the effectiveness of the restoration and management practices that are applied to the grasslands.

The sharp-shinned hawk and northern parula are forest dwelling state-listed rare bird species. The conservation of these species on Camp Edwards will include the maintenance of large contiguous tracts of forest, with an emphasis on minimizing habitat loss due to fragmentation.

9.6 Turtles

One state-listed rare turtle species, the eastern box turtle, has been documented on Camp Edwards.

The eastern box turtle has been observed in every natural community on Camp Edwards. The species is common to the forests and scrub oak barrens, but has also been observed in grasslands and disturbed areas. Sightings of the species have occurred throughout the entire installation. Radio telemetry data have indicated that eastern box turtles on Camp Edwards often travel in relatively small home ranges within a particular natural community. However, individuals have been documented traveling in excess of 1 km across more than one natural community. Therefore, the distribution of eastern box turtles extends throughout all of Camp Edwards.

Conservation of the eastern box turtle on Camp Edwards will include minimizing the fragmentation of forest and scrub oak barrens habitat and education of troops and other land users as to the presence of the species throughout the installation. A major threat to the eastern box turtle is habitat loss due to fragmentation. Therefore, it is imperative to consider the impact of land clearing, even as a result of remediation, to the species on Camp Edwards. Approximately 90% of the sightings of eastern box turtles on Camp Edwards are from soldiers and personnel training on the installation. Increased awareness of the species on Camp Edwards will contribute to the survival of the species.

9.7 Mammals

One federal candidate species occurs on Camp Edwards-the New England cottontail (*Sylvilagus transitionalis*).

With the introduction of the Eastern Cottontail in 1930's, fragmentation of habitat as the human population grows, and higher predation and hunting rates as the habitat is more and more fragmented, have all contributed to the decline of this species. It has been found that large patches of habitat, like that of Camp Edwards, are essential for sustaining populations of this species. The early successional pitch pine scrub oak and scrub oak shrublands is thought to hold a sizable population of the New England cottontail. One fragmented skull has been collected in the training area of Camp Edwards. Studies on habitat requirements and population status will be conducted (see 8.8.3).

CHAPTER 10. ADDITIONAL NATURAL RESOURCES ISSUES

Several issues surround the management of natural resources and therefore the implementation of the INRMP on Camp Edwards. Internal issues include the impacts of drilling groundwater monitoring wells and unexploded ordnance (UXO) excavation on the natural resources of Camp Edwards. Under Administrative Order 3 issued by the EPA, the MAARNG is required to define and remediate any groundwater or soil pollution that has resulted from past training activities on Camp Edwards. As a result, the Impact Area Groundwater Study (IAGWS) was created. During the course of the IAGWS, which is still operating, approximately 600 groundwater-monitoring wells have been installed on the MMR and in the surrounding areas. During the installation of each well, land must be cleared to create a pad on which drill rigs may operate. Each well pad is not usually of substantial size, but cumulatively, the well drilling results in a relatively large amount of land disturbance. Many of the well pads have resulted in soil erosion. However, restoration plans have been developed to revisit each of the well sites and re-establish vegetation to maintain soil stability. Furthermore, restoration procedures are currently included in all contracts for well drilling on the MMR.

The Impact Area Groundwater Study Program currently employs a natural resource specialist whose focus is to ensure the protection of natural and cultural resources in relation to this program's activities. These duties also include the monitoring of disturbed sites for recovery of Camp Edwards' natural communities.

The excavation of UXO in the Impact Area of Camp Edwards has the potential to dramatically impact the natural resources of the area, in particular the scrub oak shrublands, critical habitat for at least 11 state-listed rare species. The complete removal of UXO would require digging to a depth of 15 feet, potentially throughout the entire 2161-acre Impact Area. Although it is necessary to remove UXO from the ground, it may be done in such a fashion (e.g., in relatively small patches spaced far apart) that minimizes the immediate impact to the scrub oak barrens, 2100 acres of which exists within the Impact Area, as a whole on Camp Edwards. However, this option would most likely require a longer amount of time to complete than it would to excavate larger more contiguous tracts of land. The removal of UXO from the Camp Edwards Impact Area could, if performed hastily, result in removal of scrub oak root stock, thereby resulting in the long-term destruction of critical habitat and would therefore contradict the management recommendations described in Chapter 8.5 of this document.

The issues of land disturbance from drilling monitoring wells and removing UXO can be resolved by developing methods that minimize the negative impacts to the natural resources. For instance, instead of removing all vegetation and topsoil when preparing a well pad, vegetation could simply be cut flush with the ground to maintain soil stability.

SECTION V. IMPLEMENTATION OF THE CAMP EDWARDS INRMP

CHAPTER 11. PLAN IMPLEMENTATION

11.1 Organization, Roles, and Responsibilities

Implementing the Camp Edwards INRMP is ultimately the responsibility of the Adjutant General of the MAARNG. The cooperation and participation of the MAARNG Training Site Commander, the Construction and Facilities Management Officer (CFMO), the Plans, Operations, and Training Officer (POTO), and Camp Edwards Range Control with the Camp Edwards Natural Resource Office is essential throughout the development and implementation process (See Chapter 5.1). However, the day-to-day coordination and implementation of the management proposed in the INRMP will be the responsibility of the Camp Edwards Natural Resource Office. Table 11-1 will act as an aid in monitoring implementation. It lists all goals and objectives of the INRMP and serves as a checklist to aid in tracking implementation.

11.2 Staffing

11.2.1 MAARNG Personnel

The Camp Edwards Natural Resource Office requires a staff of 6 full-time and 7 part-time personnel to conduct the ITAM Program and manage the natural resources on Camp Edwards. The present full-time staffing of the office includes a Natural Resources Manager, a Natural Resources Planner, a GIS Manager, and a GIS Technician.

The part-time personnel will include 7 seasonal RTLA/Research field crew members. The responsibilities of the field crew will include, but not necessarily be limited to, conducting annual RTLA surveys, collect field data for research projects (e.g., Whip-poor-will and New England Cottontail), and assist with LRAM projects.

11.2.2 Soldier Man-Days

Troop labor is also employed during annual or drill training, primarily for implementing an LRAM project. Requests for troop assistance are submitted to the Camp Edwards Facilities Engineers (FE) through the Camp Edwards Commander. Once the request is received, FE invites any MAARNG unit to perform a project during their training on Camp Edwards. Fuel for vehicles is supplied by Camp Edwards and materials are provided by the Camp Edwards Natural Resource Office. (e.g., erosion on Wood Road)

11.2.3 Contractors

Contractors are often employed for larger projects such as bivouac restoration and fire break maintenance. If a proposed project is too large for a MAARNG unit or FE to conduct, then it is made available for contractors to bid. (e.g., Donnelly Pond and Deep Bottom Pond restoration)

11.2.4 Environmental Agencies

State environmental agencies have, in some states, partnered with the ARNG to conduct natural resources management on a training site. Personnel from these agencies may often provide expertise to guide natural resources management projects. Since the 1950s, and more frequently in the last 20 years, the MAARNG has received input and adopted management practices from several agencies and non-profit organizations in Massachusetts, including the National Park Service- Cape Cod National Seashore, The Environmental Management Commission, The Department of Conservation and Recreation, the Department of Environmental Protection, the Wampanoag Tribe of Gay Head Aquinnah and Mashpee, the Division of Fisheries and Wildlife, the Natural Heritage and Endangered Species Program, The Nature Conservancy, the Cape Cod Commission, and the University of Massachusetts at Amherst. Further and future cooperation is encouraged for Camp Edwards.

11.3 Funding Sources

Funding for implementing the Camp Edwards INRMP is available from several sources. National Guard Bureau offers three major avenues by which INRMP implementation may be funded on Camp Edwards:

- National Guard Bureau Environmental Programs Division (NGB-ARE) is the primary source of funding that supports the management of natural resources at the Camp Edwards Training Site through a master cooperative agreement (NGR 5-1, MCA) with the MAARNG. This budget is managed by the MAARNG Office of Environmental Affairs. This source provides funding for natural resource surveys, projects, and any compliance-related projects.

National Guard Bureau Army Training Division (NGB-ART) is the primary source of funding to support the components of ITAM/RTLTP at Camp Edwards. Army Operations Division (NGB-ARO) will provide funding of man-days at Camp Edwards to support troop labor projects.

- National Guard Bureau Army Installations Division (NGB-ARI) provides funding for the personnel, equipment and supplies in support of the Camp Edwards Training Site Manager Office. This office is involved in pest management, vegetation management, LRAM, maintenance of roads and trails, all of which are critical to the training site's natural resources management program.

Compliance with the Sikes Act provides for funding natural resources programs on Camp Edwards. Cooperative agreements may be entered with States, local governments, nongovernmental organizations, and individuals for the improvement of natural resources or to benefit natural and historical research on state-owned training sites. Funding and services may be contributed on a matching basis to defray the cost of programs, projects, and activities under the agreement (16 U.S.C. 670a et seq.). When U.S. Fish and Wildlife Service and the Massachusetts Division of Fisheries and Wildlife become signatory cooperators of this plan, an avenue for matching funds and services with those provided by the agencies will be created. Naturally, funding and services by both parties will be subject to the availability of funds and personnel.

Funding is available for natural or cultural resources projects through several programs. The DoD Legacy Resource Management Program provides funds to people or organizations that are interested in working in a partnership with natural and cultural resource managers within the DoD. Congress appropriates approximately \$10 million each year to protect, enhance, and restore natural and cultural resources on military owned or occupied land. To gain eligibility for funding through the program, projects should focus on ecosystem management, invasive species control, or research related to the migratory patterns of wildlife.

The DoD Forestry Reserve Fund is designed to assist military installations in sustaining, managing, and restoring forest ecosystems. The fund also provides an opportunity for military personnel to highlight the Defense Department's commitment to sustainable forest management, and to illustrate that military training and environmental protection are mutually beneficial. Up to \$50,000 is available to an installation to purchase and plant native species, remove invasive pest plants, and to test new sustainable forest management techniques.

The National Fish and Wildlife Foundation provide the challenge matching Pulling It All Together Invasive Species Grant. The grant provides funds that match those from any non-federal organization for projects managing invasive species. Grants

range from \$8,000 to over \$100,000. The deadline for grant proposals is November. Further information is available on the website <https://www.denix.osd.mil/denix/Public/ES-Programs/Conservation/Legacy/legacy.html>.

The National Environmental Education and Training Foundation provides a partnership grant of \$6,000 for public recreation projects that take place on Public Lands Day on the last Saturday of September. In order to qualify for a grant, the MAARNG must partner with a volunteer organization (e.g., Boy Scouts of America) on projects such as building nature trails or restoring bridges. The deadline for this grant is April.

The Department of Interior's Cooperative Ecosystems Studies Units program fosters partnerships between the federal government and participating universities to provide resource managers with high-quality scientific research, technical assistance, and education. Universities provide space, basic administrative support, and access to university faculty, students, staff, and resources, whereas federal agencies contribute research scientists, administrative support funds, and project funds for specific research projects and technical assistance. Projects can be coordinated through participating universities and colleges for approximately 15% of the normal cost. Any agency taking advantage of this program will be required to provide services in return such as teaching a graduate class or allowing college students to assist with research. Further information is available at the website www.cesu.org/cesu.

11.4 Command Support

The support of the Camp Edwards and MAARNG command staff is essential in implementing this INRMP. By becoming signatories of this document, the commanders and training officers on Camp Edwards pledge their support throughout the implementation process.

This document will be renewed or revised at least every 5 years to incorporate changes in staffing, funding, responsibilities, etc. An annual review process will be established, beginning one year after the approval date of this INRMP.

11.5 Implementation of INRMP Goals and Objectives 2001-2006

The Sikes Act specifically directs that the INRMPs be reviewed “as to operation and effect,” emphasizing the review is intended to determine whether existing INRMPs are being implemented to meet the requirements of the Sikes Act and contribute to the conservation and rehabilitation of natural resources on military installations (See 16 USC §670a (b) (2)). The following is the status summary of projects listed in the INRMP for years 2001-2006:

Chapter 7

- RTLA plots monitored all years
- All data entered into Database-all years
- Development of soldier’s field card-updated 2001, 2006
- Deep Bottom Pond restoration-2005
- Donnelly Pond/Tank Trail restoration-2006
- Erosion surveys-2003, 2006
- Road closure for amphibian migration-all years
- Round Swamp boulder shoulder on Jefferson Rd.-2006
- Landing Zone restoration-ongoing
- Annual commanders brief participation-all years
- “Wanted” box turtle posters posted campwide-all years
- Presented at Cape Cod Natural History Conference-all years
- Development of Camp Edwards Trainers Guide-2002
- Whip-poor-will thesis completed for UMASS student Ross Garlapow-2006
- Frosted elfin survey through UMASS student Gene Albanese-2004
- New England Wildflower Society seed collections from the training area
- Lymes disease, Rabies, and rare species posters for Range Control
- “Armored Personnel Carrier Disturbance and Recovery in a Pitch-Pine/Scrub Oak Community at Camp Edwards” published in The Bridge issue 29, March 2006

Chapter 8

- RTLA plots monitored all years
- All data entered into Database-all years
- Erosion surveys-2003, 2006
- Fire management Plan completed 2006
- 1245 acres treated, 72 miles of firebreak maintenance-total all years
- 7,000+ invasive plants eradicated-total all years
- IPMP Plan revised 2003
- Invasives species inventory-2004, 2005
- ICRMP Plan completed 2002

Chapter 9

Plots monitored-all years
All data entered into a database-all years
Road closure for amphibian migration-all years
Round Swamp boulder shoulder on Jefferson Rd.-2006
Eastern Box Turtle study-completed, rare species reports to MA Natural Heritage all years
Whip-poor-will study-ongoing, 25 birds banded and radio-tagged-total all years
Amphibian Survey-12 vernal pools certified
Reptile survey-ongoing
Grassland bird survey-rare species reports to MA Natural Heritage all years
Odonate survey-rare species reports to MA Natural Heritage all years
American Burying Beetle survey-ongoing
Moth Survey- rare species reports turned in to MA Natural Heritage all years

11.6 Tracking and Implementation Matrix of INRMP Goals and Objectives

The matrix below will act as an aid in monitoring implementation. It lists all goals and objectives of the INRMP and serves as a checklist to aid in tracking implementation. It will be a useful tool in implementing the INRMP and conducting annual or any other review of this document.

Table 11-1 Implementation of INRMP Goals and Objectives

Goal	Objective	Y/N	Notes
7.2.3 RTLA Goals and Objectives			
1. Maintain the RTLA monitoring system on Camp Edwards that will serve as a measure of the integrity of the training site's ecosystem and defend mission activities. This system also provides for the early detection of any adverse environmental impacts by the yearly monitoring of RTLA study plots.			
	a. Document existing conditions through standardized inventories to evaluate the capability of the land to meet multiple-use objectives on a sustained basis and to match land capabilities with land use.		
	b. Conduct inventories of vegetation, wildlife, and effects of training on the landscape by monitoring EM plots..		
	c. Establish additional plots as necessary on Camp Edwards.		
	d. Monitor change and detect trends, thereby providing a basis for altering land use and amending land management plans to ensure long-term resource availability.		
2. Maintain a comprehensive RTLA database with sufficient completeness, consistency, and accuracy, so that reliable and useful analysis can be achieved.			
	a. Establish consistent data entry protocols for use by all RTLA database users and field crews.		
	b. Train Camp Edwards Natural Resource Office staff in RTLA database development and maintenance.		
3. Maintain a Geographic Information System (GIS) that will provide efficient data storage, retrieval, and presentation to facilitate fully informed and integrated management decisions on Camp Edwards.			
	a. Support environmental, facilities, and training GIS needs.		
	b. Develop and implement written standards and procedures for GIS administration.		
	c. Define how GIS should be used within Camp Edwards Natural Resource Office, Facilities, and Training staffs.		
	d. Use the Federal Geographic Data		

	Committee Metadata Standard to document geo-spatial data sets as required by Executive Order 12906.		
7.3.2 TRI Goals and Objectives			
1. Ensure that there is no net loss in the capability of training site lands to support existing and projected military missions on Camp Edwards			
	a. Maximize training opportunities while minimizing impacts to training lands.		
	b. Distribute activities and minimize conflicts.		
2. Maintain quality training lands by minimizing, rehabilitating, and mitigating damage.			
	a. Site military missions (and other land uses) in the areas best capable of supporting them.		
	b. Provide command elements with the information needed to make decisions that include natural resource-related values.		
	c. Aid in coordinating development of the five-year Range Training Land Program (RTLTP) Development Plan		
3. Provide guidance to users of Camp Edwards regarding their conduct while on the installation.			
	a. Update the Camp Edwards Regulation 385-63 as needed.		
	b. Provide adequate boundary signage and boundary fencing to deter trespassing		
4. Aid in establishing consistent RFMSS data entry protocols for use by Range Control.			
	a. Continue RFMSS coordination between Range Control and Natural Resource Office.		
7.4.2 LRAM Goals and Objectives			
1. Protect, maintain, and improve soil integrity, water quality, and air quality by providing adequate vegetative cover on all soils and maintaining appropriate drainage structures. Provide improved troop training environments that can sustain training indefinitely.			
	a. Comply with all federal, state, and local laws and regulations pertaining to soil stabilization and water/air quality.		
	b. Provide protection of natural resources (i.e. native communities and species) by implementing best management practices (BMP's) for routine maintenance/repair		

	projects and LRAM projects.		
	c. Improve surface water quality by reducing sediment loading in drainages on Camp Edwards.		
	d. Rehabilitate damaged training areas with native species.		
	e. Protect soil integrity and enhance soil productivity.		
7.5.2 SRA Goals and Objectives			
1. Create a conservation ethic in those who use Camp Edwards' lands to minimize damage to lands and natural resources.			
	a. Design, produce and update soldier education materials that identify environmental considerations and guidelines for military tenants utilizing the facilities and resources on Camp Edwards (posters, ITAM video, trainer's handbook, educational displays, signs, and a website regarding natural resources on Camp Edwards)		
	b. Provide decision makers with information needed to make sound natural resources judgments		
	c. Enhance the professional skills of the Camp Edwards Environmental staff.		
2. Develop and implement a public education program to increase public awareness and acceptance of natural resource management.			
	a. Provide an understanding of the Camp Edwards natural resources program to training site and surrounding communities.		
	b. Provide general conservation education to the Camp Edwards community.		
	c. Support community and youth groups with educational tours.		
	d. Use available media effectively in public education.		
8.1.2 Natural Resource Management Goals and Objectives			
1. Follow DOD guidelines on Ecosystem Management to enhance ecosystem integrity and MAARNG training on a sustainable basis.			
	a. Implement an adaptive management strategy through updating management recommendations in the Camp Edwards INRMP along with the change or succession of natural resources, best management		

	practices, or scientific knowledge.		
	b. Emphasize protection, restoration, and management of state-listed rare species, native plants and animals, and sensitive natural communities, such as wetlands and grasslands.		
	c. Monitor and manage soils, vegetation, and wildlife on Camp Edwards considering all biological communities and the human values associated with these resources.		
	d. Take a proactive approach to managing sensitive species before federal or state listing.		
	e. Maintain natural communities in such a way that does not result in a net loss of training area.		
2. Maintain the ecosystem of Camp Edwards with variation in vegetation structure resulting from disturbance and recovery, not only to benefit the natural communities, but also to provide training opportunities in terrain with a variety of landscape structure.			
	a. Meet with MADFW yearly to coordinate ecosystem maintenance		
	b. Meet with Camp Edwards Training staff to determine needed landscape structure for training		
3. Prevent conflicts between training operations and rare species management.			
	a. Research rare species to minimize potential impacts on training		
	b. Research training to reduce potential impacts on rare species		
4. Restore and maintain native wildlife populations and habitats through the use of integrated ecosystem management principles when compatible with the military mission.			
	a. Improve the quality of wildlife habitat for game and nongame species.		
	b. Protect and conserve natural communities.		
5. Prevent the spread and further introduction of invasive exotic plant and animal species to the training site.			
	a. Inventory invasive and exotic plants on an ongoing basis		
	b. Reduce numbers of exotics and invasive species through accepted best management practices		

6. Provide research, special projects, and other studies to support natural resources management on Camp Edwards			
	a. Reach out to appropriate state agencies, local universities, and non-profits to provide natural resource research and management opportunities on Camp Edwards		
	b. Acquire funding to conduct research, special projects, and other studies to support natural resources management through seasonal staff or out side agencies on Camp Edwards		
7. Inventory the natural resources of Camp Edwards and monitor resources that are important indicators of ecosystem integrity, water quality, capability of lands to support military missions, renewable product surpluses, imperiled species or communities, and other special interests.			
	a. Conduct RTLA surveys every year		
8. Provide continuing education for Environmental staff.			
	a. Natural Resource staff will attend at least one professional workshop per year		
	b. Natural Resource staff to renew INRMP every five years		
9. Continually monitor and inventory existing natural communities to identify previously unclassified subsystems (e.g., hemlock stands within the mixed woods forest, red maple swamps within the wetlands).			
	a. Monitor and inventory natural communities by using environmental monitoring plots.		
	b. Acquire funding to hire seasonal crews to conduct monitoring and inventorying of environmental monitoring plots.		
8.2.2 Pitch Pine Scrub Oak Community Goals and Objectives			
1. Maintain the pitch pine-scrub oak community of Camp Edwards in multiple states of succession for the purposes of protection of sensitive species, soil stabilization, wildlife food and cover, and military training.			

	a. Monitor the effects of training on pitch pine-scrub oak communities and their characteristic species using RTLA methods.		
	b. Use prescribed burning to maintain pitch pine-scrub oak communities in a variety of age classes and structure.		
	c. Prevent the spread and further introduction of invasive exotic plant and animal species to the pitch pine scrub oak communities.		
	d. Preserve snags and dead logs as wildlife habitat.		
	e. Provide management that leads to recovery of rare species and protects other sensitive species through maintenance of their required habitat.		
	f. Maintain or improve wildlife species richness, productivity, and survivorship.		
	g. Inventory and manage game wildlife (i.e., white-tailed deer and wild turkey) populations through surveys and annual hunts.		
8.3.2 Pitch Pine-Oak Forest Woodland Goals and Objectives			
1. Maintain the pitch pine-oak forest woodland community on Camp Edwards for the purposes of natural community protection, soil stabilization, wildlife food and cover, and military training.			
	a. Monitor the pitch pine-oak forest woodland community using RTLA methods.		
	b. Decrease the presence of aggressive exotic plants (e.g., Japanese barberry).		
	c. Preserve snags and logs as wildlife habitat		
	d. Provide special protection to state-listed rare species and their habitats.		
	e. Maintain or improve wildlife species richness, productivity, and survivorship.		
	f. Manage game wildlife (i.e., white tailed deer and wild turkey) populations with annual hunts.		
	g. Use prescribed burning to maintain pitch pine-oak forest woodland in a variety of age classes and structure.		
8.4.2 Black Oak Scarlet Oak Forest Goals and Objectives			
1. Maintain the black oak scarlet oak			

forest community on Camp Edwards for the purposes of sensitive species and natural community protection, soil stabilization, wildlife food and cover, and military training.			
	a. Monitor the black oak scarlet oak forest community using RTLA methods.		
	b. Decrease the presence of aggressive exotic plants (e.g., Japanese barberry).		
	c. Preserve snags and logs as wildlife habitat		
	d. Provide special protection to state-listed rare species and their habitats.		
	e. Maintain or improve wildlife species richness, productivity, and survivorship.		
	f. Manage game wildlife (i.e., white tailed deer and wild turkey) populations with annual hunts.		
	g. Use prescribed burning to maintain black oak scarlet oak forests in a variety of age classes and structure.		
2. Increase the amount of black oak scarlet oak forest on Camp Edwards by converting pitch pine-oak forest woodland to black oak scarlet oak forest to create a larger, more contiguous tract of black oak scarlet oak forest on the Camp Edwards Training Site.			
	a. Delineate area in which black oak scarlet oak forest succession will be promoted.		
	b. Promote succession to black oak scarlet oak forest by selectively cutting coniferous trees.		
	c. Enhance wildlife habitat by leaving cut trees.		
8.5.2 Scrub Oak Shrubland Goals and Objectives			
1. Maintain and increase the amount of scrub oak shrubland on Camp Edwards for the purposes of state-listed rare species and natural community protection, soil stabilization, wildlife food and cover, and military training.			
	a. Monitor the scrub oak shrubland using RTLA methods, where feasible (i.e., outside of the Impact Area).		
	b. Decrease the presence of aggressive exotic plants (e.g., Japanese barberry).		
	c. Preserve snags and logs as wildlife habitat.		
	d. Provide protection to state-listed rare		

	species and their habitats.		
	e. Maintain or improve wildlife species richness, productivity, and survivorship.		
	f. Delineate other areas in which scrub oak shrubland will be maintained and promoted.		
	g. Use prescribed burning to maintain scrub oak shrubland in a variety of age classes and structure.		
	h. Enhance wildlife habitat by leaving dead snags and logs where they lie.		
8.6.2 Grasslands Goals and Objectives			
1. Maintain and restore grassland communities on Camp Edwards for the purposes of rare species protection, wildlife habitat, and, at times, military training.			
	a. Monitor grassland communities using RTLA methods.		
	b. Provide special protection and habitat management that leads to the recovery of state-listed rare species including upland sandpiper and grasshopper sparrows.		
	c. Decrease the presence of aggressive exotic plants (e.g., knapweed, Phragmites sp.) using mowing, prescribed burning, or mechanical removal.		
	d. Increase the presence of native grassland vegetation.		
	e. Prevent conflicts between training site operations and rare species management.		
	f. Monitor effects of training activities on animal and plant populations dependent on the grassland natural community.		
	g. Maintain or improve grassland bird species richness, productivity, and survivorship.		
2. Use prescribed fire and at times mowing as the primary means of grassland management while protecting and conserving natural and cultural resources, soils, water quality, flora and fauna.			
	a. Apply the Camp Edwards Training Site, Integrated Fire Management Plan (2006) to maintain certain areas of the grasslands on Camp Edwards, remove accumulated litter, and control exotic invasive species		
	b. Using mowing regimes when appropriate to create short grass areas needed for some grassland bird species (e.g. upland		

	sandpipers)		
	c. Minimize the threat to human safety when conducting prescribed burns in the grasslands within the cantonment area of Camp Edwards.		
	d. Set a precedent for grassland management to provide guidance to other branches of the military that manage grasslands on the MMR.		
3. Increase the acreage of grasslands on Camp Edwards as existing structures and facilities are demolished.			
	a. Remove all structures associated with the facility.		
	b. Plant only native grass and tree species.		
	c. Maintain grasslands using prescribed fire and mowing regimes.		
8.7.2 Wetland Resources Management Goals and Objectives			
1. Protect and maintain wetland natural communities on Camp Edwards for the purposes of rare species protection, water quality, and wildlife habitat.			
	a. Prohibit activities except those associated with natural community management or restoration and travel along existing roads within the wetlands and their buffers.		
	b. Monitor wetland communities using RTLA methods.		
	c. Prevent the introduction of or colonization by invasive exotic species (e.g., Phragmites sp., purple loosestrife) within the wetlands natural communities.		
	d. Prevent the removal or draw-down of water from wetlands as a result of any activity, including the Upper Cape Water Supply Cooperative.		
	e. Identify vernal pools on Camp Edwards and submit completed applications to NHESP for vernal pool certification.		
2. Restore disturbed wetland natural communities to their historic conditions to enhance rare species habitat, water quality, and biodiversity.			
	a. Survey wetlands for visible signs of disturbance (e.g., erosion).		
	b. Review historic aerial photographs of Camp Edwards to determine the changes, if any, to the size, shape, or condition of each wetland and its buffer		

	c. Control and eliminate runoff and sedimentation within wetlands and their buffers using sound vegetative and land management practices.		
	d. Conduct restoration activities, when practical and feasible, during periods of hibernation or inactivity (i.e., late fall and winter months).		
	e. Abide by laws and regulations governing water resources, including, but not necessarily limited to the Massachusetts Wetland Protection Act, Massachusetts Endangered Species Act, and those pertaining to local conservation commissions.		
	f. Monitor the success of restoration and rehabilitation of wetlands on at least an annual basis.		
3. Preserve and maintain groundwater quality and quantity and recharge areas to existing water supply wells.			
	a. Abide by and accommodate existing state and federal laws and regulations pertaining to water supply, the MMR Groundwater Protection Policy Plan, the CCC Regional Policy Plan's Water Quality Improvement sections, the Camp Edwards Spill Prevention Control and Countermeasures Plan, and MMR groundwater remediation and restoration programs.		
	b. Allow only activities that are associated with the Upper Cape Water Supply Cooperative and the Camp Edwards Training Site within established wellhead protection zones.		
8.8.2 Research and Monitoring Goals and Objectives			
1. Conduct long-term monitoring to determine the effects of training and management practices on the natural resources of Camp Edwards to preserve training.			
	a. Continue the Camp Edwards RTLA monitoring program on an annual basis.		
	b. Implement other monitoring programs in conjunction with the RTLA Program when additional information is required.		
2. Design and implement research projects to address specific resource or natural community concerns or interests on Camp Edwards.			

