

**Department of Conservation and Recreation
Division of State Parks and Recreation**

**Western Connecticut Valley District
Forest Resource Management Plan Update**

APPROVED JULY 30, 2015



View from the D.A.R State Forest Fire Tower

Update Prepared By:

William N. Hill, CF; State Forest Lands Manager
David Goodwin; Assistant State Forest Lands Manager and GIS Specialist
Peter Church; Director of Forest Stewardship
Nicholas Anzuoni, Western CT Valley Management Forester

Submitted By:

Peter Church, Director of Forest Stewardship

Approved By:

Whitney Hatch, DCR Stewardship Council Chairman

Carol I. Sanchez, DCR Commissioner

Western Connecticut Valley District Forest Resource Management Plan

Table of Contents

Introduction	1
I. Forest Resource Management Plan Process	15
II. Purpose, Need and Guiding Principles	20
III. The Western Connecticut Valley District Landscape	24
IV. Public Issues and Opportunities	32
V. District Overview	34
VI. Landscape Designations and Guidelines	36
A. Reserves	38
B. Parklands	53
C. Woodlands	64
D. Cultural Resources	93
E. Forest Health and Protection	95
F. Facilities, Transportation and Boundaries	100
G. Special Features and Natural Communities	105
VII. Measurable Outputs, Revenue and Cost Estimates	110
VIII. Summary Discussion of District Forest Management Direction and Projected Results	113
IX. Inventory, Monitoring and Evaluation	115
X. Public Involvement	118
Appendix A – District Maps	119
Appendix B – Property Maps	126
Appendix C – Examples of Western Connecticut Valley District CFI Data	199
Appendix D – High Conservation Value Forest	203
Appendix E – Rare Species	235
Appendix F – Cultural Resource Protection	239
Appendix G - Statutory Policy and Guiding Principles	246
Appendix H – Public Comments	248
Appendix I – Glossary	260
Appendix J – Forest Productivity and Stand Complexity Model	271
Appendix K – Bibliography	275

Western Connecticut Valley District

Forest Resource Management Plan Draft Update

Introduction

The Department of Conservation and Recreation (DCR) is responsible for the care and stewardship of State Forests, Parks, Reservations, Beaches and Recreational facilities across the Commonwealth. DCR carefully manages the public's land and natural resources for many purposes and uses that are broadly outlined in legislation establishing the agency's responsibilities. The agency manages approximately 314,000 acres of State Forests, Parks and Reservations system lands within DCR's Division of State Parks and Recreation (DSPR). DSPR land is comprised of DCR properties, with the exception of the Quabbin Reservoir, Ware River and Wachusett Reservoir watersheds, which are managed by DCR's Division of Water Supply Protection (DWSP).

Forest Resource Management Plans (FRMPs) are designed to guide the management of State Forests, Parks and Reservations and their associated natural resources. Under the FRMPs, forest management is conducted as part of an integrated approach to establish long-term sustainable levels for *all* resources and uses. Landscapes and ecosystems are dynamic systems; accordingly, FRMPs are designed to be adaptable to new conditions and information.

Many of the goals of the FRMPs are intended to balance competing interests and values. FRMPs are needed to:

- Provide direction for the sustainable and integrated management of all natural and cultural resources by defining standards and guidelines for Reserves, Parklands and Woodlands
- Restore and maintain native forests to have greater vegetative diversity of size and age classes, improved wildlife habitat and increased resilience to disturbances
- Balance recreational use and aesthetics enjoyed by Massachusetts residents and visitors with sustainable forest management
- Manage for multiple ecosystem services such as: water filtration, a steady flow of water to streams and rivers, air purification and carbon sequestration over the long-term
- Restore the ecological function of our forests while also meeting today's challenges of forest fragmentation from sprawl development, global climate change and invasive species
- Maintain the viability of rare species and their habitat and also provide for the health of native species and the vigor of forests
- Help supply locally produced "green" products and energy, and support the sustainable viability of local forest economies
- Provide educational opportunities through "leading by example" about forest values and uses

Recent Factors Impacting DCR's Forest Resource Management Planning Process

Prior to 2004, there were no comprehensive publicly reviewed Forest Resource Management Plan standards and no Forest Reserves on Massachusetts' state lands. No surveys for rare and uncommon species were conducted prior to harvesting. There were no Conservation Best Management Practices for rare species, no public notifications of future harvests, no forest vegetative community maps linked to the Continuous Forest Inventory data, and no road, trail or recreation inventory and condition surveys guiding the management of DCR - DSPR system lands. All of these improvements are a result of DCR's efforts since then to implement better forest management practices. During the years prior to these improvements, DCR conducted harvests on thousands of acres of its lands relying on the skills and training of its management foresters to administer these operations.¹

Many of the following factors influenced and changed DCR forests across the state over the last 40 years:

- Privately owned forestland in Massachusetts — which greatly outnumbers and surrounds DCR forests — is being divided up into smaller and smaller parcels. This fragmentation places added stress on DCR lands, making landscape-scale management increasingly difficult. Fragmentation poses a significant threat to biodiversity today, as species find their habitats divided by impassible roads and other barriers, more invasive species are introduced into previously large forest blocks and countless sources of non-point pollution are introduced. It threatens the viability of many ecological communities in the future, as their breeding populations are reduced and their ability to migrate in the face of climate change is diminished.
- Plantations of non-native red pine and Norway spruce that were not previously thinned are now excessively overstocked (dense), mature, and highly susceptible to mortality from competition for sunlight, water and nutrients and also susceptible to heavy damage from forest insects, diseases and windthrow
- The majority of DCR native forests have progressed from 50 to 90 years of age. They are now more mature and many are excessively overstocked.
- Global climate change is now a generally accepted process that will potentially have profound impacts on the current species composition of Massachusetts' forests and the habitat they provide. Climate change may also increase erratic and extreme weather patterns and increase the severity of threats from invasive species. The benefits of carbon sequestration by our forests, the reduction of our “carbon footprint”² through use of locally-produced forest products and sources of renewable energy have captured the attention of

¹ For example, within the Western Connecticut Valley District properties, during the 1980s, harvesting activities totaled 1,207 acres; in the 1990s, 166 acres, and from 2000 to 2008, 1,258 acres. It should be noted that prior to 2003, the database may not include all the harvesting that may have occurred. During the 1990s, harvesting activities were greatly reduced as foresters were primarily deployed to re-measure the Continuous Forest Inventory plots over a three year period.

² Carbon footprint is a measure of the impact of human activities on the level of carbon dioxide in the atmosphere as it relates to climate change and on the environment generally. It is intended to capture the impacts of emissions from burning fossil fuels for electricity generation, transportation, manufacturing processes and heating, as well as emissions associated with human land use (e.g., land clearing).

policy makers as part of climate change plans, such as those called for by the 2008 Massachusetts Global Warming Solutions Act³.

- For centuries, forest products (such as flooring and furniture) used to be grown and produced in Massachusetts. In the past decades, Massachusetts' consumption of forest products has increased but its production has significantly declined, such that the vast majority—over 95%—of forest products consumed here are now produced in other states or, more commonly, other countries. This increases Massachusetts' carbon footprint and encourages harvesting in places where standards and practices are, at best, under-regulated and, at worst, ecologically devastating.
- Invasive species are now threatening our native forests. Insects such as Asian Longhorned Beetle, Emerald Ash Borer and Hemlock Woolly Adelgid are highly destructive species that pose an immediate and significant threat to the forest. Imported plants such as Oriental bittersweet, multi-flora rose and Japanese barberry are slowly invading and occupying our forests.

From 2004 to the present time, the Massachusetts Forest Forum (organized by the Massachusetts Forest Alliance), a diverse group of organizations and individuals with a wide range of interests, developed and committed to five broad goals for Massachusetts forests. Participating members included environmental advocates, ecologists, mill owners, harvesters, forest landowners and professional foresters. This group endorsed the following consensus-based goals: to conserve Massachusetts forests from development; to sustain the economic viability of forests; to strike a balance between working forests and forest reserves; to protect forest health; and to educate the public about forest values and human connection to forests. The FRMPs incorporate these goals.

During the drafting of this plan, the Patrick administration had allocated significant resources toward three land conservation goals, one of which was to protect working landscapes. This included sustainable forest management to support local economies. In addition, energy legislation aimed at shifting the Commonwealth to renewable and local sources of energy, including bio-energy and bio-fuels, passed in 2008.

The DCR FRMPs build upon information from the following:

- The Forest Futures Visioning Process and the subsequent Landscape Designations and Management Guidelines document (these will be referenced and discussed in more detail later)
- DCR Resource Management Plans (where applicable)
- The report *Wildlands and Woodlands: A Vision for the New England Landscape* (Foster, 2010) which lays out a vision that forest reserves (wildlands), surrounded by larger areas of woodlands, be protected from development
- Extensive public notification, participation and comments resulted in the integration of public input in the final FRMP

³ Available at <http://www.mass.gov/eea/air-water-climate-change/climate-change/massachusetts-global-warming-solutions-act/>

Why Tree Cutting is Part of DCR Forest Management

It is important to utilize harvesting (the cutting and bringing to market of forest products) as a tool to manage DCR properties because it contributes to the following forest management goals:

- Speed the restoration of non-native and dead, dying, damaged or at-risk plantations to resilient communities of native species
- Control new or expanding invasions of non-native pests, pathogens or trees
- Restore, more quickly than can be accomplished through natural disturbance, our maturing forest landscape to one with greater diversity of size and age classes in order to provide more diverse wildlife habitat and increase resilience to climatic changes that may place significant and catastrophic risk to a single age-class forest
- Provide “in-kind services” used to cut and remove hazardous trees from areas near roads, campgrounds, trails and other areas where they pose a safety hazard to the public (the cost of such removal is estimated at \$150 per small tree and over \$450 per larger tree). “In-kind services” are also used to fix eroded woods roads, recreation trails, install gates and remove invasive species.
- Provide a source of forest products for the public. Provide local economic benefits in the form of employment and revenue to local cities and towns through deposits from the Forest Products Trust Fund.
- Provide a model of reasonable and sustainable forest management strategies for the tens of thousands of private landowners who own 80% of the 3 million acres of forests in Massachusetts

When trees are harvested on public land, DCR ensures that it is done sustainably and in a manner that does not compromise other forest values. Forest management is conducted by professional licensed foresters, according to the FRMP standards and guidelines, the DCR Public Notification Policy for timber sales and the following Massachusetts laws: Forest Cutting Practices Act, Wetlands Protection Act, Endangered Species Act, and the Massachusetts Slash Law. DCR prepares preliminary “project summaries,” detailed silvicultural prescriptions and timber sale contracts for all timber sales. All proposed timber sales are posted on DCR’s webpage for public review, are competitively bid, are inspected for contractual compliance and continuously overseen and monitored for full compliance.

Clearcutting (the removal of all trees in areas greater than two acres) is not a standard treatment under this FRMP. However, there are some circumstances under which clearcutting may be considered, including forests with widespread mortality from disease, insects, windthrow or snow and ice damage. The decision to use such management will be made only after close evaluation by the Program Supervisor and the Director of Forest Stewardship, and after a public field trip at the site. Reserve trees will be maintained where practicable.

Applicable Forest Resource Management Legislation

Various Commonwealth laws, the state Constitution and sound forestry practices require that DCR manage state forests for a range of purposes and goals. These include:

- Article 97 of the Articles of Amendment to the Constitution of the Commonwealth of Massachusetts (1972): "The people shall have the right to clean air and water, freedom from excessive and unnecessary noise, and the natural, scenic, historic, and aesthetic qualities of their environment; and the protection of the people in their right to the conservation, development and utilization of the agricultural, mineral, forest, water, air and other natural resources is hereby declared to be a public purpose."
- M. G. L. Chapter 21, Section 2F (2003): "Said management plans shall include guidelines for the operation and land stewardship of the aforementioned reservations, parks and forests, shall provide for the protection and stewardship of natural and cultural resources and shall ensure consistency between recreation, resource protection, and sustainable forest management."
- M. G. L. Chapter 132, Section 31 (State Forests) (enacted 1914 and revised 2003): "[The State Forester] shall reforest and develop such lands, and may, subject to the approval of the Commissioner, make all reasonable regulations which in his opinion will tend to increase the public enjoyment and benefit therefrom and to protect and conserve the water supplies of the commonwealth."
- M. G. L. Chapter 132, Section 40 (enacted 1943 and revised 1983): "It is hereby declared that the public welfare requires the rehabilitation, maintenance, and protection of forest lands for the purpose of conserving water, preventing floods and soil erosion, improving the conditions for wildlife and recreation, protecting and improving air and water quality, and providing a continuing and increasing supply of forest products for public consumption, farm use, and for the wood-using industries of the commonwealth."

Resource Management and Forest Resource Management Planning Processes

FRMP planning is an important component of DCR's statewide Resource Management Planning (RMP) Program. The RMP program provides a framework for managing DCR lands based upon a comprehensive inventory and assessment of environmental, recreational and operational resources, an identification of the unique characteristics of an individual DCR property or planning unit, the development of clear management goals and objectives, and an implementation plan to guide the short and long-term management of DCR Forests, Parks and Reservations. The RMP Program works across agency divisions and bureaus and coordinates with the DCR Stewardship Council regarding program development and the adoption of RMPs.

FRMPs serve as baseline information focusing on forest resource management and will be integrated into future RMPs that address the wide range of issues noted above. The FRMPs are based on extensive resource inventory information and are designed and developed to protect natural and cultural resources and recreational uses and values in the context of forest management. This information is developed and analyzed at the site-specific level using field and aerial inventories and Geographic Information Systems (GIS) analysis. While future property-specific RMPs will contain additional information such as more details on existing infrastructure and facilities, operational and maintenance needs, staffing needs and priorities, the FRMPs provide foundational resource information and related management recommendations in support of the Department's RMP requirements, pursuant to Massachusetts General Law (M.G.L.) Ch. 21 S. 2F.

The FRMP includes maps (see **Appendix A** for a district level map and **Appendix B** for property specific maps) designating the three land management regimes: Reserves, Parklands and Woodlands, which coincide with the RMP zoning principles. This table is taken from *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines* (Massachusetts Department of Conservation and Recreation (1), 2012)

Landscape Designation Management Guidelines → Land Stewardship Zones ↓	Reserve – <i>The least fragmented forested areas where ecological processes will predominate and inform management, and where commercial timber harvesting is not allowed.</i>	Woodland – <i>Forested areas actively managed for forest health, resource protection, sustainable production of timber, and recreation.</i>	Parkland – <i>Areas providing public recreation opportunities, connections to nature, and protection and appreciation of natural and cultural resources.</i>
Zone 1 – <i>Highly sensitive resources requiring special management approaches.</i>	Rare species habitat, natural communities, archaeological sites, or fragile cultural sites identified as being sensitive to / easily degraded by human activities.		
Zone 2 – <i>Resources that support recreational and management activities appropriate to the site.</i>	Large areas of natural vegetation and associated natural and cultural features, including rare species habitat, that is compatible with dispersed recreation.	Forest stands and associated natural and cultural features, compatible with dispersed recreation and active forest management intended to enhance species and age class diversity.	Stable / hardy natural and cultural landscapes, where a variety of outdoor recreation activities can be provided in a sustainable manner.
Zone 3 – <i>Intensive use areas such as recreational sites or maintenance areas.</i>	New zone 3s will not be established in Reserves. <i>Exception</i> – an RMP may identify existing intensive use areas missed during designation and not already captured in a Parklands designation area, in which case the application of a zone 3 may be considered.	Intensive recreation and park administration areas currently embedded within the forested landscape.	Areas that require regular maintenance by DCR staff, including altered landscapes in active use, intensive recreation areas, and park administration areas. Sites that may accommodate administrative or intensive recreation areas to meet future demands.

Participation by the public, DCR and other state agency staff has been a key feature of FRMP development. The public outreach process that began in 2004 originally included nine public presentations and discussions on the Forest Reserves, the Landscape Ecological Assessment, the “green certification” process and the FRMPs including three formal public comment periods. Notices for all public meetings were distributed to over 900 individuals and organizations, posted in the Environmental Monitor and disseminated via group e-mails. A summary of these public comments and DCR responses is contained in **Appendix H**.

After this process was completed in 2008, DCR embarked on the “Forest Futures Visioning Process.” The details are discussed in section **IV. Public Issues and Opportunities**. The Forest Futures Visioning Process (Massachusetts Department of Conservation and Recreation, 2010) created an eleven member Technical Steering Committee and Advisory Stakeholders group and held five public forums to solicit public comments. The result of this process led to the document “Landscape Designations and Management Guidelines (Massachusetts Department of Conservation and Recreation (1), 2012) where seven public forums were held to seek additional public input followed by seven public workshops to seek public input on the application of landscape designations on DCR properties.

The Western Connecticut Valley (WCV) District Forest Resource Management Plan was prepared by the Department of Conservation and Recreation with input from staff with expertise in ecology, biology, archaeology and recreation, as well as from licensed foresters. The FRMP will be used by DCR foresters to direct management activities for the 16 Western Connecticut Valley DCR properties consisting of 29,439⁴ acres of land.

⁴ These acreage statistics are derived from protected open space boundary data released by MassGIS in October of 2013 and this dataset is used throughout this report for consistency. Revised protected open space data is released by MassGIS approximately every three months.

**Parks, Forests and Reservations in the Western
Connecticut Valley District owned and managed by DCR**

Property	Acres
Buckland State Forest	93
Catamount State Forest	1,416
Conway State Forest	1,757
D. A. R. State Forest	1,728
Deer Hill State Reservation	350
Kenneth Dubuque Memorial State Forest/Park	7,529
Florida State Forest	987
H. O. Cook State Forest	1,834
Leyden State Forest	61
Mohawk Trail State Forest	6,563
Monroe State Forest	3,750
Rowe State Forest	256
Savoy Mountain State Forest	944
Shelburne State Forest	72
South River State Forest	591
Windsor State Forest	1,508
Total	29,439

The Western Connecticut Valley FRMP was developed with the most current information and available data and focuses on the following areas: biological diversity; recreational uses; forest roads, trails and boundaries; climate adaptation and carbon sequestration; cultural resources; vegetation management; and inventory, monitoring and evaluation. Within these areas, the Plan:

- Meets the Commonwealth of Massachusetts forest management legal mandates, strategic goals and objectives
- Addresses forest resource management issues identified by the public
- Informs resource managers and the public about how the forest resources in the Western Connecticut Valley District will be managed
- Provides a framework for the integration of sustainable management for wildlife, rare plants and animals, soils, water, cultural resources, and forest uses and activities
- Provides a long-term sustainable forest management strategy with a focus on the short-term implementation schedule (next 10 years)

- Provides for adaptive management and change by directing and monitoring activities of DCR land managers, including an interim 5 year Plan review; 10 year Plan revision, if needed; and ongoing long-term ecological monitoring

The FRMP meets the above goals following a balanced and strategic approach, summarized in the following table. These management regimes are discussed generally in section “**I. Forest Resource Management Plan Process**”, section “**IV. Public Issues and Opportunities**” and in much greater detail in the section “**VI. Landscape Designations and Guidelines.**”

Different strategic management regimes for the Western Connecticut Valley properties

Management Regime	Acres in District	% of District	Management Theme
Reserves	11,404	39%	The least fragmented forested areas where ecological processes will predominate and inform management, and where commercial timber harvesting is not allowed.
Woodlands	15,704	53%	Forested areas actively managed for forest diversity and resilience, resource protection, sustainable production of timber, and recreation.
Parklands	2,331	8%	Areas providing public recreation opportunities, connections to nature, and protection and appreciation of natural and cultural resources.
Currently Not Designated	0	0%	Not included in the landscape zoning process due to extenuating circumstances such as joint property ownership, previous agreements or administrative purposes.
Total	29,439	100%	

Western Connecticut Valley Forest Vegetation Management

The Western Connecticut Valley DCR system lands are heavily forested and are primarily composed of a maturing forest landscape (28,613 acres are forested (97%) and 19,279 of these forested acres are greater than 85 years old (65%)). The forest in general is presently in relatively good health; however, tree mortality is occurring at an increasing rate due to composition, age and density of the forests. While some tree mortality

is a natural part of the forest aging process, excessive mortality associated with overcrowded forest conditions, forest pests (insects and diseases) and environmental stresses (drought and wind) can be minimized through proper management. Presently, the forest is composed predominately of northern hardwoods, hemlock and white pine. There are approximately 315 million board feet of standing timber and an annual growth of approximately 8.7 million board feet per year. The mortality is approximately 3.1 million board feet per year. This indicates that the forests are sequestering carbon at a net rate equivalent to the mass in 5.6 million board feet a year plus associated larger tops, downed woody debris and roots associated with trees of increasing size.