	a. Determine a purpose or need for conducting each research project.		
	b. Research projects funded by the MAARNG should focus on continuing inventories of flora and fauna as well as projects addressing the status and requirements of rare species that inhabit Camp Edwards.		
	c. Describe the results of each project in a final report including the benefits to training and readiness.		
8.9.2 Fire Management Goals and Objectives			
1. Prevent wildfires from resulting in a threat to life and property on Camp Edwards and to surrounding towns.			
	a. Restore and maintain existing and historical firebreaks that would be beneficial and enhance the effectiveness of wildfire suppression and wildland fuel reduction activities.		
	b. Reduce wildland fuel loads with the use of prescribed fire and other fuel treatment techniques.		
	c. Provide wildland fire prevention education to the users of Camp Edwards.		
2. Restore and maintain the ecological processes that have occurred historically across the Camp Edwards landscape in such a manner so as to promote viable plant and animal populations and communities.			
	a. Revert and restore plant and animal communities to varied stages of early ecological succession with the use of prescribed fire and other vegetation management techniques.		
	b. Maintain these varied stages of ecological succession on the Camp Edwards landscape with the use of prescribed fire and other vegetation management techniques.		
	c. Ensure that specific plant and animal community targets compliment the overall ecological health and diversity of the southeastern Massachusetts region.		
	d. Ensure that prescribed fire and vegetation management techniques are conducted in such a manner that a healthy and varied suite of plant and animal population is maintained.		
	e. When possible conduct large scale		

	landscape level treatments (greater than 300 acres in size) in such a manner that the ecological results of historical large scale natural disturbances are reintroduced to the southeastern Massachusetts' region.		
3. Establish an informed and effective fire management program that will facilitate the accomplishment of Fire Management Goals 1 and 2.			
	a. Establish and maintain a cadre of staff that has experience and training in fire management techniques and practices.		
	b. Conduct fire management planning that uses best available information to refine fire management goals and objectives over time.		
	c. Monitor the success of fire management activities using the Land Condition Trend Analysis Method in addition to other methods as needed.		
	d. Ensure that the users of Camp Edwards and surrounding towns are kept informed on the fire management activities at Camp Edwards and of the benefits associated with these activities.		
	e. Ensure that the capacity to execute fire management goals and objectives is established and maintained through a combination of direct action and partnering with other organizations.		
8.10.2 Integrated Pest Management Goals and Objectives			
1. Ensure that the Camp Edwards INRMP is consistent with and supports the principles of the MAARNG Integrated Pest Management Plan to maximize safety and minimize pesticide use.			
	a. Control invasive exotic plants and pest animals in a manner that supports the military mission, promotes sustained natural community functionality and favors native species.		
	b. Update the MAARNG Integrated Pest Management Plan on a regular basis.		
	c. Conduct a comprehensive pest plant inventory and supply information regarding areas on Camp Edwards needing invasive pest plant removal.		
	d. Apply the most effective strategies when managing pest populations.		
8.11.1 Cultural Resources Goals and			

Objectives			
1. Preserve and protect cultural resources on Camp Edwards in accordance with state and federal laws and regulations.			
	a. Comply with all federal, state, and local laws and regulations pertaining to cultural resources found on the training site.		
2. Consult with applicable federally recognized American Indian Tribes to receive their guidance on preservation of cultural resources on Camp Edwards.			
	a. Determine with which federally recognized American Indian Tribes consultation should occur.		
	b. Encourage the creation of a memorandum of agreement (MOA) between the MAARNG and the tribes.		
	c. Develop standard operating procedures (SOPs) for addressing the protection of cultural resources during specific activities (e.g., excavation) that may potentially impact those resources.		
3. Continue to develop and implement an Integrated Cultural Resources Management Plan (ICRMP) for all MAARNG properties.			
8.12.2 Outdoor Recreation Goals and Objectives			
1. Provide opportunities for outdoor recreation to members of the public and the military while maintaining natural community integrity and function as well as no net loss to military training on Camp Edwards.			
	a. Continue the hunting programs on Camp Edwards.		
	b. Maintain sports fields within the cantonment area.		
	c. Provide public access upon request when consistent with the military mission.		
	d. Continue the collection of flora and fauna for cultural use		
8.13.2 Natural Resources Law Enforcement Goals and Objectives			
1. Minimize illegal ATV, motorcycle, and mountain bike use in the training area of Camp Edwards			
	a. Identify and report to Range Control illegal access points		
	b. Request Facilities Engineers to sign and block off identified illegal access points		

	c. Coordinate law enforcement efforts for ATV, motorcycle, and mountain bike illegal use with the state and surrounding communities.		

GLOSSARY

Animal: any member of the animal kingdom; any part, product, egg, or offspring, or the dead body or any part thereof

Aquatic: of the water as opposed to land or air

Bivouac: field-lodging area for troops

Cantonment: built-up area of a military (ARMY) installation

Common: ubiquitous throughout the habitat

Community: A naturally occurring group of different species of organisms that live together and interact as a self contained unit

Cultural resource: Historic properties, cultural items, archeological resources, sacred sites, and collections found on a installation

Disturbed: habitat that has been altered either naturally or anthropogenically

Dormancy: A state in which an organism reduces their metabolic activities to a minimum level during unfavorable conditions, so as to survive until conditions improve

Ecoregion: regions of relative homogeneity with respect to ecological composition, structure, and function

Ecosystem: a dynamic complex of plant, animal, fungal, and microorganism communities and their associated nonliving environment, interacting as an ecological unit

Endangered: (E) species are native species which are in danger of extinction throughout all or part of their range, or which are in danger of extirpation from Massachusetts, as documented by biological research and inventory.

Erosion: the process whereby wind and water remove sediment from the land surface

Exotic species: an organism introduced, intentionally or accidentally, from its native range into an area where the species did not previously occur.

Fauna: the animals of a region or period

Federally listed species: any species on the federal list

Flora: the plants of a region or period

Forb: Any herbaceous plant other than grass

Habitat: an area that provides important elements for the growth and survival of plants or animals such as food, shelter of living space, and includes without limitation breeding, feeding, resting, migratory, or overwintering areas

Home Range: the area in which an animal normally restricts its movements in search of food or a mate, and in which it cares for its young

Invasive species: a non-native species that negatively affects other species

Kettlehole: depression left during glacial recession by melting buried blocks of ice

Lense: a body of a sediment type thick in the center and thinning toward the edges

Lepidoptera: Ordinal name given to the insects commonly referred to as butterflies and moths

Moraine: A mound of hill made up of glacial till

Native: a species which either occurs, or has occurred, within Massachusetts; provided that the original occurrence of such species is not the result of a deliberate or accidental introduction by humans into Massachusetts nor an introduction elsewhere which spread into Massachusetts

Natural Community: Assemblages of species that occur together in space and time. These groups of plants and animals are found in recurring patterns that can be classified and described by their dominant physical and biological features.

Natural resource: The viable and/or renewable products of nature and their environments of soil, air, and water. Included are the plants and animals occurring on grasslands, rangelands, croplands, forests, lakes, and streams.

Odonate: Ordinal name given to the insects commonly referred to as dragonflies and damselflies

Ordinance: ammunition or explosives

Outwash plain: areas of sand and gravel deposited by glacial melt water streams

Qualitative: of, relating to, or involving quality

Quantitative: of, relating to, or involving quality

P-value: “probability value” relating to the probability that the groups being measured are statistically different from one another.

Palustrine: marshy

Plant: any member of the plant kingdom, including seeds, roots or other parts

Riparian: having to do with in any way with the banks of a river or lake

Snag: The upright trunk of a dead or dying tree: important as feeding, perching, and/or nesting sites for many species.

Special concern: (SC) species are native species which have been documented by biological research or inventory to have suffered a decline that could threaten the species if allowed to continue unchecked, or which occur in such small numbers or with such restricted distribution or specialized habitat requirements that they could easily become threatened within Massachusetts.

Species: a classification of related organisms that can freely interbreed

Succession: the progression from initial colonization of an area by organisms to the climax population. The term usually refers to plants.

Take: in reference to animals, means to harass, harm, pursue, hunt, shoot, hound, kill, trap, capture, collect, process, disrupt the nesting, breeding, feeding, or migratory activity or attempt to engage in any such conduct, or to assist such conduct, and in reference to plants, means to collect, pick, kill, transplant, cut, or process, or attempt to engage or assist in any such conduct.

Telemetry: employment of equipment for the reception and transmission of radio signals for tracking animal movements

Terrestrial: of the land as opposed to water or air

Threatened: (T) species are native species, which are likely to become endangered in the foreseeable future, or which are declining or rare as determined by biological research and inventory.

Topography: the outline of the form of a place showing its relief and the position of features (rivers, roads, cities, etc.)

REFERENCES

- 102nd Fighter Wing. 1999. Water Quality Report. Otis Air National Guard Base, MA.
- Barbour, H., T. Simmons, P. Swain, and H. Woolsey. 1999. Our Irreplaceable Heritage: Protecting Biodiversity in Massachusetts. Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries and Wildlife, and The Massachusetts Chapter of the Nature Conservancy
- Bent, A.C. 1940. Life Histories of North American Cuckoos, Goatsuckers, Hummingbirds, and their Allies. Bull. US. Nat. Mus. 176.
- Brigham, R.M. 1988. The influence of wing morphology, prey detection system, and availability of prey on the foraging strategies of aerial insectivores. Ph.D. diss., York Univ., North York, ON.
- Burt, W. H., and R. P. Grossenheider. 1980. A Field Guide to the Mammals of North America North of Mexico. Peterson Field Guide Series. Houghton Mifflin Company. New York.
- Cape Cod Commission. 1998. Massachusetts Military Reservation Master Plan Final Report: Prepared in conjunction with the Community Working Group by the Cape Cod Commission.
- Center for Ecological Management of Military Lands. 1999. Ecological Monitoring On Army Lands: ITAM Technical Reference Manual (Coordinating Draft). Department of Forest Sciences, Colorado State University. Fort Collins, Colorado.
- Cleere, N. 1998. Nightjars, a guide to nightjars, nighthawks and their relatives. Yale Univ. Press, New Haven. 317 pp.
- Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. US Fish & Wildlife Service Pub. FWS/OBS-79/31. Washington D. C.
- Drake, N. E. R., W. A. Patterson, and E. Babij. 1988. Environmental Impact Report for Prescription Burning of the Impact Area at Camp Edwards, MA. Massachusetts Army National Guard.
- Dueser, R.D. and H.H. Shugart, Jr. 1978. Microhabitats in a forest-floor small mammal fauna. Ecology 59: 89-98.

- Ecological Society of America. 1996. The report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management.
- Foster, D. R., and G. Motzkin. 1999. Historical influences on the landscape of martha's Vineyard: Perspectives on the management of the Manuel F. Correllus State Forest. Harvard Forest Paper No. 23. Harvard University.
- Gravatt, D. A., W. Packer, S. Sutton, M. Bishop, and A. Bishop. 1999. Delineation of wetlands and other regulated waters: Camp Edwards, MA. US Army Engineer Waterways Experiment Station.
- Jenkins, J. 1994. A Floristic Survey of Camp Edwards, Barnstable County, Massachusetts. White Creek Field School.
- Jones, A. and P. Vickery 1997. Conserving Grassland Birds. Grassland Conservation Program, Center for Biological Conservation, Massachusetts Audubon Society, Lincoln, Massachusetts, in collaboration with Silvio O. Conte National Fish and Wildlife Refuge and the USFWS North American Waterfowl Management Program,
www.massaudobon.org/Birds_&_Beyond/Grassland_Birds/index.html.
- Lovell, R. A. Sandwich: A Cape Cod Town. 1984. Sandwich Archives and Historical Center. Sandwich, Massachusetts.
- Maryland Partners in Flight 1999. www.mdbirds.org/mdpif/mdpif.html.
- Massachusetts National Guard. 2001. Final Draft of Master Plan/Area-Wide Environmental Impact Report.
- Massachusetts National Guard. 2005. fourth annual State of the Reservation Report Training Year 2005. Environmental and Readiness Center, Camp Edwards, Massachusetts.
- Massachusetts Army National Guard. 2006. Soldier's/Leader's Field Card: Natural Resources. Camp Edwards, Massachusetts.
- Mello, M. J., M. Aliberti, S. Galusha, K. Gerber, F. Hohn, A. Lawrence, D. Luers, R. Nagel, T. Ruehli, and B. Stephenson. 1999. Inventory of State-Listed Lepidoptera and Other Insects at Massachusetts Military Reservation. Report to Massachusetts Army National Guard Camp Edwards Training Site. Lloyd Center for Environmental Studies Report # 99-2.

- Mengel, R.M., R.S. Sharpe and G.E. Woolfenden. 1972. Wing clapping in territorial and courtship behavior of the Chuck-will's-widow and Poor-will (Caprimulgidae). *Auk* 89: 440-444.
- Mills, A.M. 1986. The influence of moonlight on the behavior of goatsuckers (Caprimulgidae). *Auk* 103: 370-378.
- Renard, K. G., G. R. Foster, G. A. Weesies, D. K. McCool, and D.C. Yoder. 1996. Predicting soil erosion by water: A Handbook. 703 US Government Printing Office, Washington, DC.
- Ruffner, C. M., and W. A. Patterson III. 2000a. Fire Management Plan for the Massachusetts Military Reservation, Sandwich, Massachusetts. Department of Forestry and Wildlife Management. University of Massachusetts at Amherst.
- Sawyer, R. P. 1988. From Pocasset to Cataumet: The origins and growth of a Massachusetts seaside community based on the files of Elmer W. Landers. Bourne Historical Commission. Bourne, Massachusetts.
- Stokes, A., and C. R. Griffin. 1997. Impacts of bivouac site development on scrubland nesting birds, Camp Edwards Training Site. Legacy Natural and Cultural Resources Program. DoD Project Number 95-0398.
- Strahler, A. N. 1966. A Geologist's View of Cape Cod. Parnassus Imprints. Orleans, Massachusetts.
- Swain, P.C. and J.B. Kearsley. 2001. Classification of the Natural Communities of Massachusetts. The Natural Heritage and Endangered Species Program, The Division of Fisheries and Wildlife, Westborough, MA.
- U.S. Army Corps of Engineers. 2000. Environmental Assessment: Upper Cape Water Supply Project. New England District. Concord, MA.
- U.S. Army Environmental Center. 1997a. Land Condition Trend Analysis II (LCTA II). 5-7 August 1996 Workshop Results.
- U.S. Army Construction Engineering Research Laboratories. 1992. D. Tazik, S.D. Warren, V.E. Diersing, R.B. Shaw, R.J. Brozka, C.F. Bagley, W.R. Whitworth.. U.S. Army Land Condition-Trend Analysis (LCTA) Plot Inventory Field Methods. Tech Rep. N-92/03. Champaign, Illinois.

- US Army Construction Engineering Research Laboratories. 1995. Price, D. L., A.B Anderson, W.R. Whitworth, and P.J. Guertin. Land Condition Trend Analysis Summaries. Tech. Rep. 95/39. Champaign, Illinois.
- US Army Construction Engineering Research Laboratories. 1999. Hale, T., S. White, D. Bruns, D. Palmer, D. Jones, M. Skoglund, and K. Michaels. Tactical Concealment Area Planning and Design Guidance Document. Tech. Rep. 99031. Champaign, Illinois.
- US Army National Guard Bureau. 2000. All States Memo (Log Number P00-0039) Integrated Natural Resource Management Plans, Encl 4. Arlington, Virginia.
- U.S. Department of Agriculture. 1932. Shawme State Forest Map. National Forest Service, State Forestry Conservation Work. Bourne and Sandwich, Massachusetts.
- U.S. Department of Agriculture Soil Conservation Service. 1993. Soil Survey of Barnstable County, Massachusetts. In cooperation with Massachusetts Agricultural Experiment Station.
- Veit, R. R., and W. R. Petersen. 1993. Birds of Massachusetts. Massachusetts Audubon Society. Lincoln, MA.
- White, R. P., and S. M Melvin. 1985. Rare grassland birds and management recommendations for Camp Edwards/Otis Air National Guard Base. Report prepared for the Massachusetts National Guard.
- Whitmore, R. C. 1979. Short-term changes in vegetation structure and its effect on grasshopper sparrows in West Virginia. *Auk* 96:621-625.
- _____. 1981. Structural characteristics of grasshopper sparrow habitat. *J. Wildl. Manage.* 45:811-814.
- Wilson, K. A., and P. M. Cavanagh. 1996. Call-response surveys for monitoring secretive waterbirds on Camp Edwards Army National Guard Training Site, Spring 1995. Report EDW-LCTA-96-1.
- Wojtowicz, J. A. 2000. Preliminary report on the identification of macroinvertebrates from samples from Bourne and Sandwich, Massachusetts. JAYCOR.

APPENDIX A – SOILS OF CAMP EDWARDS, MA

Soil Type	Description
BcC	Barnstable-Plymouth complex, rolling
BgC	Barnstable-Plymouth-Nantucket complex, rolling, very bouldery
BlB	Belgrade silt loam, 3 to 8 percent slopes
CdA	Carver coarse sand, 0 to 3 percent slopes
CdB	Carver coarse sand, 3 to 8 percent slopes
CdC	Carver coarse sand, 8 to 15 percent slopes
CdD	Carver coarse sand, 15 to 35 percent slopes
CoB	Carver-Hinesburg loamy coarse sand, undulating
EaC	Eastchop loamy fine sand, 8 to 15 percent slopes
EnA	Enfield silt loam, 0 to 3 percent slopes
EnB	Enfield silt loam, 3 to 8 percent slopes
EnC	Enfield silt loam, 8 to 15 percent slopes
Fm	Freetown mucky peat, 0 to 1 percent slopes, ponded
Fs	Freetown and Swansea mucks, 0 to 1 percent slopes
Ft	Freetown coarse sand, 0 to 1 percent slopes
HeA	Hinckley sandy loam, 0 to 3 percent slopes
HeB	Hinckley sandy loam, 3 to 8 percent slopes
HkC	Hinckley gravelly sandy loam, 8 to 15 percent slopes
HkD	Hinckley gravelly sandy loam, 15 to 35 percent slopes
MeA	Merrimac sandy loam, 0 to 3 percent slopes
MeB	Merrimac sandy loam, 3 to 8 percent slopes
MeC	Merrimac sandy loam, 8 to 15 percent slopes
MeD	Merrimac sandy loam, 15 to 35 percent slopes
Mg	Merrimac-Udipsamments-Urban land complex
Pg	Pits, sand and gravel
PmB	Plymouth loamy coarse sand, 3 to 8 percent slopes
PmC	Plymouth loamy coarse sand, 8 to 15 percent slopes
PmD	Plymouth loamy coarse sand, 15 to 35 percent slopes
PsB	Plymouth loamy coarse sand, 3 to 8 percent slopes, very stony
PsC	Plymouth loamy coarse sand, 8 to 15 percent slopes, very stony
PsD	Plymouth loamy coarse sand, 15 to 35 percent slopes, very stony
PvC	Plymouth-Barnstable complex, rolling, very bouldery
PvD	Plymouth-Barnstable complex, hilly, very bouldery
PxC	Plymouth-Barnstable complex, rolling, extremely bouldery
PxD	Plymouth-Barnstable complex, hilly, extremely bouldery
UD	Udipsamments, smoothed
Ur	Urban land

APPENDIX B – PLANT SPECIES OF CAMP EDWARDS, MA

Common Name (N=556)	Scientific Name		
Adder's-tounge fern	<i>Ophioglossum vulgatum</i>	Blueberry; cranberry	<i>Vaccinium sp.</i>
Alfalfa	<i>Medicago sativa</i>	Bluecurls	<i>Trichostema dichotomum</i>
Alternnate leaved dogwood	<i>Cornus alternifolia</i>	Bluegrass	<i>Poa sp.</i>
American beech	<i>Fagus grandifolia</i>	Bluejoint	<i>Calamagrostis canadensis</i>
American cow wheat	<i>Melampyrum lineare</i>	Blue-stemmed goldenrod	<i>Solidago caesia</i>
American hazel	<i>Corylus americana</i>	Bluets	<i>Houstonia caerulea</i>
American holly	<i>Ilex opaca</i>	Blunt spikerush	<i>Eleocharis obtusa</i>
American starflower	<i>Trientalis borealis</i>	Blunt-leaved sandwort	<i>Moehringia lateriflora</i>
American willow-herb	<i>Epilobium ciliatum</i>	Bluntscale-bulrush	<i>Scirpus smithii</i>
Apple	<i>Malus sylvestris</i>	Bracken fern	<i>Pteridium aquilinum</i>
Arrow-leaved tearthumb	<i>Polygonum sagittatum</i>	Bracted plantain	<i>Plantago aristata</i>
Arrow-wood	<i>Viburnum recognitum</i>	Bright-green spikerush	<i>Eleocharis olivacea</i>
Asparagus	<i>Asparagus officinalis</i>	Bristly sarsaparilla	<i>Aralia hispida</i>
Aster	<i>Aster spp.</i>	Broad-leaf cattail	<i>Typha latifolia</i>
Autumn bentgrass	<i>Agrostis perennans</i>	Broad-leaf meadowsweet	<i>Spiraea alba var. latifolia</i>
Autumn olive	<i>Elaeagnus umbellata</i>	Brown knapweed	<i>Centaurea jacea</i>
Awl-aster	<i>Aster pilosus</i>	Brown-fruit rush	<i>Juncus pelocarpus</i>
Bachelor's buttons	<i>Centaurea cyanus</i>	Brownish beakrush	<i>Rhynchospora capitellata</i>
Barnyard-grass	<i>Echinochloa crusgalli</i>	Brownish sedge	<i>Carex brunnescens</i>
Bayberry	<i>Myrica pensylvanica</i>	Bulbous buttercup	<i>Ranunculus bulbosus</i>
Bayonet rush	<i>Juncus militaris</i>	Bull thistle	<i>Cirsium vulgare</i>
Beach pinweed	<i>Lechea maritima</i>	Bur-reed	<i>Sparganium americanum</i>
Bead-grass	<i>Paspalum setaceum</i>	Bushy bluestem	<i>Andropogon glomeratus</i>
Beaked hazel-nut	<i>Corylus cornuta</i>	Butter-and-eggs	<i>Linaria vulgaris</i>
Bearberry	<i>Arctostaphylos uva-ursi</i>	Butterflyweed	<i>Asclepias tuberosa</i>
Bedstraw	<i>Galium pilosum</i>	Buttonweed; Poorjoe	<i>Dioda teres</i>
Beggar ticks	<i>Bidens fondosa</i>	Canada bluegrass	<i>Poa compressa</i>
Bellwort; Merrybells	<i>Uvularia sessilifolia</i>	Canada bunchberry	<i>Cornus canadensis</i>
Bentgrass	<i>Agrostis sp.</i>	Canada goldenrod	<i>Solidago canadensis</i>
Big-toothed aspen	<i>Populus grandidentata</i>	Canada hawkweed	<i>Hieracium canadense</i>
Bird-foot violet	<i>Viola pedata</i>	Canada mayflower	<i>Maianthemum canadense</i>
Birdsfoot-trefoil	<i>Lotus corniculata</i>	Canada rush	<i>Juncus canadensis</i>
Bittersweet nightshade	<i>Solanum dulcamara</i>	Canada St. John's-wort	<i>Hypericum canadense</i>
Black bindweed	<i>Polygonum convolvulus</i>	Carey's knotweed	<i>Polygonum careyi</i>
Black cherry; Wild cherry	<i>Prunus serotina</i>	Carolina lovegrass	<i>Eragrostis pectinacea</i>
Black gum	<i>Nyssa sylvatica</i>	Carpetweed	<i>Mollugo verticillata</i>
Black highbush blueberry	<i>Vaccinium atrococcum</i>	Cat brier	<i>Smilax glauca</i>
Black huckleberry	<i>Gaylussacia baccata</i>	Catnip	<i>Nepeta cataria</i>
Black locust	<i>Robinia pseudoacacia</i>	Cat's ear	<i>Hypochoeris radicata</i>
Black medick	<i>Medicago lupulina</i>	Cherries	<i>Prunus spp.</i>
Black Nightshade	<i>Solanum nigrum</i>	Chicory	<i>Cichorium intybus</i>
Black oak	<i>Quercus velutina</i>	Choke cherry	<i>Prunus virginiana</i>
Black raspberry	<i>Rubus occidentalis</i>	Christmas fern	<i>Polystichum acrostichoides</i>
Black snakeroot	<i>Sanicula marilandica</i>	Churchmouse three-awn	<i>Aristida dichotoma</i>
Black swallowwort	<i>Cynachum nigrum</i>	Cinnamon fern	<i>Osmunda cinnamomea</i>
Black willow	<i>Salix nigra</i>	Clasping dogbane	<i>Apocynum sibiricum</i>
Blackberry	<i>Rubus alleghaniensis</i>	Cleavers	<i>Galium aparine</i>
Black-eyed Susan	<i>Rudbeckia hirta</i>	Climbing false buckwheat	<i>Polygonum scandens</i>
Common Name (N=556)	Scientific Name	Coastal mannagrass	<i>Glyceria obtusa</i>
Blue toadflax	<i>Linaria canadensis</i>	Colt's-foot	<i>Tussilago farfara</i>
		Common boneset	<i>Eupatorium perfoliatum</i>
		Common buckthorn	<i>Rhamnus cathartica</i>
		Common burdock	<i>Arcticum minus</i>
		Common cinquefoil	<i>Potentilla simplex</i>

Common dandelion	<i>Taraxacum officinale</i>	English plantain	<i>Plantago lanceolata</i>
Common dodder	<i>Cuscuta gronovii</i>	European mountain-ash	<i>Sorbus aucuparia</i>
Common elder	<i>Sambucus canadensis</i>	European silvery cinquefoil	<i>Potentilla inclinata</i>
Common greenbrier	<i>Smilax rotundifolia</i>	Evening primrose	<i>Oenothera biennis</i>
Common ground-nut	<i>Apios americana</i>	Evergreen wood fern	<i>Dryopteris intermedia</i>
Common horsetail	<i>Equisetum arvense</i>	Fall panic grass	<i>Panicum dichotomiflorum</i>
Common milkweed	<i>Asclepias syriaca</i>	Fall-dandelion	<i>Leontodon autumnalis</i>
Common mouse-ear chickweed	<i>Cerastium vulgatum</i>	False heather	<i>Hudsonia ericoides</i>
Common mugwort	<i>Artemisia vulgaris</i>	False nutsedge	<i>Cyperus strigosus</i>
Common mullein	<i>Verbascum thapsus</i>	False Pimpernel	<i>Lindernia dubia</i>
Common pinweed	<i>Lechea intermedia</i>	False Solomon's seal	<i>Smilacina racemosa</i>
Common plantain	<i>Plantago major</i>	Feverwort	<i>Triosteum perfoliatum</i>
Common quickweed	<i>Galinsoga quadriradiata</i>	Field pennycress	<i>Thlaspi arvense</i>
Common reed	<i>Phragmites australis</i>	Field pussytoes	<i>Antennaria neglecta</i>
Common rush	<i>Juncus effusus</i>	Field-cress	<i>Lepidium campestre</i>
Common snailseed-pondweed	<i>Potamogeton bicipulatus</i>	Filiform fescue	<i>Festuca tenuifolia</i>
Common velvet grass	<i>Holcus lanatus</i>	Fireweed; Great willow-herb	<i>Epilobium angustifolium</i>
Common vetch	<i>Vicia sativa</i>	Flat topped goldenrods	<i>Euthamia sp.</i>
Common winter cress	<i>Barbarea vulgaris</i>	Floating bladderwort	<i>Utricularia radiata</i>
Common wood rush	<i>Luzula multiflora</i>	Flowering dogwood	<i>Cornus florida</i>
Common yarrow	<i>Achillea millefolium</i>	Foam-flower	<i>Tiarella cordifolia</i>
Common yellow flax	<i>Linum medium</i>	Forked rush	<i>Juncus dichotomus</i>
Common yellow wood-sorrel	<i>Oxalis stricta</i>	Fox grape	<i>Vitis labrusca</i>
Common yellow-cress	<i>Rorripa palustris</i>	Fragrant bedstraw	<i>Galium triflorum</i>
Corn speedwell	<i>Veronica arvensis</i>	Fragrant cudweed	<i>Gnaphalium obtusifolium</i>
Corn spurry	<i>Spergula arvensis</i>	Frostweed	<i>Helianthemum propinquum</i>
Crawford's sedge	<i>Carex crawfordii</i>	Gall-of-the-earth	<i>Prenanthes trifoliolata</i>
Crown vetch	<i>Coronilla varia</i>	Glossy buckthorn	<i>Rhamnus frangula</i>
Curled dock	<i>Rumex crispus</i>	Goat's rue	<i>Tephrosia virginica</i>
Cypress witchgrass	<i>Dichanthelium dichotomum</i>	Goblet-aster	<i>Aster lateriflorus</i>
Dangleberry	<i>Gaylussacia frondosa</i>	Golden ragwort	<i>Senecio aureus</i>
Dark green bulrush	<i>Scirpus atrovirens</i>	Goldenrod	<i>Solidago spp.</i>
Day-lily	<i>Hemerocallis fulva</i>	Grass leaved goldenrod	<i>Euthamia graminifolia</i>
Deertongue grass	<i>Dichanthelium clandestinum</i>	Gray birch	<i>Betula populifolia</i>
Dense-tuft hairsedge	<i>Bulbostylis capillaris</i>	Gray goldenrod	<i>Solidago nemoralis</i>
Deptford pink	<i>Dianthus armeria</i>	Gray-stemmed dogwood	<i>Cornus foemina</i>
Doorweed; Common knotgrass	<i>Polygonum aviculare</i>	Greater coreopsis	<i>Coreopsis major</i>
Dooryard Violet	<i>Viola sororia</i>	Green foxtail-grass	<i>Setaria viridis</i>
Dotted smartweed	<i>Polygonum punctatum</i>	Greene's rush	<i>Juncus greenii</i>
Downy chess	<i>Bromus tectorum</i>	Ground cedar	<i>Lycopodium tristachyum</i>
Downy goldenrod	<i>Solidago puberula</i>	Ground pine	<i>Lycopodium obscurum</i>
Downy Juneberry	<i>Amelanchier arborea</i>	Groundsel tree	<i>Baccharis halimifolia</i>
Dwarf Chinkapin oak	<i>Quercus prinoides</i>	Hairgrass	<i>Aira praecox</i>
Dwarf cinquefoil	<i>Potentilla canadensis</i>	Hairgrass	<i>Deschampsia flexuosa</i>
Dwarf dandelion	<i>Krigia virginica</i>	Hairy bush clover	<i>Lespedeza hirta</i>
Dwarf huckleberry	<i>Gaylussacia dumosa</i>	Hairy goldenrod	<i>Solidago hispida</i>
Dwarf St. John's-wort	<i>Hypericum boreale</i>	Hairy pinweed	<i>Lechea mucronata</i>
Early goldenrod	<i>Solidago juncea</i>	Hairy small-leaved tick treefoil	<i>Desmodium ciliare</i>
Early lowbush blueberry	<i>Vaccinium angustifolium</i>	Hairy thorough-wort	<i>Eupatorium pilosum</i>
Eastern Hemlock	<i>Tsuga canadensis</i>	Hardhack	<i>Spiraea tomentosa</i>
Eaton's rosette grass	<i>Dichanthelium spretum</i>	Hawkweed	<i>Hieracium sp.</i>
Enchanter's nightshade	<i>Circaea lutetiana</i>	Hawthorne	<i>Crataegus spp.</i>
Engelmann's arrowhead	<i>Sagittaria engelmanniana</i>	Hay-scented fern	<i>Dennstaedtia punctilobula</i>
		Hemlock witchgrass	<i>Dichanthelium sabulorum</i>

Highbush blueberry	<i>Vaccinium corymbosum</i>	Mild water pepper	<i>Polygonum hydropiperoides</i>
Hispid swamp dewberry	<i>Rubus hispidus</i>	Mixed bladderwort	<i>Utricularia geminiscapa</i>
Hoary bitter-cress	<i>Cardamine hirsuta</i>	Mockernut hickory	<i>Carya tomentosa</i>
Hoary mountain mint	<i>Pycnanthemum incanum</i>	Morrow's honeysuckle	<i>Lonicera morrowii</i>
Hoary sedge	<i>Carex canescens</i>	Moss pink	<i>Phlox subulata</i>
Hog peanut	<i>Amphicarpaea bracteata</i>	Moth mullein	<i>Verbascum blattaria</i>
Horse Gentian	<i>Triosteum aurantiacum</i>	Mountain Laurel	<i>Kalmia latifolia</i>
Horse nettle	<i>Solanum carolinense</i>	Mountain-holly	<i>Nemopanthus mucronatus</i>
Horseweed	<i>Conyza canadensis</i>	Mouseear hawkweed	<i>Hieracium pilosella</i>
Hyssop hedge nettle	<i>Stachys hyssopifolia</i>	Muhly	<i>Muhlenbergia frondosa</i>
Indian Cucumber Root	<i>Medeola virginiana</i>	Muhly	<i>Muhlenbergia uniflora</i>
Indian pipe	<i>Monotropa uniflora</i>	Multiflora rose	<i>Rosa multiflora</i>
Indian-hemp	<i>Apocynum cannabinum</i>	Narrow leaved mountain mint	<i>Pycnanthemum tenuifolium</i>
Inkberry	<i>Ilex glabra</i>	Narrow-leaf goldenrod	<i>Euthamia galetorum</i>
Interrupted fern	<i>Osmunda claytoniana</i>	Narrow-leaved bush clover	<i>Lespedeza angustifolia</i>
Japanese barberry	<i>Berberis thunbergii</i>	Narrow-leaved white-topped aster	<i>Aster solidagineus</i>
Japanese honeysuckle	<i>Lonicera japonica</i>	Needle grass; Black oatgrass	<i>Piptochaetium avenaceum</i>
Japanese wisteria	<i>Wisteria floribunda</i>	New York fern	<i>Thelypteris noveboracensis</i>
Jimson-weed	<i>Datura stramonium</i>	Nodding bur marigold	<i>Bidens cernua</i>
Johnny-jump-up	<i>Viola tricolor</i>	Nodding fescue	<i>Festuca obtusa</i>
Juneberry; Serviceberry;		Nodding foxtail-grass	<i>Setaria faberi</i>
Shadbush	<i>Amelanchier sp.</i>	Nodding ladies' tresses	<i>Spiranthes cernua</i>
Kentucky bluegrass	<i>Poa pratensis</i>	Nodding smartweed	<i>Polygonum lapathifolium</i>
Kentucky fescue	<i>Festuca arundinacea</i>	Northern bugleweed	<i>Lycopus uniflorus</i>
Kidney Leaf Buttercup	<i>Ranunculus abortivus</i>	Northern Catalpa	<i>Catalpa speciosa</i>
King-devil	<i>Hieracium caespitosum</i>	Northern crab-grass	<i>Digitaria sanguinalis</i>
Knawel	<i>Schleranthus annuus</i>	Northern dewberry	<i>Rubus flagellaris</i>
Lady-fern	<i>Athyrium filix-femina</i>	Northern downy violet	<i>Viola sagittata</i>
Lady's Thumb	<i>Polygonum persicaria</i>	Northern white cedar	<i>Thuja occidentalis</i>
Lance-leaved coreopsis	<i>Coreopsis lanceolata</i>	Norway spruce	<i>Picea abies</i>
Lance-leaved violet	<i>Viola lanceolata</i>	Nuttall's milkwort	<i>Polygala nuttallii</i>
Large cranberry	<i>Vaccinium macrocarpon</i>	Oakes' pondweed	<i>Potamogeton oakesianus</i>
Large purple false foxglove	<i>Agalinis purpurea</i>	Oblong-leaf Juneberry	<i>Amelanchier canadensis</i>
Late lowbush blueberry	<i>Vaccinium pallidum</i>	Orange grass	<i>Hypericum gentianoides</i>
Least hop clover	<i>Trifolium dubium</i>	Orchard grass	<i>Dactylis glomerata</i>
Least pinweed	<i>Lechea minor</i>	Oriental bittersweet	<i>Celastrus orbiculata</i>
Leatherleaf	<i>Chamaedaphne calyculata</i>	Ovate spike-rush	<i>Eleocharis ovata</i>
Leathery grape fern	<i>Botrychium multifidum</i>	Ox-eye daisy	<i>Chrysanthemum leucanthemum</i>
Lesser daisy fleabane	<i>Erigeron strigosus</i>	Ox-eye daisy	<i>Leucanthemum vulgare</i>
Lesser stitchwort	<i>Stellaria graminea</i>	Pale manna grass	<i>Puccinellia pallida</i>
Little bluestem	<i>Schizachyrium scoparium</i>	Panic grass	<i>Dichanthelium acuminatum</i>
Locust-weed	<i>Chamaecrista fasciculata</i>	Panic-grass	<i>Panicum sp.</i>
Long brached frostweed	<i>Helianthemum canadense</i>	Partridgeberry	<i>Mitchella repens</i>
Long-stalked aster	<i>Aster dumosus</i>	Pasture rose	<i>Rosa carolina</i>
Low cudweed	<i>Filaginella uliginosa</i>	Pasture-thistle	<i>Cirsium pumilum</i>
Low hop clover	<i>Trifolium campestre</i>	Path rush	<i>Juncus tenuis</i>
Low showy aster	<i>Aster spectabilis</i>	Pear tree	<i>Pyrus communis</i>
Lupine	<i>Lupinus perennis</i>	Pearly everlasting	<i>Anaphalis margaritacea</i>
Maple leaved viburnum	<i>Viburnum acerifolium</i>	Pennsylvania blackberry	<i>Rubus pensilvanicus</i>
Marsh fern	<i>Thelypteris palustris</i>	Pennsylvania sedge	<i>Carex pensylvanica</i>
Marsh skullcap	<i>Scutellaria galericulata</i>	Perennial pea	<i>Lathyrus latifolius</i>
Maryland tick-trefoil	<i>Desmodium marilandicum</i>	Petticoat climber, Purple	<i>Eragrostis spectabilis</i>
Meadow beauty	<i>Rhexia virginica</i>		
Mermaid weed	<i>Proserpinaca palustris</i>		

Lovegrass		Rock polypody	<i>Polypodium virginianum</i>
Pickeral weed; Tuckahoe	<i>Pontederia cordata</i>	Rough barnyard-grass	<i>Echinochloa muricata</i>
Pignut hickory	<i>Carya glabra</i>	Rough cinquefoil	<i>Potentilla norvegica</i>
Pilewort; Fireweed	<i>Erechtites hieracifolia</i>	Rough-fruited cinquefoil	<i>Potentilla recta</i>
Pin Cherry	<i>Prunus pensylvanica</i>	Rough-stemmed goldenrod	<i>Solidago rugosa</i>
Pinesap; False beechdrops	<i>Monotropa hypopithys</i>	Round leaved sundew	<i>Drosera rotundifolia</i>
Pink knotweed	<i>Polygonum pensylvanicum</i>	Round-headed bush clover	<i>Lespedeza capitata</i>
Pink ladies' slipper	<i>Cypripedium acaule</i>	Roundleaf Juneberry	<i>Amelanchier sanguinea</i>
Pink tickseed	<i>Coreopsis rosea</i>	Round-leafed pyrola	<i>Pyrola rotundifolia</i>
Pinweed	<i>Lechea spp.</i>	Roundseed panic grass	<i>Dichanthelium sphaerocarpon</i>
Pitch pine	<i>Pinus rigida</i>	Royal fern	<i>Osmunda regalis</i>
Plains snakecotton	<i>Froelichia floridana</i>	Rugosa rose	<i>Rosa rugosa</i>
Pointed broom sedge	<i>Carex scoparia</i>	Running pine	<i>Lycopodium clavatum</i>
Poison ivy	<i>Toxicodendron radicans</i>	Ryegrass	<i>Lolium perenne</i>
Pokeweed	<i>Phytolacca americana</i>	Sage	<i>Salvia officinalis</i>
Poor-man's pepper	<i>Lepidium virginicum</i>	Sand cherry	<i>Prunus pumila</i>
Poverty grass	<i>Danthonia spicata</i>	Sand jointweed	<i>Polygonella articulata</i>
Poverty-grass	<i>Sporobolus vaginiflorus</i>	Sand spurrey	<i>Spergularia rubra</i>
Prairie cord-grass	<i>Spartina pectinata</i>	Sassafras	<i>Sassafras albidum</i>
Prairie three-awn	<i>Aristata oligantha</i>	Scarlet oak	<i>Quercus coccinea</i>
Prickly bog sedge	<i>Carex atlantica</i>	Scotch broom	<i>Cytisus scoparius</i>
Primrose-leaf violet	<i>Viola primulifolia</i>	Scotch pine	<i>Pinus sylvestris</i>
Prince's pine	<i>Chimaphila umbellata</i>	Scrub-oak	<i>Quercus ilicifolia</i>
Purple bladderwort	<i>Utricularia purpurea</i>	Sedge	<i>Carex spp.</i>
Purple chokeberry	<i>Aronia x prunifolia</i>	Selfheal; Heal-all	<i>Prunella vulgaris</i>
Purple St. Johns-wort	<i>Triandenum virginicum</i>	Sensitive fern	<i>Onoclea sensibilis</i>
Purpletop	<i>Tridens flavus</i>	Sessile-leaved horehound	<i>Lycopus amplexens</i>
Pussy-willow	<i>Salix discolor</i>	Shallow sedge	<i>Carex lurida</i>
Quaking aspen	<i>Populus tremula</i>	Sheep fescue	<i>Festuca ovina</i>
Queen Anne's Lace	<i>Daucus carota</i>	Sheep sorrel	<i>Rumex acetosella</i>
Rabbit-foot clover	<i>Trifolium arvense</i>	Sheep-laurel	<i>Kalmia angustifolia</i>
Racemed milkwort	<i>Polygala polygama</i>	Shining sumac; Winged sumac	<i>Rhus copallina</i>
Ragweed	<i>Ambrosia artemisiifolia</i>	Shinleaf	<i>Pyrola elliptica</i>
Rattlesnake mannagrass	<i>Glyceria canadensis</i>	Sickle-leaved golden aster	<i>Heterotheca falcata</i>
Rattlesnake weed	<i>Hieracium venosum</i>	Silky dogwood	<i>Cornus amomum</i>
Red baneberry	<i>Actaea rubra</i>	Silvery cinquefoil	<i>Potentilla argentea</i>
Red cedar	<i>Juniperus virginiana</i>	Siver-hairgrass	<i>Aira carophyllea</i>
Red chokeberry	<i>Aronia arbutifolia</i>	Skunk cabbage	<i>Symplocarpos foetidus</i>
Red clover	<i>Trifolium pratense</i>	Slender bush clover	<i>Lespedeza virginica</i>
Red fescue	<i>Festuca rubra</i>	Slender fimbry	<i>Fimbristylis autumnalis</i>
Red hickory	<i>Carya ovalis</i>	Slender ladies' tresses	<i>Spiranthes lacera</i>
Red maple	<i>Acer rubrum</i>	Slender pondweed	<i>Potamogeton pusillus</i>
Red pine	<i>Pinus resinosa</i>	Slender wheatgrass	<i>Elymus trachycaulus</i>
Red raspberry	<i>Rubus idaeus</i>	Small-headed aster	<i>Aster vimineus</i>
Red spruce	<i>Picea rubens</i>	Small-leaved Linden	<i>Tilia cordata</i>
Red-stemmed dogwood	<i>Cornus stolonifera</i>	Smooth brome-grass	<i>Bromus inermis</i>
Red-stemmed plantain	<i>Plantago rugelii</i>	Smooth Winterberry	<i>Ilex laevigata</i>
Reed-grass	<i>Calamagrostis cinnoides</i>	Soapwort; Bouncing bet	<i>Saponaria officinalis</i>
Rhode Island bent	<i>Agrostis capillaris</i>	Southern sneezeweed	<i>Helenium flexuosum</i>
Rhodora	<i>Rhododendron canadense</i>	Southern three-lobed bedstraw	<i>Galium tinctorium</i>
Rice cut-grass	<i>Leersia oryzoides</i>	Southern yellow wood-sorrel	<i>Oxalis dillenii</i>
Ricegrass	<i>Oryzopsis pungens</i>	Speargrass	<i>Poa annua</i>
Robbin's spikerush	<i>Eleocharis robbinsii</i>	Spike-rush	<i>Eleocharis acicularis</i>
Robin's plaintain	<i>Erigeron pulchellus</i>	Spotted spurge; Milk-purslane	<i>Euphorbia maculata</i>

Spotted St. John's-wort	<i>Hypericum punctatum</i>	Virginia mountain mint	<i>Pycnanthemum virginianum</i>
Spotted Touch-me-not	<i>Impatiens capensis</i>	Virginia rose	<i>Rosa virginiana</i>
Spotted wintergreen	<i>Chimaphila maculata</i>	Virginia yellow flax	<i>Linum virginianum</i>
Spreading dogbane	<i>Apocynum androsaemifolium</i>	Wand-like bush clover	<i>Lespedeza intermedia</i>
Squarrose white aster	<i>Aster ericoides</i>	Water horehound	<i>Lycopus americanus</i>
St. John's-wort	<i>Hypericum perforatum</i>	Water pepper	<i>Polygonum hydropiper</i>
St. John's-wort	<i>Hypericum spp.</i>	Water purslane	<i>Ludwigia palustris</i>
Staghorn sumac	<i>Rhus typhina</i>	Water-bulrush	<i>Scirpus subterminalis</i>
Star-thistle; Knapweed	<i>Centaurea maculosa</i>	Water-milfoil	<i>Myriophyllum humile</i>
Starved panic grass	<i>Dichanthelium depauperatum</i>	Watershield	<i>Brasenia shreberi</i>
Sticky hawkweed	<i>Hieracium scabrum</i>	Water-willow	<i>Decodon verticillatus</i>
Stiff aster	<i>Aster linariifolius</i>	Wavy Leaf Aster	<i>Aster undulatus</i>
Swamp beggar ticks	<i>Bidens connata</i>	Waxy meadow rue	<i>Thalictrum revolutum</i>
Swamp candles	<i>Lysimachia terrestris</i>	White ash	<i>Fraxinus americana</i>
Swamp rose	<i>Rosa palustris</i>	White avens	<i>Geum canadense</i>
Swamp-azalea	<i>Rhododendron viscosum</i>	White buttons	<i>Eriocaulon septangulare</i>
Swan's sedge	<i>Carex swanii</i>	White campion	<i>Silene pratensis</i>
Sweet fern	<i>Myrica asplenifolia</i>	White clover	<i>Trifolium repens</i>
Sweet gale	<i>Myrica gale</i>	White colicroot, Stargrass	<i>Aletris farinosa</i>
Sweet goldenrod	<i>Solidago odora</i>	White goosefoot	<i>Chenopodium album</i>
Sweet pepper-bush	<i>Clethra alnifolia</i>	White oak	<i>Quercus alba</i>
Sweet vernal grass	<i>Anthoxanthum odoratum</i>	White pine	<i>Pinus strobus</i>
Sweet William silene	<i>Silene armeria</i>	White poplar	<i>Populus alba</i>
Sweetgrass	<i>Hierochloe odorata</i>	White sweet clover	<i>Melilotus alba</i>
Sweet-scented water-lily	<i>Nymphaea odorata</i>	White wood aster	<i>Aster divaricatus</i>
Swith-grass	<i>Panicum virgatum</i>	Whitehair rosette grass	<i>Dichanthelium villosissimum</i>
Tall beakrush	<i>Rhynchospora macrostachya</i>	Whitlow-grass	<i>Draba verna</i>
Tall lettuce	<i>Lactuca canadensis</i>	Whorled loosestrife	<i>Lysimachia quadrifolia</i>
Tansy	<i>Tanacetum vulgare</i>	Wild cucumber	<i>Echinocystis lobata</i>
Taper-tip rush	<i>Juncus acuminatus</i>	Wild garlic	<i>Allium canadense</i>
Tawny cotton-grass	<i>Eriophorum virginicum</i>	Wild geranium; Purple crane's bill	<i>Geranium maculatum</i>
Thimble Weed	<i>Anemone virginiana</i>	Wild indigo	<i>Baptisia tinctoria</i>
Three-toothed cinquefoil	<i>Potentilla tridentata</i>	Wild oat grass	<i>Danthonia compressa</i>
Three-way sedge	<i>Dulichium arundinaceum</i>	Wild radish	<i>Raphanus raphanistrum</i>
Thyme-leaved sandwort	<i>Arenaria serpyllifolia</i>	Wild sarsaparilla	<i>Aralia nudicaulis</i>
Ticklegrass	<i>Agrostis hyemalis</i>	Wild strawberry	<i>Fragaria virginiana</i>
Timothy	<i>Phleum pratense</i>	Willow	<i>Salix spp.</i>
Tiny vetch	<i>Vicia hirsuta</i>	Winged burningbush	<i>Euonymus alatus</i>
Toothed flatsedge	<i>Cyperus dentatus</i>	Winterberry	<i>Ilex verticillata</i>
Toothed white-topped aster	<i>Aster paternus</i>	Wintergreen; Teaberry	<i>Gaultheria procumbens</i>
Torrey's beakrush	<i>Rhynchospora torreyana</i>	Witch grass	<i>Panicum capillare</i>
Trailing arbutus; Mayflower	<i>Epigaea repens</i>	Withe-rod	<i>Viburnum cassinoides</i>
Trailing Bushclover	<i>Lespedeza procumbens</i>	Wolly hudsonia	<i>Hudsonia tomentosa</i>
Tree of heaven	<i>Ailanthus altissima</i>	Wood anemone	<i>Anemone quinquefolia</i>
Tumble mustard	<i>Sisymbrium altissimum</i>	Wool grass	<i>Scirpus cyperinus</i>
Umbrella-grass	<i>Fuirena pumila</i>	Woolly-fruit sedge	<i>Carex lasiocarpa</i>
Upland willow; Gray willow	<i>Salix humilis</i>	Wormseed; Mexican tea	<i>Chenopodium ambrosioides</i>
Upright scorpion grass	<i>Myosotis micrantha</i>	Wormseed-mustard	<i>Erysimum cheiranthoides</i>
Velvety sedge	<i>Carex vestita</i>	Yellow bartonia	<i>Bartonia virginica</i>
Venus' looking-glass	<i>Triodanis perfoliata</i>	Yellow foxtail-grass	<i>Setaria glauca</i>
Vetch	<i>Vicia sp.</i>	Yellow hedge-hyssop	<i>Gratiola aurea</i>
Viper's bugloss	<i>Echium vulgare</i>	Yellow nutsedge	<i>Cyperus esculentus</i>
Virginia chain fern	<i>Woodwardia virginica</i>	Yellow stargrass	<i>Hypoxis hirsuta</i>
Virginia creeper	<i>Parthenocissus quinquefolia</i>		