Forest management within Woodlands will fulfill the purpose of Woodlands (Massachusetts Department of Conservation and Recreation (1), 2012, pp. 37 – 38), also referred to as the “Mission of Woodlands” later in this document. While providing opportunities to demonstrate excellent forest management, it is carried out to achieve the following goals:

- Meet rare species, wildlife habitat and biodiversity goals
- Reduce the risks of catastrophic disturbances such as insects, disease and wildfires
- Restore and maintain native ecosystems
- Provide a more natural balance of age classes for forest successional types, including increasing older and younger age classes
- Reduce the threat and potential area of excessive forest mortality by improving growth and vigor of the forest
- Enhance future carbon storage and sequestration capacities
- Restore native species to sites where they have traditionally grown prior to overcutting, the introduction of invasive species and agricultural impacts
- Provide a sustainable flow of locally produced forest products, renewable energy sources and local economic benefits

Areas selected for forest management to meet the above goals are then prioritized in order of the following criteria:

- Forest stands in which management has previously been conducted, in order to: 1) release new forest growth in the understory; 2) conduct a second thinning to continue to improve forest composition and health; and 3) establish new forest growth in the understory
- Forest stands that are at imminent risk of mortality from insects, disease, fire, etc.
- Forest stands that are poorly stocked and do not fully occupy the site or in stands that are currently stocked with species that are ill-suited to the site such as non-native red pine and Norway spruce on northern hardwood sites
- Low quality forest stands where cuttings could improve the quality of the forest

- A maturing forest landscape composed of forest stands that are homogeneous in age and/or species composition
- Overstocked forest stands where thinning will restore a diversity of species suited to the site, improve growth and insect/disease resistance, and accelerate the growth and maintenance of large tree forests

Biological Diversity

Biological diversity can be defined as the totality of genes, species and ecosystems in a given place, as well as the ecosystem structure and function - the ecosystem processes - that support and sustain life. Forest management practices provide habitat for the range of species found within the planning area, thereby helping sustain biological diversity. This FRMP promotes biological diversity by:

- Protecting rare species and their habitat through pre-harvest reviews conducted by experts on all proposed timber sales, and proper management and maintenance of rare species habitat, including mandatory consultation with the Massachusetts Department of Fish and Game, Natural Heritage and Endangered Species Program on all vegetation and/or ground disturbing projects
- Protecting uncommon natural vegetation communities and species through pre-harvest surveys and management practices consistent with the stewardship of such resources
- Implementing guidelines from Rare Species Conservation Management Practices that will be followed within known priority or estimated habitat for rare species - these guidelines can be accessed online at:

<http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/forestry-rare-species-review/forestry-cmps-for-rare-species.html>
- Establishing 11,404 acres of Reserves to provide late-successional native forest habitat in which forest succession and natural processes are allowed to occur relatively free of human intervention
- Establishing approximately 800 acres within Woodlands of older extended rotation forests managed according to even-age and uneven-age silvicultural principles to promote healthy, multi-age, large stand areas with complex structure that complement Reserves, trail and road corridors, aquatic corridors and buffers, and rare species habitat, where possible, in each 10 year period
- Protecting aquatic resources such as lakes, rivers, streams, riparian areas, wetlands and vernal pools by establishing and properly managing these areas and their associated buffer zones or filter strips
- Establishing approximately 290 acres of young forest in Woodlands across the District in each 10 year period

- Improving species and age class diversity of the maturing forest landscape (predominately even-aged), including replacing non-native plantation monocultures with diverse native species and age classes
- Managing all Western Connecticut Valley lands for appropriate native species by inventorying and scheduling the removal of non-native vegetation through the treatment of known populations of invasive species, requiring equipment to be free of a potential source of invasive species, post harvest invasive species surveys and quickly treating new populations of invasive species
- Providing direction for the retention and maintenance of complex forest structures such as legacy, wildlife and den trees, and the retention of coarse woody debris on the forest floor

Recreational Activities and Uses

This FRMP does not directly address recreational uses and policies. However, it takes into consideration the recreational facilities and uses that occur within the Western Connecticut Valley District lands such as camping, hiking, fishing, cross-country skiing, picnicking, snowmobiling and scenic driving. All trails, roads and existing recreational facilities are buffered by mapped transition areas, where the forest will be managed for older and larger trees and forest floor woody debris will be managed at natural levels, designed to maintain high recreation and visual quality objectives. Additional details of recreational uses and future enhancements will be addressed in RMPs developed for specific properties or management units within the Western Connecticut Valley District. The following are highlights of the forest management direction as it relates to recreational uses:

- Managing the vegetation in the trail corridors with sensitivity to the protection and aesthetics of the trail system and ensuring that the trails are maintained to DCR standards consistent with the FRMP objectives
- Evaluating unauthorized trails for potential removal or inclusion into the DCR trail system
- Allowing snowmobile use on designated trails when there is snow cover
- Prohibiting off-highway vehicle use on all DCR lands in this District
- Requiring adherence to the DCR Special Use permitting process for special use applications and review of proposed special uses for compatibility with the FRMP direction

Cultural Resources

Cultural resources (historic and pre-historic) are identified and evaluated by DCR Cultural Resources staff for significance. Appropriate site plans are developed to protect and maintain significant cultural resources. In some cases, cultural resources may be enhanced through specific management activities or presented to the visiting public through interpretive, educational programs. The Western Connecticut Valley FRMP calls for the inventory, consultation, protection and interpretation of cultural resources.

Roads, Trails and Boundaries

Generally, roads and trails are minimally maintained, sometimes resulting in unsafe access and degradation of water quality due to soil erosion and sedimentation. Some road and trail maintenance and re-construction is occurring through forest management activities, volunteer efforts and occasionally as part of DCR projects. DCR's goal is to ensure that the transportation network will be safe and environmentally sound. In addition, the network should have a minimum impact on the natural resources of the DCR system while serving public safety needs and allowing visitors to enjoy and experience these resources. While temporary skid roads and landings are necessary to complete harvests, no new forest roads are anticipated during this 10 year planning period. In addition, DCR's goal is to locate and post all boundaries and maintain them on a 10 year cycle.

Forest Management Guidelines and Recommendations

Using the information presented in the section "Silviculture and Vegetation Guidelines for Woodlands" discussed at length in **VI. Landscape Designations and Guidelines** (under **C. Woodlands**) to choose sites, this Plan recommends an average annual target of forest management of 147 acres which is about 1 percent of the forested Woodlands in this District - during the initial 10 year implementation period. The following statistics are based on output from the "Forest Productivity and Stand Complexity Model" discussed in **Appendix J** which spells out exactly how these acreage numbers were derived. Each subsequent 10 year implementation period will have a unique combination of the forest management practices described below.

- **Even age management on 100 year rotation:** manage approximately 19% (2,896 acres) of the 14,729 acres of forest vegetation in Woodlands (about 10% of all DSPR lands in the district) on an even age rotation of 100 years or roughly 29 acres annually, work to add diversity to high graded/damaged stands, lower productivity stands or stands that are currently even aged
- **Uneven age management using a 20 year cutting cycle:** manage approximately 55% (8,037 acres) of the 14,729 acres of forest vegetation in Woodlands (about 27% of all DSPR lands in the district) using uneven age management methods or roughly 80 acres annually to create and/or maintain uneven age or multi-aged stands with a high level of structural diversity and/or restore late-successional forest structure and characteristics
- **Late successional stand structure** (extended rotation): manage approximately 26% (3,796 acres) of the 14,729 acres of forest vegetation in Woodlands (about 13% of all DSPR lands in the district) using late successional/extended rotation methods or approximately 38 acres per year that complement Reserves, trail and road corridors, aquatic buffers and/or rare species habitats where possible, manage for late successional stand characteristics according to even and uneven aged silvicultural principles to promote healthy, multi-age, stand areas with complex structure

Establishing a mix of Reserves, 100 year and "extended" rotation forests, DCR forests will in the future be markedly older and have a greater diversity of ages and species than many surrounding private forests, which are typically either not harvested or not selectively harvested and thinned. At the end of the 100 year period, it is anticipated that the amount of very young forest (0-14 years) will increase and become an important component in a wildlife habitat type that is used by 50% of vertebrates and which provides most of the life needs for 20% of vertebrates. Very young forest areas will be selected to maximize their ecological benefits and complement other components of the landscape. Massachusetts' original forest contained much more age and structural diversity than the current maturing forest landscape of "even-

aged” forest. This plan will help restore some of that diversity while strengthening the forests to meet the challenges that lie ahead.

Throughout this plan, as in the table below, there are tables and charts of “predicted” conditions. They display the anticipate results of managing as directed in this plan. An explanation of how the predictions were derived and why certain outcomes occurred is included in **Section VIII. Summary Discussion of District Forest Management Direction and Projected Results.**

Present and predicted forest condition in the Western Connecticut Valley District

	Age class						
	Non Forest	0-14 years	15-59 years	60-89 years	90-125 years	125+ years	Uneven Age
Present	2%	1%	33%	54%	8%	0%	2%
2113	2%	6%	15%	2%	70%	5%	0%

This Plan lays out the first 10 years of implementation of a long-term 100 year vision. It will be reviewed through monitoring in year five as more information is gathered and the effectiveness of its implementation can be assessed. The impacts of climate change and new information evaluated in the course of these reviews may alter the Plan. At the end of the 10 year initial Plan period, the strategy will again be reviewed and revised based on the current state of science and in response to the concerns of the citizens of Massachusetts.

Inventory, Monitoring and Evaluation

This FRMP was developed to be adaptable to future information generated from the evaluation of inventory and monitoring data. It is expected to improve over time. The level and intensity of monitoring will be dependent on the availability of funding. The following summarizes the key inventory, monitoring and evaluation requirements.

- Data on the condition or status of things such as vegetation, cultural resources, rare species, invasive species, boundaries, roads, recreation and uses should continue to be collected over time
- Upon completion and five years after completion, all forest management projects should be monitored or sampled for meeting project and FRMP objectives
- Interim monitoring reports will be completed at year 5 of the first 10 year implementation cycle and the FRMP will be adjusted if needed
- Long-term ecological monitoring at the landscape, site and species level should be continued to evaluate and compare Reserves and areas under active management regimes (i.e., Woodlands), in cooperation with the University of Massachusetts and other partners

Western Connecticut Valley District Forest Management Plan

I. Forest Resource Management Plan Process

This section summarizes the Forest Resource Management Planning (FRMP) process, the format of the process and guidance on how to use the Plan effectively. In addition, a brief introduction to the “Forest Futures Visioning Process” and the “Landscape Designation Process” is presented to frame the discussions later in the document.

Forest Management Framework

FRMPs cover approximately 314,000 acres of State Forests, Parks and Reservations system lands within DCR’s Division of State Parks and Recreation. These lands are comprised of DCR properties with the exception of the Quabbin, Ware River, Sudbury and Wachusett watershed areas, which are managed by DCR’s Division of Water Supply Protection.

Planning Process and Outline

The FRMP process is based on the concept of stepping down in geographic scales: from the regional landscape, to the Western Connecticut Valley District, to the individual forest, park or reservation. Overall, the Plan is based on meeting Massachusetts’ statutes, enabling legislation and regulations that establish the DCR, the state forest and parks system, and the Bureau of Forestry management forestry program.

The planning process for all of the western district FRMPs identified public issues and opportunities for the Berkshire Highlands, Taconic Mountains, Marble Valley Ecoregions, and the Western Connecticut Valley District. This plan contributes towards meeting the public needs, desires and expectations for the State Forest and Park system. Additionally, in the spring of 2009, DCR convened the Forest Futures Visioning Process (FFVP) to seek public input on the stewardship of 314,000 acres of DCR parks and forests and to develop a renewed vision for the management these lands. While public criticism of DCR’s forestry practices served as the impetus for launching the FFVP, it was also recommended by the DCR Stewardship Council.

Forest Futures Visioning and Landscape Designation Processes on DCR Lands

Forest Futures Visioning Process

A Technical Steering Committee (TSC) of outside experts was tasked with developing recommendations for DCR. Over the course of a year, this Committee received input from an advisory group of stakeholders, other experts and the general public. Opportunities for public input included five public forums that collectively attracted more than 500 participants, approximately 450 written comments and more than 250 responses to an on-line survey. The FFVP sought and engaged the wide range of views about forestry – ranging from strong pro- to anti-logging sentiments. Given this diversity of opinions, unfortunately no single policy approach could ever satisfy all sides. Informed by robust public input, in April 2010, the TSC issued its final recommendations to DCR (Massachusetts Department of

Conservation and Recreation, 2010)⁵. The recommendations were balanced and accounted for the divergent and often conflicting public values concerning the management of state forests.

Following this approach, the TSC laid out a compromise where DCR properties are managed for different benefits and certain activities - especially commercial timber harvesting – are limited to a subset of properties. The TSC underscored the importance of active forestry to demonstrate sustainable forest management on DCR land but recommended a shift in emphasis to “lighter touch” forestry with smaller openings and an expanded public process. At the same time, the committee also recommended a considerable expansion of the network of large intact blocks of forests, known as Reserves.

Landscape Designation Process

The TSC recommended a management approach centered on the range of services DCR forests offer the public and the overall environment: extensive public recreational opportunities, clean water, clean air, carbon storage, biodiversity, protection for rare and endangered habitats and species and a supply of locally-grown wood products. This new paradigm is centered on setting priorities for stewardship based on prioritizing these services and through a process called “Landscape Designation” - designating DCR’s state parks properties into three categories (note – Quabbin and other DCR watershed lands were not part of this process).

- Parklands – lands that are managed primarily for recreation where commercial harvesting will not be allowed
- Woodlands – working lands where DCR will demonstrate/model sustainable forest management through commercial harvesting
- Reserves – lands where management will be guided by natural processes (except in limited cases) and where commercial harvesting will not be allowed

The TSC provided a recommended allocation of acreage for each of three designations. In April of 2010, the Executive Office of Energy and Environmental Affairs Secretary at the time, Ian Bowles, accepted this recommendation and added a specific target – namely, that at least 60% of the land would be allocated as Parklands and Reserves – and at the same time recognizing the importance of Woodlands within the DCR system.

Implementation & Outcomes

In the fall of 2010, DCR launched the Landscape Designation process to develop management guidelines, outline selection criteria and apply the three designations to properties in DCR’s state parks system within the framework set forth by the TSC. The agency held seven public workshops and sought input on accomplishing the designation process. With the benefit of public guidance, DCR developed and applied GIS models to assess all state parks properties as Parklands, Reserves and Woodlands during the winter of 2010 and the spring of 2011.

In the spring of 2011, DCR hosted seven additional workshops around the state to share maps displaying the draft designations and to distribute a revised set of management guidelines. Overall, DCR proposed designation of over 75,000 acres as Parklands and over 112,000 acres as Reserves (meeting the 60%

⁵ Available at: <http://www.mass.gov/eea/docs/dcr/news/public-meetings/materials/forestry/finalwannexes.pdf>

target for these categories) and about 123,000 acres as Woodlands. The agency received a considerable amount of public comment regarding individual property designations and the Landscape Designations Management Guidelines. After a thorough review of these comments and discussion with many stakeholders, including the state's major environmental organizations, DCR presented the final Landscape Designations Management Guidelines to the Stewardship Council at its March, 2011 meeting, which they endorsed.

Public Input & Resulting Changes

What follows is a summary of the major themes expressed in public input and the changes made as a result of the TSC's recommendations and the Landscape Designation process. Throughout the process, the familiar and disparate views about forest management were raised. While the process itself is a compromise that respects the range of views on forestry, it is important to note that this disparity is likely to persist and not everyone will be completely satisfied with the outcome.

Another concern/misconception that surfaced during the public input process relates to the availability of recreational opportunities and general public access under these designations which for the most part will not change. DCR has underscored this point in the final version of the Management Guidelines. The TSC recommendations emphasized the importance of integrating DCR's natural resource planning systems and the agency received considerable input on this issue. Consequently, DCR effectuated the integration of its existing planning framework with the new Landscape Designations. In doing so, DCR worked closely with the state's major statewide environmental groups, including The Nature Conservancy, Mass Audubon and the Appalachian Mountain Club. Each of these groups publicly supported the Landscape Designation process and its products to the DCR Stewardship Council before it was approved in April of 2011.

Concerns over past lack of transparency and opportunities for public input were raised. DCR addressed this in part by ensuring that the FFVP and Landscape Designation processes included a meaningful public process. In addition, the agency is expanding its public outreach policy for forestry projects, which is in line with many of the suggestions received.

District Overview

This section contains the guidelines for recreation and natural resource managers. This is followed by information on measurable outputs (public expectations), inventory, monitoring and evaluation direction and public involvement documentation. Finally, the appendices include detailed information and supporting documentation.

A filtering approach is used to identify three management areas: Reserves, Parklands and Woodlands. The Reserves will be passively managed where ecological processes determine the forest structure. The Parklands consist of developed facilities and structures such as administration sites, campgrounds, playgrounds and parking lots. Vegetation management will be applied in Woodlands to meet the biodiversity and forest structural goals of this plan.

Each section provides information on the **present condition**, the **predicted condition** and the **management guidelines** designed to reach the predicted condition.

Present Condition – The present condition information provides baseline information on the resource in text and/or table form. It is also where map references for the resource may be found. These present conditions are intentionally broad as they apply to all the DCR - DSPR lands in the district.

Predicted Condition – The predicted condition is a general goal statement describing the resource condition that can be achieved by full implementation of this plan.

Management Guidelines – One of the most important outputs of the planning process is the establishment of management guidelines. Management guidelines are the means by which the predicted conditions can be achieved. Natural resource managers will use these guidelines to prioritize, direct, and implement management activities to ensure that daily work follows the planning framework and consistently furthers the objectives in the FRMP throughout DSPR properties. Although the Plan provides flexibility for on-the-ground decisions, the management guidelines serve as a check to meet the specific goals and standards set forth in this plan. The management guidelines in the main body of this plan apply to all DSPR lands in the Western Connecticut Valley District.

Maps and Tables

Most of the plan sections have maps and tables that support the text information. District level maps display information on a landscape or district level and are found in **Appendix A**:

- Western Connecticut Valley Management Forestry District - Properties
- Western Connecticut Valley District – 2005 Land Use – Land Cover
- Western Connecticut Valley District – Protected Open Space
- Western Connecticut Valley District – Forest Interiors
- Western Connecticut Valley District – Landscape Zones
- Western Connecticut Valley District – Watersheds, Public Water Supply and Surface Water Supply Protection Zones A, B and C

Appendix B presents property level maps for district State Parks, Forests or Reservations in a series of ten maps as follows:

- Map 1 DCR Landscape Zones
- Map 2 Vegetation
- Map 3 Prime Forest Soils
- Map 4 100' Hydrology Buffers
- Map 5 50'/500' Road and Legal Trail Buffers
- Map 6 MA Natural Heritage and Endangered Species Program Rare Species
- Map 7 Archeologically Sensitive Areas
- Map 8 Landscape Zones with Resource Overlays
- Map 9 Anticipated Silvicultural Regimes
- Map 10 Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113

Additional Appendices

Following the map appendices are additional appendices containing the following information:

- **Appendix C** **Examples of Western Connecticut Valley District CFI Data**
- **Appendix D** **High Conservation Value Forest**
- **Appendix E** **Rare Species**

- **Appendix F** **Cultural Resource Protection**
- **Appendix G** **Statutory Policy and Guiding Principles**
- **Appendix H** **Public Comments**
- **Appendix I** **Glossary**
- **Appendix J** **Forest Productivity and Stand Complexity Model**
- **Appendix K** **Bibliography**

Intended Users

This plan is designed for use by a variety of audiences. Decision makers may be interested in the planning process, public involvement, land and resource allocation, expected outcomes, and costs and benefits. The public might be most interested in the personally important public issues, zoning and management area land allocation, where uses and activities may or may not occur, and management guidelines. The Forest Resource Management Plan is part of the social contract with the citizens of the Commonwealth, and a commitment by the government to safeguard and enhance the public well-being through the proper management of the State Forest and Parks system lands.

While this is a public document developed in consideration of public comment, its ultimate purpose is operational: to direct DCR staff in the implementation of sustainable land and forest management. Recreation and natural resource managers are the appointed stewards of the Commonwealth's valuable public natural resources; the public trust is preserved through their careful and responsible execution of their duties. The value of this Forest Resource Management Plan ultimately rests on the faithfulness with which they adhere to its dictates.

II. Purpose, Need and Guiding Principles

A. Legislative Mandate

The Department of Conservation and Recreation Division of State Parks and Recreation is responsible for the stewardship and management of approximately 314,000 acres of state forests, parks and reservations. Various Commonwealth laws, the state Constitution and sound forestry practices require that DCR manage state forests for a range of purposes and goals. These include:

1. **Article 97 of the Articles of Amendment to the Constitution of the Commonwealth of Massachusetts (1972):** "The people shall have the right to clean air and water, freedom from excessive and unnecessary noise, and the natural, scenic, historic, and esthetic qualities of their environment; and the protection of the people in their right to the conservation, development and utilization of the agricultural, mineral, forest, water, air and other natural resources is hereby declared to be a public purpose."
2. **M. G. L. Chapter 21, Section 2F (2003):** "Said management plans shall include guidelines for the operation and land stewardship of the aforementioned reservations, parks and forests, shall provide for the protection and stewardship of natural and cultural resources and shall ensure consistency between recreation, resource protection, and sustainable forest management."
3. **M. G. L. Chapter 132, Section 31 (State Forests) (enacted 1914 and revised 2003):** "[The State Forester] shall reforest and develop such lands, and may, subject to the approval of the Commissioner, make all reasonable regulations which in his opinion will tend to increase the public enjoyment and benefit thereof and to protect and conserve the water supplies of the commonwealth."
4. **M. G. L. Chapter 132, Section 40 (enacted 1943 and revised 1983):** "It is hereby declared that the public welfare requires the rehabilitation, maintenance, and protection of forest lands for the purpose of conserving water, preventing floods and soil erosion, improving the conditions for wildlife and recreation, protecting and improving air and water quality, and providing a continuing and increasing supply of forest products for public consumption, farm use, and for the wood-using industries of the commonwealth."

B. Purpose

This Forest Resource Management Plan partially meets the intent of M.G.L. Chapter 21 Section 2F regarding the preparation of management plans by providing strategic sustainable forest management direction for 16 DSPR system properties on 29,439 acres⁶ in the Western Connecticut Valley District (see **Appendix G**). **The purpose of this FRMP is to:**

1. Provide direction for the sustainable and integrated management of all natural and cultural resources by defining standards and guidelines
2. Address the forest resource management issues identified by the public particularly those included in the 2010 Forest Futures Visioning Process and the 2012 *Landscape Designations for*

⁶ Acres used in this report are the best available at the time of publication.

DCR Parks and Forests: Selection Criteria and Management Guidelines (Massachusetts Department of Conservation and Recreation (1), 2012)

3. Inform the public on how the forest resources in the Western Connecticut Valley District will be managed
4. Guide the restoration and maintenance of native forests that are presently dominated by primarily even aged, maturing forests over large areas to have greater diversity of size and age classes, improved wildlife habitat and increased resilience to disturbances
5. Direct the management of forests that will provide ecosystem services such as: water protection and production, diverse habitats, recreation, wood products and carbon sequestration over the long-term
6. Establish guidelines that will protect and enhance rare species and their habitat and provide for the health of native species
7. Provide a balanced approach to recreational use management and sustainable forest management activities
8. Help supply locally grown and produced wood products and thereby support the viability of local forest economies
9. Give the basis for educational opportunities through “leading by example” about forest values and uses

C. Methods

1. Develop a long-term strategy for the sustainable management of Western Connecticut Valley District lands
2. Develop a specific short-term (next 10 years) implementation schedule to meet predicted long-term conditions
3. Determine the location and extent of forest lands to be designated as Reserves, Parklands and Woodlands
4. Provide resource management implementation and monitoring guidance
5. Meet and exceed the Massachusetts Forestry Best Management Practices and meet standards for future third party forest certification

D. Planning Principles

1. The FRMP was developed with the most current information and data available, based upon the following planning principles:
 - a. Consideration of larger landscape-scale patterns and surrounding activities

- b. Adaptability to change over time, as new biological and social conditions and information become available
 - c. Consideration of ecological, social and economic factors
 - d. Adherence to ecologically and economically sustainable and environmentally sensitive practices
 - e. Provision of clear strategic implementation and monitoring directives
 - f. Thorough documentation of key present conditions, predicted conditions, goals and objectives
 - g. Coordination with recreational planning to produce a balanced resource protection strategy
2. Forest management planning and FRMPs are an important component of the overall framework of DCR's Resource Management Planning (RMP) Program. DCR's RMP Program is based upon M.G.L. Chapter 21: Section 2F, which requires DCR to develop resource management plans for all agency reservations, parks and forests. The RMP Program is located within the Bureau of Planning and Resource Protection and works across agency divisions, bureaus and programs, and coordinates with the DCR Stewardship Council regarding program development and adoption. Information from FRMPs prepared by the Bureau of Forest Fire Control and Forestry will be incorporated into RMPs as RMPs are prepared and completed for each DCR planning unit. For more information about the RMP Program, please consult the following web page: <http://www.mass.gov/dcr/stewardship/rmp/>.

E. Best Management Practices and Forest Certification

1. Best Management Practices (BMPs) - Forest management on DCR lands will, wherever possible, exceed current BMPs identified in the *Massachusetts Forestry Best Management Practices Manual* (Catanzaro, 2013). The BMPs are designed to minimize the overland speed and volume of water carrying sediment and nutrients that impact wetlands and water bodies, drinking water supplies and fish/amphibian/reptile habitat. BMPs properly applied and exceeded will also prevent rutting from machinery, preserve and improve aesthetics of timber harvest areas and help minimized the danger of forest fires. Specific areas of Massachusetts Forestry BMPs that can be exceeded are listed later in the section "Water and Soil Resources in Woodlands."
2. Forest Certification - In 2004, the Commonwealth of Massachusetts received initial Forest Stewardship Council endorsed forest management certification for the lands managed by the principal agencies of the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA):
 - a. Department of Recreation and Conservation, Division of State Parks and Recreation – 285,000 acres
 - b. Department of Fish and Game – 110,000 acres
 - c. DCR, Division of Water Supply Protection – 45,000 acres
 - d. Re-certification of the Quabbin Reservoir – 59,000 acres

Subsequent to the initial certification per Forest Stewardship Council (FSC) guidelines, five annual audits were conducted to ascertain ongoing compliance with the requirements and standards of certification. The certificate remained in place until April of 2009 upon which it expired. A full audit of the forest management operation of the Commonwealth agencies listed above was conducted using FSC criteria in April of 2009. The audit report (Scientific Certification Systems, 2009) stipulated that Major Corrective Action Requests (CARs) would need to be addressed and cleared by the auditor if a certificate was to be issued. EOEEA and the

agencies decided to launch the Forest Futures Visioning Process to address public concerns with forestry and that process would take too long for the timelines of the FSC process. The agencies also felt that many of the Major CARs were not based in forestry research and would divert limited resources associated with the Major CARs from the first assessment in 2004 (completing inventories, plans, boundary marking, road restorations and reduction of off highway vehicle (OHV) damage and other issues).

Regarding lands managed by DCR – DSPR, the Technical Steering Committee of the Forest Futures Visioning Process stated that “certification is a potentially valuable tool for advancing the ecosystem service goals”. Therefore, it is the intention of the DCR - DSPR, Bureau of Forestry to seek third party certification within the timing scope of this plan.

3. Some broad goals of forest management certification of state land are to (Fernholz, 2012 and Howe, 2012)⁷:
 - a. Recognize the protection and preservation of diverse natural forests and unique forest ecosystems
 - b. Improve public understanding and confidence in active forest management practices on state forestlands, by providing an independent, third party audit of those properties
 - c. Encourage improvements in private forestland practices, by providing examples of responsible forest management
 - d. Provide materials from sustainably managed forests to the marketplace that demands them

⁷ These goals were paraphrased from the two referenced reports

III. The Western Connecticut Valley District Landscape

A. The Landscape

The Western Connecticut Valley District is located in four ecoregions (as fully described in the *Landscape Assessment and Forest Management Framework for the Berkshire Ecoregions*⁸). The higher elevations and corresponding cooler climate of the Berkshires lead to vegetation patterns more typical of northern New England with spruce-fir and northern hardwood forests dominating the landscape. Lakes and ponds are relatively abundant in the area.

The Western Connecticut Valley District drains into five different watersheds. The percentage of the district landscape draining into each is as follows: 66% Deerfield, 18% Connecticut, 14% Westfield, 1% Hudson and less than 1% drains into the Housatonic River watershed.

The Deerfield arises in Vermont and its tributary streams flow from the Berkshire Plateau in narrow, steep-sided valleys. The relatively high, rugged terrain supports a variety of northern forests types, including spruce and hemlock dominated communities. Much of the remaining Old Growth forest in Massachusetts occurs on the steep, inaccessible slopes of some of the tributaries to the Deerfield. Most are in large patches of unfragmented forests. Cool ponds in the high elevation areas provide distinctive habitat for aquatic plants. Upstream reservoirs and power plants cause extreme daily fluctuations in flow on the Deerfield. Enhanced low flow and flood control have limited the hydrological conditions necessary to maintain floodplain forests and other riverside communities, as well as the species they support. Despite this, along the Deerfield are high-energy riverbanks, riverside rock outcrop communities and major river floodplain forests where the valley broadens as it approaches the Connecticut. This wider, flatter area also provides the best mussel habitat in the watershed; above this the gradient is too steep and substrates too bare.

The Connecticut is the largest river in Massachusetts and the largest drainage system in New England. Because of its length, it crosses a variety of topographic and geologic conditions, which produce many different types of habitats for the large number of species found there. Tributaries from the west arise in forest blocks as high gradient streams off the Berkshire Plateau. They have less acidic soils than the eastern tributaries. Ponds with less acidic waters support uncommon aquatic plants. The Connecticut Valley itself formed on sedimentary rocks but is surrounded by less erodible and more acidic metamorphic and igneous rocks. Oxbows in the broad floodplain of this large meandering river provide important habitat for rare and common plant and animal species.

Old industrial cities were established along the river to use the river's energy for power and pollution dilution capabilities, from which it is now recovering. The flow of the main stem and many of the tributaries is regulated by power plants and reservoirs, with diversions for municipal supplies. The valley's prime agricultural lands on old floodplains are slowly disappearing under development. The altered and less frequent, flooding maintains the remaining floodplain forests along the river's sides, but may not be sufficient for regeneration of the dominant species. Many river fish and mussel species that were historically present still occur, but their populations have been greatly reduced. All of the state's twelve mussel species occur within the watershed, however, the tributary streams support the most diverse and abundant populations.

⁸ Available at: <http://masswildlife.com/eea/docs/eea/lf/berkshire/1-introduction.pdf>

The Farmington and Westfield Rivers drain east through rugged terrain from the Berkshire Plateau into the flatter Connecticut Valley. The area is sparsely populated, with large areas of unfragmented forest blocks. The West Branch of the Westfield is the largest entirely unmanaged river in the state. Although a minimum flow is maintained in the other branches of both the Westfield and Farmington, they are regulated by dams, reservoirs and diversions for municipal water supply. Although the presence of dams and impoundments that collect silts and finer sands limits mussel habitat, mussels are found in some of the moderately flowing portions of streams where there is firm sand and cobble substrate. High-energy riverbanks and riverside rock outcrop communities are important along these quickly flowing rivers. These ledge outcrops and cobble-bottoms provide distinctive habitat for rare aquatic plants. Cold water flowing rapidly over rocky substrates provides important habitat for diverse communities of fish and bottom dwelling invertebrates.

25% (74,103 acres) of the land in the Western Connecticut Valley District is protected (fee ownership or conservation restrictions held by state, federal, municipal government or non-governmental conservation organizations). The present landscape is characterized by forests with dispersed, sparse residential development. Population is concentrated in the cities of Pittsfield, Northampton, Easthampton and Westfield. These population centers are all on the edge of the Western Connecticut Valley District, but like the rest of the state, modern social issues are resulting in an increasingly more dispersed development pattern throughout the district.

The structure and composition of today's forest in this region, on a landscape scale, is heavily influenced by past land use, particularly agricultural use dating from colonial times, subsequent farm abandonment and past logging practices. Soil cation depletion and a number of insect and disease disturbances also affect the forest in this area.

B. Population and Development

The human population (based on the 2010 U. S. Census) for the 26 towns that are fully or partially within the Western Connecticut Valley District is 93,477. This overestimates the population since 14 of the 26 towns in the district are only partially in the Western Connecticut Valley (conversely, 12 towns are completely within the Western Connecticut Valley District) and the population numbers in this database are for the entire town. If we revise this calculation based on the percentage of land area in the district divided by the total land area of these 26 town ($296,533 / 427,955 = 69.3\%$), we could multiply the total town population of 93,477 by this correction factor to come up with a more realistic (but still not exact) Western Connecticut Valley District 2010 population of 64,780. Town populations range from the smallest, Monroe (total population 121) to the largest, Northampton (total population 28,549). Half (13) of all communities in the district have populations of less than 1,400 so it is safe to say that many of these communities are small towns. As is typical of small rural communities, residential development is often dispersed across the landscape, meaning that many residents live in close proximity to (and often surrounded by) the forest. This results in a different relationship to and understanding of the natural world than is typical of more urban dwellers. Population densities range from 11 people/mi² (Hawley and Monroe) up to 798 and 799 people/mi² (Greenfield and Northampton respectively) for an average district density of 140 people/mi². Total population of these 26 towns has changed from 94,893 in 1980 to 97,347 in 1990 to 95,597 in 2000 to 93,477 in 2010. This is a net population loss of 1,416 from 1980 to 2010 (or 1.5%).

The amount of developed land in the Western Connecticut Valley District increased by 31.6% from 1971 to 2005. Developed land in 1971 included the categories commercial, residential, industrial, mining, transportation, urban open and public and waste disposal (11,190 acres total). Developed land in 2005 included the categories listed for 1971 with a somewhat different classification system (cemetery,

commercial, residential (5 categories), industrial, junkyard, mining, transitional, transportation, urban public/institutional and waste disposal) but the categories could be crosswalked as they were mostly comparable (14,721 acres total). Build-out analyses conducted by EOEEA several years ago indicates that the population in the district could more than triple if all available buildable land was developed.

One result of the recent development trends is the further subdivision of large forested tracts into smaller units. Approximately 26% of the forestland in the Western Connecticut Valley District is publicly-owned (64,973 acres out of 245,379 forested acres in the Western Connecticut Valley District). This is consistent with the statewide average (also 26% - 816,058 acres out of 3,186,715 acres), so 74% of the forest land is privately owned.

It is estimated that the number of landowners with fewer than 50 acres of timberland has more than doubled since 1973 (Hall, 2002) in Massachusetts. This can have a strong influence on how forestland is managed, because owners of relatively small blocks of forest are less likely to manage their land for forest products. They may also be more reluctant to allow others on their land for hunting, fishing and other recreational activities, thereby increasing the pressure on publicly-owned lands to meet these demands.

Massachusetts is the third most densely populated state yet it has the eighth highest percentage of forest cover. Massachusetts has long recognized that the state's extensive forests furnish a broad array of benefits that support our quality of life. The state's forest ecosystems provide habitat for wildlife, a resource base for timber production, a wide range of opportunities for recreation, a natural filter to purify the air and water, and a vital source of aesthetic pleasure. As development rates have outpaced population growth over the past four decades, the state has sought ways to ensure that forest resources are used in a sustainable manner.

C. Climate Adaptation and Carbon Sequestration

Climate adaptation and carbon sequestration are two key forest resource issues emerging on a local, regional, national and global scale, especially when it comes to practical approaches and strategies foresters and forest land managers can take to help forests adapt to changing climate conditions. These approaches are outlined in great detail in the U. S. Forest Service (U.S.F.S.) publication titled *Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers* (Swanston and Janowiak (eds.), 2012) and further synthesized in *A Practical Approach for Translating Climate Change Adaptation Principles into Forest Management Actions* (Janowiak, et. al., 2014). The premise of these two publications is that by following a structured approach to forest management through specific management actions and silvicultural practices, it will help forest ecosystems and landscapes adapt to changing climatic conditions.

Additionally, according to the *Massachusetts Climate Protection Plan* (Commonwealth of Massachusetts, 2004), “[c]limate change could have serious impacts on the state's diverse ecosystems, native species and may encourage the spread of non-native species.” The Western Connecticut Valley District FRMP recognizes climate change as resulting from increases in temperature due primarily to elevated greenhouse gas levels that are caused primarily by human activities such as the burning of fossil fuels.

Scientific research has shown that climate change poses a significant risk to our already stressed natural resources. Climate change can be significantly lessened by reducing greenhouse gas emissions through changes in agricultural and forestry management. Natural resource managers and land conservation advocates need to integrate these latest scientific findings into their planning processes and day-to-day management techniques. The state will nurture awareness of the connection between climate change, greenhouse gas pollution, and our forests, oceans, fisheries, and farms. The state will actively foster new

ways to protect these resources while conserving carbon and reducing greenhouse gas emissions.

As temperatures increase globally, Massachusetts forest species composition will undoubtedly change over time. Vegetation models predict that the range of forest communities will slowly shift north with the composition of Massachusetts' forests becoming more typical of forests currently found farther south. Climate change will also likely alter historic precipitation levels and form (snow, rain, etc.) which will also affect Massachusetts forests. Other likely effects include increased frequency and intensity of fires, insect and disease infestations and erratic weather patterns such as damaging winds, drought, flood and ice storms.

Just within the past six years, Massachusetts has experienced an unprecedented number of extreme weather events, including a devastating ice storm, a major tornado and a hurricane that caused serious damage unusually far inland. The ice storm in December of 2008 left 1 ¼ million people without power and dramatically changed the forested and urban landscape of central and western Massachusetts. The 3 / 4 scale tornado (on the Enhanced Fujita scale) on June 1, 2011 that ripped a 39 mile swath from Westfield to Charlton leveled millions of trees and many houses along its path, including 940 acres of near total devastation in Brimfield State Forest alone. This was followed two months later by Hurricane Irene that intensified over western Massachusetts and became an "extratropical" cyclone as it moved north into Vermont and New Hampshire, causing massive flooding, property damage and huge landslides that closed a six mile stretch of the major east/west Route 2 (in the Western Connecticut Valley District) in Charlemont for four months.

Forests play a significant role in keeping carbon dioxide out of the earth's atmosphere by sequestering carbon. It is estimated that forests contain approximately 75% of the earth's biomass. The carbon annually taken up by Massachusetts forests and vegetation equals an estimated 8% of the carbon emitted by humans in Massachusetts (Commonwealth of Massachusetts, 2004).

Massachusetts is studying the role of forests in climate change. Forests are highly complex systems and there is no scientific consensus on the impact of harvesting on forest carbon sequestration in middle-aged forests like those found in most of Massachusetts. Harvesting increases the growth rates of the remaining trees. Local use of forest products may replace fossil fuels for electricity generation and heating and various non-renewable materials (Cresko, 2009)⁹ in consumer products, thereby reducing or slowing carbon emissions into the atmosphere by sequestering it in durable forest products.

While established carbon-accounting models predict that carbon uptake declines as a function of forest age, this may not always be the case. In one study of four different watersheds, each with a different silvicultural history (no harvesting, clear-cutting, single tree selection cutting and a diameter limit cutting), long term carbon sequestration rates (55 years) were similar between three of these forests (no harvest, single tree and diameter limit harvesting) while the clear-cut watershed had a 33% lower sequestration rate over the same time period (Davis, 2009). Research at Harvard Forest in central Massachusetts found a middle-aged forest still increasing carbon sequestration rates (Urbanski, 2007). Other research also suggests older forests may still sequester carbon (Bormann and Likens, 1979; Keeton 2007). More recent research suggests that reserves balanced with active forestry regimes, increased time

⁹ There are various metrics of materials sustainability. Energy intensity (or embodied energy) of materials is measured as the amount of energy consumed in the acquisition of raw material, processing, manufacture, transportation, and construction. Lumber has an embodied energy of 1,380 MJ/m³; recycled aluminum, 21,870 MJ/m³; recycled steel 37,210 MJ/m³; PVC 93,620 MJ/m³; virgin steel 251,200 MJ/m³; virgin aluminum 515,700 MJ/m³ (p. 5-47). This means that using steel or aluminum requires from 16 to 182 times the amount of energy required to produce timber. "Carbon footprint" is a broader measure of the impact human activities have on the environment, specifically as they relate to greenhouse gas emissions (generally, carbon dioxide). It applies to behaviors as well as materials.

between harvest entries and structural retention are important for carbon sequestration (Nunery and Keeton, 2010). Establishing the nature of the relationship with any certainty will require comprehensive, long-term monitoring and analysis; such certainty is unlikely to be arrived at in the near future. FRMPs were created with the best information currently available.

In consideration of potential climate change and the biological impacts to forests, and with a goal of increasing the rates of carbon sequestration, the Western Connecticut Valley District Plan includes the following strategy:

- Continue to expand DCR forests via land acquisitions and private landowner incentives, this reduces the likelihood of deforestation land use change, one of the leading contributors of carbon emissions and maintains the carbon sequestering functions of Massachusetts forests
- Designate, protect and monitor a reserve system of 11,404 acres (39% of Western Connecticut Valley District lands) that, in their present condition, serve as carbon sinks
- Diversify the Western Connecticut Valley District's maturing forest landscape into a more complex forest composed of native species in different vegetative communities, with various age classes and structures
- Remove, contain or mitigate the impacts of non-native species and minimize their future spread, which will likely increase with continued climatic change
- Build capacity to offset carbon dioxide emissions from non-renewable energy sources such as coal, oil and gas by storing carbon in local forest products
- Manages forests in longer rotations (100 and longer) designed to increase carbon sequestration as opposed to shorter commercial and economic rotations (70 to 80 year cycles) designed to maximize revenue and forest products
- Adjust the FRMP based on new forest research and data from monitoring information as required by the 2008 Massachusetts Global Warming Solutions Act¹⁰ and climate adaptation priorities

Carbon resource conservation strives to encourage activities that remove or keep more carbon out of the atmosphere and discourage activities that release carbon into the atmosphere. Massachusetts promotes integrated conservative strategies to maintain working forests and their safe storage of carbon. Massachusetts will promote local forest product networks and energy solutions. It seeks to use forest carbon markets to encourage the retention of higher value-added products in the local timber industry, which currently exports most unfinished product out of state. It will also pursue the use of sustainably harvested biofuels to offset fossil fuel consumption, planting trees in urban areas to reduce the heating and cooling load of buildings and the use of wood products instead of more energy-intensive materials such as concrete, plastics and steel (Cresko, 2009, p. 5-47). The state's goal is to fully incorporate net greenhouse gas emissions impacts when making forest management and land use decisions.

¹⁰ Available at <http://www.mass.gov/eea/air-water-climate-change/climate-change/massachusetts-global-warming-solutions-act/>

Actions

HOST WORKSHOPS ON THE POTENTIAL IMPACTS OF CLIMATE CHANGE ON NATURAL RESOURCES AND LAND MANAGEMENT

In March of 2004, the state convened an interdisciplinary workshop to disseminate scientific information on the potential impacts of climate change on the natural resources of Massachusetts and the New England region, and the implications for resource management. The workshop drew upon the talents of traditional conservation organizations, land managers, universities and colleges, science centers and museums, oceanographers, natural resource-based industries, recreation industries, other non-governmental organizations and interested citizens.

In September of 2014, forestry staff from DCR participated in a two day conference sponsored by the Northern Institute of Applied Climate Science at the University of Massachusetts at Amherst titled “Climate Change and Southern New England Forests.” The conference was organized to enable natural resource professional to integrate climate change considerations into forest management decisions and featured presentations by top experts in the fields of climate research, climate effects on forest ecosystems and wildlife, and forest adaptation. The second day featured a day-long session on forest adaptation planning and practices.

Follow-up workshops will continue to connect sound science with public and private managers and practitioners, to shape feasible, cost-effective solutions.

PROMOTE COASTAL PLANNING PROGRAMS THAT RESPOND TO CLIMATE CHANGE AND HELP PRESERVE WETLANDS

The Massachusetts Coastal Zone Management Office (CZM) will integrate climate change considerations into their policy-making and their planning and management of state-owned coastal areas. They will encourage coastal municipalities to institute adaptation measures to reduce climate impacts, assist state open space preservation programs in the identification of coastal lands in need of protection, and encourage coastal municipalities to consider development strategies that include protection measures such as bulkheads, dikes, and seawalls in critical areas.

PROMOTE A NEW FOREST VISION THAT INTEGRATES CARBON RESOURCE MANAGEMENT WITH OTHER NATURAL RESOURCE GOALS

The state will continue its efforts to maintain existing forests, increase land conservation areas, and give incentives for native (non-invasive) reforestation of previously forested area. The amount of carbon stored or sequestered by these activities will be measured and monitored over time to ensure that real carbon benefits accrue, and to better understand the long-term benefits of such programs. The state will focus on measures including:

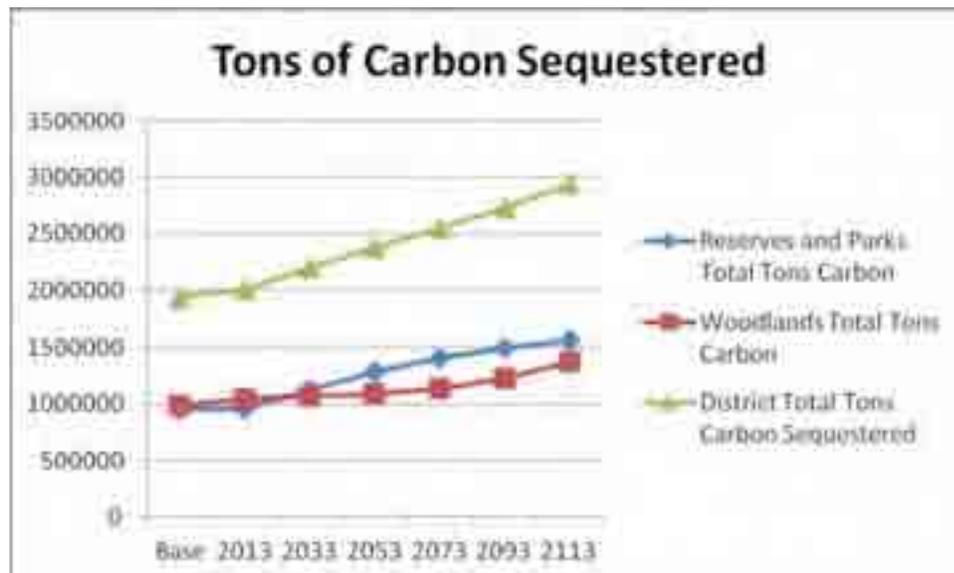
- Tree selection that will both increase carbon storage and shepherd adaptation to climate change over time
- Continued support for urban tree planting programs, additional shade in certain urban areas mitigates the “heat island effect” and an urban tree-planting program can help lower energy demand by diminishing the need for air-conditioning, reducing the size of the heat island has the additional benefit of reducing the formation of ground-level ozone smog in our cities

- Listing carbon resource management as one criterion in the management plan of state forests and other public lands, the state will encourage similar practices on private lands affected by conservation restrictions
- Renewed research on the role of controlled and uncontrolled forest fires in returning carbon to the soil rather than emitting it into the atmosphere
- The state will encourage land and building development practices that preserve existing trees during construction, encourage the planting of native replacement trees, and emphasize reforestation of cleared land in and around developments, the state will meet its obligation to replace trees affected by state projects

Carbon sequestration in the Western Connecticut Valley District

One of the ecosystem service objectives of all of the forests in the district, whether in Reserves, Parklands or Woodlands, is to provide a sink for carbon (also referred to as “carbon sequestration”). The following figure illustrates the predictions of carbon sequestered on site in above-ground live and dead biomass and below-ground live tissue in the forested areas of Reserves, Parklands and Woodlands of this district. Carbon sequestration predictions were made with the Forest Vegetation Simulator (FVS) during forest growth and yield modeling for other forest type attributes. FVS calculates carbon sequestration in a variety of aboveground and belowground carbon pools at each time step.