Yellow water-lily	<i>Nuphar lutea</i>
Yellow-eyed grass	<i>Xyris difformis</i>
Yellowfruit sedge	<i>Carex annectens</i>
	<i>Agropyron trachycaulum</i>
	<i>Carex emmonsii</i>
	<i>Carex longii</i>
	<i>Carex rosea</i>
	<i>Carex rugosperma</i>
	<i>Cyperus filiculmis</i>
	<i>Cyperus grayii</i>
	<i>Dichanthelium linearifolium</i>
	<i>Eupatorium hyssopifolium</i>
	<i>Lespedeza nuttallii</i>
	<i>Panicum verrucosum</i>
	<i>Populus nigra var. italica</i>
	<i>Viburnum sp.</i>

**APPENDIX C –
MACROLEPIDOPTERA (MOTH AND
BUTTERFLY) SPECIES OF CAMP
EDWARDS, MA.**

Abagrotis alternata
Abagrotis brunneipennis
Abagrotis cupida
Abagrotis nefascia
Achatodes zea
Acronicta afflicta
Acronicta albarufa
Acronicta americana
Acronicta haesitata
Acronicta hasta
Acronicta increta (= "*inclara*")
Acronicta lithospila
Acronicta lobeliae
Acronicta longa
Acronicta modica
Acronicta noctivaga
Acronicta oblinita
Acronicta ovata
Acronicta retardata (= "*caesarea*")
Acronicta sperata
Acronicta superans
Acronicta tristis
Acronicta tritona
Aethalura intertexta
Agnorisma badinodis
Agriopodes fallax
Agrotis gladiaria
Agrotis ipsilon
Agrotis manifesta
Agrotis stigmosa
Agrotis venerabilis
Agrotis vetusta
Agrotis volubilis
Allotria elonympha
Amolita fessa
Amolita roseola
Amphipoea americana
Amphipyra pyramidoides

Anacamptodes ephyraria
Anacamptodes humara
Anacamptodes vellivolata
Anagoga occiduaria
Anagrapha falcifera
Anaplectoides prasina
Anavitrinella pampinaria
Anisota stigma
Anisota virginiensis
Anomis commoda
Anorthodes tarda
Antepione thiosaria
Antheraea polyphemus
Anticarsia gemmatalis
Apamea amputatrix
Apamea burgessi
Apamea devastator
Apamea dubitans
Apamea finitima
Apamea helva
Apamea inordinata
Apamea lignicolora
Apamea verbascooides
Apantesis nais
Apantesis phalerata
Apatelodes torrefacta
Apharetra dentata
Aplectoides condita
Argyrostromis anilis
Autographa ampla
Autographa precationis
Automeris io
Bagisara rectifascia
Baileya ophthalmica
Balsa labecula
Balsa tristrigella
Besma endropiaria
Besma quercivoraria
Biston cognataria
Bleptina caradrinalis
Bomolocha baltimoralis
Bomolocha palparia
Cabera erythemaria

Caenurgina crassiuscula
Caenurgina erechtea
Callopietria cordata
Callopietria mollissima
Callosamia promethea
Campaea perlata
Caripeta sp. Nr. *Piniata*
Catocala sp. Nr. *Lineella*
Catocala amica
Catocala andromedae
Catocala antinympha
Catocala badia
Catocala coccinata
Catocala gracilis
Catocala grynea
Catocala herodias
Catocala ilia
Catocala lineella
Catocala micronympha
Catocala paleogama
Catocala praeclara
Catocala relictata
Catocala similis
Catocala sordida
Catocala ultronia
Catocala unijuga
Cepphis armataria
Cerma cerintha
Cerura multiscrypta
Chaetagnaea cerata
Chaetagnaea sericea
Chaetagnaea tremula
Charadra deridens
Chlorochlamys chloroleucaria
Chloroclystis rectangularata
Chrysanympa formosa
Chytolita morbidalis
Chytonix palliatricula
Chytonix sensilis
Cicinnus melsheimeri
Cingilia catenaria
Cisseps fulvicollis
Cisthene packardi
Clostera albosigma
Clostera strigosa
Colobochyla interpuncta
Colocasia propinquilinea
Cosmia calami
Crambidia pallida
Crocigrapha normani
Cucullia convexipennis
Cyclophora packardi
Cyclophora pendulinaria
Cycnia oregonensis
Cycnia tenera
Darapsa myron
Darapsa pholus
Dasychira basiflava
Dasychira cinnamomea
Dasylophia anguina
Dasyshira obliquata
Dasyshira pinicola
Datana drexelii
Datana ministra
Derrima stellata
Diacrisia aeroides
Dichorda iridaria
Dolba hylaeus
Drasteria graphica
Drasteria occulta
Drepana arcuata
Dryocampa rubicunda
Dypterygia rozmani
Dyspyralis illocata
Dyspyralis nigella
Dyspyralis puncticosta
Ecpanteria scribonia
Ectropis crepuscularia
Egira alternans
Elaphria festivoides
Elaphria versicolor
Ennomos magnaria
Ennomos subsignaria
Epignaea apiata
Epignaea decliva
Epimecis hortaria

<i>Estigmene acrea</i>	<i>Furcula borealis</i>
<i>Euagrotis (lubricans)</i>	<i>Furcula modesta</i>
<i>Euagrotis illapsa</i>	<i>Gabara subnivosella</i>
<i>Eubaphe mendica</i>	<i>Galgula partita</i>
<i>Euchaetes egle</i>	<i>Glena cognataria</i>
<i>Euchlaena effecta</i>	<i>Glena cribrataria</i>
<i>Euchlaena irraria</i>	<i>Gluphisia septentrionis</i>
<i>Euchlaena johnsonaria</i>	<i>Grammia figurata</i>
<i>Euchlaena madusaria</i>	<i>Grammia parthenice</i>
<i>Euchlaena marginaria</i>	<i>Grammia virgo</i>
<i>Euchlaena muzaria</i>	<i>Gueneria similaria</i>
<i>Euchlaena serrata</i>	<i>Halysidota tessellaris</i>
<i>Eucirroedia pampina</i>	<i>Haploa clymene</i>
<i>Euclidea cuspeida</i>	<i>Harrisimemna trisignata</i>
<i>Eucoptocnemis fimbriaris</i>	<i>Helicoverpa zea</i>
<i>Eudryas unio</i>	<i>Heliomata cycladata</i>
<i>Eueretagrotis attenta</i>	<i>Heterocampa biundata</i>
<i>Eufidonia convergaria</i>	<i>Heterocampa guttivitta</i>
<i>Eufidonia discospilata</i>	<i>Heterocampa obliqua</i>
<i>Eufidonia nototaria</i>	<i>Heterocampa umbrata</i>
<i>Eugonobapta nivosaria</i>	<i>Hethemia pistasciaria</i>
<i>Eulithis diversilineata</i>	<i>Holomelina aurantiaca</i>
<i>Eulithis explanata</i>	<i>Holomelina ferruginosa</i>
<i>Eumacaria latiferrugata</i>	<i>Holomelina laeta</i>
<i>Eumorpha pandorus</i>	<i>Holomelina opella</i>
<i>Euparthenos nubilis</i>	<i>Homochlodes fritillaria</i>
<i>Euphyia unangulata</i>	<i>Homorthodes furfurata</i>
<i>Euplexia benesimilis</i>	<i>Hyalophora cecropia</i>
<i>Eurois occulta</i>	<i>Hydrelia condensata</i>
<i>Eusarca confusaria</i>	<i>Hydria prunivorata</i>
<i>Eutrapela clemataria</i>	<i>Hypagyrtis esther</i>
<i>Euxoa bostoniensis</i>	<i>Hypagyrtis piniata</i>
<i>Euxoa obeliscoides</i>	<i>Hypagyrtis unipunctata</i>
<i>Euxoa perpolita</i>	<i>Hyparpax aurora</i>
<i>Euxoa pleuritica</i>	<i>Hyphenodes fractilinea</i>
<i>Euxoa tessellata</i>	<i>Hyperaeschra georgica</i>
<i>Euxoa vellerpennis</i>	<i>Hyperstrotia flaviguttata</i>
<i>Euxoa violaris</i>	<i>Hyperstrotia villificans</i>
<i>Faronta diffusa</i>	<i>Hyphantria cunea</i>
<i>Feltia geniculata</i>	<i>Hypomecis umbrosaria</i>
<i>Feltia herilis</i>	<i>Hypoprepia fucosa</i>
<i>Feltia jaculifera</i>	<i>Hyppa xylinoides</i>
<i>Feltia subgothica</i>	<i>Idia aemula</i>

<i>Idia americalis</i>	<i>Lomographa vestaliata</i>
<i>Idia diminuendis</i>	<i>Lophocampa caryae</i>
<i>Idia forbesi</i>	<i>Lycophotia phyllophora</i>
<i>Idia julia</i>	<i>Lymantria dispar</i>
<i>Idia lubricalis</i>	<i>Lytrosis unitaria</i>
<i>Idia rotundalis</i>	<i>Macrochilo absorptalis</i>
<i>Idia scobalis</i>	<i>Macrochilo litophora</i>
<i>Idia sp. Nr. "concisa"</i>	<i>Macrochilo orciferalis</i>
<i>Ipimorpha pleonectuosus</i>	<i>Macruocampa marthesia</i>
<i>Iridopsis larvaria</i>	<i>Magusa orbifera</i>
<i>Itame argillacearia</i>	<i>Malacosoma americanum</i>
<i>Itame pustularia</i>	<i>Malacosoma disstria</i>
<i>Itame sp. 1</i>	<i>Marathyssa inficita</i>
<i>Itame sulphurea</i>	<i>Meganola minuscula</i>
<i>Lacanobia atlantica</i>	<i>Meganola phylla</i>
<i>Lacinipolia anguina</i>	<i>Meganola spodia</i>
<i>Lacinipolia meditata</i>	<i>Melanolophia canadaria</i>
<i>Lacinipolia renigera</i>	<i>Melanolophia signataria</i>
<i>Lacosoma chiridota</i>	<i>Metalectra discalis</i>
<i>Lambdina fervidaria</i>	<i>Metalectra quadrisignata</i>
<i>Lambdina fiscellaria</i>	<i>Metalectra richardsi</i>
<i>Lambdina pellucidaria</i>	<i>Metanema inatomaria</i>
<i>Lapara bombycoides</i>	<i>Metarranthis amyrisaria</i>
<i>Lapara coniferarum</i>	<i>Metarranthis angularia</i>
<i>Leucania commoides</i>	<i>Metarranthis broweri</i>
<i>Leucania extincta</i>	<i>Metarranthis duaria</i>
<i>Leucania inermis</i>	<i>Metarranthis hypocharia</i>
<i>Leucania insueta</i>	<i>Metarranthis indeclinata</i>
<i>Leucania lapidaria</i>	<i>Metarranthis obfirmaria</i>
<i>Leucania linita</i>	<i>Metarranthis pilosaria</i>
<i>Leucania phragmatidicola</i>	<i>Metarranthis sp. Nr. Lateritiaria</i>
<i>Leucania pseudargyria</i>	<i>Metaxaglaea inulta</i>
<i>Leucania ursula</i>	<i>Metaxaglaea semitaria</i>
<i>Leuconycta diphtheroides</i>	<i>Morrisonia confusa</i>
<i>Lithacodia albidula</i>	<i>Morrisonia evicta</i>
<i>Lithacodia bellicula</i>	<i>Morrisonia mucens</i>
<i>Lithacodia carneola</i>	<i>Nacophora quernaria</i>
<i>Lithacodia muscosula</i>	<i>Nadata gibbosa</i>
<i>Lithacodia synochitis</i>	<i>Nedra ramosula</i>
<i>Lobocleta ossularia</i>	<i>Nematocampa resistaria</i>
<i>Lobophora nivigerata</i>	<i>Nemoria bistriaria</i>
<i>Lochmaeus manteo</i>	<i>(=rubromarginaria)</i>
<i>Lomographa semiclarata</i>	<i>Nemoria mimosaria</i>

Nemoria rubrifrontaria
Nephelodes minians
Noctua pronuba
Nola clethrae
Nola pustulata
Notodonta scitipennis
Nycteola frigidana
Ochropleura plecta
Oligia illocata
Oligia mactata
Oligia modica
Oligocentra lignicolor
Oligocentra semirufescens
Oncocnemis riparia
Oreta rosea (= "irrorata")
Orgyia definita
Orgyia leucostigma
Orthodes crenulata
Orthodes cynica
Orthofidonia tinctaria
Orthonama centrostrigaria
Orthonama obstipata
Orthosia revicta
Oruza albocostaliata
Paectes abrostoloides
Paectes pygmaea
Palthis angulalis
Pangrapta decoralis
Panopoda carneicosta
Panopoda rufimargo
Panthea pallescens
Paonias astylus
Paonias excaecatus
Paonias myops
Papaipema baptisiae
Papaipema pterisii
Papaipema sp. 1
Parallelia bistriaris
Patalene olyzonaria
Peridea angulosa
Peridea ferruginea
Peridroma saucia
Pero honestaria
Pero hubneraria
Pero morrisonaria
Petrophora subaequaria
Phalaenophana pyramusalis
Phalaenostola larentioides
Phalaenostola metonalis
Pheosia rimosa
Phlogophora iris
Phlogophora periculosa
Phosphila miseloides
Phosphila turbulenta
Phragmatobia assimilans
Phragmatobia fuliginosa
Phragmatobia lineata
Phyllodesma americana
Phyprosopus callitrichoides
Plagodis alcoolaria
Plagodis fervidaria
Plagodis phlogosaria
Plagodis serinaria
Plathypena scabra
Platyperigea meralis
Platysenta vecors
Platysenta videns
Pleuroprucha insulsaria
Polia detracta
Polia latex
Polygrammate hebraeicum
Polypogon sp. 1
Polypogon cruralis
Polypogon jacchusalis
Polypogon laevigata
Polypogon lituralis
Polypogon obscuripennis
Polypogon ochreipennis
Polypogon protumnusalis
Polypogon theralis
Probole alienaria
Probole amicaria
Probole nepiasaria
Prochoerodes transversata
Proitame virginalis
Protoarmia porcelaria

<i>Protolampra brunneicollis</i>	<i>Sideridis maryx</i>
<i>Protorthodes oviduca</i>	<i>Sideridis rosea</i>
<i>Proxenus miranda</i>	<i>Smerinthus jamaicensis</i>
<i>Psectraglaea carnosa</i>	<i>Spaelotis clandestina</i>
<i>Pseudaletia unipuncta</i>	<i>Spargaloma sexpunctata</i>
<i>Pseudohermonassa bicarnea</i>	<i>Sphinx drupiferarum</i>
<i>Pseudothyatira cymatophoroides</i>	<i>Sphinx gordius</i>
<i>Pyrrharctia isabella</i>	<i>Sphinx poecilla</i>
<i>Raphia frater</i>	<i>Spilosoma congrua</i>
<i>Redectis vitrea</i>	<i>Spilosoma dubia</i>
<i>Renia "adspergillus"</i>	<i>Spilosoma latipennis</i>
<i>Renia discoloralis</i>	<i>Spilosoma virginica</i>
<i>Renia factiosalis</i>	<i>Spiramater grandis</i>
<i>Renia flavipunctalis</i>	<i>Spiramater lutra</i>
<i>Renia nemoralis</i>	<i>Spodoptera frugiperda</i>
<i>Renia salusalis</i>	<i>Spodoptera ornithogalli</i>
<i>Renia sobrialis</i>	<i>Sunira bicolorago</i>
<i>Rheumaptera hastata</i>	<i>Sutnya privata</i>
<i>Rhizedra lutosa</i>	<i>Symmerista albifrons</i>
<i>Schinia arcigera</i>	<i>Syngrapha octoscripta</i>
<i>Schinia septentrionalis</i>	<i>Tacparia atropunctata</i>
<i>Schinia spinosae</i>	<i>Tacparia detersata</i>
<i>Schizura apicalis</i>	<i>Tarachidia candefacta</i>
<i>Schizura badia</i>	<i>Tetracis cachexiata</i>
<i>Schizura ipomoeae</i>	<i>Tetracis crocallata</i>
<i>Schizura leptinoides</i>	<i>Tolype laricis</i>
<i>Schizura unicornis</i>	<i>Tolype velleda</i>
<i>Scoliopteryx libatrix</i>	<i>Tricholita signata</i>
<i>Scopula cacuminaria</i>	<i>Ulolonche culea</i>
<i>Scopula inductata</i>	<i>Ulolonche modesta</i>
<i>Scopula limboundata</i>	<i>Xanthia togata</i>
<i>Semiothisa aemulitaria</i>	<i>Xanthorhoe lacustrata</i>
<i>Semiothisa bicolorata</i>	<i>Xanthotype sospeta</i>
<i>Semiothisa bisignata</i>	<i>Xanthotype urticaria</i>
<i>Semiothisa continuata</i>	<i>Xestia c-nigrum</i>
<i>Semiothisa granitata</i>	<i>Xestia c-nigrum/dolosa</i>
<i>Semiothisa minorata</i>	<i>Xestia dilucida</i>
<i>Semiothisa multilineata</i>	<i>Xestia dolosa</i>
<i>Semiothisa pinistrobata</i>	<i>Xestia elimata/praevia</i>
<i>Semiothisa sexmaculata</i>	<i>Xestia normaniana</i>
<i>Semiothisa transitaria</i>	<i>Xestia smithii</i>
<i>Semiothisa ulsterata</i>	<i>Xylomoia chagnoni</i>
<i>Sideridis congermana</i>	<i>Xylotype capax</i>

Xystopeplus rufago

Zale aeruginosa

Zale curema

Zale helata

Zale horrida

Zale lunata

Zale metatoides

Zale minerea

Zale obliqua

Zale submediana

Zale unilineata

APPENDIX D – ODONATE
(DRAGONFLY and DAMSELFLY)
SPECIES OF CAMP EDWARDS, MA.

Common Name (N=68)	Scientific name		
Amber-winged Spreadwing	<i>Lestes eurinus</i>	Ruby Meadowhawk	<i>Sympetrum rubicundulum</i>
Atlantic Bluet	<i>Enallagma doubledayi</i>	Scarlet Bluet	<i>Enallagma pictum</i>
Azure Bluet	<i>Enallagma aspersum</i>	Seaside Dragonlet	<i>Erythrodiplex berenice</i>
Black Saddlebags	<i>Tramea lacerata</i>	Sedge Sprite	<i>Nehalennia irene</i>
Black-tipped Darner	<i>Aeshna tuberculifera</i>	Shadow Darner	<i>Aeshna umbrosa</i>
Blue Corporal	<i>Libellula deplanata</i>	Skimming Bluet	<i>Enallagma geminatum</i>
Blue Dasher	<i>Pachydiplax longipennis</i>	Skimming Bluet	<i>Enallagma signatum</i>
Calico Pennant	<i>Celithemis elisa</i>	Slaty Skimmer	<i>Libellula incesta</i>
Carolina Saddlebags	<i>Tramea carolina</i>	Slender Spreadwing	<i>Lestes rectangularis</i>
Citrine Forktail	<i>Ischnura hastata</i>	Spangled Skimmer	<i>Libellula cyanea</i>
Comet Darner	<i>Anax longipes</i>	Spatterdock Darner	<i>Aeshna mutata</i>
Common Baskettail	<i>Epitheca cynosura</i>	Sphagnum sprite	<i>Nehalennia gracilis</i>
Common Green Darner	<i>Anax junius</i>	Spotted Spreadwing	<i>Lestes congener</i>
Common or Sweetflag		Spot-winged Glider	<i>Pantala hymenaea</i>
Spreadwing	<i>Lestes disjunctus/forcipatus</i>	Stream Cruiser	<i>Didymops transversa</i>
Common Sanddragon	<i>Progomphus obscurus</i>	Swamp Spreadwing	<i>Lestes vigilax</i>
Common Spreadwing	<i>Lestes disjunctus</i>	Sweetflag Spreadwing	<i>Lestes forcipatus</i>
Common Whitetail	<i>Libellula lydia</i>	Twelve-spotted Skimmer	<i>Libellula pulchella</i>
Dot-tailed Whiteface	<i>Leucorrhinia intacta</i>	Twelve-spotted Skimmer	<i>Libellula pulchella</i>
Eastern Amberwing	<i>Perithemis tenera</i>	Variable Dancer	<i>Argia fumipennis</i>
Eastern Forktail	<i>Ischnura verticalis</i>	Vesper Bluet	<i>Enallagma vesperum</i>
Eastern Pondhawk	<i>Erythemis simplicicollis</i>	Wandering Glider	<i>Pantala flavescens</i>
Elegant Spreadwing	<i>Lestes inaequalis</i>	White Corporal	<i>Libellula exusta</i>
Four-spotted Skimmer	<i>Libellula quadrimaculata</i>	Widow Skimmer	<i>Libellula luctuosa</i>
Fragile Forktail	<i>Ischnura posita</i>	Yellow-legged Meadowhawk	<i>Sympetrum vicinum</i>
Fragile Forktail	<i>Ischnura posita</i>		
Frosted Whiteface	<i>Leucorrhinia frigida</i>		
Golden-winged Skimmer	<i>Libellula auripennis</i>		
	<i>Libellula</i>		
Goldenwings	<i>auripennis/needhami</i>		
Great Blue Skimmer	<i>Libellula vibrans</i>		
Green-striped Darner	<i>Aeshna verticalis</i>		
Halloween Pennant	<i>Celithemis eponina</i>		
Lancet Clubtail	<i>Gomphis exilis</i>		
Lilypad Forktail	<i>Ischnura kellicotti</i>		
Lyre-tipped Spreadwing	<i>Lestes unguiculatus</i>		
Martha's Pennant	<i>Celithemis martha</i>		
Mottled Darner	<i>Aeshna clepsydra</i>		
New England Bluet	<i>Enallagma laterale</i>		
Northern Bluet	<i>Enallagma cyathigerum</i>		
Common Name (N=68)	Scientific name		
Painted Skimmer	<i>Libellula semifasciata</i>		
Petite Emerald	<i>Dorocordulia lepida</i>		
Pond Damselfly	<i>Coenagrionidae species</i>		

**APPENDIX E – BIRD SPECIES OF
CAMP EDWARDS, MA**

Common Name (N=105)	Scientific name		
Acadian Flycatcher	<i>Empidonax veriscens</i>	Fish Crow	<i>Corvus ossifragus</i>
American Crow	<i>Corvus brachyrhynchos</i>	Grasshopper Sparrow	<i>Ammodramus savannarum</i>
American Goldfinch	<i>Carduelis tristis</i>	Gray Catbird	<i>Dumetella carolinensis</i>
American Kestrel	<i>Falco sparverius</i>	Great Blue Heron	<i>Ardea herodias</i>
American Robin	<i>Turdus migratorius</i>	Great Crested Flycatcher	<i>Myiarchus crinitus</i>
American Woodcock	<i>Scolopax minor</i>	Great Horned Owl	<i>Bubo virginianus</i>
Bank Swallow	<i>Riparia riparia</i>	Green-backed Heron	<i>Butorides striatus</i>
Barn Swallow	<i>Hirundo rustica</i>	Hairy Woodpecker	<i>Picoides villosus</i>
Belted Kingfisher	<i>Ceryle alcyon</i>	Hermit Thrush	<i>Catharus guttatus</i>
Black-and-white Warbler	<i>Mniotilta varia</i>	Herring Gull	<i>Larus argentatus</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	Horned Lark	<i>Eremophila alpestris</i>
Black-capped Chickadee	<i>Parus atricapillus</i>	House Finch	<i>Carpodacus mexicanus</i>
Blackpoll Warbler	<i>Dendroica striata</i>	House Sparrow	<i>Passer domesticus</i>
Blue Jay	<i>Cyanocitta cristata</i>	House Wren	<i>Troglodytes aedon</i>
Broad-winged Hawk	<i>Buteo platypterus</i>	Indigo Bunting	<i>Passerina cyanea</i>
Brown Creeper	<i>Certhia americana</i>	Killdeer	<i>Charadrius vociferus</i>
Brown Thrasher	<i>Toxostoma rufum</i>	Mallard	<i>Anas platyrhynchos</i>
Brown-headed Cowbird	<i>Molothrus ater</i>	Mourning Dove	<i>Zenaida macroura</i>
Canada Goose	<i>Branta canadensis</i>	Mourning Warbler	<i>Oporornis philadelphia</i>
Carolina Wren	<i>Thryothorus ludovicianus</i>	Mute Swan	<i>Cygnus olor</i>
Cedar Waxwing	<i>Bombycilla cedrorum</i>	Northern Bobwhite	<i>Colinus virginianus</i>
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Northern Cardinal	<i>Cardinalis cardinalis</i>
Chimney Swift	<i>Chaetura pelagica</i>	Northern Flicker	<i>Colaptes auratus</i>
Chipping Sparrow	<i>Spizella passerina</i>	Northern Harrier	<i>Circus cyaneus</i>
Clay-colored Sparrow	<i>Spizella pallida</i>	Northern Mockingbird	<i>Mimus polyglottos</i>
Common Grackle	<i>Quiscalus quiscula</i>	Northern Oriole	<i>Icterus galbula</i>
Common Loon	<i>Gavia immer</i>	N. Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>
Common Tern	<i>Sterna hirundo</i>	Orchard Oriole	<i>Icterus spurius</i>
Common Yellowthroat	<i>Geothlypis trichas</i>	Osprey	<i>Pandion haliaetus</i>
Cooper's Hawk	<i>Accipiter cooperii</i>	Ovenbird	<i>Seiurus aurocapillus</i>
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	Peregrine falcon	<i>Falco peregrinus</i>
Downy Woodpecker	<i>Picoides pubescens</i>	Pine Warbler	<i>Dendroica pinus</i>
Eastern Bluebird	<i>Sialia sialis</i>	Prairie Warbler	<i>Dendroica discolor</i>
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Purple Finch	<i>Carpodacus purpureus</i>
Eastern Meadowlark	<i>Sturnella magna</i>	Red Knot	<i>Calidris canutus</i>
Eastern Phoebe	<i>Sayornis phoebe</i>	Red-bellied Woodpecker	<i>Melanerpes carolinus</i>
Eastern Wood-pewee	<i>Contopus virens</i>	Red-breasted Nuthatch	<i>Sitta canadensis</i>
Empidonax Flycatchers	<i>Empidonax spp.</i>	Red-eyed Vireo	<i>Vireo olivaceus</i>
European Starling	<i>Sturnus vulgaris</i>	Red-necked Grebe	<i>Podiceps grisegena</i>
Field Sparrow	<i>Spizella pusilla</i>	Red-tailed Hawk	<i>Buteo jamaicensis</i>
		Red-winged Blackbird	<i>Agelaius phoeniceus</i>
		Rock Dove	<i>Columba livia</i>
		Ruby-throated Hummingbird	<i>Archilochus colubris</i>
		Ruffed Grouse	<i>Bonasa umbellus</i>

Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>
Scarlet Tanager	<i>Piranga olivacea</i>
Sharp-shinned Hawk	<i>Accipiter striatus</i>
Song Sparrow	<i>Melospiza melodia</i>
Swamp Sparrow	<i>Melospiza georgiana</i>
Tree Swallow	<i>Tachycineta bicolor</i>
Tufted Titmouse	<i>Parus bicolor</i>
Turkey Vulture	<i>Cathartes aura</i>
Upland Sandpiper	<i>Bartramia longicauda</i>
Veery	<i>Catharus fuscescens</i>
Vesper Sparrow	<i>Poocetes gramineus</i>
Whip-poor-will	<i>Caprimulgus vociferous</i>
White-breasted Nuthatch	<i>Sitta carolinensis</i>
White-eyed Vireo	<i>Vireo griseus</i>
Wild Turkey	<i>Meleagris gallopavo</i>
Wood Thrush	<i>Hylocichla mustelina</i>
Yellow Warbler	<i>Dendroica petechia</i>
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>

**APPENDIX F – MAMMAL SPECIES
OF CAMP EDWARDS, MA.**

Common Name (N=30)	Scientific Name
Big brown bat	<i>Eptesicus fuscus</i>
Coyote	<i>Canis latrans</i>
Domestic cat	<i>Felis domesticus</i>
Domestic dog	<i>Canis familiaris</i>
Eastern chipmunk	<i>Tamias striatus</i>
Eastern cottontail	<i>Sylvilagus floridanus</i>
Eastern mole	<i>Scalopus aquaticus</i>
Eastern pipistrelle	<i>Pipistrellus subflavus</i>
Fisher	<i>Martes pennanti</i>
Gray fox	<i>Urocyon cinereoargenteus</i>
Gray squirrel	<i>Sciurus carolinensis</i>
Long-tailed weasel	<i>Mustela frenata</i>
Masked shrew	<i>Sorex cinereus</i>
Meadow jumping mouse	<i>Zapus hudsonius</i>
Meadow vole	<i>Microtus pennsylvanicus</i>
Muskrat	<i>Ondatra zibethicus</i>
New England cottontail	<i>Sylvilagus floridanus</i>
Northern myotis	<i>Myotis septentrionalis</i>
Opossum	<i>Didelphis virginiana</i>
Porcupine	<i>Erethizon dorsatum</i>
Raccoon	<i>Procyon lotor</i>
Red bat	<i>Lasiurus borealis</i>
Red fox	<i>Vulpes vulpes</i>
Red squirrel	<i>Tamiasciurus hudsonicus</i>
Short-tailed shrew	<i>Blarina brevicauda</i>
Southern flying squirrel	<i>Glaucomys volans</i>
Southern red-backed vole	<i>Clethrionomys gapperi</i>
Striped skunk	<i>Mephitis mephitis</i>
White-footed mouse	<i>Peromyscus leucopus</i>
White-tailed deer	<i>Odocoileus virginianus</i>
Woodchuck	<i>Marmota monax</i>

APPENDIX G – MEMORANDUMS OF AGREEMENT and MEMORANDUMS OF UNDERSTANDING

MEMORANDUM OF AGREEMENT
Between
The Commonwealth of Massachusetts
And
The United States Army and National Guard Bureau

This Memorandum of Agreement (“Agreement”) is made by and among the Governor of the Commonwealth of Massachusetts (the “Governor”), the United States of America, represented by the Department of the Army (“Army”) and the National Guard Bureau, The Adjutant General of the Massachusetts National Guard and the Military Division of the Commonwealth, the Secretary of Environmental Affairs, the Commissioner of the Department of Fisheries, Wildlife, and Environmental Law Enforcement (“DFWELE”), the Commissioner of the Department of Environmental Management (“DEM”), the Commissioner of the Department of Environmental Protection (“DEP”), collectively referred to herein as the “Parties.”

The purpose of this Agreement is to establish a long-term management structure for the northern 15,000 acres of the Massachusetts Military Reservation (“MMR”) in order to ensure the permanent protection of the drinking water supply and the wildlife habitat, and to ensure that military and other activities are compatible with protection of the drinking water supply and the wildlife habitat.

WHEREAS, the Massachusetts Military Reservation (“MMR”), consisting of approximately 22,000 acres, was established by 1935 Mass. Acts c. 196; 1936 Mass. Acts c. 320; 1936 Mass. Acts. c. 344; 1941 Mass. Acts c. 5; 1955 Mass. Acts c. 655; and 1956 Mass. Acts c. 617 (collectively, the “Enabling Acts”) for the purpose of the use and training of the military forces of the Commonwealth and entrusted to the jurisdiction of the Special Military Reservation Commission; and

WHEREAS, the 22,000 acres of MMR is currently leased by the Commonwealth to the United States of America until the year 2026 by three separate leases: one to the United States represented by the Department of the Army; one to the United States represented by the Department of the Air Force; and one to the United States represented by the Department of Transportation; and

WHEREAS, the northern approximately 15,000 acres are leased by the Commonwealth to the United States acting through the Department of the Army for military uses; and

WHEREAS, the Department of the Army licensed the northern 15,000 acres of the MMR to the Commonwealth, acting through the Massachusetts Army and Air National Guard (the "Massachusetts National Guard") for year-round training and support of the Massachusetts National Guard;

WHEREAS, the northern approximately 15,000 acres of the MMR are environmentally sensitive lands; and

WHEREAS, the Massachusetts Army National Guard, as the primary occupant of the northern approximately 15,000 acres of the MMR, provides operational staffing, maintenance and repair, environmental compliance and security programs for this property. The Massachusetts Army National Guard's programs for the northern 15,000 acres of the MMR include, but are not limited to, a Real Property and Maintenance program, an Integrated Training Area Management Program, environmental awareness and compliance programs, an Installation Restoration Program, an Integrated Cultural Resources Management Plan, and an Integrated Natural Resources Management Plan, all as described in more detail in Appendix 1; and

WHEREAS, pursuant to the Massachusetts Environmental Policy Act ("MEPA"), Mass. Gen. L. c. 30 §§61-62H, the Secretary of Environmental Affairs issued a Certificate in April 1997 to the Massachusetts National Guard to develop, in coordination with community participants, an environmental master plan for the future use of MMR. A second MEPA Certificate issued by the Secretary to The Adjutant General in May 1997 established a scope for the master plan effort and created a Community Working Group ("CWG") to advise the Secretary and develop a consensus vision for MMR, including public participation in environmental review of the forthcoming master plan, of specific proposed projects, and of those projects that may be developed through the master plan; and

WHEREAS, in September 1998, the CWG issued its *Master Plan Final Report*, which recommended future uses and activities at MMR. The *Master Plan Final Report* distinguished between the Cantonment Zone, where more intensive military and civilian activities may be anticipated, and the Water Supply Management Zone, which is co-extensive with the northern 15,000 acres of the MMR. The *Master Plan Final Report* described the purpose of the northern 15,000 acres as "permanent protection and coordinated management plans for water supply, wildlife habitat, and open space protection consistent with necessary and compatible military activities"; and

WHEREAS, the Final Environmental Impact Report and a subsequent informational supplement proposed a comprehensive set of Environmental Performance Standards (EPS) (Appendix 2) designed to guide all activities on the northern 15,000 acres of the MMR, and in particular training on the northern 15,000 acres. The proposed EPS received extensive review and were strengthened throughout the MEPA process. Each EPS meets or exceeds applicable regulatory standards. On July 16, 2001, the Secretary issued a Certificate finding that the Final Environmental Impact Report adequately and properly complies with MEPA, subject to the execution of an enforceable management agreement that embodies the Guiding Principles (Appendix 3); and

WHEREAS, the Parties mutually agree that a cooperative partnership between the Commonwealth and the military for the management of the northern 15,000 acres of the MMR is necessary in order to ensure the permanent protection of the drinking water supply and wildlife habitat, and to ensure that military and other activities are compatible with protection of the drinking water supply and the wildlife habitat;

NOW, THEREFORE, the Parties agree as follows:

General Responsibilities

1. All military and other activities conducted on the northern 15,000 acres of the MMR shall be conducted in accordance with all applicable federal and state environmental laws and regulations and the EPS.
2. The Massachusetts National Guard shall coordinate the activities of the various military and other users of the northern 15,000 acres of the MMR, excluding the Air Force PAVE PAWS site and the Coast Guard Transmitter site, which are addressed in paragraph 24, to ensure security and maintenance of the area.

Environmental Management Commission

3. The Governor shall establish by Executive Order an independent Environmental Management Commission ("EMC") of MMR. The Governor will file legislation to codify the EMC and its functions. The EMC shall consist of three *ex officio* members: the Commissioner of the Department of Fisheries, Wildlife, and Environmental Law Enforcement; the Commissioner of the Department of Environmental Management; and the Commissioner of the Department of Environmental Protection.
4. The purpose of the EMC shall be to ensure the permanent protection of the drinking water supply and wildlife habitat of the northern 15,000 acres of the MMR. The EMC shall ensure, by independent oversight, monitoring, and evaluation, that all military and other activities on the northern 15,000 acres are consistent with this purpose. The EMC shall oversee compliance with and enforcement of the Environmental Performance Standards (EPS); coordinate the actions of state environmental agencies in the enforcement of laws and regulations, as appropriate; and facilitate an open and public review of all activities on the northern 15,000 acres of the MMR.

Advisory Councils

5. The EMC shall be assisted by two advisory councils:
 - a. Community Advisory Council ("CAC"). The CAC shall be comprised of the following members: one representative of each of the towns of Falmouth, Bourne, Sandwich, and Mashpee; one family member resident of MMR; two representatives of the military; one representative of the Cape Cod Commission; one representative of the Upper Cape Regional Water Supply Cooperative; one representative of the Wampanoag Tribe; and five other members. All members shall be appointed by the Governor, provided that the

town representatives shall be recommended by the towns' respective Boards of Selectmen; the MMR family member resident shall be selected from among a list of five persons provided by the Commander of the Coast Guard Air Station Cape Cod; the military representatives shall be recommended by the Military Division of the Commonwealth; the Cape Cod Commission representative shall be recommended by the Cape Cod Commission; the Upper Cape Regional Water Supply Cooperative representative shall be recommended by the Upper Cape Regional Water Supply Cooperative; and the Wampanoag Tribe representative shall be recommended by the tribal leadership. The CAC shall assist the EMC by providing advice on issues related to the protection of the drinking water supply and wildlife habitat on the northern 15,000 acres of the MMR

b. Science Advisory Council ("SAC"). The SAC shall be appointed by the Governor and be comprised of five (5) to nine (9) scientists and engineers who are recognized for their expertise in the areas of public health, water protection, wildlife habitat management, or land use management. The SAC shall assist the EMC by providing advice on scientific and technical issues related to the protection of the drinking water supply and wildlife habitat on the northern 15,000 acres of the MMR.

Environmental Officer

6. The EMC shall designate a state employee to serve as the MMR Environmental Officer ("EO") and may designate such additional persons as may be necessary to carry out the activities of the Commission. The EO shall report to the EMC. The duties and responsibilities of the EO shall be to monitor the activities being conducted on and the uses of the northern 15,000 acres of the MMR and the impact of such activities and uses on the drinking water supply and wildlife habitat of the northern 15,000 acres of the MMR. The EO shall also coordinate with appropriate personnel from DFWELE, DEM, and DEP to monitor and evaluate the environmental impact of activities conducted on and uses of the northern 15,000 acres of the MMR. The Massachusetts National Guard shall provide the EO with office space located within the Environmental Readiness Center (ERC) or other such location on the MMR as may be appropriate to carry out the EO's duties. The Massachusetts National Guard shall designate an individual as its representative and liaison to the EMC.

Access and Information

7. EMC, DFWELE, DEM, and DEP personnel shall have access to the northern 15,000 acres of the MMR in order to monitor, oversee, evaluate, and report to the EMC on the environmental impact of military training and all other activities. Such access shall be allowed prior to, during, and immediately following training or other activities upon proper notice and in accordance with Camp Edwards Standard Operating Procedures (SOP), regulations, and security requirements.

8. The Massachusetts National Guard and the Army shall allow the EO, acting on behalf of the EMC, regular and unrestricted access to all data and information from the various environmental and management programs and activities operating on Camp Edwards. These programs and activities include, but are not limited to, the Integrated Training Area Management Program

(ITAM); the Integrated Natural Resources Management Plan (INRMP); the Integrated Cultural Resources Management Plan (ICRMP); Camp Edwards SOPs; and any other program or activity created by the Army or the Massachusetts National Guard for the purpose of managing or maintaining the northern 15,000 acres of the MMR. Access to data and information shall not include restricted or classified information, unless the EO obtains the appropriate level of security clearance. The Army and the Massachusetts National Guard shall use its best efforts to assist the EO in obtaining the appropriate level of security clearance. The Massachusetts National Guard shall also submit all draft and final Impact Area Ground Water Study Reports to the EMC for information, as soon as such reports become available.

Annual State of the Reservation Report

9. The Massachusetts National Guard shall submit to the EMC, with copies to the SAC and CAC, the Annual State of the Reservation Report, required by Mass. Gen. L. c. 30, §61, describing in detail: (a) the nature and extent of military training and other activities; (b) all resource management activities and projects; (c) the status of compliance with applicable federal and state environmental laws and regulations and the EPS; and (d) long-term trends in the major areas of resource management and activities. The Massachusetts National Guard shall make the Annual Report publicly available. This report shall be based primarily upon the management programs referenced in paragraph 8.

Notification Requirements

10. The Massachusetts National Guard shall notify the EMC, in writing and within two (2) business days after discovery, of any violation of an EPS. The notification shall include the nature and extent of the violation and any corrective action that has been taken or will be taken to return to compliance. With respect to a violation of federal or state law that is reported to or by a state or federal agency, the Massachusetts National Guard shall provide the EMC with a copy of any such notice provided to or by the federal or state agency.

11. The Massachusetts National Guard shall also notify the EMC, in writing and within two (2) business days after discovery, of any damage or threat of damage to the drinking water supply or wildlife habitat, even if the damage results, or may result from, an activity that is otherwise compliant with law, regulation, or EPS. Damage shall not include any insignificant damage to these resources.

EMC Actions and Enforcement

12. The EMC shall evaluate all information and data regarding the activities and uses of the northern 15,000 acres of the MMR and the environmental impacts upon the drinking water supply and wildlife habitat of the northern 15,000 acres of the MMR and may take appropriate action. The EMC may consult with the SAC, CAC, or other entities in evaluating such information and in taking such action.

13. If the EMC determines that a user has violated or is violating an EPS, the EMC will notify the violator of the violation and may: (1) in the case of an imminent and substantial damage,

order such activity to cease immediately, or require adjustments in the activity to eliminate the imminent and substantial damage or threat of damage; or (2) in all other cases, require the violator to return to compliance within a reasonable time and to notify the EMC of the corrective action taken, including steps to ensure future compliance. Repeat or willful violations of an EPS may result in sanctions up to and including cessation of activities.

14. The state environmental agencies on the EMC retain all their respective, independent enforcement authority. In response to an enforcement action brought by one of the state environmental agencies, including DFWELE, DEM, and DEP, members of the EMC shall work together to implement coordinated actions at the MMR. In order to avoid, minimize, and mitigate any negative impacts, they shall, in good faith and where appropriate, seek comment and input from one another, the military, and the public before issuing decisions or taking actions at the MMR.

15. If the EMC determines, based upon sound and accepted scientific analysis and evidence, that an activity that is otherwise compliant with law, regulation, or EPS is causing or threatens to cause imminent and substantial damage to the drinking water supply or wildlife habitat of the northern 15,000 acres of MMR, the EMC may: (1) order such activity to cease immediately; or (2) require adjustments in the activity to eliminate the imminent and substantial damage or threat of damage.

Cessation of Activities

16. The Massachusetts National Guard, the Army, and any other user of MMR shall immediately cease or adjust any activity that, in the determination of the Massachusetts National Guard or the EMC, causes or threatens to cause imminent and substantial damage to the drinking water supply or the wildlife habitat of the northern 15,000 acres of the MMR.

Adjustment to Environmental Performance Standards

17. After consultation with the SAC and CAC, the EMC may adjust EPS based upon sound and accepted scientific analysis, monitoring data, and other relevant information. The proponent of any adjustment shall bear the burden of justifying the proposed adjustment and demonstrating that the proposed adjustment is protective of the drinking water supply and wildlife habitat. If the EMC determines that a proposed adjustment may be warranted and does not significantly reduce the standard of environmental protection, it shall publish a notice of availability of the proposed adjustment to the EPS in the *Environmental Monitor*, furnish copies to all members of the CAC and SAC, and accept public comment for a period of at least 30 days following the publication date. Thereafter, the proposed EPS will become effective on a date determined by the EMC. The EMC shall not consider adjustments to the EPS prior to submission of the first State of the Reservation Report, required under paragraph 9 above and to be filed on or about 1 January 2003, unless such an adjustment is necessary to abate an imminent and substantial damage or for national security reasons.

Compliance

18. The military agrees to comply with all decisions and orders of the EMC, provided such decisions or orders do not conflict with federal or state law.

Administrative Process and Reconsideration

19. Prior to issuing an order or deciding an issue that does not involve an imminent and substantial damage, the EMC shall provide the military with an opportunity to be heard.

20. If the EMC issues an order to cease or adjust an activity to avoid imminent and substantial damage, the EMC shall provide the military an opportunity to be heard on the matter within two (2) business days after issuing the order.

21. In the case of an order to abate an activity that causes or threatens to cause imminent and substantial damage to the drinking water supply or wildlife habitat, the Parties agree that the activity shall cease during the pendency of any request for reconsideration.

22. The military may request reconsideration of any decision or order of the EMC by submitting its concerns in writing. The EMC will consider all such requests. The EMC shall reconsider its decision or order, in light of all relevant information, and either affirm, amend, or reverse its decision or order and so indicate in writing within 30 days, unless such time is further extended by mutual agreement of the Parties.

Assumption of Duties

23. In the event the Massachusetts National Guard's license is terminated, the duties and obligations of the Massachusetts National Guard under this Agreement shall be assumed by the Army or any subsequent licensee of the northern 15,000 acres of the MMR.

Exclusion of PAVE PAWS and Coast Guard Transmitter Sites

24. This MOA shall not in any way affect the powers, rights, duties, and liabilities of the Parties with respect to the PAVE-PAWS site or the U.S. Coast Guard Transmitter site:

a. The PAVE-PAWS site, so called, consisting of approximately 87 acres as described in permit # DACA 51-4-81-475 issued by the U.S. Department of the Army to the U.S. Department of the Air Force; said site being a portion of land owned by the Commonwealth and leased to the United States of America, represented by the Department of the Army, as described in its lease contract # DACA 51-5-77-127 and associated supplemental lease agreements,

b. The United States Coast Guard Transmitter site, so called, consisting of approximately 542 acres and shown as "Parcel P" on a plan of land titled "Compiled Plan Showing Leased Areas at Camp Edwards Military Reservation," scale 1"=2000', dated September 30, 1982, and prepared by the United States Army Corp of Engineers; said site being a portion of land owned by the Commonwealth and leased to the United States of America, represented by the Department of Transportation,

United States Coast Guard, as described in its lease document #34836, dated July 1, 1976.

Funding

25. The Parties agree to seek sufficient funding through their budgetary processes in order to share the costs of implementing this Agreement.

Anti-Deficiency Act

26. Any requirement for the payment or obligation of funds established by the terms of this Agreement shall be subject to the availability of appropriated funds, and no provision herein shall be interpreted to require obligation or payment of funds in violation of the Anti-Deficiency Act, 31 U.S.C §1341.

Amendment, Modification, and Termination of Agreement

27. This Agreement may be amended or modified solely upon the written consent of all Parties. Such amendments or modifications shall have as the effective date that date on which they are signed by all Parties and notice thereof is provided to each signatory. This Agreement shall remain in effect for as long as the Army continues to lease the northern 15,000 acres of the MMR, unless sooner terminated upon the mutual agreement of the Parties.

Other Claims

28. Nothing in this Agreement shall be construed to create any rights in, or grant any cause of action to, any person not a Party to this Agreement.

Enforceability

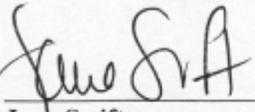
29. In addition to the rights and obligation arising under this Agreement, the Parties retain their rights and obligations under law. This Agreement shall be enforceable in accordance with applicable laws and regulations in any court of competent jurisdiction.

SIGNATURE PAGE FOLLOWS

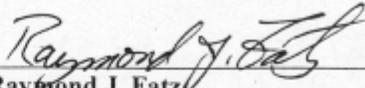
NOW, THEREFORE, this 4th day of October 2001, the Parties so agree:

Commonwealth of Massachusetts

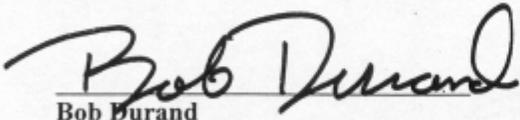
Department of the Army

Active


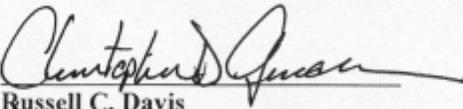
Jane Swift
 Governor



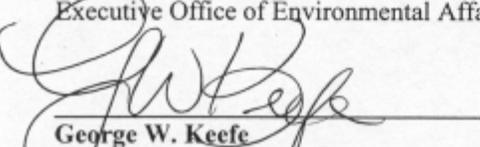
Raymond J. Fatz
 Deputy Assistant Secretary of the Army
 (Environment, Safety & Occupational Health)
 Office of the Assistant Secretary of the Army
 (Installations & Environment)



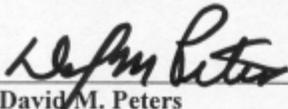
Bob Durand
 Secretary
 Executive Office of Environmental Affairs



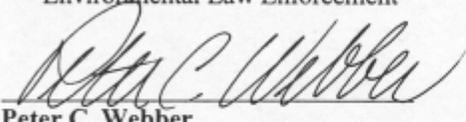
Russell C. Davis
 Lieutenant General, USAF
 Chief, National Guard Bureau



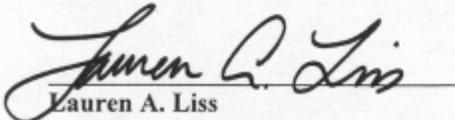
George W. Keefe
 Brigadier General, USAF
 The Adjutant General of the Massachusetts National Guard
 and the Military Division of the Commonwealth



David M. Peters
 Commissioner
 Department of Fisheries, Wildlife, and
 Environmental Law Enforcement



Peter C. Webber
 Commissioner
 Department of Environmental Management



Lauren A. Liss
 Commissioner
 Department of Environmental Protection



MEMORANDUM OF UNDERSTANDING
between
The Wampanoag Tribe of Gay Head-Aquinnah
and
The Massachusetts Army National Guard
for
Cultural Resource Planning and Management



WHEREAS the Massachusetts Army National Guard (MAARNG) owns, uses and controls land for the purposes of federal military training and related activities and conducts training and support operations on lands other than those owned or controlled by the MAARNG in the State of Massachusetts, AND

WHEREAS the Massachusetts National Guard recognizes the status of the Wampanoag Tribe of Gay Head-Aquinnah (TRIBE) as a Sovereign Nation and a federally recognized Indian Tribe, AND

WHEREAS the MAARNG recognizes that it has an obligation pursuant to federal law, policy and executive orders to provide timely and meaningful opportunities for the tribes participation and input on MAARNG activities or determinations that impact, or may potentially impact, the Tribe, AND

WHEREAS the MAARNG and the Wampanoag Tribe of Gay Head-Aquinnah AGREE that the military training activities of the Massachusetts Army National Guard may from time to time affect cultural resources affiliated with the Wampanoag Tribe of Gay Head-Aquinnah, and its non-federally recognized sister Tribe, The Mashpee Wampanoag, including Traditional Cultural Properties, properties of traditional religious and cultural importance, sacred sites, human remains and associated cultural items, AND

WHEREAS the MAARNG recognizes the Wampanoag Tribe of Gay Head-Aquinnah's, here after referred to as the Wampanoag Tribe, special expertise with respect to the cultural resources set forth in the foregoing paragraph, AND

WHEREAS the MAARNG seeks to work cooperatively with the Wampanoag Tribe in managing affiliated cultural resources on land under MAARNG's ownership and control and on lands other than those owned or controlled by MAARNG but used for training and support operations by MAARNG, and in meeting all legal requirements, polices, guidance applicable to conservation, protection and management of Tribal cultural resources; AND

WHEREAS the Wampanoag Tribe and MAARNG have consulted on a government-to-government basis and mutually agree on the principles set forth in this document, NOW, THEREFORE: the MAARNG and the Tribe agree that the following principles and procedures will guide conservation, protection and management of affiliated cultural resources on land under the ownership or control of the MAARNG and on other lands other than those owned or controlled by the MAARNG but used for training and support activities:

The MAARNG, in consultation with the Wampanoag Tribe, shall establish procedures for Such procedures will be incorporated into the MAARNG Integrated Cultural Resource Management Plan (ICRMP) and shall follow and adhere to the regulations and guidelines in regard to federally recognized Indian Tribes as published in AR 200-4 and DA-PAM 200-4 and all other applicable federal laws, polices, guidance and executive orders.

- The MAARNG shall consult with the Wampanoag Tribe in development of the Massachusetts Army National Guard's Integrated Cultural Resources Management Plan (ICRMP). The Tribe shall have a timely and meaningful opportunity for review, comment and input at all phases of plan development that include issues pursuant to Wampanoag cultural resources, including scoping sessions, as well as, suggested levels and locations for surveys.

The MAARNG will not complete the ICRMP without first soliciting, considering, and responding to the written comments of the Wampanoag Tribe. The FINAL ICRMP shall, to the greatest extent practicable, reflect the mutual agreement of the MAARNG and the Wampanoag Tribe regarding management of affiliated cultural resources. During the course of ICRMP preparation and implementation, the following procedures will be followed to avoid conflicts over management of affiliated cultural resources:

The MAARNG shall require their contractor(s) TO provide a monthly report to the Wampanoag Tribe's Designated Historic Preservation Officer and the Tribal Chairperson, summarizing cultural resource management activities and other undertakings as may be applicable, to Traditional Cultural Properties or potential cultural properties locations and findings of such, both pre-historic and historic during the annual field survey period or when any undertakings or action takes place which may or will affect Traditional Cultural Properties, properties of traditional, religious, and cultural importance, sacred sites, human remains or associated cultural items.