In the case of Woodlands, the total tons reported of carbon sequestered also include the values of carbon sequestered in long term forest products. The Woodlands figures assume continuation of silvicultural regimes beyond the 100 year vision (harvesting 2113 and beyond). Although active forest management takes place over the Woodlands landscape, the total tons of carbon continues to climb through the 100 year rotation. Of particular note is the long term gradual climb in carbon sequestration over the entire district for virtually the entire analysis period.



Predicted tons of carbon sequestered in the three landscape zones in the Western Connecticut Valley District

D. Protected Land

The Western Connecticut Valley District landscape consists of 296,500 acres of which 245,379 acres are forested. Approximately 26% of Western Connecticut Valley District forestland (64,973 acres) is publicly owned and therefore is assumed to have *some level* of long-term protection. The following table looks at protected land and protected forest lands with *any level* of protection.

Protected land and protected forestland in the Western Connecticut Valley, by ownership

Owner	Total Acres	Percent of Total Protected Land	Total Forested Acres	Percent of Total Protected Forest Land
Federal (F)	0	0.0%	0	0.0%
State Agencies*(S)	35,309	47.6%	33,924	52.2%
County (C)	0	0.0%	0	0.0%
Municipal (M)	7,783	10.5%	6,690	10.3%
Public Non-profit (B)	0	0.0%	0	0.0%
Private – For Profit (P)	22,636	30.5%	16,504	25.4%
Private – Non-Profit (N)	700	0.9%	570	0.9%
Conservation Trust (G)	245	0.3%	243	0.4%
Land Trust (L)	7,425	10.0%	7,038	10.8%
Other (O)	5	0.0%	5	0.0%
Unknown (X)	0	0.0%	0	0.0%
Total	74,103	100%	64,973	100%
Breakdown by State Agencies (S)				
*State – DCR	29,439	39.7%	28,613	44.0%
*State – Dept. of Fish & Game	5,867	7.9%	5,310	8.2%
*State – Other	3	0.0%	1	0.0%

IV. Public Issues and Opportunities

The most important feature of the FRMP is the coordination of public participation and other state agency staff input in the Plan's development. The following is a summary of the public outreach process:

Prior to November, 2008 approved original draft:

- **Forest Reserve** deliberations: three public meetings and a formal public comment period
- **Berkshire Landscape Assessment** deliberations: two public meetings and a formal public comment period
- **Western Connecticut Valley District** deliberations: three public meetings and a formal public comment period

Public notification of meetings and public comment opportunities occurred through mailings to over 900 individuals and organizations, press releases, Environmental Monitor publications, emails and posting of information on the DCR Bureau of Forestry web pages. Pre-planning public issues are located in section **IV. Public Issues and Opportunities** and responses to all written public comments in **Appendix H. Public Comments**.

Prior to March, 2012 completion of the Forest Futures Visioning Process and Landscape Designations:

- **Forest Futures Visioning Process** ([click here for a link to the website-based document called "Forest Futures Visioning Process Recommendations of the Technical Steering Committee"](#)) (Massachusetts Department of Conservation and Recreation, 2010)
 - Conducted by an 11 member Technical Steering Committee and Advisory Stakeholders group
 - Five public forums that collectively attracted more than 500 participants, approximately 450 written public comments and more than 250 responses to an on-line survey
 - The Technical Steering Committee Report provided 12 recommendations to the DCR for forest management policy and land allocation, the report highlighted land zoning (Parks, Reserves and Woodlands), new and innovative approaches to forest management and improving public outreach
 - A document (with the link above) was created that describes these recommendations
- **Landscape Designations and Management Guidelines Process** ([click here for a link to the website-based document called *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines*](#)) (Massachusetts Department of Conservation and Recreation (1), 2012)
 - Series of seven public workshops and the public comment period held in Fall 2010/Winter 2011 sought input on how to accomplish the designation process, focusing on what criteria to use to select lands for each designation and how to manage the Parklands, Reserves and Woodlands within the framework set out by the Technical Steering Committee
 - DCR hosted an additional seven public workshops in May and June 2011 to seek public input on the application of landscape designations for DCR properties, at the workshops, DCR presented the statewide context for the draft designations and hosted a public

dialogue focused on the respective DCR land in that particular region of the Commonwealth

- A document (with the link above) was created that describes this process

V. District Overview

The Western Connecticut Valley District contains 29,439 acres in the state forest and parks system. These lands range from the 61 acre Leyden State Forest to the 7,529 acre Kenneth Dubuque Memorial State Forest/Park. There are different administrative boundaries for forest fire control, forest management, service forestry, and recreation programs. All information in this plan is based on the Western Connecticut Valley's Forest Management District. Since information is collected by the forest management district, properties have been arranged by this district. The properties in the Western Connecticut Valley District have been grouped into six management units for administration of the forest management program. The following table shows the groupings as well as the forest numbers, property names and acres:

Management unit and acreage of properties in the Western Connecticut Valley District

Management Unit	Forest #	Site Name	Acres
Unit 2	20	Monroe State Forest	3,750
Unit 2	21	Rowe State Forest	256
Unit 2 Total			4,006
Unit 3	30	H. O. Cook State Forest	1,834
Unit 3	31	Leyden State Forest	61
Unit 3 Total			1,895
Unit 4	40	Savoy Mountain State Forest	944
Unit 4	41	Windsor State Forest	1,508
Unit 4	42	Florida State Forest	987
Unit 4	43	Deer Hill State Reservation	350
Unit 4 Total			3,789
Unit 5	50	Mohawk Trail State Forest	6,563
Unit 5 Total			6,563
Unit 6	60	Kenneth Dubuque Memorial State Forest/Park	7,529
Unit 6	61	Buckland State Forest	93
Unit 6	63	Catamount State Forest	1,416
Unit 6 Total			9,038
Unit 8	80	Conway State Forest	1,757
Unit 8	81	Shelburne State Forest	72
Unit 8	82	D.A.R. State Forest	1,728
Unit 8	85	South River State Forest	591
Unit 8 Total			4,118
Total			29,439

Other (non - DSPR system) protected lands in the Western Connecticut Valley landscape provide complementary natural resource values, protection of BioMap core areas and opportunities for cooperative resource management. See the map in **Appendix A** titled “Protected Open Space” to see other protected lands by ownership in the district. Although current use properties (privately owned properties managed under the Chapter 61 and 61A programs) are not permanently protected, they do provide and support a large matrix of actively managed forested acres representing a significant part of the Western Connecticut Valley District landscape. They do not show up on this map since this dataset is no longer maintained and is therefore no longer available through MassGIS as it was in the past.

VI. Landscape Designations and Guidelines

Based on the Landscape Designation process that was discussed earlier, the 16 DCR properties of the Western Connecticut Valley District are split into the following three categories – Reserves, Parklands and Woodlands. As was presented earlier, 39% of the Western Connecticut Valley District has been classified as Reserve, 53% has been classified as Woodland and 8% has been classified as Parkland.

Total acres and percentage of properties in each landscape zone in the Western Connecticut Valley District

Property Name	Reserve Acres	% of Reserves	Parkland Acres	% of Parklands	Woodland Acres	% of Woodlands
Buckland State Forest	0	0%	0	0%	93	1%
Catamount State Forest	1,416	12%	0	0%	0	0%
Conway State Forest	0	0%	0	0%	1,757	11%
D. A. R. State Forest	0	0%	1,728	74%	0	0%
Deer Hill State Reservation	0	0%	0	0%	350	2%
Florida State Forest (WCV part)	0	0%	0	0%	987	6%
H. O. Cook State Forest	0	0%	0	0%	1,834	12%
Kenneth Dubuque Memorial State Forest/Park	0	0%	47	2%	7,482	48%
Leyden State Forest	0	0%	0	0%	61	0%
Mohawk Trail State Forest (WCV part)	6,254	55%	309	13%	0	0%
Monroe State Forest	3,734	33%	16	1%	0	0%
Rowe State Forest	0	0%	0	0%	256	2%
Savoy Mountain State Forest (WCV part)	0	0%	0	0%	944	6%
Shelburne State Forest	0	0%	72	3%	0	0%
South River State Forest	0	0%	141	6%	450	3%
Windsor State Forest (WCV part)	0	0%	18	1%	1,490	9%
Total	11,404	100%	2,331	100%	15,704	100%

To parse this data even further, the table on the next page summarizes the acreage and percentage breakdown of these three landscape designations by the 26 towns that are partially or fully within the Western Connecticut Valley District:

Town	Total Town Acres	Acres in District	Town Percent of District	Percent of Town in District	Reserve Acres	Percent of All Reserves	Parkland Acres	Percent of All Parklands	Woodland Acres	Percent of All Woodlands
ASHFIELD	25,802	25,802	8.7%	100%	0	0.0%	285	12.2%	0	0.0%
BERNARDSTON	14,973	6,946	2.3%	46%	0	0.0%	0	0.0%	0	0.0%
BUCKLAND	12,679	12,679	4.3%	100%	0	0.0%	0	0.0%	136	0.9%
CHARLEMONT	16,860	16,860	5.7%	100%	1,780	15.6%	243	10.4%	0	0.0%
CLARKSBURG	8,195	1,576	0.5%	19%	0	0.0%	0	0.0%	129	0.8%
COLRAIN	27,861	27,860	9.4%	100%	1,340	11.8%	0	0.0%	922	5.9%
CONWAY	24,211	24,210	8.2%	100%	0	0.0%	141	6.1%	2,152	13.7%
CUMMINGTON	14,764	4,902	1.7%	33%	0	0.0%	0	0.0%	136	0.9%
DEERFIELD	21,388	8,010	2.7%	37%	0	0.0%	0	0.0%	0	0.0%
FLORIDA	15,739	10,017	3.4%	64%	2,476	21.7%	78	3.3%	831	5.3%
GOSHEN	11,350	6,015	2.0%	53%	0	0.0%	1,443	61.9%	0	0.0%
GREENFIELD	14,036	7,008	2.4%	50%	0	0.0%	0	0.0%	0	0.0%
HATFIELD	10,766	3,690	1.2%	34%	0	0.0%	0	0.0%	0	0.0%
HAWLEY	19,728	19,727	6.7%	100%	1,643	14.4%	35	1.5%	6,195	39.4%
HEATH	15,932	15,932	5.4%	100%	0	0.0%	0	0.0%	912	5.8%
LEYDEN	11,508	11,508	3.9%	100%	0	0.0%	0	0.0%	61	0.4%
MONROE	6,913	6,912	2.3%	100%	2,626	23.0%	0	0.0%	0	0.0%
NORTH ADAMS	13,211	893	0.3%	7%	0	0.0%	0	0.0%	27	0.2%
NORTHAMPTON	22,848	4,674	1.6%	20%	0	0.0%	0	0.0%	0	0.0%
PLAINFIELD	13,623	13,622	4.6%	100%	0	0.0%	12	0.5%	1,449	9.2%
ROWE	15,360	15,360	5.2%	100%	0	0.0%	0	0.0%	256	1.6%
SAVOY	23,070	7,861	2.7%	34%	1,539	13.5%	5	0.2%	1,158	7.4%
SHELBURNE	14,978	14,977	5.1%	100%	0	0.0%	72	3.1%	0	0.0%
WHATELY	13,228	9,588	3.2%	72%	0	0.0%	0	0.0%	0	0.0%
WILLIAMSBURG	16,425	10,658	3.6%	65%	0	0.0%	0	0.0%	55	0.4%
WINDSOR	22,510	9,238	3.1%	41%	0	0.0%	18	0.8%	1,287	8.2%
Total	427,956	296,502			11,404	100.0%	2,332	100.0%	15,704	100.0%

A. Reserves

There are 11,404 acres of Reserves in the Western Connecticut Valley District. They are located in the:

<i>Catamount State Forest</i>	<i>1,416 acres</i>	<i>12% of all Reserves in the WCV</i>
<i>Mohawk Trail State Forest (WCV part)</i>	<i>6,254 acres</i>	<i>55% of all Reserves in the WCV</i>
<i>Monroe State Forest</i>	<i>3,734 acres</i>	<i>33% of all Reserves in the WCV</i>

1. The Purpose of Reserves

The primary purpose of setting aside large areas of forest as Reserves is to allow forests to develop relatively unimpeded by human disturbance and to create late successional habitat. Given a sufficient amount of time without major disturbances, the forest will develop characteristics associated with true old growth forest. These late successional and old growth conditions include a wide diversity of tree sizes and ages, tip-up mound topography, micro-site conditions from fallen trees and large amounts of downed woody debris.

Another reason for the establishment of Reserves is to provide areas where forest conditions can be influenced to the extent possible by natural (versus human-caused) disturbances, where natural disturbance regimes can play out indefinitely and where visitors will be able to experience these unique conditions first hand. Users of Reserves often value them for spiritual reasons since they may provide elements of a wilderness recreational experience.

DCR anticipates that Reserves will also provide an aspect of biodiversity less prevalent in the rest of the forests so it is important that the system of Reserves includes representatives from the main forest types across the Commonwealth.

Reserves also provide “control” areas for comparison to “treatments” applied to harvested sites - they are the prerequisite for ensuring sustainable, adaptive management of other lands into the future. Reserves provide reference sites for objective assessment of the sustainability of forest management practices (Norton, 1999) and are essential for practicing adaptive resource management (Walters and Holling, 1990). Reserves create opportunities for connectivity within the landscape, conservation of species and processes, buffering against future uncertainty and other hard to measure but valuable functions (Hunter 1996). By comparing the species and communities that occupy reserves over time to those on harvested sites, forest managers can measure the effects of different management regimes and adjust them as needed to ensure that forestry practices on DSPR lands sustain all components of biological diversity.

2. Reserve Size

A goal of Reserves is to understand how natural disturbance processes shape the structure and composition of forest ecosystems. Accordingly, some reserves should be equal or greater in size than the largest expected natural disturbance patch. Natural disturbances are common in southern New England forests and range from frequent, small disturbances (e.g., annual wind events that disrupt <1 acre of forest canopy) to occasional, catastrophic disturbances (e.g. major windstorms that disrupt as much as 5,000 contiguous acres of forest canopy once every few centuries). The following table¹¹ shows expected disturbances, patch size and return intervals:

¹¹ Based on Seymour, et al., 2002

Typical disturbance in northeastern North American forests, by size and frequency

	Disturbance		
	Natural canopy gaps (senescence, wind, pathogens, insects)	Stand – replacing wind	Stand – replacing fire
Individual patches (acres)	0 – 0.28	0.5 – 9,353	5 - >200,000
Mean individual patch size in acres (number of references)	0.01 – 0.03 (12)	35 – 230 (4)	5 – 494 (8)
Return interval (years)	50 – 200	855 – 14,300	806 – 9,000

Management Approach for Reserves

Reserves are meant to contain natural features across a landscape, ideally located across the state representing different ecological settings. Reserves are also intended to be several thousand acres in size to provide adequate protection of resources, with the potential to be increased over time (either via state or local land conservation efforts or by co-management of non-state protected forest) to reach sizes of 10,000 to 15,000 acres. The Nature Conservancy recommends large Reserves in the Eastern United States be a minimum of 15,000 acres; EOEEA recommends a minimum of 5,000 acres; and BioMap2 (Natural Heritage & Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife and the Massachusetts Program of The Nature Conservancy, 2011) selects “forest cores” (the least fragmented remaining forests) at a minimum of 500 acres in eastern Massachusetts, 1,500–2,000 acres in Worcester County and the Berkshire Plateau and 3,000+ acres for the Taconics.

While large contiguous blocks of land are important to Reserve creation, DCR recognizes that Massachusetts is a relatively small, highly developed state and that Reserves need to be scaled appropriately for Massachusetts. DCR believes that Reserves can also be effective at smaller scales and has identified Reserves that vary by size in each region of the state due to several factors, including the level of development within properties as well as the size of DCR properties throughout the state. DCR was guided by BioMap2 in selecting “forest cores” to adjust the minimum sizes for “Large Reserves” across the state so that this designation would not be limited to large properties in the Berkshires. In addition, the new and more detailed Ecological Land Units (ELUs) developed by DCR, in collaboration with The Nature Conservancy, contain representation among Reserves as well as Parklands and Woodlands.

Management approach recommended by the Technical Steering Committee (TSC):

Recommendation 4: Management of large forest Reserves should allow ecological processes to determine the long-term structure, composition, function, and dynamics of the forest to the maximum extent possible. However, the areas that have been considered for large Reserves range widely in their natural and historical disturbance regimes. In this context, flexible yet thoroughly vetted reserve management will support ecological functions in the varied forest ecosystems of the

Commonwealth and under the ecological and climatic uncertainties of the future (Massachusetts Department of Conservation and Recreation, 2010, p. 9).

The dominant ecosystem service objectives in Reserves will be:

- biodiversity expansion, including complex forest systems
- carbon sequestration
- provision of wilderness recreation opportunities

Management of Reserves should allow natural processes to determine the long-term structure, composition, function and dynamics of the forest to the maximum extent possible. Equally important is monitoring and studying these conditions, then applying this knowledge to low impact forest management techniques within Parklands and Woodlands, and on privately-managed forests. The TSC also recommended the formation of a Forest Reserves Science Advisory Committee (FRSAC), consisting of conservation biologists and forest ecology experts to assist and review management and major restoration activities within Reserves. This committee was created and had their first meeting in September of 2012. One of the big issues they have taken on since their formation was to support the removal of 576 acres of dead or declining red pine plantations at Myles Standish State Forest in a Reserve area.

3. Selection Criteria for Reserves

This plan emphasizes the conservation of ecological communities and ecosystems, and addresses natural processes and landscape-level factors that sustain these communities and ecosystems. One of the goals of the Landscape Designation Zoning Process and district-wide planning is to identify viable examples of all types of ecosystems at an appropriate scale to conserve their component species and processes. ELUs were used within the Landscape Designation Zoning Process are areas of land and water having similar characteristic combinations of physical environment – elevation, geology and land form (a measure of topography) – and as a result, similar vegetation and habitats

Approximately 40,000 acres of State Park and Forest lands were previously designated as “Large Reserves” in 2006 through a process involving DCR – Divisions of State Parks and Water Supply Protection – and the Division of Fisheries and Wildlife (DFW), which was coordinated by EOEEA.¹² GIS models based upon a continuum using the best available data were utilized to guide the selection of additional Reserves. The most favorable units of land for designation as additional Reserves are those:

- with least fragmented tracts of land
- with the highest amount of forest interior
- that are well buffered from development
- that are contiguous with other protected land
- that represent a major ecological setting in the Commonwealth
- that conserve ecological and evolutionary processes

¹² The original Large Reserves were at Chalet, East Branch, Otis, Mohawk/Monroe/Savoy, Middlefield/Peru, Mt Greylock, Mt. Washington and Myles Standish. Reports documenting the baseline characteristics of many of these Reserves are found at: <http://www.mass.gov/eea/docs/eea/lf/whatare-forestreserves.pdf>

- that are large enough at a regional scale to capture a range of ecological processes
- that provide redundancy within each ecological land unit
- that contain special attributes, such as old growth or continuously forested sites
- with limited recreational infrastructure
- with a low density of officially designated trails

For these criteria, several existing data sets were drawn upon from a variety of sources, including the forest cores identified in BioMap2, DCR's new ELUs and DFW's forest interior data.

The Nature Conservancy previously developed ELUs for a significantly larger region stretching from Virginia to New Hampshire. These regional ELUs were used to select candidate areas for the nine Large Reserves designated by EOEEA in 2006. These ELUs utilized geology, elevation and landform to map where different ecosystems occur, mapping very large landscape units across half of the eastern seaboard.

For the current Landscape Designation Zoning Process, DCR felt it was important to update The Nature Conservancy's regional process so that more refined ELUs could be scaled to Massachusetts and mapped at a DCR property level. For example, if a 5,000 acre DCR property was part of a 100,000 acre ELU, the attributes of that property may or may not reflect the designation of the overall ELU. DCR collaborated with TNC to develop 11 new ELUs for Massachusetts that have been more useful in the categorization and designation of all DCR properties, allowing DCR to balance Reserves, Parklands and Woodlands within each of the new ELUs across the state.¹³

Since the original FRMP document was written in 2008 and approved by the DCR Stewardship Council, there has been one significant public process and one significant document produced. These have changed the way that forest management activities and planning efforts are conducted on DCR land where the Bureau of Forestry has management responsibilities.

The Forest Futures Visioning Process was convened in April of 2009 and a report was presented a year later in April of 2010. This report was called the *Forest Futures Visioning Process Recommendations of the Technical Steering Committee* (referenced previously). This public process led to the document called *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines* (referenced previously). These are 171 and 163 page documents respectively and are not included in this planning document as appendices due to their length but can be referenced above.

4. Present Condition of Reserves

As mentioned above, there are 11,404 acres of Reserves in the Western Connecticut Valley District, located in Catamount State Forest, Mohawk Trail State Forest (WCV part) and Monroe State Forest. Based on the 2003 *MA DEM Bureau of Forestry Land Cover Classification* (DEM is the acronym for the Department of Environmental Management which became the Department of Conservation and Recreation in 2003) inventory done by the James W. Sewall Company in Old Town, Maine, the Reserve areas are predominately forested with beech, birch, maple and hemlock cover types. None of the properties in the Reserves currently allow off road vehicle use. Recreational uses that are allowed include

¹³ For more information on the development of ELUs, see the GIS Model Descriptions in Appendix 9 of *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines*

hunting, hiking, fishing, bird watching, mountain biking, snowmobiling and horseback riding. The following statistics are derived from this forest land cover classification inventory:

Land cover types and acres on Reserves in the Western Connecticut Valley District

Land Cover Type	Acres
Beech - birch – maple	6283.9
Eastern hemlock – hardwoods	2543.8
Eastern white pine – hardwood	769.9
Oak – hardwoods	376.5
Sugar maple	284.7
Red spruce	259.4
Eastern white pine	209.7
Eastern hemlock	98.3
Mixed oak	85.3
Abandoned agricultural land	68.6
Red pine plantation	67.6
Open water	64.2
Norway spruce - white spruce plantation	61.4
Utility rights-of-way - electrical, gas, etc.	39.7
Northern red oak	39.0
Poplar-aspen	38.7
White birch	29.9
Shrub swamp	13.7
Shallow marsh, meadow or fen	13.6
Eastern white pine - eastern hemlock	12.7
Eastern white pine plantation	11.0
Red maple - swamp hardwood	9.3
Black cherry	8.2
Spruce-fir	7.1
Administrative, non-paved, lawns, etc.	3.2
Borrow pits, gravel and sand banks	1.7
Reserve Total	11,404

5. Predicted Condition of Reserves

The predicted condition for Reserves is vegetative communities that are functioning ecologically with as little human intervention as possible. In the forested component of Reserves in the district where disturbance events and patterns are understood to be minimal, temporally and spatially, the predicted condition is late successional native forests that approach “old growth” conditions. In those Reserves

where disturbance events such as fire and wind are known to occur frequently on the landscape, the predicted condition is early and mid successional stages. It is in these Reserves that human intervention using tools such as fire and limited cutting may be used to sustain native vegetation and wildlife species.



Large trees in an old growth stand in the Reserve at Mohawk Trail State Forest

The Reserves of the Western Connecticut Valley District are almost exclusively within the Berkshire landscape where natural disturbance patterns are minimal, temporally and spatially, and the predicted condition is late successional native “old growth forests” and their associated habitats. Human use is allowed in Reserves, however, uses and activities must be consistent with providing a natural landscape.

Predicted age class distribution of Western Connecticut Valley District Reserves and Parklands (no management regime) areas over 100 years minus regeneration level natural disturbance¹⁴

Age Classes	Non Forest	Age class and size descriptions					
		0-14 years old	15-59 years old	60-89 years old	90 - 125 years old	125+ years old	Uneven aged
Size Classes		Seedling-Sapling 0-4.5" dbh	Poles 4.6-10.9" dbh	Immature 11-14.9" dbh	Large ≥15" dbh	Very Large ≥26" dbh	All Size Classes
Present Distribution	4%	< 1%	25%	58%	14%	0%	2%
Present Acres	484	58	3,363	7,707	1,846	0	277
2033 Distribution	4%	0%	2%	11%	72%	< 1%	0%
2033 Acres	484	0	288	1,533	11,387	42	0
2053 Distribution	4%	0%	0%	1%	95%	< 1%	0%
2053 Acres	484	0	0	204	13,004	42	0
2073 Distribution	4%	0%	0%	1%	95%	< 1%	0%
2073 Acres	484	0	0	199	13,010	42	0
2093 Distribution	4%	0%	0%	0%	95%	2%	0%
2093 Acres	484	0	0	0	13,020	231	0
2113 Distribution	4%	0%	0%	0%	95%	2%	0%
2113 Acres	484	0	0	0	13,001	250	0

6. Management Guidelines for Reserves

Once land is designated as a Reserve, there are some significant threats that may impede natural processes. These include:

- fragmentation and destruction of adjacent forests due to residential or commercial development
- disruption of ecological processes from invasive species and climate change
- inconsistent enforcement of management policies
- unregulated recreational use such as off highway vehicle trespass

¹⁴ Numbers in this plan are derived from aerial photo interpretation, GIS analysis, Continuous Forest Inventory Plot data and the modeling of data using the Forest Vegetation Simulator (Dixon, 2008). Any differences in comparable numbers in the tables or text are due to using different sources or rounding. The predictions shown do not include the effects of large natural disturbance which, although inevitable, are very unpredictable.

- human-caused wildfires
- development of dense trail systems or heavy use of trails and potential habitat fragmentation, soil compaction and wildlife disturbance

Most DCR properties are less than the 15,000 acres recommended through the FFVP as the minimum size of Reserves (based on The Nature Conservancy's work). Therefore, it will be critical to work toward the protection of forested lands adjacent to Reserves to help retain the large forest blocks envisioned for Reserves. DCR will seek partnerships with statewide and regional conservation organizations to help accomplish this.

The lack of resources for monitoring and study present a challenge to attaining the predicted value of Reserves. Since it will likely take decades for Reserves to look and function differently than other forests, it is important to routinely document changes so that the public can learn of their values and allow this knowledge to be applied to the management of other forests in the Commonwealth. DCR plans to elicit partnerships with private and academic conservation organizations and alternative funding sources to assist with monitoring Reserves and assess the efficacy with which Reserves are meeting this designation's goals.

In general, removal of trees and other vegetation (including commercial or salvage harvests) will not be allowed in Reserves. However, some situations may call for ecological restoration and vegetation management. Situations where some management may be appropriate include the removal of invasive species or for the protection of existing rare species. Fire adapted Reserves in Southeastern Massachusetts may require active restoration and management to maintain habitat for rare species and reduce the risk of catastrophic wildfire that can threaten human health and safety. Insect infestations, such as the recent discovery of the Asian Longhorned Beetle in the Worcester area, may also necessitate more active control and management activities than would normally be considered appropriate in Reserves. Finally, some management flexibility will be needed for Reserves that are part of municipal water supply watersheds so that unanticipated future threats to those water supplies can be dealt with in effective and appropriate ways in accordance with the Landscape Designation management guidelines and in consultation with FRSAC, the municipal water supplier and/or the Department of Environmental Protection (DEP). Some management flexibility, with the safeguards discussed below, is crucial to maintain Reserve functions given the diversity of forest types, and the tremendous range of land use histories and disturbance regimes across the Commonwealth.

In order to consistently guide DCR in these decisions, the FRSAC, consisting of conservation biologists and forest ecology experts, will provide guidance on vegetation management and assist with long term scientific monitoring and research opportunities within Reserves.

Recreation and Public Access Guidelines for Reserves

- a. Recreational activities that are compatible with Reserves include dispersed, non-motorized activities, including hiking, hunting, fishing, cross-country skiing, snowshoeing, mountain biking and horseback riding. Management needed to maintain those activities (e.g., trail maintenance) will be permitted, subject to agency guidelines and policies and existing property specific regulations.
- b. Off Highway Vehicles (OHV), other than snowmobiles, are prohibited. However, where currently designated as an approved use prior to Reserve designation, OHV use may be

continued if consistent with DCR's *Motorized Trail Recreation Facility Assessment Policy* and managed to minimize natural resource impacts and use conflicts.¹⁵

- c. Snowmobile use shall be limited to designated trails and forest roads that are not maintained for vehicle use. Existing use regulations and policies apply.
- d. Development of new intensive-use recreation sites (such as campgrounds, picnic areas, visitor centers, administrative offices, parking lots, etc.) is not permitted.
- e. New trail construction is permitted only after the trail has been reviewed by DCR staff using the guidance and procedures established by the *Trails Guidelines and Best Practices Manual* (Massachusetts Department of Conservation and Recreation (2), 2012). Trail density and use levels will be evaluated to see how they may affect the values of Reserves.
- f. Trail relocations to reduce adverse impacts to critical resources will be prioritized. DCR will strive to maintain a low density of trails that are not highly developed (class 1–3¹⁶) within Reserves to protect their ecological and recreational intent. DCR may close trails to achieve the values of Reserves.
- g. DCR will work with local fire and safety officials where Reserves are located to balance the need for fire and rescue access with the above goals for trail access in Reserves.
- h. DCR will examine vehicle use on public roads that cross Reserves to determine whether fire and public safety access could be maintained and Reserve qualities enhanced by gating these roads. Any closing of public roads to vehicles would not negatively impact access to camping areas or other facilities and would require close communication with the local towns and public safety officials.

Silviculture and Vegetation Management Guidelines for Reserves

Habitat manipulation, silvicultural treatments and commercial harvesting operations are not permitted in Reserves. However, if deemed appropriate by DCR and reviewed by the FRSAC, the following exceptions may be allowed:

- a. Implementation of the Massachusetts Natural Heritage and Endangered Species Program (NHESP) recommendations to restore, maintain or enhance habitat for rare and endangered species and exemplary natural or rare communities.
- b. Removing plantations would not be permitted except to restore important wildlife habitat such as pitch pine barrens or other habitats and after consultation with DFW and FRSAC.

¹⁵ In these cases, DCR is committed to applying the fine filter criteria developed in 2007 to determine whether the location may be able to provide safe and sustainable OHV recreation. If it passes the fine filter DCR will continue that use, but may also seek alternative locations for OHV recreation where management of this intensive recreational activity better matches the predicted goals and conditions of the surrounding landscape. For more information on the fine filter criteria, see the *DCR Motorized Trail Recreation Facility Assessment Policy* available at: <http://www.mass.gov/eea/docs/dcr/recreate/ohv-policy.pdf>

¹⁶ Trails are classified into 5 classes by tread, obstacles, constructed elements, signs, and typical recreational experience, the first 3 classes being the lower end of trail development. Class 1 trails are Minimal/Undeveloped Trails, Class 2 trails are Simple/Minor Development Trails, and Class 3 trails are Developed/Improved trails. For more info on these classifications, please see the *DCR Trails Guidelines and Best Practices Manual*, updated January 2010, pp 37 – 38. Available at: http://www.mass.gov/dcr/stewardship/greenway/docs/DCR_guidelines.pdf

- c. Removing non-native invasive species may occur after consultation with FRSAC.
- d. Managing vegetation to control erosion or to stabilize soils.
- e. Cutting of vegetation to maintain established public vistas and trails is permitted (e.g., the small Spruce Mountain vista located in Monroe State Forest).
- f. Removal of hazardous trees directly adjacent to official DCR trails and abutting properties that pose significant risk to public safety.
- g. Vegetation management is permitted by parties who have secured pre-existing rights (e.g., easement holders, utility easements) to perform such activity, subject, however, to standard regulatory and permitting requirements.
- h. Cutting vegetation to maintain existing agricultural fields or existing wildlife habitat openings is permitted.
- i. Creation of new fields, vistas and wildlife openings is prohibited.

Water and Soil Resource Guidelines for Reserves

- a. Management may be permitted to control erosion or stabilize soils by closing roads and unauthorized trails or other means such as stabilizing slopes with water bars or other erosion control structures. DCR will consult with local emergency management officials on road closures and request FRSAC review for significant work of this type.
- b. Where DCR Reserves are designated on local or regional public water supply watersheds, appropriate management activities may be undertaken in accordance with the Landscape Designation management guidelines, after consultation with the public water supplier, FRSAC and/or DEP, to confirm the need for, and the type and extent of, management actions to address water quality protection issues (e.g., due to wildfires, insect or disease outbreaks or other unanticipated threats to water quality). See Appendix 5 in *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines* for a list of DCR properties on public water supply watersheds.

Habitat Protection Guidelines for Reserves

- a. Identification, documentation and protection of rare species occurrences and important habitats will be addressed using the following tools:
 - 1) Review of the NHESP GIS database, which includes datalayers from statewide databases such as BioMap2, Priority Habitats of rare species, Estimated Habitats of rare wildlife, Certified or Potential Vernal Pools and Natural Communities.
 - 2) Review of and consultation with other sources of natural resource information, where appropriate and available (e.g., Mass Audubon, New England Wildflower Society, The Vernal Pool Association, other non-governmental organizations (NGOs), local naturalists, etc.)

- 3) Surveys and monitoring, by trained DCR staff and/or outside consultants, to document and map rare species and important habitats when necessary for project specific purposes or long-term documentation.
 - 4) If any state listed species are listed pursuant to the U.S. Endangered Species Act (16 U.S. Code §§ 1531 – 1544), the U.S. Fish & Wildlife Service must approve the project and the appropriate species Recovery Plan shall be consulted.
 - 5) Consult and work with NHESP to identify and develop appropriate conservation practices for Natural Communities.
 - 6) Consider certifying potential vernal pools if applicable; apply accepted Massachusetts and federal protection guidelines around all certified or potential vernal pools (304 Code of Massachusetts Regulations (CMR) 11.00).
- b. Work closely with DFW, and consult the Comprehensive Wildlife Conservation Strategy (often referred to as the “State Wildlife Action Plan” or SWAP)¹⁷ for guidance in protecting rare species and their habitats and the Forestry Conservation Management Practices for Rare Species,¹⁸ where appropriate.
 - c. Using the resources noted in section A, Habitat Restoration Plans should be generated to improve degraded habitats important to rare species and/or state/regional biodiversity.
 - d. Consult with DFW and DEP prior to conducting any work adjacent to coldwater fisheries habitats; apply protection guidelines recommended.
 - e. Form partnerships with friends groups, local naturalists, environmental organizations, etc., to assist in the identification, protection and monitoring of important habitats or rare species population where appropriate.

Forest Health and Protection Guidelines for Reserves

- a. Spread of invasive epidemic forest pathogens, insects and diseases or other biological risks to the forest (such as Asian Longhorned Beetle or Emerald Ash Borer) may be controlled as part of a coordinated effort, if there is a major threat to forest health or risk to private or public natural resources.
- b. Wildfires will be contained, controlled and suppressed, unless there is an approved site specific controlled fire plan and conditions are within the fire plan prescription.
- c. Fire breaks, where necessary, may be created and maintained.
- d. Prescribed fire may be used when it is compatible with protection of Reserves, restoration of native communities and ecological processes, and the protection of life and property adjacent to Reserves and surrounding landscape. The prescribed fire burn plan would be subject to the review of the local fire chief(s) and the FRSAC.

¹⁷ Available at: <http://www.mass.gov/eea/agencies/dfg/dfw/wildlife-habitat-conservation/state-wildlife-conservation-strategy.html>

¹⁸ Available at: <http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/forestry-rare-species-review/forestry-cmps-for-rare-species.html>

- e. Where the use of pesticides is the only feasible method to remove invasive species that threaten the values of Reserves, this approach may be considered after gaining input from the FR SAC.

Cultural Resource Management Guidelines for Reserves

- a. As per DCR's regulatory responsibilities, any projects undertaken on DCR land must be reviewed during the planning stages by DCR's Office of Cultural Resources for their potential impacts to historic and archaeological resources.
- b. Maintenance of historic buildings and structures within Reserves is allowed.
- c. Vegetation management for the protection of historic or archaeological sites is allowed, with some restrictions on the time of year, types of equipment and techniques used to minimize resource disturbance, as guided by DCR Cultural Resources staff.

Facilities, Transportation and Boundary Guidelines for Reserves

- a. Existing roads will be managed and maintained to assure continued administrative and/or emergency access. Public roads within Reserves that are open to vehicles will be reviewed for vehicle closure via gating to enhance Reserve qualities only after an evaluation of impacts to public access, fire and emergency vehicles, and after communication with local communities and the public.
- b. No new roads will be constructed.
- c. Existing roads not needed for recreation, administration or emergency use may be closed and restored to their natural condition, only after consultation with local emergency management officials.
- d. Replacement of existing facilities, as needed, will be allowed, but construction of new facilities where none previously existed is prohibited. Exceptions may include small-scale, low impact, context appropriate informational kiosks, universal access structures for trails, composting toilets, trailheads, parking areas and carefully designed boardwalks or other projects that protect the integrity of the reserve interior by locating those facilities that are necessary at the edge of the reserve.
- e. Maintenance and marking of property boundaries is allowed.
- f. All boundaries will be located and maintained on a ten year cycle or when needed for project implementation. Boundaries will be maintained clearly and in a way that is sensitive to adjacent private lands with visible residences.
- g. All boundaries needing formal surveys will be identified. All newly acquired DCR properties should have their boundaries surveyed and marked. (Interior line boundaries should be discontinued.)
- h. Boundaries will be surveyed as needed for project implementation, where trespass is an issue or where there are disputes.

Interpretation, Public Information and Outreach Guidelines for Reserves

- a. DCR will seek to balance maintaining the values of an unimpeded experience and the need to address complex scientific concepts through a combination of on-site public information (notices, rules signs, etc.), interpretation (educational signage or programming) and outreach (off-site information sharing). To be consistent with the values of Reserves, on-site media will need to harmonize with the environment and intrude on a visitor's experience only when necessary.
- b. A minimalist approach to interpretation and public information is appropriate for Reserves. Outreach may be more important than on-site interpretation and there will be opportunities to highlight ecological restoration.
 - 1) Interpretation in Reserves should serve to prepare visitors for their experience in the Reserve. In the case of programming, it offers engaging educational opportunities.
 - 2) Public information provides orientation or notices about management or security issues.
 - 3) Outreach may be informational, interpretive or educational with the aim of attracting visitors or informing non-visitors of management rationale or activities.
- c. Interpretation (programming and media) connected to Reserves should focus on the reserve's ecological services, support management goals and be based on relevant interpretive plans; should adhere to DCR interpretive, graphic and signage standards; and may engage friends groups, schools, universities and other organizations for support when appropriate.
- d. Developed interpretive signage and public information are generally most suited for main trailheads or parking areas.
- e. Trails signs should follow *Trails Guidelines and Best Practices Manual* (Massachusetts Department of Conservation and Recreation (2), 2012) signage standards for primitive areas. Interpretive media should conform to DCR's graphic standards.
- f. Infrastructure for interpretation may be added, however no new infrastructure should be applied within Reserves unless exceptional circumstances warrant otherwise.

Monitoring, Enforcement and Research Guidelines for Reserves

- a. Non-destructive, low impact research for monitoring forest conditions may be conducted. In order to meet the intended purposes of Reserves, regular monitoring and research to document changing habitat conditions are needed. For example, monitoring information from Reserves will be critical in evaluating how climate change is affecting forest ecosystems and how species are adapting to this over time. Any research proposed by an outside entity must be developed and implemented in close consultation with DCR staff to assure coordination of efforts and copies of all research results must be provided to DCR.
- b. DCR will seek partnerships with appropriate conservation organizations to assist with regular monitoring of Reserves
- c. Continuous Forest Inventory (CFI) plots will be measured on a regular cycle and data used in conjunction with ongoing research needs such as Reserve vegetation development, carbon storage and climate adaptation

- d. Prior to conducting monitoring and research on Reserves, a proposal outlining the purpose of the research, the techniques used and the potential impacts on the land will be reviewed by the FRSAC and approved by DCR
- e. DCR acknowledges the need for active enforcement of prohibited activities (such as dumping of refuse, construction of illegal motorized or non-motorized trails, use of off-highway vehicles in areas where not allowed or cutting of trees at boundary encroachments) and regulated activities is critical to allow Reserves to develop under natural conditions without negative human impacts. However, DCR's current and historic level of resources does not allow for optimal enforcement and joint or cooperative oversight is a long term goal.

Special Use Guidelines for Reserves

- a. Special uses such as events and activities will be evaluated on an individual basis by DCR and may be allowed if they do not adversely impact and are compatible with the purposes of the Reserve. DCR's Special Use policy and guidelines apply.¹⁹
- b. Existing special uses such as transmission lines, communication sites and commercial uses that are not compatible with the intent of Reserves will be evaluated to determine if they can be relocated to another area.
- c. DCR will not grant new commercial rights for communications sites. However, it should be noted that such uses are subject to legislative action, pursuant to Article 97 of the Constitution of the Commonwealth. In such circumstances, compliance with the Secretary of Energy and Environmental Affairs' "No Net Loss" policy for mitigation of loss of open space is required.²⁰ Full environmental permitting and review would also apply.
- d. Adding new communication hardware to existing fire towers and communications sites will be allowed. All applicable permits and DCR's Special Use policy and guidelines apply.²¹
- e. DCR will not grant rights for new commercial wind installations and commercial solar installations. However, it should be noted that such uses are subject to legislative action, pursuant to Article 97 of the Constitution of the Commonwealth. In such circumstances, compliance with the Secretary of Energy and Environmental Affairs' "No Net Loss" policy for mitigation of loss of open space is required.²² Full environmental permitting and review would also apply.
- f. DCR will not grant new commercial rights for transmission lines. However, it should be noted that such uses are subject to legislative action, pursuant to Article 97 of the Constitution of the Commonwealth. In such circumstances, compliance with the Secretary of

¹⁹ Information and permit applications available at <http://www.mass.gov/eea/agencies/dcr/massparks/permits-rentals/special-use-permits.html>

²⁰ This policy is available at: <http://www.mass.gov/eea/docs/eea/dcs/dcsarticle97.pdf>

²¹ Information and permit applications available at <http://www.mass.gov/eea/agencies/dcr/massparks/permits-rentals/special-use-permits.html>

²² This policy is available at: <http://www.mass.gov/eea/docs/eea/dcs/dcsarticle97.pdf>

Energy and Environmental Affairs’ “No Net Loss” policy for mitigation of loss of open space is required.²³ Full environmental permitting and review would also apply.

- g. Granting rights for new commercial uses is prohibited except to the extent necessary for activities that advance Reserves goals.

7. Small-Scale Reserves

Land Stewardship Zoning

The Technical Steering Committee recommended that DCR designate “patch reserves” within the Parkland and Woodland Landscape Designations to identify areas where standard best management practices may not be adequate to fully protect highly significant and sensitive ecological or cultural resources from certain human uses or management and to recognize areas of special significance to park users and the public.

However, DCR believes the term “patch reserve” has different meanings for different people, and as the TSC pointed out, these areas should be selected by another set of criteria and have goals that are altogether distinct from the land designated as landscape-level Reserves (Massachusetts Department of Conservation and Recreation, 2010, pp.39, 50 and 54). Further, all of the site-specific information that is needed to properly identify candidate areas for “patch reserves” was simply not available during the Landscape Designation process. Therefore, DCR will identify sensitive resources and apply specific management guidelines to protect them (thereby meeting – and in some cases exceeding – the intent of “patch reserve designation” as described in the TSC report) by categorizing them as Zone 1 under the land stewardship zoning system during the Resource Management Planning (RMP) process and in the exclusion process in forest management project planning.

In suggesting the designation of smaller “patch reserves,” the TSC report points to the need for protection of ecological and cultural sites of sensitivity and/or significance, old growth and forest dependent rare species habitat. DCR believes that the Zone 1 designation within its land stewardship zoning system is designed and intended to encompass such areas and provide an appropriate level of management and protection. In the Land Stewardship Zoning Guidelines (available in Appendix 4 of that document), Zone 1 is described as encompassing “areas that contain highly sensitive ecological and cultural resources that require additional and more restrictive management approaches and practices to protect and preserve the special features and values identified in the Resource Management Plan. These can also include areas with resources that are threatened by a high level of use.” In addition, Zone 1 areas are described as “not suitable for future intensive development.” In providing examples, Zone 1 areas are identified as being “highly sensitive to human activity include rare species habitat or natural communities, archaeological sites or fragile cultural sites, where stewardship of these resources must be the primary consideration when assessing management and recreational activities in these areas.” Actual examples of Zone 1 areas in completed RMPs include most of the Blue Hills Reservation to the east of Route 28, an area that provides habitat for five state-listed species, four of which are state-endangered and sensitive to disturbance and the Spot Pond Brook Archaeological District in the Middlesex Fells Reservation.