The MAARNG will provide an annual report to the Wampanoag Tribe, but not limited to, dispositions, treatment, and curation, that includes the site locations and all other pertinent information on sites including, present and ongoing surveys conducted by their archaeology contractor.

The Wampanoag Tribe agrees to make A good faith effort to respond within thirty (30) days or less, where feasible and warranted, to requests for information from MAARNG for, consultation, or concurrence in relation to issues of Traditional Cultural Properties, sacred sites, burials or human remains.

The Wampanoag Tribe agrees to protect the confidentiality of site locations by limiting access to such information to the Wampanoag Tribe's Designated Historic Preservation Officer, Tribal Chairperson, and the Tribal Council. The MAARNG agrees to protect the confidentiality of site locations by limiting access to such information to only necessary National Guard operations, the SHPO, and the Wampanoag Tribe, to the greatest extent allowed by law.

The MAARNG recognizes that present and future surveys cannot identify all surface and sub-surface Traditional Cultural Properties, properties of traditional, religious and cultural importance, sacred sites, human remains and associated cultural items, and that such properties may be discovered through future cultural resource management activities or other training related ground disturbing activities. The Wampanoag Tribe agrees that the process created pursuant to this agreement shall be followed, and will not exceed thirty (30) days without further agreement of the parties.

If the MAARNG, at any time, unintentionally discovers, or seeks to intentionally excavate human remains, it will immediately notify the Wampanoag Tribe's Designated Historic Preservation Officer and Tribal Chairperson along with appropriate law enforcement and other local and state agencies, cease activities that could impact such remains, consulting with the Wampanoag Tribe on a government-to-government basis in recognition of the Sovereign status of the Wampanoag, and secure and safeguard the site. Activities in the vicinity of the site shall then cease until such time as the Wampanoag Tribe's Designated Historic Preservation Officer and National Guard Cultural Resource Officer can arrange for mutual inspection of the site and proper disposition.

The MAARNG shall at each site ensure that human remains and cultural items (i.e. associated and unassociated grave goods, sacred objects, and objects of cultural patrimony) are secured, treated and repatriated in accordance with the provisions of the Native American Graves Protection and Repatriation Act, its implementing regulations and Army Regulation 200-4 and DA-PAM 200-4.

The MAARNG agrees, for purposes of compliance with Section 106 of the National Historic Preservation Act, that the Wampanoag Tribe shall be included as a concurring party and signatory on all Memoranda of Agreement and Programmatic Agreements, or similar documents, for undertakings affecting Tribally affiliated Traditional Cultural Properties, properties of traditional, religious and cultural importance, sacred sites, human remains and associated cultural items. The MAARNG shall consult with the Wampanoag Tribe, on all no effect, beneficial effect, no adverse effect, and adverse effect determinations for undertakings with potential to impact Traditional Cultural Properties and sacred sites.

The parties to this agreement designate and mutually recognize and endorse the following points of contact for purposes of carrying out any communication and consultation necessary for implementation of the principles and processes of this agreement.

Matthew J. Vanderhoop
Tribal Historic Preservation Officer
Wampanoag Tribe of Gay Head-Aquinnah

Cultural Resource Management Officer
Massachusetts Army National Guard

The afore mentioned points of contact shall refer matters arising under this agreement to higher National Guard and Tribal Authority as the occasion and/or protocol demand. Should the MAARNG point of contact change, the MAARNG agrees that it shall contact the Wampanoag Tribe and inform the Tribal Chairperson regarding the appointment of a new point of contact. The Wampanoag Tribe agree that should their point of contact change, they shall inform the Massachusetts Army National Guard and the Adjutant General regarding the appointment of a new point of contact.

Flora and Fauna identified by species and locations must be included in any survey leading to or incorporated in development of an ICRMP. Such information shall be shared with the Wampanoag Tribe's Designated Historic Preservation Officer and the Tribal Chairperson and held confidential by the Massachusetts Army National Guard when such flora and fauna are of cultural importance to the tribe.

Although the DOD Secretary's Professional Qualifications and Standards do not apply to a federally recognized Indian tribe that has agreed to provide expertise, information or technical assistance regarding Traditional Cultural Properties and Sacred Sites, the Wampanoag Tribe agrees to this provision.

Consultation between the Massachusetts Army National Guard Cultural Resource Officer and the Wampanoag Tribe and their Designated Historic Preservation Officer shall be conducted to review no effect, beneficial effect, no adverse effect, and adverse effect determinations to a Traditional Cultural Property or Sacred Site or a nomination to the National Register of Historic Places. Such consultation shall give signatory authority to any Memorandum of Agreement or Programmatic Agreement as is referenced in AR 200-4 and DA-PAM 200-4. The Massachusetts Army National Guard AGREES that in all consultations, including review of individual undertakings pursuant to 36 CFR 800, the Tribe shall be invited to concur or not to concur in any Memorandum of Agreement, Programmatic Agreement or other pertinent documents that have the potential to affect Wampanoag Cultural Resources.

The Massachusetts Army National Guard ICRMP will be developed in a context, regarding Traditional Cultural Properties and Sacred Sites that reflect Tribal Cultural Values.

Nomination/eligibility to National Register of Historic Places.

While the Wampanoag Tribe Indians acknowledge that the only person delegated statutory authority to sign National Register of Historic Places nominations is the Deputy Assistant Secretary of the Army, the Tribe does, however, reserve the right, as it is expressed in the National Historic Preservation Act and Sections 60.11 and 60.12 of 36 CFR 60, to concur or not to concur in preparation of recommendations for nomination to the National Register of Historic Places in consultation with the MAARNG when such is related to, or in regard of, those elements which are Traditional Cultural Properties, Sacred Sites, or of Traditional Cultural Value to the tribe, and further reserves the right of appeal as referenced in 36 CFR 60.

Nominations to the National Register of Historic Places on Traditional Cultural Properties and Sacred Sites can only be submitted if mutually agreed upon by both the MAARNG and the Wampanoag Tribe.

It is neither the intent, nor is in the interest of the Wampanoag Tribe of Gay Head-Aquinnah, to act as representatives of any other federally recognized Indian tribe without their express authorization in writing. It is understood that this document may be employed in whole or in part, MADE into separate agreements made by other federally recognized Indian tribes and the Massachusetts Army National Guard and/or the other elements of the Department of Defense or any other federal agency.

MAARNG agrees that Traditional Cultural Properties will be defined by the Wampanoag Tribe and include but are not limited to:

Any pre-historic or historic site location and its components, which relate, or may relate to the Wampanoag Tribe and their ancestral kin groups, clans, or tribes.

Artifacts with surface or sub-surface locations.

Man-made or natural features including dwellings, mounds and other earth works.

Certain trees, shrubs, and plants.

Certain stones, minerals, and fossils.

Animal parts either terrestrial or marine.

MAARNG AGREES THAT Sacred Sites can only be designated on a case by case basis by the Wampanoag Tribe Designated Historic Preservation Officer and with the concurrence of the Wampanoag Tribal Chairperson and Tribal Council, as they may relate to the Wampanoag Tribe.

MAARNG agrees that Executive Order 13007 expresses in general the parameters of sacred sites and expresses the accommodations that must be made for access, use and protection of such sacred sites.

The parties agree that this Memorandum of Understanding shall take effect on the date it is signed by the Adjutant General of the Massachusetts Army National Guard and the Chairperson of the Wampanoag Tribe as properly witnessed and shall remain in effect until 01 January 2010 unless properly terminated by either party. This Memorandum of Understanding may be extended and/or amended past that date by accord of both parties.

If at any time during implementation of this Memorandum of Understanding, either party raises an objection, both agree to appropriate consideration and consultation intended to resolve the objection.

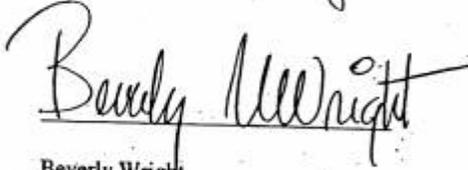
The Massachusetts Army National Guard and/or the Wampanoag Tribe of Gay Head-Aquinnah may terminate this Memorandum of Understanding by providing sixty- (60) working days notice to the other signatory party by Registered Mail. After such notification, but prior to the date of termination, both parties shall within ten (10) working days of notification, set a mutual date to consult and seek a satisfactory solution that would avoid termination.

Nothing in this agreement prohibits or reduces either party's right to full lawful remedy or recourse for failure to comply with any and all terms agreed to herein.

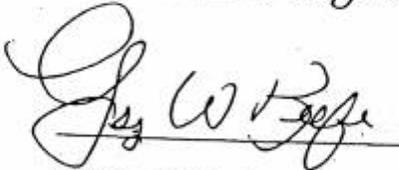
NOW THEREFORE, it is agreed that the MAARNG and the Wampanoag Tribe of Gay Head-Aquinnah will jointly cooperate to achieve the principles and purposes set forth in this Memorandum of Understanding.

Signed this 30th day of Aug, 2001.

Signed this 30th day of Aug, 2001



Beverly Wright
Chairperson
Wampanoag Tribe of Gay Head-Aquinnah



BG George W. Keefe
The Adjutant General
Massachusetts Army National Guard

Witnesses:



**MEMORANDUM OF AGREEMENT BY AND BETWEEN
THE
COMMONWEALTH OF MASSACHUSETTS,
DEPARTMENT OF CONSERVATION AND RECREATION
AND
THE MASSACHUSETTS ARMY NATIONAL GUARD**

PARTIES

The Department of Conservation and Recreation (“DCR”) at 251 Causeway Street, Suite 600, Boston MA 02114, acting through its Acting Commissioner, Priscilla E. Geigis and The Massachusetts Army National Guard (“MAARNG”), maintaining a principal office at Building 3468, Camp Edwards, MA 02542 (“MAARNG”)

PURPOSE

The purpose of this AGREEMENT is to facilitate the cooperation of the two parties in the use of prescribed fire to maintain and restore ecosystems and endangered or threatened species habitat. This AGREEMENT also provides for the limited exchange of personnel, equipment, information, and funding to obtain this goal.

The MAARNG’s mission is to protect the nature of Camp Edwards and manage over 15,000 acres of land that contains a diverse array of plants, animals and natural communities.

DCR manages over 285,000 acres of state forest and park lands. These lands contain a diverse array of plants and animals, recreational opportunities, and environmental conditions. DCR’s core mission involves the protection and maintenance of the native ecosystems, providing for the health and safety of public and commonwealth employees, and protection of private and public property found within and adjacent to state forests and parks.

Where and when appropriate, management of MAARNG and DCR lands may require the use of prescribed fire. The MAARNG and DCR have the necessary expertise and employ or have under contract personnel and equipment capable of performing prescribed fire management and it may be of mutual benefit of both parties to combine resources on certain prescribed fire management projects.

AGREEMENT

A. DCR and the MAARNG mutually agree to the following:

- 1. At the sole discretion of the assisting party, provide prescribed fire management assistance to the other party, in the form of personnel and/or equipment. Either party may be responsible for supervising a particular prescribed fire including providing the burn boss and otherwise implementing the fire. Such party shall be referred to herein as the "Lead Party" for such fire, and the other party shall be referred to as the "Cooperating Party." The following are examples of assistance that may be provided:**
 - a) Technical assistance, including preparation or review of fire management documents such as fire management plans and prescribed burn plans, instruction of fire management courses, and repair and maintenance of fire management equipment;**
 - b) Pre-burn preparations, including vegetation and fuel load sampling, control line construction and maintenance, and fuels manipulation;**
 - c) Prescribed fire services such as a qualified burn boss, ignition, holding, monitoring of fire behavior and weather, and mop-up.**
- 2. In the event that DCR or the MAARNG requests that the other party be the Lead Party for a particular prescribed burn on land owned by a third party, the party requesting assistance shall provide to the Lead Party written permission from the landowner to conduct fire management on the landowner's property before the fire is initiated.**
- 3. For activities outlined in this agreement, radio frequencies may be shared between the two parties. Each party must adhere to the restrictions and guidelines outlined by the Federal Communications Commission's license for the frequency being used.**
- 4. Each party shall meet the following requirements prior to the initiation of a prescribed burn:**
 - a) An approved prescribed burn plan.**
 - b) All conditions and requirements within the prescribed burn plan are met.**
 - c) The land management official responsible for the property provides written support for the burn.**

- d) The municipal Forest Warden or Fire Chief has agreed in writing or in a recorded verbal communication to allow parties to perform the prescribed burn on the day of the burn.
5. Each party shall follow its own standards with respect to the necessary qualifications of such party's staff. The Lead Party for each project shall be entitled, but not obligated, to review the training, experience, and physical fitness of participating staff of the Cooperating Party to ensure that each crew member meets the minimum standards of the Cooperating Party and shall have the right to deny participation to any individual who does not meet such standards.
6. The burn boss for each prescribed fire shall be responsible for prescribed fire activities. The burn boss shall serve as the incident commander, unless otherwise agreed upon by the parties.
7. The Cooperating Party for each prescribed fire shall designate a chief-of-party, who shall be primarily responsible for the Cooperating Party's personnel and equipment during such fire. The chief-of-party shall work closely with the Lead Party's prescribed burn boss or incident commander. Prior to the initiation of any prescribed fire, the Cooperating Party shall provide to the Lead Party a list of the Cooperating Party's staff and equipment that will be involved in such activities.
8. If at any time the chief-of-party of the Cooperating Party determines that a particular burn or other work is unsafe, or has serious concerns about the advisability of burning or conducting such work, and is unable to reach a satisfactory agreement with the burn boss or incident commander on a prescribed fire or other project so as to rectify the situation, the Cooperating Party shall have the right to withdraw its assistance from such burn or other work; provided, however, that the Cooperating Party shall under no circumstances withdraw such assistance at any time that fire is on the ground (whether due to a test fire, or prescribed fire).
9. Prescribed burning shall take place in a safe manner. A prescribed fire shall be declared an escape fire warranting immediate suppression activities when the holding crew is unable to successfully contain and control burned areas outside of the perimeter of the primary prescribed burn area. The burn boss, incident commander, or municipal Forest Warden or Fire Chief has the authority to declare that the prescribed fire has escaped. On DCR lands, the local DCR District Forest Fire Warden or his/her designee, will serve as the incident commander for escaped fire suppression, unless the municipal Forest Warden or Fire Chief has assigned an incident commander.

10. Annually, each party shall develop a list of its priority prescribed burns and other related projects including services requested, and shall distribute such list to the other party.
11. Annually, an agreement shall be prepared documenting the services each party shall provide and under what conditions such as timing, costs, etc.
12. Each party shall be responsible for paying the salaries of its own personnel and for maintaining its own equipment. However, nothing contained herein shall prevent DCR and the MAARNG from agreeing to share funding or other services not provided for in this agreement, provided that any such agreement shall be specified in a separate document or amendment to this agreement.
13. DCR to the extent allowable by law shall be responsible for claims or damages as a result of or arising out of the negligent act or omission of the DCR, its employees, contractors, or agents. The MAARNG to the extent allowable by law shall hold harmless, indemnify, and defend DCR from any and all liabilities, injuries, losses, damages, judgments, costs, expenses of every kind, and fees, including reasonable attorney's fees actually incurred, that DCR may suffer or incur as a result of or arising out of the negligent act or omission of the MAARNG, its employees, contractors, or agents.
14. It is understood that for the purpose of DCR's worker's compensation coverage, DCR's employees assisting in prescribed burns on MAARNG land are to be considered as employees of DCR and not the MAARNG employees, and that for purposes of the MAARNG's worker's compensation coverage, employees of the MAARNG assisting in prescribed burns on DCR lands are to be considered as employees of the MAARNG and not DCR.
15. The following individuals shall be the sole authorized representatives authorized to implement this AGREEMENT on behalf of their respective organizations.

DCR Authorized Representatives:

James Dimaio, Chief Forester
Massachusetts Bureau of Forestry and Fire Control

Chief or Acting Chief of Fire Control
Massachusetts Bureau of Forest Fire Control

MAARNG Authorized Representative:

Dr. Michael Ciaranca
Natural Resource Manager
Massachusetts Army National Guard

TERM

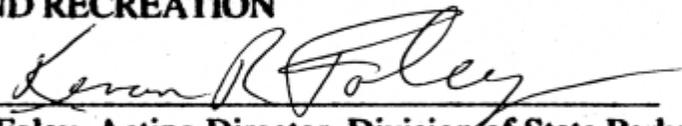
This AGREEMENT shall be effective for a four (4) year term commencing March 1, 2007 through February 28, 2011, and thereafter shall have the option for annual renewal for an additional four (4) years through February 28, 2015.

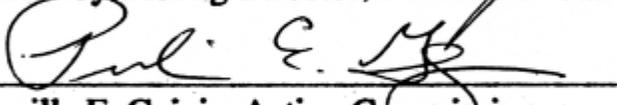
This AGREEMENT may be terminated by either party with not less than thirty (30) days prior notification in writing to the other party at any time.

SIGNATORIES

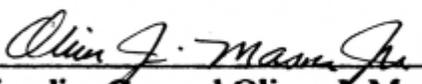
IN WITNESS THEREOF, the parties to this AGREEMENT have caused this Memorandum of Agreement to be signed by their duly authorized officers the day and year below written.

DEPARTMENT OF CONSERVATION AND RECREATION, DIVISION OF STATE PARKS AND RECREATION

Recommended By: 
Ken Foley, Acting Director, Division of State Parks and Recreation

Approved By:  3-22-2007
Priscilla E. Geigis, Acting Commissioner

THE MASSACHUSETTS ARMY NATIONAL GUARD

Approved By: 
Brigadier General Oliver J. Mason, Jr.
The Adjutant General

FIRE MANAGEMENT COOPERATIVE AGREEMENT
Between
THE MASSACHUSETTS ARMY NATIONAL GUARD
And
THE NATURE CONSERVANCY

This Cooperative Agreement is made and entered into between the Massachusetts Army National Guard, maintaining a principal office at Building 3468, Camp Edwards, MA 02542 ("MAARNG"), and The Nature Conservancy, a non-profit corporation organized under the laws of the District of Columbia and having a Massachusetts Field Office at 205 Portland Street, Suite 400, Boston, MA 02114-1708 ("the Conservancy"). The purpose of this Agreement is to facilitate the cooperation of the two parties in the use of fire management to maintain and restore ecosystems and endangered or threatened species habitat. This Agreement provides for the limited exchange of personnel, equipment, information, and funds to obtain this goal.

WHEREAS, the Conservancy's mission is to preserve plants, animals, and natural communities that represent the diversity of life on earth by protecting the lands and water they need to survive; and

WHEREAS, the Conservancy owns and manages more than twenty preserves in the Commonwealth of Massachusetts; and

WHEREAS, one of MAARNG's missions is to protect the nature of Camp Edwards; and

WHEREAS, MAARNG at Camp Edwards manages over 15,000 acres of land that contains a diverse array of plants and animals; and

WHEREAS, proper management of many Conservancy and MAARNG lands requires the use of fire management; and

WHEREAS, the Conservancy and MAARNG have expertise in fire management; and

WHEREAS, MAARNG and the Conservancy currently employ or have under contract personnel and equipment capable of performing fire management activities; and

WHEREAS, it will be of mutual benefit of both parties to combine resources on certain fire management projects

NOW, THEREFORE, in consideration of the mutual covenants contained herein, the parties agree as follows:

1. During the term of this Agreement, the Conservancy and MAARNG may each provide prescribed fire assistance to the other party, in the form of personnel and/or equipment, at the sole discretion of the assisting party. Either party may be

responsible for supervising a particular prescribed fire, as the parties may agree, including providing the burn boss (or other project supervisor), and otherwise implementing the fire. Such party shall be referred to herein as the "Lead Party" for such fire, and the other party shall be referred to as the "Cooperating Party".

2. Either party may provide a variety of services to the other, including:
 - A. Technical assistance, including preparation or review of fire management documents such as fire management plans and prescribed burn plans, instruction of fire management courses, and repair and maintenance of fire management equipment;
 - B. Pre-burn preparations, including vegetation and fuel load sampling, control line construction and maintenance, and fuels manipulation;
 - C. Lead Party services, including burn implementation, burn bossing, ignition, holding, suppression activities, monitoring of fire behavior, weather monitoring, and mop-up
 - D. Fire effects monitoring and evaluation.
3. In the event that MAARNG or the Conservancy requests that the other party be the Lead Party for a particular prescribed burn on land owned by a third party, before the fire is initiated the party requesting assistance shall provide to the Lead Party written permission from the landowner to conduct fire management on the landowner's property.
4. For activities outlined in this agreement, radio frequencies may be shared between the two participating organizations. Each organization must adhere to the restrictions and guidelines outlined by the Federal Communications Commission's license for the frequency being used.
5. Each organization shall follow its own standards with respect to the necessary qualifications of such organization's crew members, including burn bosses and incident commanders. The Lead Party for each prescribed burn shall be entitled, but not obligated, to review the training, experience, and physical fitness of all burn crew members of the Cooperating Party to ensure that each crew member meets the minimum standards of the Lead Party, and shall have the right to deny participation to any individual who does not meet such standards.
6. The burn boss for each prescribed fire shall also be the incident commander for that fire, unless otherwise agreed upon by the parties.

7. The Cooperating Party for each prescribed fire shall designate a chief-of-party, who shall be primarily responsible for the Cooperating Party's personnel and equipment during such fire. The chief-of-party shall work closely with the Lead Party's prescribed burn boss, project supervisor, or incident commander. Prior to the initiation of any prescribed fire, the Cooperating Party shall provide to the Lead Party a list of the Cooperating Party's staff, volunteers and equipment that will be involved in such activities.
8. If at any time the chief-of-party of the Cooperating Party determines that a particular burn or other work is unsafe, or has serious concerns about the advisability of burning or conducting such work, and is unable to reach a satisfactory agreement with the burn boss, project supervisor, or incident commander of the Lead Party so as to rectify the situation, the Cooperating Party shall have the right to withdraw its assistance from such burn or other work; provided, however, that the Cooperating Party shall under no circumstances withdraw such assistance at any time that fire is on the ground (whether due to a test fire, prescribed fire or wildfire).
9. Annually, prior to the initiation of fire season, each party shall develop a list of such party's priority prescribed burns and other related projects, and shall distribute such list to the other party.
10. Each party shall be responsible for paying the salaries of its own personnel and for maintaining its own equipment. However, nothing contained herein shall prevent MAARNG and the Conservancy from agreeing to share funding or other services not provided for in this agreement, provided that any such agreement shall be specified in a separate document or amendment to this agreement.
11. The MAARNG to the extent allowable by law shall hold harmless, indemnify, and defend the Conservancy from any and all liabilities, injuries, losses, damages, judgments, costs, expenses of every kind, and fees, including reasonable attorney's fees actually incurred, that the Conservancy may suffer or incur as a result of or arising out of the negligent act or omission of the MAARNG, its employees, contractors, volunteers or agents. The Conservancy to the extent allowable by law shall hold harmless, indemnify, and defend MAARNG from any and all liabilities, injuries, losses, damages, judgments, costs, expenses of every kind, and fees, including reasonable attorney's fees actually incurred, that MAARNG may suffer or incur as a result of or arising out of the negligent act or omission of the Conservancy, its employees, contractors, volunteers or agents.
12. It is understood that for the purpose of MAARNG's worker's compensation coverage, MAARNG's employees assisting in prescribed burns on Conservancy land are to be considered as employees of MAARNG and not the Conservancy's employees, and that for purposes of the Conservancy's worker's compensation

coverage, employees of the Conservancy assisting in prescribed burns on MAARNG land are to be considered as employees of the Conservancy and not MAARNG.

- 13. The following individuals shall be the sole authorized representatives authorized to implement this agreement on behalf of their respective organizations:

MAARNG 's Authorized Representative:

Dr. Michael Ciaranca
Natural Resource Manager
Massachusetts Army National Guard

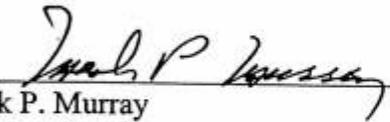
The Conservancy Authorized Representative:

Joel R. Carlson
Fire Manager
Massachusetts Chapter of The Nature Conservancy

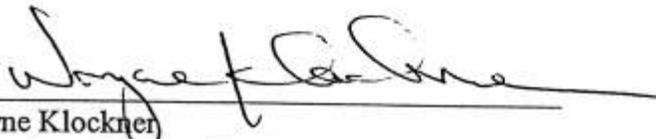
- 14. This Agreement shall be effective from the date hereof and will continue in effect for five years, unless earlier terminated by either party by giving at least thirty days written notification to the other party.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on _____, 2004.

MASSACHUSETTS ARMY NATIONAL GUARD

By: 
Mark P. Murray
State Quartermaster

THE NATURE CONSERVANCY

By: 
Wayne Klockner
Massachusetts State Director

APPENDIX H - COMMENTS AND CORRESPONDENCEREPLY TO
ATTENTION OF:**DEPARTMENTS OF THE ARMY AND THE AIR FORCE
JOINT FORCE HEADQUARTERS
MASSACHUSETTS NATIONAL GUARD
OFFICE OF THE ADJUTANT GENERAL
50 MAPLE STREET
MILFORD, MA 01757-3604**

21 June 2006

Maria Tur
US Fish and Wildlife Service
New England Field Office
70 Commercial Street
Suite 300
Concord, NH 03301

Dear Maria,

The purpose of this letter is to inform you that we have completed the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision and request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

As the foremost authority within the federal government on fisheries and wildlife management, the US Fish and Wildlife Service (USFWS) has the ability to provide valuable advice and guidance during the revision of the Camp Edwards INRMP.

I have enclosed two copies, one hard copy and one CD, of the Camp Edwards INRMP for your review. Please distribute among the staff of the USFWS. The MAARNG is interested in meeting with you and the staff of the USFWS at any time to discuss the Camp Edwards INRMP and any suggestions that you may have for the document. If you have any questions, please call the MAARNG's Natural Resources Manager, Dr. Michael Ciaranca at (508) 968-5121 or the Natural Resources Planner, Mr. John P. Kelly, at (508) 968-5848. I thank you for your time in reviewing this document.

The plan will enter the NEPA process in August 2006. If we receive comments by 1 August 2006, the document will reflect your input for the NEPA process. If however you choose to wait, any input from your agency will not be addressed until the final product.

PLEASE NOTE: THIS DRAFT DOCUMENT IS NOT YET READY FOR PUBLIC DISTRIBUTION.

Sincerely,

A handwritten signature in black ink, appearing to read "William F. FitzPatrick".

William F. FitzPatrick

COL, FA

Deputy Director

Environmental Readiness Center



REPLY TO
ATTENTION OF:

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JOINT FORCE HEADQUARTERS
MASSACHUSETTS NATIONAL GUARD
OFFICE OF THE ADJUTANT GENERAL
50 MAPLE STREET
MILFORD, MA 01757-3604

21 June 2006

Mr. Jason Zimmer
South East District Manager
Massachusetts Division of Fisheries and Wildlife
195 Bournedale Road
Buzzards Bay, MA 02532

Dear Mr. Zimmer,

The purpose of this letter is to inform you that we have completed the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision and request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

As the foremost authority within the state government on fisheries and wildlife management, the MADFW/NHESP has the ability to provide valuable advice and guidance during the development of the Camp Edwards INRMP.

I have enclosed two copies, one hard copy and one CD, of the Camp Edwards INRMP for your review. Please distribute among the staff of the MADFW/NHESP. The MAARNG is interested in meeting with you and the staff of the MADFW/NHESP at any time to discuss the Camp Edwards INRMP and any suggestions that you may have for the document. If you have any questions, please call the MAARNG's Natural Resources Manager, Dr. Michael Ciaranca at (508) 968-5121 or the Natural Resources Planner, Mr. John P. Kelly, at (508) 968-5848. I thank you for your time in reviewing this document.

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William F. FitzPatrick
COL, FA
Deputy Director
Environmental Readiness Center



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MILFORD, MA 01757-3604

21 June 2006

Cheryl Andrews - Maltais
Tribal Historic Preservation Officer
Wampanoag Tribe of Gay Head (Aquinnah)
20 Black Brook Road
Gay Head, Massachusetts 02535-9701

Dear Cheryl Andrews - Maltais,

The purpose of this letter is to inform you that we have completed the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision and request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

The Camp Edwards INRMP briefly addresses cultural resources management; however a more comprehensive Integrated Cultural Resources Management Plan (ICRMP) has been developed by the MAARNG. Therefore, it is of the utmost importance that the MAARNG consult with the Wampanoag Tribe regarding the INRMP. This draft of the document is not final, as we are seeking input and scientific advice from several environmental agencies on the most effective management recommendations for the resources of Camp Edwards.

I have enclosed copies of the Camp Edwards INRMP for your review. The MAARNG is interested in meeting with you and any other members of the Wampanoag Tribe at any time to discuss the Camp Edwards INRMP and any suggestions that you may have for the document. If you have any questions, please call the MAARNG's Natural Resources Manager, Dr. Michael Ciaranca at (508) 968-5121 or the Natural Resources Planner, Mr. John P. Kelly, at (508) 968-5848. I thank you for your time in reviewing this document.

The plan will enter the NEPA process in August 2006. If we receive comments by 1 August 2006, the document will reflect your input for the NEPA process. If however you choose to wait, any input from your agency will not be addressed until the final product.

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Sincerely,

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William F. FitzPatrick
COL, FA
Deputy Director
Environmental Readiness Center



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50 MAPLE STREET
MILFORD, MA 01757-3604**

21 June 2006

Mark Begely
Executive Officer
Enviro. Mngmnt. Comm.
Bldg 1204
Camp Edwards, MA 02542

Dear Mark,

The purpose of this letter is to inform you that we have completed the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision and request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

As part of the oversight authority, EMC, with regards to the MMR and within the state government the EMC has the ability to provide valuable advice and guidance during the development of the Camp Edwards INRMP.

I have enclosed a copy of the Camp Edwards INRMP for your review. The MAARNG is interested in meeting with you at any time to discuss the Camp Edwards INRMP and any suggestions that you may have for the document. The document has been sent to DFW for review and comment. It has also been distributed to the other members of the EMC, SAC, and CAC. If you have any questions, please call the MAARNG's Natural Resources Manager, Dr. Michael Ciaranca at (508) 968-5121 or the Natural Resources Planner, Mr. John P. Kelly, at (508) 968-5848. I thank you for your time in reviewing this document.

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William F. FitzPatrick
COL, FA
Deputy Director
Environmental Readiness Center



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MILFORD, MA 01757-3604**

21 June 2006

Commissioner Stephen H. Burrington
Department of Conservation and Recreation
251 Causeway Street
Boston, MA 02114
617-626-1250

Dear Commissioner Burrington,

The purpose of this letter is to inform you that we have completed the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision and request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

As part of the oversight authority EMC with regards to the MMR and within the state government on fisheries and wildlife management, the EMC has the ability to provide valuable advice and guidance during the development of the Camp Edwards INRMP.

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William F. FitzPatrick
COL, FA
Deputy Director
Environmental Readiness Center



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MILFORD, MA 01757-3604

21 June 2006

Commissioner Robert W. Golledge Jr.
Department of Environmental Protection
One Winter Street
Boston, MA 02108
617-292-5500

Dear Commissioner Golledge,

The purpose of this letter is to inform you that we have completed the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision and request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

As part of the oversight authority EMC with regards to the MMR and within the state government, the EMC has the ability to provide valuable advice and guidance during the development of the Camp Edwards INRMP.

I have enclosed a copy of the Camp Edwards INRMP for your review. The MAARNG is interested in meeting with you at any time to discuss the Camp Edwards INRMP and any suggestions that you may have for the document. The document has been distributed to the other members of the EMC, SAC, and CAC. If you have any questions, please call the MAARNG's Natural Resources Manager, Dr. Michael Ciaranca at (508) 968-5121 or the Natural Resources Planner, Mr. John P. Kelly, at (508) 968-5848. I thank you for your time in reviewing this document.

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Sincerely,


William F. FitzPatrick
COL, FA
Deputy Director
Environmental Readiness Center



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MILFORD, MA 01757-3604

21 June 2006

Commissioner David M. Peters
Department of Fish & Game
251 Causeway St., Suite 400
Boston, MA 02114
Tel: (617) 626-1500

Dear Commissioner Peters,

The purpose of this letter is to inform you that we have completed the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision and request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

As part of the oversight authority, EMC, with regards to the MMR and within the state government on fisheries and wildlife management, the EMC has the ability to provide valuable advice and guidance during the development of the Camp Edwards INRMP.

I have enclosed a copy of the Camp Edwards INRMP for your review. The MAARNG is interested in meeting with you at any time to discuss the Camp Edwards INRMP and any suggestions that you may have for the document. The document has been sent to DFW for review and comment. It has also been distributed to the other members of the EMC, SAC, and CAC. If you have any questions, please call the MAARNG's Natural Resources Manager, Dr. Michael Ciaranca at (508) 968-5121 or the Natural Resources Planner, Mr. John P. Kelly, at (508) 968-5848. I thank you for your time in reviewing this document.

The plan will enter the NEPA process in August 2006. If we receive comments by 1 August 2006, the document will reflect your input for the NEPA process. If however you choose to wait, any input from your agency will not be addressed until the final product.

PLEASE NOTE: THIS DRAFT DOCUMENT IS NOT YET READY FOR PUBLIC DISTRIBUTION.

Sincerely,

A handwritten signature in black ink, appearing to read "William F. FitzPatrick".

William F. FitzPatrick
COL, FA
Deputy Director
Environmental Readiness Center



REPLY TO
ATTENTION OF:

DEPARTMENTS OF THE ARMY AND THE AIR FORCE
JOINT FORCE HEADQUARTERS
MASSACHUSETTS NATIONAL GUARD
OFFICE OF THE ADJUTANT GENERAL
50 MAPLE STREET
MILFORD, MA 01757-3604

21 June 2006

Paul M. Cavanagh
Chair-SAC
225 Thomas Landers Road
East Falmouth, MA 02536

Dear Paul,

The purpose of this letter is to inform you that we have completed the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision and request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

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50 MAPLE STREET
MILFORD, MA 01757-3604

21 June 2006

Lawrence Cole
Chair-CAC
3 Parsons Path
Harwich, MA 02645-3307

Dear Larry,

The purpose of this letter is to inform you that we have completed the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision and request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

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Environmental Readiness Center



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OFFICE OF THE ADJUTANT GENERAL
50 MAPLE STREET
MILFORD, MA 01757-3604**

MAAR-CFMO-ENV-ERC

21 June 2006

MEMORANDUM THRU

Deputy Post Commander, Camp Edwards Headquarters, ATTN: LTC Randall Cordeiro, Bldg 3468, Camp Edwards, MA 02542

FOR Commander, Camp Edwards Headquarters, ATTN: COL Steven E. Wujciak, Bldg 3468, Camp Edwards, MA 02542

SUBJECT: Review and Comment on The Camp Edwards Integrated Natural Resource Plan

The purpose of this letter is to inform you that we have completed the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision and request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

I have enclosed a copy of the Camp Edwards INRMP for your review. The Natural Resource Office of the MAARNG is interested in meeting with you at any time to discuss the Camp Edwards INRMP and any suggestions that you may have for the document. The document has been sent to all other appropriate out side agencies and Joint Force Headquarters for review and comment. If you have any questions, please call the MAARNG's Natural Resources Manager, Dr. Michael Ciaranca at (508) 968-5121 or the Natural Resources Planner, Mr. John P. Kelly, at (508) 968-5848. I thank you for your time in reviewing this document.

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William F. FitzPatrick

COL, FA

Deputy Director

Environmental Readiness Center



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50 MAPLE STREET
MILFORD, MA 01757-3604

MAAR-CFMO-ENV-ERC

21 June 2006

MEMORANDUM THRU

Director Environmental Affairs, Joint Force Headquarters, ATTN: Shawn Cody, 50 Maple Street,
Milford, MA 01757-3604

FOR CFMO, Joint Force Headquarters, ATTN: MAJ Thomas A. Harrop, 50 Maple Street, Milford, MA
01757-3604

SUBJECT: Review and Comment on The Camp Edwards Integrated Natural Resource Plan

The purpose of this letter is to inform you that we have completed the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision and request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

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William F. FitzPatrick
COL, FA
Deputy Director
Environmental Readiness Center



United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087



August 1, 2006

Colonel William F. Fitzpatrick
Massachusetts National Guard
Office of the Adjutant General
50 Maple Street
Milford, MA 01757-3604

Dear Colonel Fitzpatrick:

This responds to your June 21, 2006 request for comments on the draft "Camp Edwards Training Site Integrated Natural Resources Management Plan" (Plan). Our comments are provided in accordance with the Sikes Act (16 U.S.C. 670a et seq.) as amended. Integrating the following comments and suggestions into the Plan will reflect the mutual agreement of the Department of Defense and the U.S. Fish and Wildlife Service concerning conservation, protection, and management of fish and wildlife resources at Camp Edwards and mutual agreement that this Plan constitutes an integrated natural resources management plan that complies with the Sikes Act.

On August 30, 2000, the Service received a petition requesting that we list the New England cottontail (*Sylvilagus transitionalis*) as a threatened or endangered species. We published our initial finding relative to the petition on June 30, 2004 in the Federal Register (enclosure). Our preliminary finding indicates that the petitioned action may be warranted and that a full status review is needed. Consequently, it appears that the New England cottontail will be officially acknowledged as a species in need of conservation attention (most likely as a candidate species). The Plan notes that the species is present at the Camp Edwards facility, and recognizes the need for additional surveys (Chapter 8.8.1). We believe that surveys to assess the distribution and densities of the New England cottontail at the Camp Edwards training site should be among the highest of priorities identified in the Plan.

In addition to the New England cottontail, the early successional shrub/pitch pine barrens at Camp Edwards are likely to support significant numbers of prairie warblers, brown thrasher, eastern towhee and indigo buntings. These birds have experienced significant long-term population declines, as indicated in the Southern New England Partners in Flight Plan (http://www.blm.gov/wildlife/plan/pl_09_10.pdf). Habitat management at Camp Edwards should also consider the needs of these species.

- 2 -

~~Overall~~, the draft Plan is thorough and well written; we appreciate the opportunity to review and comment on it. Please contact Mr. Anthony Tur if we can be of any assistance in future planning efforts, or in the development or conduct of surveys and inventories. Mr. Tur can be reached at 603-223-2541, extension 24.

Sincerely yours,



Michael J. Bartlett
Supervisor
New England Field Office

Enclosure

Ciaranca, Michael Mr NGMA

From: Zimmer, Jason (FWE) [Jason.Zimmer@state.ma.us]
Sent: Tuesday, August 01, 2006 8:50 AM
To: Ciaranca, Michael Mr NGMA
Subject: Comments for INRMP

Mike: Listed below are a few coments that I have come up with or received from staff the INRMP. Please call/email with any questions. Thanks,

Jason

pg 56. Table: Acronicta misspelled, Apharetra has been delisted, Ssp maia maia has r been described, use maia, General status tables: "Heritage status", change to National Status.

pg. 79. Table: Apharetra again.

Section 8.1.1, last paragraph: add "and their habitats" to sentence referring to MESA "take".

Section 8.3-8.5: Excellent discussions. On page 114, however, 1st paragraph, I questi the statement confining all burning to dormant season. Can you achieve all the goals a representative mosaic of community types without occassional growing season fires?

Page 9, last paragraph: deer have not been hit on roads?

Page 47, table: the State status of the eastern box turtle is not listed (SC).

General comments: The INRMP discusses the landscape and habitats, and surveys of them but does not define clear habitat goals. For example, it discusses how much of each habitat type exists, [but does not state how much of each habitat is desired on the landscape and how this will be achieved]

Also, it appears that a lot of field surveys for individual species are conducted (i.e whip-poor-will), but it does not clearly define what the survey data will be used for how the surveys play into the landscape/habitat management goals.

That is it for now. If we come up with anything else, I will forward it along.

Jason

CONVERSATION RECORD			TIME	DATE
TYPE <input type="checkbox"/> VISIT <input type="checkbox"/> CONFERENCE <input checked="" type="checkbox"/> TELEPHONE <input checked="" type="checkbox"/> INCOMING <input type="checkbox"/> OUTGOING			4:30	5 JULY 2006
Location of Visit/Conference:			ROUTING	
NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU			NAME/SYMBOL	INT
MARK HARDING				
ORGANIZATION (Office, dept., bureau, etc.)			TELEPHONE NO.	
CAC MEMBERS WAMPANAGUI reps. of WAMPANAGUI				
SUBJECT				
INWMP				
SUMMARY				
5.7 -				
5.7 SHOULD NOTE MASHPEE IS INITIALLY RECOGNIZED ETC.				
5.8 - PUT THEM IN AS WELL HERE				
✓ 8.11.2 - AIRFA mentioned twice there				
8.11.5 - write MASHPEE soon to be recognized here as well				
8.13.1 - # 3 ^{WAMPANAGUI} signed their rights away w/ federal recognition but MASHPEES retained rights.				
✓ # 4 Camp EDWARDS → Camp EDWARDS				
<i>copy into INWMP</i>				
ACTION REQUIRED				
NAME OF PERSON DOCUMENTING CONVERSATION			SIGNATURE	DATE
JOHN KEIM				5 JULY 2006
ACTION TAKEN				
SIGNATURE			TITLE	DATE
50271-101	1985-485-494	CONVERSATION RECORD	OPTIONAL FORM 271 (12-76) DEPARTMENT OF DEFENSE	

Mark Begely

Comments; big picture

1. Over all, very good document.
2. Explain relationship of the document to other programs, e.g., the relationship of the INRMP the Camp Edwards Environmental Management System, etc.
3. Draft needs further updating to make current, several sections contain narrative from first INRMP that is outdated.
4. Very little attention in the INRMP to some natural resources, e.g., water resources.
5. The Range and Training Land Assessment does not include the area where most of scrub oak shrubland is located, the impact area. Where extensive clearing, UXO clearance, and assessment work for the cleanup is ongoing in that area, and it is in such a key resource area, monitoring and natural resource assessment under the IMRMP should be crafted in a manor that is both safe and inclusive.
6. The word "increase" is used in some of the Goals and Objectives (see pages 176 – 177 for example). Adding measures or metrics to the goal or objective will help quantify how much of an increase is desired.

Specific comments (most of which were pointed out in our meeting);

- a. Preface, page vii: Update to include EMC, SAC CAC, and update the names of the agencies listed.
- b. Executive Summary, page xxi: Mention that Camp Edwards training area is also the Upper Cape Water Supply Reserve ("the Reserve") and the purpose of the Reserve.
- c. Section 1.2, page 1, last paragraph: point out the shift in custody to DFW.
- d. Section 1.3, page 3, 4th paragraph: "Tungsten tin" needs correction.
- e. Section 1.3, page 4; Update to include MOA and Chapter 47.
- f. Section 2.1.4, page 7: The sentence "However, all vehicle traffic is currently restricted to established roads and does not present an evident threat to the natural resources on Camp Edwards" is correct, but does not address the "maneuver corridors" mentioned on page 10.
- g. Table 2-1; Range D date for the 5.56 ammo needs correction.
- h. Section 2.3; 2161 acres in the IA are closed to all training, explain why vehicle maneuvers are not conducted there given that numerous vehicles pass through their on a daily basis. Also see page 86, figure 7-1 for illustration of no EM plots.
- i. Section 2.3, page 10; Include how EPS 17.1 and 18.1 fit with the use of off road maneuver corridors.
- j. Section 3.1, page 11; Update section to current status, i.e., Textron lease, Otis Fish & Game vs. Rod & Gun, add the Reserve and the Upper Cape Regional Water Supply Cooperative.
- k. Figure 3-1, page 12; Check colors on map, Town of Bourne on legend is not seen on map and Pave Paws is a similar color as the base ponds. Add figure showing facilities and utilities (Range Control, water lines, water

tanks/towers, gas pipelines power lines, sub-stations, wastewater pipeline, wastewater discharge area, etc.

- l. Section 3.5, page 18; Add the additional range upgrades and dig sites currently projected or anticipated.
- m. Section 4.2, page 21; Add the Environmental Performance Standards to the Required and Relevant Environmental Regulations section (after Chapter 47), remove the EPS from the policies section (4.3).
- n. Section 5.4.1, page 27; Update MDFWELE to Dept of Fish & Game.
- o. Section 5.9, page 29; Check for redundancies, the signatory partners seems to be mentioned twice.
- p. Figure 6-5, page 42; Figure includes more than title suggests. Legend/key need work (UCRWSC), co-op wells shown as 5, text (page 18) says there are 3 Co-op wells. Monitoring wells shown in two colors but colors not explained, MW info appears to be over 2 years old.
- q. Section 6.8.7, page 62; The percent wetlands is off by a factor of ten.
- r. Section 7.2.1, page 84; “water quality monitoring” is mentioned but not included.
- s. Section 7.5, page 100; Explain relationship of other programs, e.g., range pollution prevention plans, EMS (other than the mention of the DVD on page 102) etc.
- t. Section 8.7, page 121; Section was titled “Water Resource Management” in previous INRMP, which seemed a better fit in that sub-section 8.7.4 is “Groundwater Management”
- u. Section 8.7.3, page 122; Add surface Water to current title “Wetland Resource Management” where first sentence talks about surface water.
- v. Section 8.7.4, page 123; Add goals and objectives for section.
- w. Section 8.8, page 124; Add objectives for Research and Monitoring related to surface waters and groundwater. Mention other ongoing research and monitoring programs ongoing, e.g., the AEC tungsten mobility study. Why no surface water monitoring for basics like pH, hardness, etc
- x. Section 8.8.3, page 126; check table number vs. text reference to table number.
- y. Section 11.2.4, page 167; Expand title to include groups mentioned and add current groups like SAC, DCR, etc.
- z. Table 11-1, page 170-183; Add Goals and Objectives as appropriate to address above comments. Add measures or metrics where applicable to help quantify where possible, for example the word “increase” is used three times on pages 176 – 177, by how much of an increase is the goal or objective.

Again, nice job.

Mark,

Please forward to Col FitzPatrick, Mike Ciaranca and John Kelly; I don't have their e-mail addresses in my address book.

Larry

Bill, this is a last minute response to your letter of 21 June. I have read the INRMP Draft, in proof-reading mode, of course, and have a few general comments before picking the nits.

It is well and clearly written, hence very readable, with only a few unexplained technical terms that would not be understood by the lay public. It is informative about the history of the base. It is also a little repetitive, but I understand it is for completeness. I think any concerned citizen reading this document could not fail to see that the Natural Resource Office is very competent, professional, and focused on protecting the water supply and habitats on Camp Edwards. I am a little picky for the picky stuff.

- p. xxi, first para: "...the land and resources [of] Camp Edwards must be ..."
- p. xxi, second para: "... natural resources management at Camp Edwards from Fiscal Year 1950 to 1990 ..."
- p. xxii: next to last para: "provide a [variety] of terrain ..." (Consistent with later usage)
- p. 2 Figure 2-1: Where is NSTAR yellow?
- p. 3 next to last para: " ... tungsten-nylon "green" ... " (Consistent with Table 2-1)
- p. 5 last para: " ... any lead-base ammunition may not be fired on Camp Edwards. (Unless the ranges were upgraded to capture the lead, right?) Also, "tungsten-tin again"
- p. 9 bullets: "an[y] IRP ..."

- p. 9 second para" 395 + 113 + 135 = 643
- p. 11 first para: 55% + 40% + 1% + 1% + 1% + 1% + 10% + 109% of northern training area.
- p. 12 Figure 3-1: Again, NSTAR is invisible.
- p. 12 bullets: AR200-2 ... word(s) missing.
- p. 27 third para: "... consisting of nine members[,] both of which ..."
- p. 29 bullets: Senior Environment[al] Corps ... (I think PACERS is defunct, but Friends of MMR [FMMR] should be on list.
- p. 30 last line: It was the Bourne Integrated Solid Waste Management Facility w[hat] it came to the Cape Cod Commission.
- p. 41 first para: This is a bit confused. It's the Sagamore Lens that supplies water to the Upper Cape, and except for bottled water, it supplies 100% of the drinking water. An aquifer is termed a sole source aquifer by definition, if more than 50% of drinking water comes from it.
- p. 42 Figure 6-5: The title is misleading. The vast majority of what is on that are test wells.
- p. 43 first para: "These communities were [classified] ..."
- p. 43 last para: " ... Spanish pine (Pinus sp.[?])
- p. 46 second para: " ... shrub layer of blu[e]berry ..."
- p. 58 second para: " ... only XXXX acres..."
- p. 58 third para: " ... remove these exotic and ... "
- p. 63 6.8.7d: " ... consist of [] 5 of the ... "
- " " ... and hig[h]bush blueberry ... "
- p. 68 second para: " ... less than a 5[%] chance ...
- p. 68 third para: " ... diverse plant communities[,] with "
- p. 73 last para: " ... spring 2006 (XX hunters, 4 turkeys)."
- p. 79 last para: the words "as either threatened or special concern" are in the wrong place in the sentence.
- p. 81 last para: managers is plural subject of sentence; does not need 's
- p. 82 third para: (SRA) after Awareness is redundant.
- p. 86 Figure 7-1: the monitoring plot symbol in the legend looks like a solid black dot.
- p. 88 first para: line intercept and belt transect sampling are not defined anywhere.
- p. 89 next to last para: " ... better-trained personnel[,] GIS is ... "
- p. 90 first para: " ... mission in environmental [what?], facility ... " (Word missing)
- p. 96 second para: " Specifically, ..." This sentence alludes to any training activities that cause significant effects, but then says ability to support vehicles is the criterion for recovery.
- p. 102 third para: "A[n] Environmental "
- p. 103 first line" Guide[1] ...
- p. 103 last para: "The Camp Edwards Natural [R]esource [O]ffice ... "
- p. 109 GOAL: only 1; don't need to number it. Likewise at top of p. 111 and mis of p. 113.
- p. 117 third para from bottom: " ... and when necessary[,] mowing."
- p. 119 and p. 120: lots of spaces in midst of lines.
- p. 120 f: " ... fire [e]very two to ...
- p. 126 Table 8-1: "Jefferson road [b]etween ..."
- p. 127 next to last para: "Most of the helicopter landing zones ... "
- p. 130 Amphibian Survey: Racco[o]n Swamp
- p. 133 GOAL 2 c. "compl[e]ment "
- p. 134 third para from last: " ... increasingly important [to] the rapidly ..."
- p. 139 & p. 140: spaces between "this" and "block" in Management Objective
- p. 146 next to last para: " ... has been document[e]d ..."
- p. 155 list at bottom: American [H]azelnut ?
- p. 157 8.12.3: " SOP for hunting [on] Camp Edwards ..."
- p. 158 last para: " ... around Camp Edwar[r]ds ...
- BTW< on this page Aquinnah has two ns, but on 155 it has one.
- p. 160 third para: " ... and it[is] implementing { not contraction of it is)
- " " ... cut, or process[or] attempt ..."
- p. 162 first para: " ... powerlines ... serve[] as a ...
- p. 167 second para: " ... of Gay Head Aquinnah[s], (and two ns again)
- Wow! Whoever squeezed all that little type into Table 11-1 proofed it carefully.
- p. 188 Cleere: nigh[t]jars
- p. 189 Mass. Nat. Guard 2005: Training Year 2005
- p. 190 Swain: Classification



CAPE COD COMMISSION

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P.O. BOX 226
BARNSTABLE, MA 02630
(508) 362-3828
FAX (508) 362-3136

E-mail: frontdesk@capecodcommission.org

August 8, 2006

William F. Fitzpatrick
COL, FA
Deputy Director, Environmental Readiness Center
Massachusetts National Guard
Office of the Adjutant General
50 Maple Street
Milford, MA 01757-3604

Re: Camp Edwards Integrated Natural Resources Management Plan (INRMP)

Dear Col. Fitzpatrick:

Staff of the Cape Cod Commission have reviewed the above referenced document, and wish to offer the following comments.

In general we found the document very comprehensive, and were encouraged to see the breadth of natural resources studies, analysis, and coordination that the plan provides for. The sensitivity of natural resources and the significance of water supply protection at Camp Edwards demands close examination of the relationship between training activities and natural resource protection, and the Commission staff believes this document goes a long way toward meeting that need. However, we recommend that the INRMP should provide a broader context for the resource management issues by making more frequent reference at strategic points in the document to the Upper Cape Water Supply and Wildlife Reserve created in 2001. It is our impression that the INRMP, with its goal of balancing continued training with the protection of natural resources, is an appropriate document to incorporate the water supply and wildlife habitat considerations for which the reserve was established.

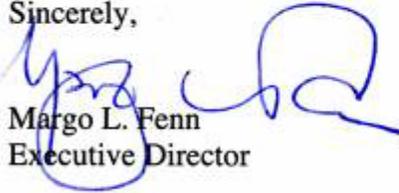
In addition, we had some comments in specific sections of the plan. The Preface should be updated to reflect the outcome of the MEPA process, including establishment of the environmental performance standards, the EMC, SAP, etc. The Preface could more specifically mention the role of the Environmental Readiness Center, and make reference to that website as a whole, not just the natural resources page. We recommend clarifying, in Section 2.3, for those who may not be familiar with the Impact Area, that the removal of 2,100 acres from active training is due to prior military activities (and not other encroachment). We noted also that of the many study plots located throughout Camp Edwards, none are located within the Impact Area, which is comprised in large part of scrub oak shrublands. Is it possible, to the extent it may improve our understanding of



changes in the scrub oak habitat, to include study plots within this area (scrub oak being the only habitat suitable for some state listed endangered species)? In Section 11.2.4, Coordination with State Agencies, we recommend updating this to Governmental Agencies, making reference to the Cape Cod Commission, DEP, and surrounding towns, as appropriate.