Exclusion from Forest Management - Additionally, “no cut” areas will be naturally established in Woodlands as forest management activities are considered. DCR Management Foresters will, in

²³ This policy is available at: <http://www.mass.gov/eea/docs/eea/dcs/dcsarticle97.pdf>

contemplating forest management activities, formulate a decision process of analyzing the forest site conditions and subsequently prescribing (or deciding against) silvicultural treatments. Often the forester must and will decide against harvesting. The exclusion of harvesting at any given time may be a deferral for the length of a cutting or thinning cycle or it may be long term exclusion due to the constraining characteristics of a site. Reasons for which harvesting is excluded within Woodlands include:

- wetlands and vernal pools
- riparian and trail buffers
- old-growth forests
- endangered species habitat and rare natural communities – appropriate surveys will be conducted (no harvests where Conservation Management Practices (CMPs) recommend not harvesting)
- wildlife habitat – retention of trees to meet diversity goals primarily to meet species habitat requirements
- areas of historical and cultural significance, where harvesting activities could destroy a resource
- steep slopes

B. Parklands

There are 2,331 acres of Parklands in the Western Connecticut Valley District. They are located in the:

<i>D. A. R. State Forest</i>	<i>1,728 acres</i>	<i>74% of all Parklands in the WCV</i>
<i>Kenneth Dubuque Memorial State Forest/Park</i>	<i>47 acres</i>	<i>2% of all Parklands in the WCV</i>
<i>Mohawk Trail State Forest (WCV part)</i>	<i>309 acres</i>	<i>13% of all Parklands in the WCV</i>
<i>Monroe State Forest</i>	<i>16 acres</i>	<i>1% of all Parklands in the WCV</i>
<i>Shelburne State Forest</i>	<i>72 acres</i>	<i>3% of all Parklands in the WCV</i>
<i>South River State Forest</i>	<i>141 acres</i>	<i>6% of all Parklands in the WCV</i>
<i>Windsor State Forest (WCV part)</i>	<i>18 acres</i>	<i>1% of all Parklands in the WCV</i>

1. The Purpose of Parklands

DCR facilities offer an incredibly diverse mix of recreational opportunities, ranging from back country camping to urban swimming pools. Equally diverse are the size and character of properties on which these activities occur. Although public recreation occurs on all DCR properties, for many, the agency’s active recreational areas are the main draw. These facilities accommodate millions of visitors each year. As interests and recreational technologies change, the range of activities is expected to continue to evolve. DCR’s intent is to continue to provide the best possible recreational experiences for the public at these facilities.

2. Management Approach for Parklands

Many of the recreational opportunities and experiences offered by DCR are directly reliant upon the wide range of natural and cultural resources within the parks and forest system – without their protection and

careful management, those opportunities and experiences would be lost. DCR is committed to continuing to provide a diverse range of recreation opportunities that are consistent with its goals for public safety, resource protection and management, public health, visitor education and enjoyment.

Management approach recommended by the Technical Steering Committee:

DCR should develop and implement management guidelines for Parklands that focus on enhancing recreation, while continuing to provide additional ecosystem services, including those identified for Reserves as well as the aesthetic and cultural values of the property (Massachusetts Department of Conservation and Recreation, 2010, p.44).

Ecosystem services provided by Parklands:

- protection of ecologically significant sites
- protection of cultural resources
- provision of public outdoor recreational and environmental education opportunities

Recognizing that the focus of the FFVP was on DCR forestry practices, the TSC's primary guidance regarding Parklands management was that "... wood production is not a utilized ecosystem service in the Parklands. Any cutting would be limited to what is necessary to support recreational assets and uses, including public safety." However, DCR's adoption of the Landscape Designation system will encompass and guide all of the agency's operations and as such, these guidelines propose that all management activities in Parklands should focus on maintaining or improving the recreational experiences of visitors (Massachusetts Department of Conservation and Recreation, 2010, p.45).

3. Selection Criteria for Parklands

GIS models based upon a continuum using the best available data were utilized to guide the selection of Parklands. The most favorable units of land for designation as Parklands are those that have:

- a high surrounding population density
- forested areas with high recreational values
- a high density of officially designated trails
- established recreational areas, such as campgrounds, golf courses, etc.
- water access points for recreation
- active day use areas
- high recreational use/visitation
- easily accessible unique natural features: views, water features, chasms, unusual forest types
- unique historic/cultural features
- unique settings in comparison to the surrounding landscape
- suitable natural forested boundaries between active use areas and woodland areas

For these criteria, several existing internal and external data sets were used, including U.S. Census data, DCR Roads and Trails data set, orthophotos, as well as internally developed intensive use area and cultural resource inventory data.

4. Management Guidelines for Parklands

As properties that have the most recreational infrastructure and/or recreational uses, Parklands are likely also those areas that are assumed to have the highest levels of visitation. Attempting to protect and maintain areas that are heavily utilized can be a challenge. Overuse can lead to competition for space, conflicts among different user groups and damage to resources. However, popularity can also bring with it large and active friends groups and other potentially positive partnerships. DCR is seeking with the Parkland designation to provide clear guidance on what can be done to protect the natural, cultural and recreational resources that form the essence of a Parkland property.

Recreation and Public Access Guidelines for Parklands

- a. A diverse mix of recreational activities will be allowed in the wide range of Parklands properties. While not every activity will be appropriate in every location, the range across the system could include athletic field uses such as baseball and soccer, intensive uses such as swimming pools, downhill ski areas and golf courses and dispersed recreational activities such as motorized and non-motorized trail uses. Agency policies, resource protection, public safety and recreational goals will continue to determine activities that are encouraged and/or allowed in individual properties.
- b. Recreational uses should be consistent with DCR's determination for recreational demands and opportunities as assessed through planning efforts and tools.
- c. Development of new intensive-use sites within Parklands (e.g., campgrounds, athletic fields, playgrounds, picnic areas, visitor centers, administrative offices, parking lots, etc.) are allowed when consistent with public access, resource protection, public safety and management goals.
- d. DCR will strive to maintain a density and diversity of trails within Parklands that protects the natural and cultural resources of each property and meets the recreational intent for the property. Proposals for new trail development need to follow the existing process established through the *Trails Guidelines and Best Practices Manual* (Massachusetts Department of Conservation and Recreation (2), 2012). Creating loop trails that enhance recreational experiences while supporting the other values of the Parklands will be encouraged. DCR may close trails to achieve the values of Parklands.



Swimming area at D.A.R. State Forest

Silviculture and Vegetation Management Guidelines for Parklands

- a. Commercial production of wood for wood products or energy is not an objective in Parklands. Vegetation management will only occur as needed to further the purposes of Parklands to protect ecologically significant sites and cultural resources and to provide environmental education and outdoor recreation opportunities in a natural and safe setting. Within these limited purposes, DCR will implement vegetation management in an effective and low-impact manner, whether that be via hiring arboriculture firms (if budgets permit) or via bidding projects to arboriculture or forestry firms (at either no cost or small payment to DCR, which is incidental to the operation).
- b. Forest habitat manipulation, vegetation management, silvicultural treatments and operations will be permitted for the following purposes:
 - 1) Vegetation management necessary to protect public health and safety, public interests, public assets and/or restore or maintain recreation sites following significant natural disturbances or destructive insects or diseases.
 - 2) Vegetation management necessary for the control of non-native invasive plant species.
 - 3) Removal of plantations to restore more natural and diverse vegetative communities – if public health and safety are at risk or to restore ecologically significant communities such as pitch pine barrens. Controlled burns to maintain significant natural communities such as pine barrens is allowed with close coordination with municipal fire and safety, local friends groups and the general public.
 - 4) Vegetation management necessary to control erosion, to stabilize soils, or to close unauthorized trails or roads not needed for administrative or emergency purposes. Local emergency officials will be consulted in all road closures.
 - 5) Vegetation management necessary for the development or maintenance of trails, recreation area aesthetics and existing roads.
 - 6) Vegetation management necessary to create or maintain agricultural fields, lawns, turf, greens or scenic vistas associated with recreational or educational goals.
- c. Vegetation management mandated by environmental regulatory requirements.
- d. Hazardous trees or excessive fuel loads that pose significant risk to public safety may be removed.
- e. Vegetation management is permitted by parties who have pre-existing legal rights (e.g., easement holders, utility easements) to perform such activity, subject, however, to standard regulatory and permitting requirements.

Water and Soil Resource Guidelines for Parklands

- a. Management may be permitted to control erosion or stabilize soils, by closing roads and unauthorized trails, or other means such as stabilizing slopes with water bars or other erosion control structures. Local emergency management officials will be consulted for any road closures being considered.

- b. Where DCR Parklands occur on local or regional public water supply watersheds, appropriate management activities may be undertaken in accordance with the Landscape Designation management guidelines, after consultation with the public water supplier and/or DEP, to confirm the need for and the type and extent of, management actions to address water quality protection issues (e.g., due to wildfires, insect or disease outbreaks or other unanticipated threats to water quality). See Appendix 5 for a map and list of DCR properties on public water supply watersheds in the document *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines*.

Habitat Protection Guidelines for Parklands

- a. Vegetation management necessary to comply with NHESP recommendations for the restoration, maintenance or enhancement of habitats for rare and endangered species and exemplary natural or rare communities may be allowed.
- b. Vegetation management to support species of greatest conservation need (SGCN) as described in the Comprehensive Wildlife Conservation Strategy (CWCS) may be allowed if a particular SGCN is historically and or culturally associated with a specific Parkland.
- c. Identification, documentation and protection of rare species occurrences and important habitats will be addressed using the following tools:
 - 1) Review of the NHESP GIS database, which includes datalayers from statewide databases such as BioMap2, Living Waters, Priority Habitats of rare species, Estimated Habitats of rare wildlife, Certified or Potential Vernal Pools and Natural Communities.
 - 2) Review of and consultation with other sources of natural resource information, where appropriate and available (e.g., Mass Audubon, New England Wildflower Society, The Vernal Pool Association and other NGOs, local naturalists, etc.).
 - 3) Surveys and monitoring (for project specific purposes or long-term documentation), by trained DCR staff and/or outside consultants, to document and map rare species and important habitats when necessary.
 - 4) If any state listed species are listed pursuant to the U.S. Endangered Species Act (16 U.S. Code §§ 1531 – 1544) the U.S. Fish & Wildlife Service must approve the project and the appropriate species Recovery Plan shall be consulted.
 - 5) Consider certifying potential vernal pools if applicable; apply accepted Massachusetts and federal protection guidelines around all certified or potential vernal pools (304 CMR 11.00).
- d. DCR will work closely with DFW, and consult the CWCS for guidance in protecting rare species and their habitats, and the Forestry Conservation Management Practices for Rare Species, where appropriate.
- e. DCR will work closely with DFW to resolve conflicts between wildlife and park facilities (such as beaver flooding problems).
- f. Using the resources available from NHESP, Habitat Restoration Plans should be generated to improve degraded habitats important to rare species and/or state/regional biodiversity.

- g. DCR will consult with DFW and DEP prior to conducting any work adjacent to coldwater Fisheries habitats; apply protection guidelines recommended.
- h. Partnerships with friends groups, local naturalists, environmental organizations, etc., will be formed to assist in the identification, protection and monitoring of important habitats or rare species population, where appropriate.

Forest Health and Protection Guidelines for Parklands

- a. Spread of major significant forest pathogens and invasive species (such as Asian Longhorned Beetle or Emerald Ash Borer) may be controlled as part of a coordinated effort if there is a major threat to forest health or risk to private or public interests.
- b. Pesticide use will be allowed for removal of invasives only when no other feasible alternative is available. Removal of invasives to provide the public with examples of native vegetation and habitats, as demonstration projects for other lands, and to protect the integrity of the environmentally significant sites represented within the Parklands is permitted.
- c. Wildfires will be contained, controlled and suppressed unless there is an approved site specific controlled fire plan and conditions are within the fire plan prescription.
- d. Fire breaks, where necessary, may be created and maintained.
- e. Prescribed fire may be used when it is compatible with protection of the property, restoration of native communities and ecological processes and the protection of life and property in the Parkland and surrounding landscape. The fire burn plan would be subject to the review of the local fire chief(s).

Cultural Resource Management Guidelines for Parklands

- a. As per DCR's regulatory responsibilities, any projects undertaken on DCR land must be reviewed by DCR's Office of Cultural Resources during the planning stages for their potential impacts to historic and archaeological resources.
- b. Maintenance of historic buildings, structures and landscapes within Parklands is allowed.
- c. Vegetation management for the protection of historic or archaeological sites is allowed, with some restrictions on the time of year, types of equipment and techniques used to minimize resource disturbance, as guided by the DCR's cultural resources staff.

Facilities, Transportation and Boundary Guidelines for Parklands

- a. Existing roads will be managed and maintained according to either the DCR *Historic Parkways Preservation Treatment Guidelines*²⁴ where appropriate or other applicable road standards to assure continued access.

²⁴ Available at <http://www.mass.gov/eea/agencies/dcr/massparks/parkways/>

- b. New roads necessary for public, administrative and emergency use may be constructed after review for impacts to natural and cultural resources.
- c. Existing roads not needed for recreation, administration or emergency use may be closed and restored to their natural condition, after consultation with local emergency management officials.
- d. Construction of new facilities may occur as necessary for public and administrative use after review of impacts to natural and cultural resources.
- e. Maintenance and marking of property boundaries is allowed.
- f. All boundaries will be located and maintained on a ten year cycle or when needed for project implementation. Maintain all boundaries clearly and in a way that is sensitive to adjacent private lands with visible residences.
- g. All boundaries needing formal surveys will be identified. All newly-acquired DCR properties should have their boundaries surveyed and marked (interior line boundaries should be discontinued).
- h. Boundaries will be surveyed as needed for project implementation, where trespass is an issue or where there are disputes.

Interpretation, Public Information and Outreach Guidelines for Parklands

- a. The combination of existing infrastructure, natural and cultural features, and the availability of an audience in Parklands creates a strong opportunity to connect with visitors. Therefore, formal programming and media are appropriate in Parklands.
 - 1) Interpretation in Parklands seeks to build emotional and intellectual connections between visitors and the resource.
 - 2) Public information in Parklands will provide orientation, wayfinding and notices about management activities or security issues.
 - 3) Outreach may be informational, interpretive, or educational with the aim of attracting visitors or informing non-visitors of park activities and opportunities.
- b. Interpretation (programming and media) connected to Parklands should focus on the natural, cultural and recreational themes of the property; support management goals; be based on relevant interpretive plans; should adhere to DCR interpretive, graphic and signage standards; and may engage friends groups, schools, universities and other organizations for support when appropriate.
- c. Informational signs and interpretive kiosks are appropriate for siting throughout Parklands in a manner consistent with the character of the facility.
- d. Trails signs should follow *Trails Guidelines and Best Practices Manual* (Massachusetts Department of Conservation and Recreation (2), 2012) signage standards. Interpretive media should conform to DCR's graphic guidelines.

- e. Interpretation in Parklands may take advantage of existing resources and infrastructure or may initiate new infrastructure to enhance interpretive opportunities.

Monitoring, Enforcement and Research Guidelines for Parklands

- a. Monitoring and research projects may be conducted as approved through DCR's Special Use Permit process. Any research proposed by an outside entity must be developed and implemented in close consultation with DCR staff to assure coordination of efforts and copies of all research results must be provided to DCR.
- b. Active enforcement of prohibited or regulated activities, such as dumping of refuse, construction of illegal motorized or non-motorized trails and use of off-highway vehicles in areas where not allowed, is critical to the maintenance of resources within Parklands.
- c. CFI plots will be measured on a regular cycle and data used in conjunction with ongoing research needs such as vegetation development and forest health monitoring.

Special Use Guidelines for Parklands

- a. Special uses such as events and activities are allowed and will be evaluated on an individual basis as provided in DCR Special Use Policies and Procedures and/or volunteer guidelines.²⁵
- b. Existing special uses such as transmission lines, communication sites and commercial uses that are not compatible with the intent of Parklands will be evaluated to determine if they can be relocated to another area.
- c. DCR will not grant new commercial rights for communications sites. However, it should be noted that such uses are subject to legislative action, pursuant to Article 97 of the Constitution of the Commonwealth. In such circumstances, compliance with the Secretary of Energy and Environmental Affairs' "No Net Loss" policy for mitigation of loss of open space is required. Full environmental permitting and review would also apply.
- d. Adding new or replacing existing communication hardware on existing fire towers and communications sites will be allowed. All applicable permits and DCR's Special Use policy and guidelines apply.²⁶
- e. DCR will not grant rights for new commercial wind installations and commercial solar installations. However, it should be noted that such uses are subject to legislative action, pursuant to Article 97 of the Constitution of the Commonwealth. In such circumstances, compliance with the Secretary of Energy and Environmental Affairs' "No Net Loss" policy for mitigation of loss of open space is required.²⁷ Full environmental permitting and review would also apply. Wind and solar installations that have a primary purpose of supplying electricity to a Parkland facility (for example a visitor center or maintenance facility) will be

²⁵ Information and permit applications available at <http://www.mass.gov/eea/agencies/dcr/massparks/permits-rentals/special-use-permits.html>

²⁶ Ibid.

²⁷ This policy is available at <http://www.mass.gov/eea/docs/eea/dcs/dcsarticle97.pdf>

considered if the site is already impacted by an existing facility and the added impact to resources is insignificant.

- f. DCR will not grant new commercial rights for transmission lines. However, it should be noted that such uses are subject to legislative action, pursuant to Article 97 of the Constitution of the Commonwealth. In such circumstances, compliance with the Secretary of Energy and Environmental Affairs' "No Net Loss" policy for mitigation of loss of open space is required.²⁸ Full environmental permitting and review would also apply.
- g. Granting rights for new commercial uses is prohibited except to the extent necessary for activities that advance Parklands goals (e.g., food concessions associated with beaches).

The following table lists the recreation assets found in the Western Connecticut Valley District. Not all of these resources are in Parklands but they must be considered in the forest and vegetation resource management activities.

²⁸ Ibid.

Recreation assets on DSPR properties in the Western Connecticut Valley District

State Forest or Park	Facility Assets
Buckland State Forest	Trails: All Trails (0.3 miles)
Catamount State Forest	1 Dam: McCloud Pond Dam Trails: All Trails (8.5 miles)
Conway State Forest	Trails: All Trails (7.3 miles)
D.A.R. State Forest	3 Dams, 1 Dike: Upper Highland Lake Dam Lower Highland Lake Dam Twinning Brook Pond Dam Upper Highland Lake Dike (north) 3 Boat Launches: North end of Lower Highland Lake Southwest end of Upper Highland Lake Dam West side of Upper Highland Lake 2 Campgrounds/Day Use Areas: Main camping area (51 sites) Group camping area (up to 75 people) 3 Parking Areas: Main parking area in day use (75) Campground parking lot (100) HQ staff parking area (7) Trails: All Trails (22.2 miles)
Deer Hill State Reservation	Trails: All Trails (1.5 miles)
Florida State Forest (WCV part)	Trails: All Trails (2.2 miles)
H. O. Cook State Forest	Trails: All Trails (8.1 miles)
Kenneth Dubuque Memorial State Forest/Park	2 Dams: Hallockville Road Dam Crooked Pond Dam 1 Boat Launch: Canoe launch at Crooked Pond 3 Parking Areas: Kings Corner (50) East Hawley Road (25) Americorps Camp (25) Trails: All Trails (43.2 miles)

Leyden State Forest	None
Mohawk Trail State Forest (WCV part)	<p>1 Dam: Cold River Dam</p> <p>3 Campgrounds/Day Use Areas: Regular campground (56 sites) Day use area (44 sites) Log cabins (6)</p> <p>2 Parking Areas: HQ staff and visitor parking area (30) Log cabins, 1 vehicle each (6)</p> <p>Trails: All Trails (23.3 miles)</p>
Monroe State Forest	<p>2 Parking Areas: Near bridge across Dumbar Brook (6) Raycroft Lookout (6)</p> <p>Trails: All Trails (21.6 miles)</p>
Rowe State Forest	None
Savoy Mountain State Forest (WCV part)	<p>Trails: All Trails (7.9 miles)</p>
Shelburne State Forest	<p>1 Boat Launch: Wilcox Hollow</p> <p>1 Parking Area: Wilcox Hollow (8)</p> <p>Trails: All Trails (1.2 miles)</p>
South River State Forest	<p>1 Dam: owned by electric company</p> <p>1 Parking Area: Private land maintained by DCR (10)</p> <p>Trails: All Trails (3.6 miles)</p>
Windsor State Forest (WCV part)	<p>1 Dam: Westfield River</p> <p>2 Campgrounds/Day Use Areas: Main camping area (24 sites) Group camping area (up to 25 people)</p> <p>2 Parking Areas: Main parking area in day use (100) Jambs parking area (15)</p> <p>Trails: All Trails (13.6 miles)</p>

C. Woodlands

There are 15,704 acres in Woodlands of the Western Connecticut Valley District, including 15,360 acres of forest and 344 acres of non-forest. They are located in the:

<i>Buckland State Forest</i>	<i>93 acres</i>	<i>1% of all Woodlands in the WCV</i>
<i>Conway State Forest</i>	<i>1,757 acres</i>	<i>11% of all Woodlands in the WCV</i>
<i>Deer Hill State Forest</i>	<i>350 acres</i>	<i>2% of all Woodlands in the WCV</i>
<i>Florida State Forest (WCV part)</i>	<i>987 acres</i>	<i>6% of all Woodlands in the WCV</i>
<i>H. O. Cook State Forest</i>	<i>1,834 acres</i>	<i>12% of all Woodlands in the WCV</i>
<i>Kenneth Dubuque Memorial State Forest/Park</i>	<i>7,482 acres</i>	<i>48% of all Woodlands in the WCV</i>
<i>Leyden State Forest</i>	<i>61 acres</i>	<i><1% of all Woodlands in the WCV</i>
<i>Rowe State Forest</i>	<i>256 acres</i>	<i>2% of all Woodlands in the WCV</i>
<i>Savoy Mountain State Forest (WCV part)</i>	<i>944 acres</i>	<i>6% of all Woodlands in the WCV</i>
<i>South River State Forest</i>	<i>450 acres</i>	<i>3% of all Woodlands in the WCV</i>
<i>Windsor State Forest (WCV part)</i>	<i>1,490 acres</i>	<i>9% of all Woodlands in the WCV</i>

1. Management Approach for Woodlands

The emphasis of forest management in Woodlands will be to provide the range of ecosystem services that sustainably managed forestlands offer, as well as educational examples of excellent forestry to landowners and the general public. Forestry practices will be directed at protecting forest productivity through sustainable forestry, providing resilience in watershed forests through active management, managing conditions to promote late forest successional structure and early forest successional stages and producing high quality, high value, local forest products. Forest management will also play a role in the ecological restoration of areas that have been significantly altered by past land use and management practices such as plantations of non-native species and high-grading.

2. Mission of Woodlands

The mission of the Bureau of Forestry Management Forestry Program in lands designated as Woodland on State Forests, Parks and Reservations is to provide ecosystem services and benefits associated with active forest management.

Ecosystem services that are provided through active forest management on the Woodland landscape are:

- **Production of wood products** that is ecologically and economically sustainable benefiting local economies
- **Water quality** protection and enhancement of water supply
- **Diverse habitats** that range from early seral vegetation to late successional forest, encompassing many structural components which help to provide protection from extreme disturbance events
- **Recreational opportunities** that are safe and fitting for their location determined in conjunction with the operations staff of the Division of Parks and Recreation

- **Carbon stock management** using innovative and scientific forest management methods for increasing sequestration

Forest management on DCR forests, parks and reservations endeavors to demonstrate excellent forestry practices to private landowners and the public. The ecosystem services that state lands provide will be balanced across the landscape and the scale of time where they are deemed appropriate.

3. Selection Criteria for Woodlands

GIS models based upon existing digital data were used to produce output that results in a continuum of values to rate Woodlands. The most favorable lands for designation as Woodlands are:

- a. areas suitable for wood production based on soils, vegetation, distance from roads and past management
- b. sites with a history of recent silvicultural treatment
- c. areas where late successional characteristics could be restored via management
- d. areas that currently have low forest type diversity
- e. areas where the potential impact on communities the most dependent on the local forest economy is the greatest
- f. areas suitable for early successional habitat creation
- g. sites requiring ecological restoration or those prone to disturbance
- h. watershed areas that would benefit from active forest manipulation
- i. areas in closest proximity to wood processing facilities
- j. areas where forest management could increase carbon storage
- k. areas with good access for model forest demonstration activities
- l. areas suitable for demonstration purposes as a representative of forest type, age class and logging conditions

For these criteria, sixteen different datasets were used and/or created to identify and classify lands best suited for the Woodlands designation. The goal was to use the best data currently available and the best data that could be developed to identify Woodlands. For example, to identify areas most suitable for wood production, the existing “Prime Forest Soils” and “Past Management” datasets were used as well as the newly created “Vegetation Suitability” and “Distance from Roads” datasets. To assess the positive impacts on communities most dependent on the local forest economy, a “Distance to Sawmills” dataset was created (based on sawmill locations identified in January of 2010 by a University of Massachusetts at Amherst study) and were used along with the existing “Sawmill Woodsheds” and “Harvester Woodsheds” dataset (also from UMass researchers). Ultimately, all of these datasets were added together (for TSC criteria that used more than one dataset, the multiple datasets were added together and rescaled so that each of the twelve TSC criteria were weighted evenly) to come up with a ranking of DCR land that quantifies their relative value as Woodlands.²⁹

²⁹ For more information on the GIS model developed for Woodlands see Appendix 9 in *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines*

DCR intends to conduct further categorization of Woodlands at the forest stand level as described below in order to achieve Woodlands goals. (Appendix 2 in that document has additional information on this process.)

4. Assessment and Classification of Forest Stands in Woodlands

The primary goal in the assessment of forest stands is to match forest productivity and condition with broad silvicultural regimes. Note that the guidelines and directions presented in this plan are at a landscape level – each site or stand considered for treatment will be evaluated at ground level resolution.

The 2008 FRMPs used the Priority Timber Harvest Model,³⁰ developed by DCR staff, which produced silvicultural options in “active forest management areas” (now called “Woodlands”) on forest type, stocking levels and size classes. Forest type, stocking levels and size class were determined from aerial photographs taken and interpreted in 2003. This dataset is the Bureau of Forestry Land Cover Classification.³¹

The 2010 TSC Report recommended classifying forest stands based on land use history and forest development as represented through origin, age and condition of stands. Generally, the classification system recommended depends on whether these lands were always woodland, not cultivated, cut and cultivated or cut and pastured. The classifications suggested in the TSC Report are “Primary”, “Secondary” and “Tertiary” forests. Unfortunately, there is not consistent, accurate statewide data available to provide a strong evaluation of primary, secondary and tertiary forests on Woodlands as defined in the TSC Report.

To observe the spirit and intent of the TSC Report, the DCR Bureau of Forestry has developed the “Forest Productivity and Stand Complexity Model,” a GIS based classification model based on vegetation mapping and forest inventory data (see **Appendix J**) that reflects the land use history, current land condition, development stage and productivity. The recommendation from the TSC carries with it the inherent message that more productive, more complex forest conditions will require more complex silviculture.

Data sets used to produce the Forest Productivity and Complexity model are:

- a. The Bureau of Forestry “Land Cover Classification” produced by James W. Sewall Co., Inc., 2003
- b. The Prime Forest Soils data layer produced by the University of Massachusetts and Massachusetts Bureau of Forestry
- c. Continuous Forest Inventory - Massachusetts Bureau of Forestry
- d. Land Use Cover 2005 - MassGIS

³⁰ A GIS model developed by DCR staff that utilized district specific statistics to identify and prioritize areas for active forest management

³¹ This data was created by James W. Sewall Co., Inc. for the Land Cover Classification project.

All forested areas in Woodlands are on a continuum fitting their productivity, structural complexity (or potential thereof) and diversity. The forest stands then were analyzed for silvicultural approach based on the level of productivity/complexity. The Silviculture and Vegetation Management Guidelines, below, provide information on the broad approaches to the application of silviculture.

For example, forests that are plantations or are developing from recent agricultural use (approximately the last 60 years), are composed of species indicative of young forest and recent regeneration (e.g., birch, red maple, white pine) and are on lower productivity sites that will rank low on the continuum of condition and productivity. Stands that are composed of species that indicate higher levels of natural disturbance such as pitch pine and scrub oak and those particularly on lower productivity sites also will rank low on the classification continuum. As forest stands increase in species diversity, vertical and horizontal structure, size, age and site productivity, they rank higher on the classification continuum.

For purposes of predicting silviculture for Woodlands, an algorithm was developed to match productivity/complexity to silvicultural approach. Even age stands that are less productive and diverse rank lower on the continuum and are considered for silvicultural approaches designed to increase landscape diversity and improve damaged and high graded stands. Conversely more productive and complex forests are matched with silviculture can create and maintain higher levels of species and structural diversity.

5. Management Guidelines for Woodlands

Recreation, Public Access and Visual Resources Guidelines for Woodlands

The most common types of recreation in Woodlands will include dispersed recreational uses such as hiking, mountain biking, hunting, fishing, horseback riding, primitive camping, snowmobiling and OHV use (where compliant with DCR OHV siting criteria). Property specific regulations and policies apply. DCR will strive to maintain a moderate to low density and diversity of trails within Woodlands that protects the objectives of each property as well as recreational access. Proposals for new trail development will be evaluated through the process established in the *Trails Guidelines and Best Practices Manual* (Massachusetts Department of Conservation and Recreation (2), 2012). Creating loop trails that enhance recreational experiences while supporting the other values of the Woodlands will be encouraged. Creating small vistas along trails may be allowed. DCR may close trails to achieve the values of Woodlands. Hazardous trees within a “tree length” distance from official trails, parking areas and access roads that pose significant risk to public safety, may be removed.

Forestry practices that can support recreational values within Woodlands will be incorporated where feasible and designed to promote aesthetics, native vegetation, species diversity, large diameter older trees, multiple age classes, and a safe recreational experience in recreation areas and at public access points. Also, see the section on Recreation and Forestry starting on page 68 in Appendix 2 of *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines*.

During timber sale activities, existing trails will be protected. Where impacts are unavoidable, DCR will include a plan for trail rehabilitation in the harvest plan according to the *Trails Guidelines and Best Practices Manual* (Massachusetts Department of Conservation and Recreation (2), 2012) and documentation of trail interfaces. During timber sale activities, logging equipment will be used to control erosion or stabilize soils, by closing trails and roads not needed for administrative or emergency access. Local emergency management officials will be consulted prior to closing or restricting use of permanent roads to ensure that access for emergency purposes is maintained.

Where OHVs are prohibited, roads and trails used for harvesting that will not be used for other activities will be closed and stabilized. However, where OHVs are allowed, foresters will consider whether existing access for OHVs can be improved via roads and trails used to access the harvest site (by replacing poorly planned trails, stabilizing well located trails etc.).

Special attention and care will be given to provide long-term quality scenery, consider general property aesthetics and improve vistas where possible and appropriate. Scenery management should be planned according to the following road and trail corridor and socially important area guidance:

Interstate, Intrastate and Local Roads and Trails - include a 100 foot wide corridor on each side of the road or trail. Local roads and trails that are included in the DSPR road and trail database (mapped and officially designated) include a 50 foot wide corridor on each side of the road or trail.

- Sustainable forest management, including salvage, is allowed within road and trail corridors
- Forest management within the trail corridors will be designed to promote native diverse vegetation, large-diameter trees, multiple age classes and forest structures, healthy forest, safe recreation experience and quality scenery
- Slash, as a result of forest management within 25 feet of interior forest, roads, interstate, intrastate and local trails, shall meet the Massachusetts Slash Law and should result in a light and natural appearing forest ground cover
- Natural resource managers will coordinate with park supervisors and user groups when vegetation management is planned
- Natural resource managers will coordinate with park supervisors and user groups to determine if “field identified” roads and trails (not mapped or signed) should have corridor forest management guidelines applied, have no special treatment or should be closed and rehabilitated

a. Present condition of recreation, public access and visual resources in Woodlands

Recreational opportunities and aesthetic quality are important to all visitors to DSPR system lands. The Western Connecticut Valley District lands are used for many types of recreation. Uses include camping, hiking, cross country skiing, snowshoeing, horseback riding, birding, nature study, mountain biking, sightseeing, swimming, hunting and fishing.

The following table shows the acres in road and trail corridors (areas along trails where vegetation management is modified to meet safety and aesthetic concerns) by facility. More specific trail and road information for each property can be found in the management unit appendices.

**Acres in legal road and trail corridors in Western Connecticut Valley District
Woodlands (500 feet/side for National Scenic Trails, 50 feet/side for other trails)
subject to aesthetic modification of vegetation management, by facility**

Facility	Acres in legal road or trail corridors
Buckland State Forest	5
Catamount State Forest	0
Conway State Forest	85
D.A.R. State Forest	0
Deer Hill State Reservation	19
Florida State Forest (WCV part)	65
H.O. Cook State Forest	98
Kenneth Dubuque Memorial State Forest/Park	475
Leyden State Forest	0
Mohawk Trail State Forest (WCV part)	0
Monroe State Forest	0
Rowe State Forest	0
Savoy Mountain State Forest (WCV part)	80
Shelburne State Forest	0
South River State Forest	28
Windsor State Forest (WCV part)	152
Total	1,008

b. Predicted condition of recreation, public access and visual resources in Woodlands

The predicted condition is a state forest or park where a variety of passive and active natural resource-based recreational opportunities and uses occur in a safe and environmentally sustainable manner that is consistent and compatible with natural resource management goals. The aesthetic and visual qualities of the recreation and other use areas provide a variety of forested experiences. The OHV study and subsequent formulation of policies are completed and the results are incorporated into the Western Connecticut Valley District Forest Resource Management Plan.

Silviculture and Vegetation Management Guidelines for Woodlands

The maintenance of appropriate native biodiversity is the underlying silvicultural and vegetation management goal on all state forest and parks lands. Biological diversity is, in part, a measure of the variety of plants and animals, the communities they form and the ecological processes (soil, climate, water, nutrient cycling, disturbance, etc.) that sustain them. Silvicultural treatments should generally promote native, diverse, healthy forests and habitats across the landscape of Woodlands. The decision to choose silvicultural systems and practices to implement will be based on analysis and consideration of the forest stand and site condition.

This is accomplished by applying both coarse and fine filter approaches. A coarse filter approach to conserving appropriate native biodiversity involves maintaining a variety of ecosystems; it assumes that a representative array of ecosystems (types and ages) will contain the vast majority of the species in the region. The fine filtered approach is directed towards individual species and habitats known to be rare and strives to catch them even if they “passed through” the coarse filter.

These filters are applied on DSPR system lands by first creating Reserves to promote relatively undisturbed forest conditions and provide late successional habitat. The overarching goal on the remaining lands will be to promote appropriate native biodiversity through the protection, restoration and maintenance of rare species and their habitat, rare natural communities and related species while managing for diverse native forests in an effort to balance the forest age classes. The species composition and structure of the forests are equally important biodiversity elements and will be taken into consideration.

The Silvicultural and Vegetation Management Section is organized in the following subsections: conservation of rare species, restoration and maintenance of native ecosystems and the establishment and maintenance of a diversity of forest types, age classes and forest structures.

a. Rare species in Woodlands

1) Present condition of rare species in Woodlands

The Massachusetts Endangered Species Act (MESA), M.G.L. Ch. 131A and its regulations (321 CMR 10.00) prohibit the taking of any state-listed rare plant or animal species. MassWildlife’s Natural Heritage and Endangered Species Program regularly updates and publishes *The Natural Heritage Atlas* that shows the Estimated Habitats of rare wetlands wildlife and the Priority Habitats of all state listed rare species. Rare species include those that are “Endangered,” “Threatened” or of “Special Concern” as defined in the MESA.

“Endangered” means any species of plant or animal in danger of extinction throughout all or a significant portion of its range and species of plants or animals in danger of extirpation as documented by biological research and inventory.

“Threatened,” means any species of plant or animal likely to become an endangered species within the near future throughout all or a significant portion of its range, and any species declining or rare as determined by biological research and inventory and likely to become endangered in the foreseeable future.

“Special Concern” means any species of plant or animal which has been documented by biological research and inventory to have suffered a decline that could threaten the species if allowed to continue unchecked or that occurs in such small numbers or with such restricted distribution or specialized habitat requirements that it could easily become threatened within Massachusetts.

All rare species habitat is identified as “High Conservation Value Forest” according to the Forest Stewardship Council Northeast Standards for sustainable and well-managed forests (**Appendix D**).

See **Appendix E** for a list of the acres of rare species habitat and natural communities that are currently known to occur in the Western Connecticut Valley District.

Additionally, another table lists the Massachusetts Endangered Species Act state protection rank as well as the data sensitivity. Finally, a list of field definitions is included.

“Priority Habitats” delineate habitats for rare plant and animal populations protected under the MESA Regulations (321 CMR 10.00). They are comprised of GIS polygons indicating the approximate extent of rare species habitat based on records in the National Heritage and Endangered Species Program. The following table shows the priority habitat for the Western Connecticut Valley District.

Priority habitat in the Western Connecticut Valley District

2008 Priority Habitat Data	Acres
<i>NHESP Priority Habitat polygons on non - DSPR lands in the Western Connecticut Valley District</i>	26,628
<i>NHESP Priority Habitat polygons on DSPR lands in the Western Connecticut Valley District</i>	3,193
Buckland State Forest	0
Catamount State Forest	70
Conway State Forest	27
D. A. R. State Forest	0
Deer Hill State Reservation	45
Florida State Forest (WCV part)	441
H. O. Cook State Forest	55
Kenneth Dubuque Memorial State Forest/Park	195
Leyden State Forest	0
Mohawk Trail State Forest (WCV part)	1,157
Monroe State Forest	755
Rowe State Forest	44
Savoy Mountain State Forest (WCV part)	0
Shelburne State Forest	19
South River State Forest	325
Windsor State Forest (WCV part)	61
Total	29,821

Estimated Habitats delineate the approximate geographical extent of habitats of state-protected rare wildlife (not plants) and indicate approximate locations of certified vernal pools for use with the Wetlands Protection Act Regulations (310 CMR 10.00). The following table shows the estimated habitat for the Western Connecticut Valley District:

Estimated habitat in the Western Connecticut Valley District

2008 Estimated Habitat Data	Acres
<i>NHESP Estimated Habitat polygons on non - DSPR lands in the Western Connecticut Valley District</i>	19,140
<i>NHESP Estimated Habitat polygons on DSPR lands in the Western Connecticut Valley District</i>	792
Buckland State Forest	0
Catamount State Forest	0
Conway State Forest	0
D. A. R. State Forest	0
Deer Hill State Reservation	9
Florida State Forest (WCV part)	0
H. O. Cook State Forest	0
Kenneth Dubuque Memorial State Forest/Park	142
Leyden State Forest	0
Mohawk Trail State Forest (WCV part)	443
Monroe State Forest	0
Rowe State Forest	0
Savoy Mountain State Forest (WCV part)	0
Shelburne State Forest	19
South River State Forest	119
Windsor State Forest (WCV part)	61
Total	19,932

2) Predicted condition of rare species in Woodlands

The predicted condition is a forested landscape where rare species and their habitats are appropriately valued, protected and conserved. In addition, DSPR staff will work cooperatively with the Natural Heritage and Endangered Species Program to conduct periodic rare species and habitat inventories and surveys for the conservation, restoration and maintenance of rare species.

3) Management guidelines for rare species in Woodlands

- a) Review of the NHESP GIS database, which includes datalayers from statewide databases such as BioMap2, Priority Habitats of rare species, Estimated Habitats of rare wildlife, Certified or Potential Vernal Pools and Natural Communities
- b) Review of and consultation with other sources of natural resource information where appropriate and available (e.g., Mass Audubon, New England Wildflower Society, The Vernal Pool Association, other NGOs, local naturalists, etc.). Surveys and monitoring (for project specific purposes or long-term documentation) by trained DCR staff and/or outside consultants with the advice of NHESP to document and map rare species and important habitats.

- c) DCR will work closely with DFW and consult the Comprehensive Wildlife Conservation Strategy for guidance in protecting rare species and their habitats, as well as the current versions of the “Massachusetts Forestry Conservation Management Practices for Rare Species”³² where appropriate
 - d) If there are any state listed species pursuant to the U.S. Endangered Species Act (16 U.S. Code §§ 1531 – 1544), the U.S. Fish & Wildlife Service must approve the project and the appropriate species Recovery Plan shall be consulted
 - e) Consult and work with NHESP to identify and develop appropriate conservation practices for Natural Communities
 - f) Wetlands and vernal pools will be mapped and documented. All vernal pools will be treated as if they were certified. Potential vernal pools will be submitted for certification if applicable and we will apply accepted Massachusetts and federal protection guidelines around all certified or potential vernal pools (304 CMR 11.00).
- b. Native vegetation in Woodlands

1) Present condition of native vegetation in Woodlands

For over 5,000 years, people have moved plants with commercial value all over the globe. In Massachusetts, the Civilian Conservation Corp was very active in establishing plantations on areas that were previously cleared for agriculture, cut over and/or burned. Many of these planted species were non-natives such as Norway spruce and Scots pine or native trees that were planted out of their historic ranges (off-site) such as red pine and larch. The DSPR system lands in the Western Connecticut Valley District contain 946 acres of non-native and off-site plantations. Although these plantations are not usually invasive (invasive non-native species are discussed in the forest health section) and may contain valuable wood products, they support markedly lower diversity of native flora and fauna when compared to native forest types. The benefits (wood production) do not outweigh the negative ecological effects and potential threats of these plantations.

2) Predicted condition of native vegetation in Woodlands

The predicted condition is a forest where appropriate native biodiversity is supported through the maintenance and restoration of native ecosystems and species components. Non-native species will be removed and the area restored to native conditions where possible through the application of active vegetation management including silvicultural treatments and prescribed fire.

3) Management guidelines for native vegetation in Woodlands

- a) Restore non-native forest conditions to native and natural conditions
- b) Maintain a diversity of native forest types and age classes

³² Available at: <http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/forestry-rare-species-review/forestry-cmps-for-rare-species.html>

- c) Provide for an appropriate diversity of native species including herbs, forbs and woody vegetation
- d) Maintain non-native and off-site plantations only where their removal would have severe environmental consequences or in areas where they provide other societal benefits, such as high use recreational areas or historical context

c. Forest type and age class diversity in Woodlands

A major factor influencing forest biodiversity in Massachusetts is the composition, age structure and distribution of forest types and their forest successional stages. This is important from a biological diversity perspective because each forest successional stage provides different components of species life cycle needs and each stage may have a different, although not usually unique, set of species. Because various plant and animal species are associated with different stages of succession, balancing the age structure of a forest provides the widest range of habitats and therefore biological diversity. Thus, when viewed on the time scale of forest succession and the spatial scale of landscapes, active vegetation management provides for and enhances biological diversity.

1) Present condition of forest type and age class diversity in Woodlands

The Western Connecticut Valley District's forest vegetation is currently composed of 1.1% early successional forest habitat (0 to 14 years old), 90.9% mid-successional forest habitat (15 to 90 years old), 3.9% late-successional forest habitat (90+ years old), 2.6% uneven aged and 1.6% non-forested. These are distributed over nine general forest and non-forest types. The table on the next page displays the breakdown of total acreage in Woodlands in the Western Connecticut Valley District by age class and forest/non-forest types

Present condition of forest and non-forest types and age class diversity in Western Connecticut Valley District Woodlands

Age Classes	Age class and size descriptions						All types
	Non Forest	0-14 years old	15-59 years old	60-90 years old	90+ years old	Uneven aged	
Size Classes		Seedling-Sapling 0-4.5" dbh	Poles 4.5-10.9" dbh	Large 11-17.9" dbh	Very Large 18" + dbh	All size classes	
Total Current Distribution	1.6%	1.1%	41.0%	49.9%	3.9%	2.6%	100%
Forest and Non-Forest Types	ACRES	ACRES	ACRES	ACRES	ACRES	ACRES	ACRES
Birch/Red Maple	0.0	66.5	88.8	11.7	0.0	0.0	167.0
Hemlock	0.0	12.9	2,577.1	2,236.3	0.0	16.1	4,842.4
Northern Hardwoods	0.4	85.2	2,977.4	3,956.7	118.9	268.6	7,407.1
Oak	0.0	0.0	40.3	40.9	36.1	0.0	117.3
Spruce/Fir	0.0	8.5	325.9	662.3	135.6	0.0	1,132.3
Swamp Hardwoods	0.0	0.0	94.9	5.2	0.0	0.0	100.1
Swamp Softwoods	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wetland	189.8	0.0	0.0	0.0	0.0	0.0	189.8
White/Red Pine	0.0	0.0	330.0	919.0	317.3	125.6	1,691.9
Non-forest	55.6	0.0	0.0	0.0	0.0	0.0	55.6
Total	245.4	173.1	6,434.4	7,832.6	608.0	410.3	15,703.6

2) Predicted condition of forest type and age class diversity in Woodlands

The predicted condition is a forest with appropriate native biodiversity provided through the maintenance of habitats in which all successional stages are represented for each forest type. Biodiversity is further ensured through a planned range of species composition and structural components and a well-functioning ecosystem.