Thank you for the opportunity to comment. Should you have any questions, please contact Heather McElroy or Tom Cambareri at 508-362-3828.

Sincerely,



Margo L. Fenn
Executive Director

Cc: Robert Jones, Sandwich rep. to the Cape Cod Commission
Carol Tinkham, Bourne rep. to the Cape Cod Commission
Jay Zavala, Falmouth rep. to the Cape Cod Commission
Ernie Virgilio, Mashpee rep. to the Cape Cod Commission

**Notice of Availability
of the
Draft Environmental Assessment
for the Camp Edwards' Training Site
Integrated Natural Resource Management Plan**

The Massachusetts Army National Guard has prepared a Draft Environmental Assessment (EA) for the Integrated Natural Resource Management Plan (INRMP) designed for the Camp Edwards Training Site.

- The INRMP provides the Camp Edwards' commander an adaptive plan for coordinating natural resource protection and management with the Integrated Training Area Management Program (ITAM), ecosystem management, and military training at Camp Edwards.
- This plan ensures that natural resource conservation measures, and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates.

The Draft EA for the INRMP complies with appropriate provisions of the National Environmental Policy Act. A 30-day public comment period on the Draft EA for the INRMP begins on May 4, 2007, and concludes on June 2, 2007.

- Printed copies of the INRMP and the Draft EA are available for public review and comment at the Information Repositories in the main libraries of Bourne, Falmouth, Mashpee and Sandwich.
- Copies are also available on-line at the Massachusetts National Guard Environmental & Readiness Center web site: www.eandrc.org.

All written comments should be submitted no later than June 2, 2007 to:

Massachusetts National Guard
Environmental & Readiness Center
Attn: Dr. Michael Ciaranca
Bldg. 2808 Richardson Road
Camp Edwards, MA 02542

Falmouth, Mashpee, Sandwich, and Bourne Enterprise-4 May 2007



REPLY TO
ATTENTION OF:

DEPARTMENTS OF THE ARMY AND THE AIR FORCE
JOINT FORCE HEADQUARTERS
MASSACHUSETTS NATIONAL GUARD
OFFICE OF THE ADJUTANT GENERAL
50 MAPLE STREET
MILFORD, MA 01757-3604

2 May 2007

Ms. Maria Tur
US Fish and Wildlife Service
New England Field Office
70 Commercial Street
Suite 300
Concord, NH 03301

Dear Ms. Tur,

The purpose of this letter is to inform you that the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision is entering the NEPA process on 4 May and will end on 2 June 2007. We request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

As the foremost authority within the federal government on fisheries and wildlife management, the US Fish and Wildlife Service (USFWS) has the ability to provide valuable advice and guidance during the revision of the Camp Edwards INRMP.

The Sikes Act Improvement Act requires a joint review of the INRMP for operation and effect. We request that you review the INRMP and tell us if, in your opinion, the plan is achieving its goals. Chapter 11.5 will aid in this process. Chapter 11.6 will aid in future implementation monitoring.

I have enclosed two copies, one hard copy and one CD, of the Camp Edwards INRMP for your review. Please distribute among the staff of the USFWS. The MAARNG is interested in meeting with you and the staff of the USFWS at any time to discuss the Camp Edwards INRMP and any suggestions that you may have for the document. If you have any questions, please call the MAARNG's Natural Resources Manager, Dr. Michael Ciaranca at (508) 968-5121 or the Natural Resources Planner, Mr. John P. Kelly, at (508) 968-5848. I thank you for your time in reviewing this document.

PLEASE NOTE: THIS DRAFT DOCUMENT IS NOT YET READY FOR DISTRIBUTION.

Sincerely,

William F. FitzPatrick

COL, FA

Deputy Director

Environmental Readiness Center

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50 MAPLE STREET
MILFORD, MA 01757-3604

2 May 2007

Mr. Jason Zimmer
South East District Manager
Massachusetts Division of Fisheries and Wildlife
195 Bournedale Road
Buzzards Bay, MA 02532

Dear Mr. Zimmer,

The purpose of this letter is to inform you that the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision is entering the NEPA process on 4 May and will end on 2 June 2007. We request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

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MILFORD, MA 01757-3604

2 May 2007

Ms. Cheryl Andrews - Maltais
Tribal Historic Preservation Officer
Wampanoag Tribe of Gay Head (Aquinnah)
20 Black Brook Road
Gay Head, Massachusetts 02535-9701

Dear Ms. Andrews - Maltais,

The purpose of this letter is to inform you that the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision is entering the NEPA process on 4 May and will end on 2 June 2007. We request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

The Camp Edwards INRMP briefly addresses cultural resources management; however a more comprehensive Integrated Cultural Resources Management Plan (ICRMP) has been developed by the MAARNG. Therefore, it is of the utmost importance that the MAARNG consult with the Wampanoag Tribe regarding the INRMP. This draft of the document is not final, as we are seeking input and scientific advice from several environmental agencies on the most effective management recommendations for the resources of Camp Edwards.

I have enclosed copies of the Camp Edwards INRMP for your review. The MAARNG is interested in meeting with you and any other members of the Wampanoag Tribe at any time to discuss the Camp Edwards INRMP and any suggestions that you may have for the document. If you have any questions, please call the MAARNG's Natural Resources Manager, Dr. Michael Ciaranca at (508) 968-5121 or the Natural Resources Planner, Mr. John P. Kelly, at (508) 968-5848. I thank you for your time in reviewing this document.

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William F. FitzPatrick
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Deputy Director
Environmental Readiness Center



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MILFORD, MA 01757-3604

2 May 2006

Mr. Mark Begely
Executive Officer
Enviro. Mngmnt. Comm.
Bldg 1204
Camp Edwards, MA 02542

Dear Mr. Begely,

The purpose of this letter is to inform you that the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision is entering the NEPA process on 4 May and will end on 2 June 2007. We request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

As part of the oversight authority, EMC, with regards to the MMR and within the state government the EMC has the ability to provide valuable advice and guidance during the development of the Camp Edwards INRMP.

I have enclosed a copy of the Camp Edwards INRMP for your review. The MAARNG is interested in meeting with you at any time to discuss the Camp Edwards INRMP and any suggestions that you may have for the document. The document has been sent to DFW for review and comment. It has also been distributed to the other members of the EMC, SAC, and CAC. If you have any questions, please call the MAARNG's Natural Resources Manager, Dr. Michael Ciaranca at (508) 968-5121 or the Natural Resources Planner, Mr. John P. Kelly, at (508) 968-5848. I thank you for your time in reviewing this document.

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William F. FitzPatrick
COL, FA
Deputy Director
Environmental Readiness Center



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MILFORD, MA 01757-3604

2 May 2007

Commissioner Priscilla E. Geigas
Department of Conservation and Recreation
251 Causeway Street, Suite 600
Boston, MA 02114

Dear Commissioner Geigas,

The purpose of this letter is to inform you that the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision is entering the NEPA process on 4 May and will end on 2 June 2007. We request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

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Sincerely,

A handwritten signature in cursive script that reads "William F. FitzPatrick".

William F. FitzPatrick
COL, FA
Deputy Director
Environmental Readiness Center



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JOINT FORCE HEADQUARTERS
MASSACHUSETTS NATIONAL GUARD
OFFICE OF THE ADJUTANT GENERAL
50 MAPLE STREET
MILFORD, MA 01757-3604

2 May 2007

Commissioner Arleen O'Donnell
Department of Environmental Protection
One Winter Street, 2nd floor
Boston, MA 02108

Dear Commissioner O'Donnell,

The purpose of this letter is to inform you that the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision is entering the NEPA process on 4 May and will end on 2 June 2007. We request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

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William F. FitzPatrick

COL, FA

Deputy Director

Environmental Readiness Center



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MILFORD, MA 01757-3604

2 May 2007

Commissioner Thomas French
Department of Fish & Game
251 Causeway St., Suite 400
Boston, MA 02114
Tel: (617) 626-1500

Dear Commissioner French,

The purpose of this letter is to inform you that the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision is entering the NEPA process on 4 May and will end on 2 June 2007. We request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

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Sincerely,

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William F. FitzPatrick
COL, FA
Deputy Director
Environmental Readiness Center



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JOINT FORCE HEADQUARTERS
MASSACHUSETTS NATIONAL GUARD
OFFICE OF THE ADJUTANT GENERAL
50 MAPLE STREET
MILFORD, MA 01757-3604

2 May 2007

Mr. Paul M. Cavanagh
Chair-SAC
225 Thomas Landers Road
East Falmouth, MA 02536

Dear Mr. Cavanaugh,

The purpose of this letter is to inform you that the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision is entering the NEPA process on 4 May and will end on 2 June 2007. We request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

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Deputy Director
Environmental Readiness Center

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50 MAPLE STREET
MILFORD, MA 01757-3604

2 May 2007

Mr. Lawrence Cole
Chair-CAC
3 Parsons Path
Harwich, MA 02645-3307

Dear Mr. Cole,

The purpose of this letter is to inform you that the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision is entering the NEPA process on 4 May and will end on 2 June 2007. We request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

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Sincerely,

William F. FitzPatrick
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Deputy Director
Environmental Readiness Center



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50 MAPLE STREET
MILFORD, MA 01757-3604

MAAR-CFMO-ENV-ERC

2 May 2007

MEMORANDUM THRU

Deputy Post Commander, Camp Edwards Headquarters, ATTN: LTC Randall Cordeiro, Bldg 3468, Camp Edwards, MA 02542

FOR Commander, Camp Edwards Headquarters, ATTN: COL Steven E. Wujciak, Bldg 3468, Camp Edwards, MA 02542

SUBJECT: Review and Comment on The Camp Edwards Integrated Natural Resource Plan

The purpose of this letter is to inform you that the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision is entering the NEPA process on 4 May and will end on 2 June 2007. We request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

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Sincerely,

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William F. FitzPatrick

COL, FA

Deputy Director

Environmental Readiness Center



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50 MAPLE STREET
MILFORD, MA 01757-3604

MAAR-CFMO-ENV-ERC

2 May 2007

MEMORANDUM THRU

Director Environmental Affairs, Joint Force Headquarters, ATTN: Shawn Cody, 50 Maple Street,
Milford, MA 01757-3604

FOR CFMO, Joint Force Headquarters, ATTN: LTC Thomas A. Harrop, 50 Maple Street, Milford, MA
01757-3604

SUBJECT: Review and Comment on The Camp Edwards Integrated Natural Resource Plan

The purpose of this letter is to inform you that the Camp Edwards Integrated Natural Resources Management Plan (INRMP) five year revision is entering the NEPA process on 4 May and will end on 2 June 2007. We request your comments. The Massachusetts Army National Guard (MAARNG) is required by the Sikes Act to develop and implement an INRMP for the Camp Edwards Training Site. The INRMP is the installation commander's adaptive plan for managing ecosystems and natural resources to support and be consistent with the military mission while protecting and enhancing those ecosystems and resources for multiple use, sustainable yield, and biological integrity. The purpose of the INRMP is to ensure that natural resource conservation measures and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates while resulting in no net loss of training land.

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William F. FitzPatrick

COL, FA

Deputy Director

Environmental Readiness Center

AUG-30-2007 THU 01:34 PM U.S. Fish & Wildlife

FAX NO. 6032230104

P. 02



United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087



August 21, 2006

Colonel William F. Fitzpatrick
Massachusetts National Guard
Office of the Adjutant General
50 Maple Street
Milford, MA 01757-3604

Dear Colonel Fitzpatrick:

This responds to your July 24, 2007 request for comments on the final draft "Camp Edwards Training Site Integrated Natural Resources Management Plan" (Plan). Our comments are provided in accordance with the Sikes Act (16 U.S.C. 670a et seq.) as amended. Integrating the following comments and suggestions into the Plan will reflect the mutual agreement of the Department of Defense and the U.S. Fish and Wildlife Service concerning conservation, protection, and management of fish and wildlife resources at Camp Edwards and mutual agreement that this Plan constitutes an integrated natural resources management plan that complies with the Sikes Act.

On August 1, 2006, the Service provided comments on an earlier draft of the Plan. In that correspondence, we provided you with information regarding an ongoing assessment on the status of the New England cottontail (*Sylvilagus transitionalis*) (NEC). On September 12, 2006, the Service published its annual "Review of Native Species that are Candidates or Proposed for Listing as Endangered or Threatened" in the Federal Register (link to the document is available on our website). In that document, the Service announced that a federal listing for NEC was warranted, but precluded at this time by higher priority listing actions. While the NEC remains an official candidate species, there is no legal obligation to avoid affecting the habitat of the species. However, a formal, proposed listing rule could be announced at any time. As such, if the NEC is known or suspected to occur on federal or state lands, we strongly recommend that planning documents consider the conservation and habitat management requirements for this species.

Previous communications with your staff indicate that the NEC is known to occur on the Camp Edwards Training Site. In view of the above, the Service feels that the species should receive more attention than that provided in the draft Plan. In our view, the current draft of the Plan does not adequately discuss the importance of Camp Edwards to the species' continued occurrence in southeastern Massachusetts. For example, there is no mention of the NEC in Mammals (Chapter 6.9.3), in Endangered, Threatened, and Special Concern Species (Chapter 6.10), Conservation of

AUG-30-2007 THU 01:34 PM U.S. Fish & Wildlife

FAX NO. 6032230104

P. 03

- 2 -

State-Listed Rare Species (Chapter 9), or in the "Mammals Species of Camp Edwards, MA" (Appendix F). The only mention of the NEC we observed in the document is in Chapter 8.8.3, New England Cottontail Survey. Given the general lack of discussion with regard to the NEC, the Service is concerned that the NEC has not been fully integrated into the Goals and Objectives identified in the Plan.

Despite these concerns, the NEC most likely occurs on the Fort Edwards Training Site because of the activities and early successional habitat management that have taken place in the past. In addition, several of the Goals and Objectives identified in Chapter 8, Natural Resource Management, appear to be consistent with the management needs of the NEC.

Overall, the draft Plan is thorough and well written and we appreciate the opportunity to review it and provide these comments. Please contact Mr. Anthony Tur for further assistance and coordination on ways in which the Plan can more fully consider the conservation needs of the NEC, including the planning and conducting of rabbit surveys and inventories. Mr. Tur can be reached at 603-223-2541, extension 24. Information regarding the New England cottontail can be found on our website (www.fws.gov/northeast/newenglandfieldoffice).

Sincerely yours,



Michael J. Bartlett
Supervisor
New England Field Office



Commonwealth of Massachusetts

Division of Fisheries & Wildlife

Jason E. Zimmer, District Supervisor

July 11, 2007

MA National Guard Environmental Readiness Center
 ATTN: Dr. Michael Ciaranca
 South Inner Road, BLDG. 1017
 Camp Edwards, MA 02542

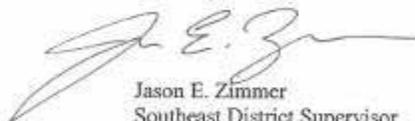
Dear Dr. Ciaranca,

Thank you for forwarding the Final Camp Edwards Training Site Integrated Natural Resources Management Plan 2006 Draft to the Division of Fisheries and Wildlife for review. As you are aware, all sections within the Division have reviewed and provided comments on the INRMP and we are very pleased to see that they have been incorporated and/or addressed in this final draft. We have no further comments at this time and are satisfied with the document as it stands. Further, we are pleased to both be witness to and directly involved in important management actions taking place on the Camp Edwards Training Site including, but not limited to, controlled burning, habitat and species surveys and research and the operation and management of controlled hunts for white-tailed deer and wild turkeys. It is through both these management actions and future actions, as outlined in the INRMP, that we will collectively achieve compliance with the SIKES Act and other relevant regulations and continue to practice sound stewardship and management of natural resources at the Camp Edwards Training Site.

The Division of Fisheries and Wildlife is proud to be a partner with the Massachusetts National Guard and the U.S. Fish and Wildlife Service in this effort. We are very pleased with the quality and content of the document and look forward to continuing our strong professional relationship throughout its implementation and future revisions.

Should you have any questions, please do not hesitate to contact me at (508) 759-3406.

Sincerely,



Jason E. Zimmer
 Southeast District Supervisor

cc. US Fish & Wildlife Service

www.masswildlife.org

Division of Fisheries and Wildlife
 Southeast District, 195 Bourne Road, Buzzards Bay, MA 02532 (508) 759-3406 Fax (508) 759-0381
 An Agency of the Department of Fish & Game



COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY & ENVIRONMENTAL AFFAIRS
ENVIRONMENTAL MANAGEMENT COMMISSION

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June 1, 2007

Massachusetts National Guard
Environmental & Readiness Center
ATTN: Dr. Michael Ciaranca
Building 1204, W. Inner Road
Camp Edwards, Ma. 02542

RE: Camp Edwards Training Site, Integrated Natural Resources Management Plan, 2006 Draft

Dear Dr. Ciaranca:

Please find below the EMC's comments on the Environmental Assessment (EA) and the Draft of the INRMP provided under your cover letter of 2 May 2007. The Camp Edwards INRMP is a key document and, for the most part, of exceptional high quality. I look forward to working with you, Col FitzPatrick, your staff, and the other reviewers of the draft document to add to this draft INRMP's continuous improvement.

The following are specific comments that I would like to go over with you at your convenience.

EA Comments:

Some of the objectives mentioned on page 2 of the EA, specifically goals 3, and 4 are not yet fully realized in the draft INRMP. The outcome of the NEPA process should include a suggestion that the INRMP should spell out additional opportunities to show the public the natural resource protection and conservation in the Reserve as indicated in goal 3. The 4th goal states "once they (the Environmental Performance Standards) are approved", specific natural resource management guidelines will be provided. The Environmental Performance Standards (EPS) were, as you know, approved a few years ago and the INRMP should increase its focus on compliance with the EPS as suggested by some of the INRMP goals noted below.

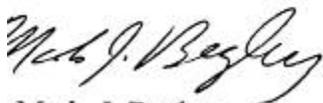
Draft INRMP comments:

1. Page 5, section 1.3 last paragraph, add mention of Environmental Performance Standards (EPS).
2. Page 7, last paragraph of section 2.1.2, add EMC and EPS changes to mention of EPA and AO change.
3. Page 8, please confirm “maneuver corridors” on page 8 is restricted to existing roads as noted on page 7. If “maneuver corridors” means something else, as suggested on page 11, please explain how they are defined and where they are located and how the conflict with the FEIR and EPS would be addressed, i.e. the requirement for prior “consultation with the Massachusetts Division of Fisheries and Wildlife.”
4. Page 10, section 2.3, where the impact area is no longer used for the impact of banned activities such as anti-tank missile fire, artillery or mortar fire and the Impact area “effectively excludes” the vast majority of the land restricted from training (approximately 2161 acres), please explain what planning or actions are being taken to make that land available for training, as well as habitat management steps like controlled burns.
5. Page 13, first paragraph, please mention the wastewater system (pipeline and infiltration beds) and where the second gas pipeline is now in, may want to mention that one too.
6. Page 24, section 4.3, “Policies”, in addition to mentioning the EPS in section 4.3 as to how they will guide training and resource management, the EPS themselves are not a policy. As stated in Chapter 47, the EPS were promulgated under sections 61 to 62H of chapter 30 of the General Laws. They should be added with Chapter 47 on page 23.
7. Page 29, by legislation, the number of SAC members is a range; Chapter 47 states the SAC “shall be comprised of 5 to 9 scientists and engineers”, not as stated in the draft “consisting of 9 members”.
8. Page 30 section 5.7, the number of federally recognized tribes needs updating.
9. Page 63, Figure 6-8, the cross-hatched “Grassland Management Area” includes areas where buildings and/or trailers were recently built or located for the Corps of Engineers, etc. Please explain the role of grassland management in controlling building or site development on Camp Edwards.
10. Page 83, while section 7.1 states a goal of the Integrated Training Area Management Program is “to ensure compliance with existing statutory regulations”, little attention is given to M.G.L. Chapter 47’s EPS, in fact some sections of the INRMP seems to suggest positions contrary to the EPS.
11. Page 83, also listed in section 7.1 as a goal of the ITAM is “to prevent future pollution and reduce hazardous waste and toxic releases”, little if any of the INRMP seems to cover pollution prevention nor “integrate” the ITAM as suggested on page xxiii of the INRMP not coordinate the ecosystem management with the ITAM as suggested on page 1 of the EA.
12. Page 115, Goal 1, Objective a, steps should be taken to add monitoring areas in the impact area using appropriate methods, RTLA or otherwise. Significant sections of the Impact Area have been cleared of UXO. Plans to facilitate additional coordination on controlled burns and UXO clearance should be made for sections of the Impact area.

- Monitoring recovery of “cleared areas” associated with the Groundwater Program or IRP program in the impact area should be made part of the INRMP.
13. Page 128, the fact that there are groundwater programs that look as some aspects of groundwater quality should not negate the need to monitor surface waters.
 14. Page 128, the tungsten study was not a “feasibility Study, the report is called “Fate and Transport of Tungsten at Camp Edwards Small Arms Ranges”. The MAARNG made the request to the AEC in response to requests from the EMC.
 15. Page 129, table 8-1 does not appear to be complete.
 16. Page 161, while section 8.12.2, “Outdoor Recreation Goals and Objectives”, suggests public access and outdoor recreation are provided upon request, the actual implementation of the objectives has been somewhat wanting. Both section 8.12.2 and section 8.12.3 of the INRMP “Outdoor Recreation Opportunities on Camp Edwards” should lay out a strategy to streamline approval of the “extensive outdoor recreation opportunities” listed in the section and add to the list as appropriate. Also please elaborate of the Camp Edward’s fishing program mentioned in the section.
 17. Page 169, Chapter 10 raises a good point by mentioning a major threat to the most sensitive habitat containing 11 of the state-listed rare species. The coverage of the issue of UXO clearance in the impact area and its “potential to dramatically impact the natural resources of the area” if “performed hastily” is a key issue for the Upper Cape Water Supply Reserve. This topic deserves greater focus in the INRMP than currently provided by this draft of the INRMP. At a minimum the INRMP should set out a schedule to develop plans to guarantee this important topic is properly coordinated and deliberated so as to assure any actions are appropriately planned and implemented. Failure to plan and the associated lack of action that results could ultimately cause this fairly dire warning of a major threat to natural resources to come to fruition.
 18. Page 177 and elsewhere in the document, metrics for the goals and objectives are not provided and should be where ever possible. For example, when the INRMP states an objective is to “Increase the presence of native grassland vegetation”, increase by how much? Set a goal and if it is reached, great; if not, provide the reasons.

Thank you for the opportunity to comment and provide input on the draft INRMP now as well as through future Science Advisory Council meetings.

Sincerely,



Mark. J. Begley
Environmental Officer

CC: DF&G, MassWildlife



Massachusetts Chapter
205 Portland Street, Suite 400
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June 1, 2007

John Kelly
Natural Resource Planner
Facilities Engineers, Bldg 2808
Camp Edwards, MA 02542

Dear John;

Thank you for the opportunity to comment on the most recent revision of the Camp Edwards Integrated Natural Resources Management Plan (INRMP).

The document is an extremely comprehensive summary of what is known about Camp Edwards to date and is an impressive compilation of research to date and management goals for the site.

As you know, The Nature Conservancy has identified Camp Edwards and the larger Massachusetts Military Reservation site as a critical site for biodiversity in the North Atlantic Coast Ecoregion. You may want to mention in the plan that not only does Camp Edwards contain one of the last remaining coastal pitch pine – scrub oak barrens worldwide, but that it is part of one of the few large remaining forested or undeveloped areas greater than 10,000 acres along the coast from Maine to New Jersey. The lack of fragmentation is beneficial to many organisms and may help reduce threats. One example is the threat of the *Compsilura* parasite on native Lepidoptera which may be less in unfragmented ecosystems. The large size of the site also allows management to occur at a large scale which is rare in the northeast.

We applaud the focus on ecosystem management and encourage the INRMP to think beyond the borders of Camp Edwards to cooperative management at the larger site including Shawme-Crowell State Forest and Crane Wildlife Management Area. In addition this site has similar ecosystems to Myles Standish and Manuel F. Correllus State Forests and cooperation with the State of Massachusetts could be beneficial to both parties (as is already done in prescribed burning).

In listing your management goals for specific community types, you do not mention specific acreage goals for each type. We realize that you do not want to be locked into producing a specific amount of each community given that succession is a dynamic process and management is subject to both environmental factors and resource availability, but a rough goal of a range of acres would provide a hypothesis or benchmark in the short term that could be adjusted as management evolves.

There is a long list of objectives for natural resource management in the plan as summarized in table 11-1. These may benefit from prioritization in order to stage implementation or if resources are scarce. What do you feel are the most important management priorities at the site? It may also be useful to summarize major constraints to successful management (e.g. lack of burn boss on site given large acreage that needs fire management, need for aerial ignition, or regulatory barriers).

Thank you again for the opportunity to comment on the plan. Please feel free to contact me with any questions.

Sincerely,

Karen Lombard
Assistant Director of Conservation Science

Notice of Availability
of the
Integrated Natural Resource Management Plan
and associated
Environmental Assessment
for the Camp Edwards Training Site

The Massachusetts Army National Guard has prepared an Environmental Assessment (EA) for the Integrated Natural Resource Management Plan (INRMP) designed for the Camp Edwards Training Site.

- The INRMP provides the Camp Edwards' commander an adaptive plan for coordinating natural resource protection and management with the Integrated Training Area Management Program (ITAM), ecosystem management, and military training at Camp Edwards.
- This plan ensures that natural resource conservation measures, and Army activities on mission lands are consistent with federal stewardship requirements to sustain native natural resources on an ecosystem scale and to comply with current legal mandates.

The EA for the INRMP complies with appropriate provisions of the National Environmental Policy Act. A 15-day public comment period on the EA for the INRMP begins on October 1, 2008, and concludes on October 15, 2008.

- Printed copies of the INRMP and the EA are available for public review and comment at the Information Repositories in the main libraries of Bourne, Falmouth, Mashpee and Sandwich.
- Additional copies are available by calling the Environmental and Readiness Center at 508-968-5143.

All written comments should be submitted no later than October 15, 2008, to:

Massachusetts National Guard
Environmental & Readiness Center
Attn: Dr. Michael Ciaranca
Bldg. 2808 Richardson Road
Camp Edwards, MA 02542