Native forest will be managed under three sustainable management regimes:

- a) Even-age regeneration system at 100 year rotation
- b) Extended rotation to produce *late successional forest structure*
- c) Uneven-aged regeneration system involving at least 5 distinct management entries (approximately one every 20 years)

Intermediate thinning will be conducted in all management regimes when forest tree densities (stocking) are at a high level and where competition for sunlight, water and nutrients pose limiting factors. The following table shows the anticipated age and size class distribution in the Woodland zone over the next 100 years of forest management.³³

³³ Woodland stand and tree characteristics, such as species, age, diameter and size, were projected using the Forest Vegetation Simulator – Northeast Variant (Dixon, 2008). The projections were based on simulating harvesting practices dictated in this plan (including subtracting areas reserved from harvest due to steep slopes, wetlands, etc.) and the resulting subsequent growth and natural stand mortality. The predictions shown do not include the affects of large natural disturbance which, although inevitable, are very unpredictable.

**Predicted age and size class distribution of
Western Connecticut Valley District Woodlands over the next 100 years**

Age Classes	Non Forest	Age class and size descriptions					
		0-14 years old	15-59 years old	60-89 years old	90 - 125 years old	125+ years old	Uneven aged
Size Classes		Seedling-Sapling 0-4.5" dbh	Poles 4.6-10.9" dbh	Immature 11-14.9" dbh	Large ≥15" dbh	Very Large ≥26" dbh	All Size Classes
Present Distribution	2%	1%	41%	49%	4%	0%	3%
Present Acres	246	173	6,434	7,832	608	0	410
2033 Distribution	2%	0%	3%	12%	83%	0%	0%
2033 Acres	246	0	500	1,816	13,074	69	0
2053 Distribution	2%	2%	0%	4%	81%	11%	0%
2053 Acres	246	276	49	577	12,788	1,768	0
2073 Distribution	2%	2%	29%	1%	53%	13%	0%
2073 Acres	246	373	4,600	118	8,313	2,053	0
2093 Distribution	2%	24%	27%	0%	40%	7%	0%
2093 Acres	246	3,746	4,301	0	6,267	1,144	0
2113 Distribution	2%	11%	28%	3%	48%	9%	0%
2113 Acres	246	1,775	4,325	453	7,541	1,365	0

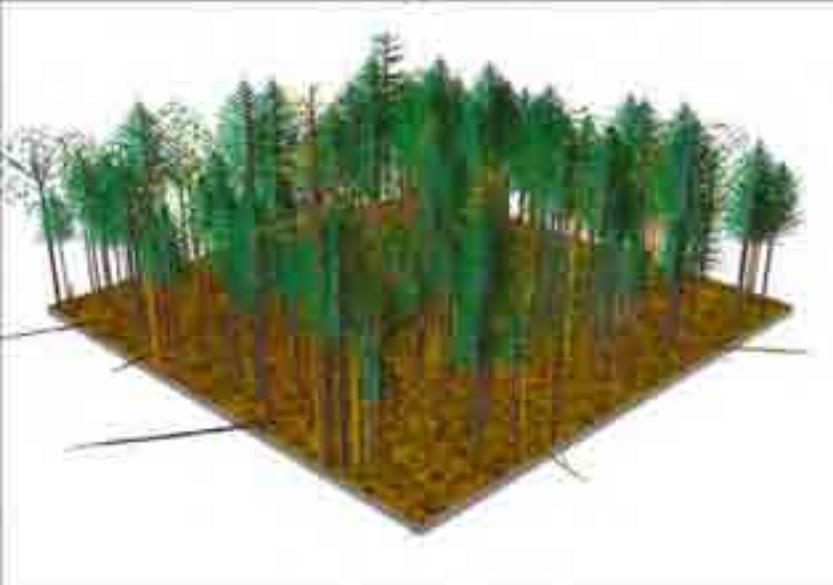
The following pages present four different depictions of stylized silvicultural regimes from the present condition (2013) up to the year 2133 for three common forest types in the district and a “no harvest” scenario. Using CFI data, these visual depictions were generated by modeling forest growth, potential harvests and results over the 100 year planning scope. Note that as in all the prediction scenarios in this plan, the modeling include natural stand dynamic mortality; it does not include natural disturbance events.

The silvicultural regimes presented in the following diagrams are:

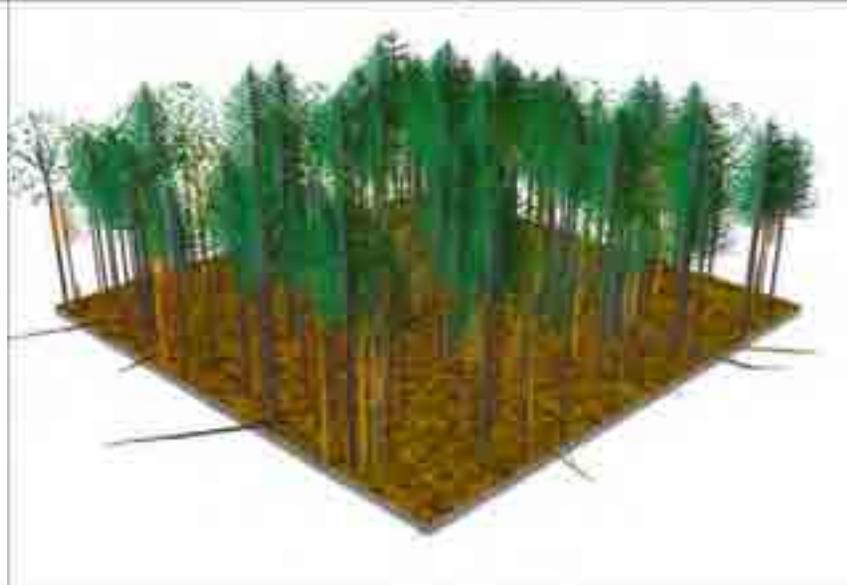
1. Hemlock – no harvest regime from the present condition and then through the years 2033, 2073 and 2133
2. White pine – uneven age management – group/single tree selection from 2013 – 2033, 2033, 2073 and 2113
3. Hemlock – even age management – thinning from 2013- 2033, a shelterwood harvest in 2033, an overstory removal with reserves in 2053 and regeneration and growth 60 years post harvest in 2113

4. Spruce – late successional/extended rotation – post harvest in 2033, 2053, 2073 and then after four harvests showing regeneration and growth in 2113

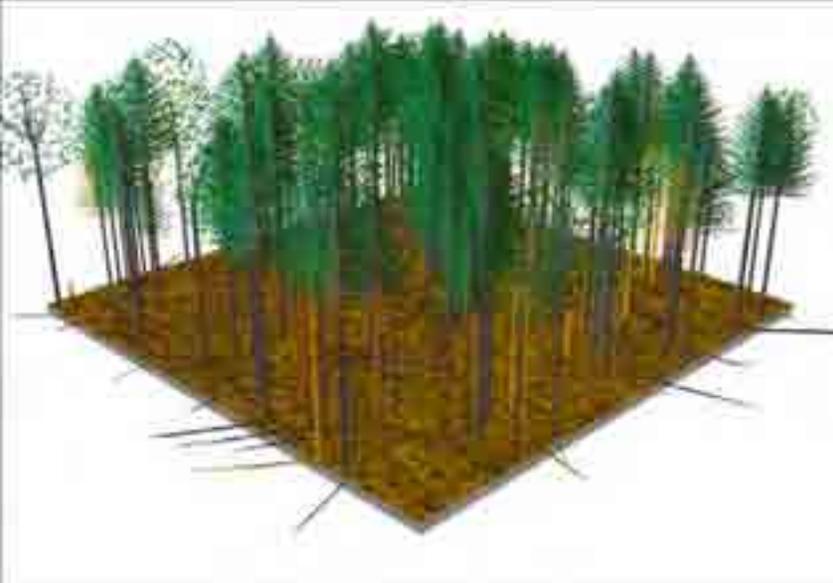
Hemlock - No Harvest Regime - Present Conditions



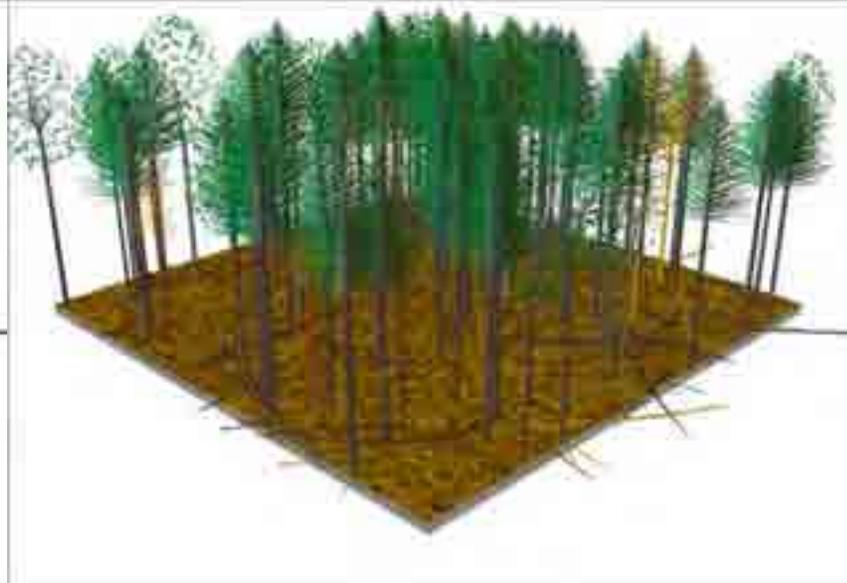
Hemlock - No Harvest Regime - Year 2033



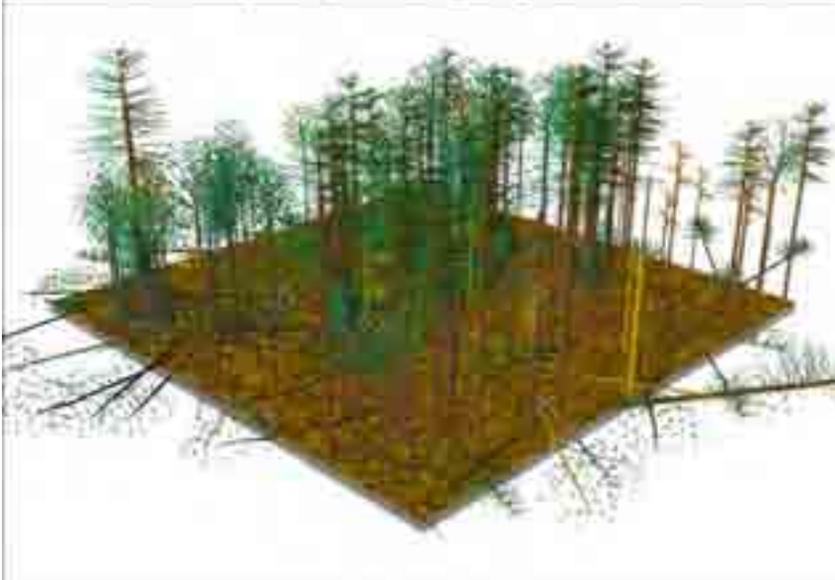
Hemlock - No Harvest Regime - Year 2073



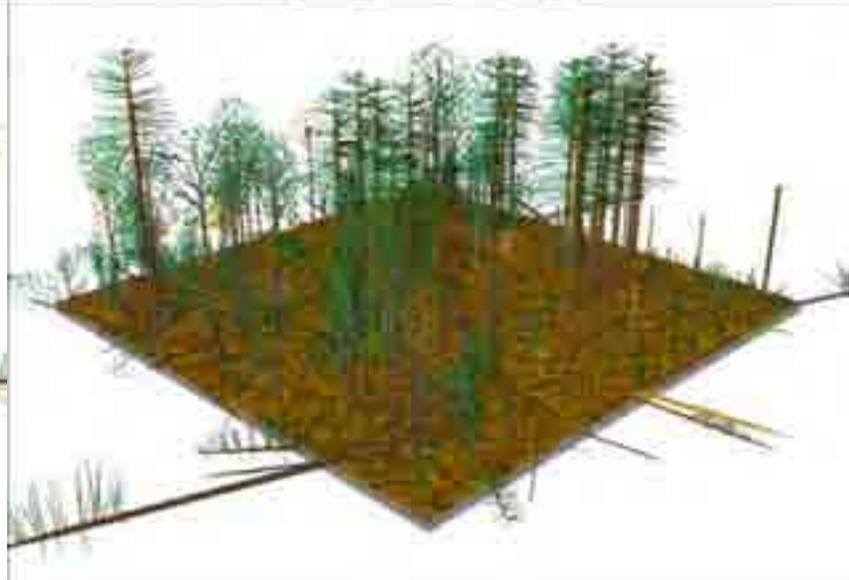
Hemlock - No Harvest Regime - Year 2113



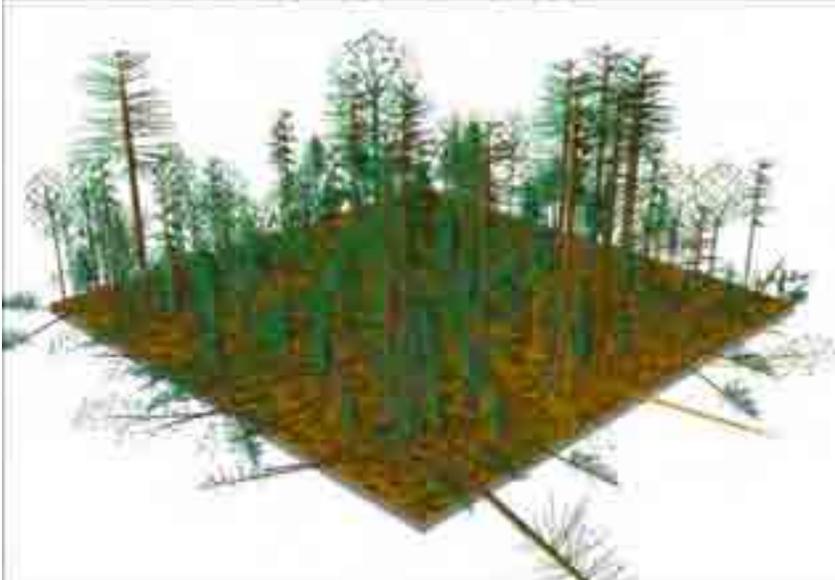
White Pine - Uneven Age Management - Group / Single Tree Selection - 2013 - 2033



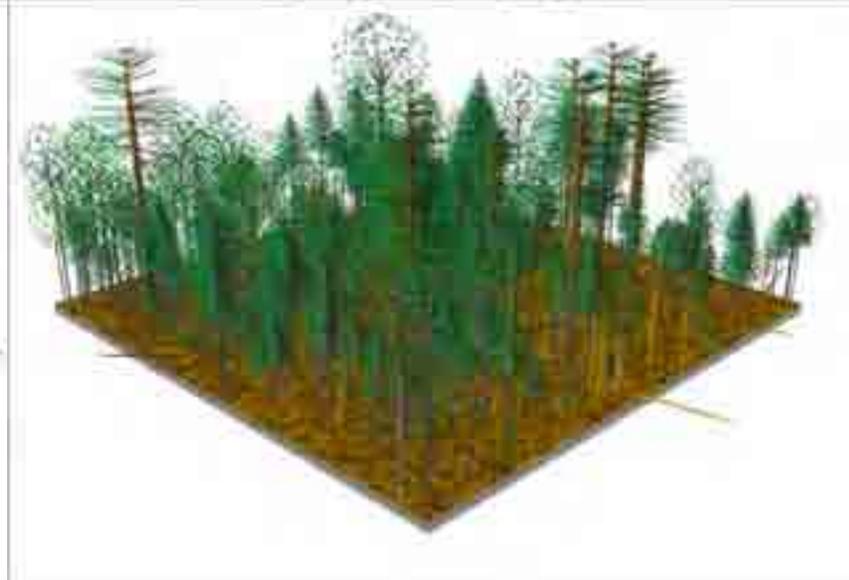
White Pine - Uneven Age Management - Group / Single Tree Selection - 2033



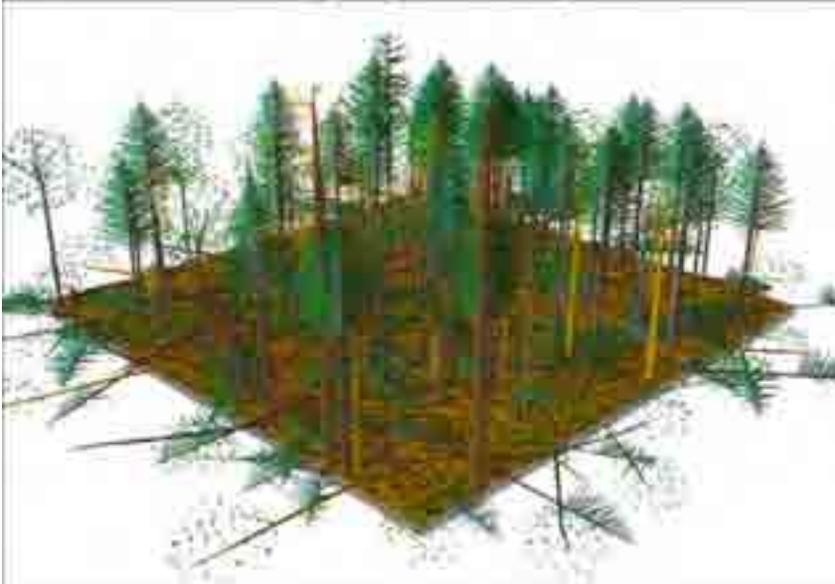
White Pine - Uneven Age Management - Group / Single Tree Selection - 2073



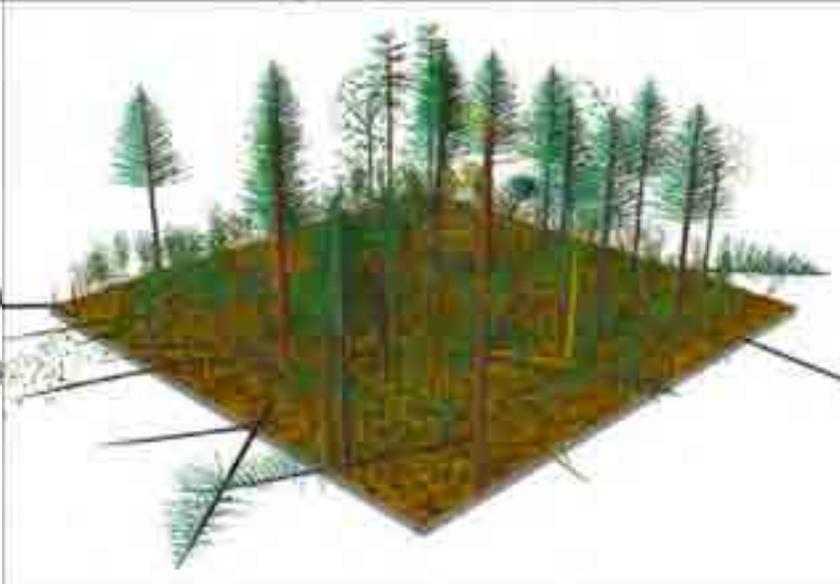
White Pine - Uneven Age Management - Group / Single Tree Selection - 2113



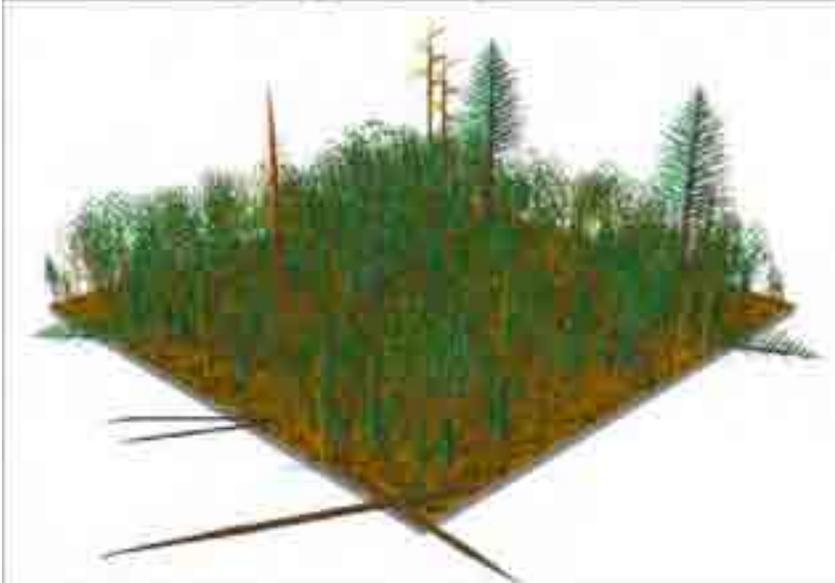
Hemlock - Even Age Management - Thinning - 2013 - 2033



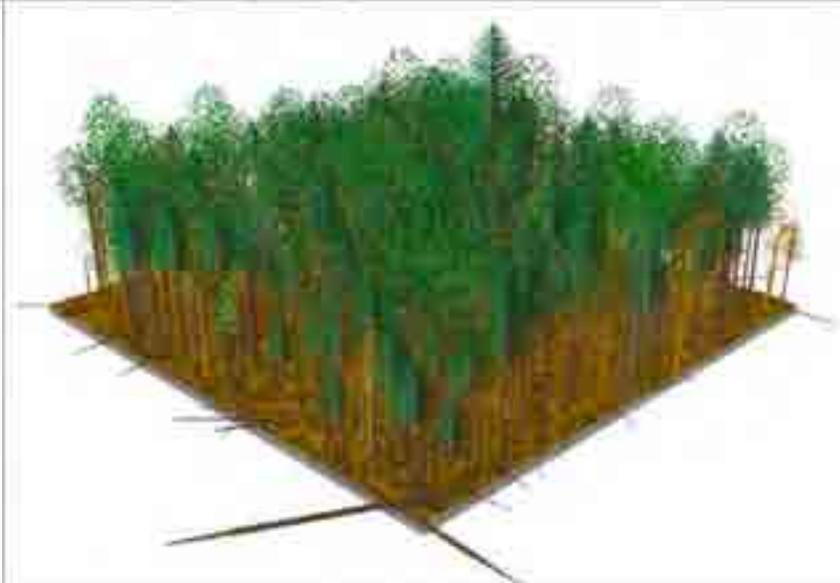
Hemlock - Even Age Management - Shelterwood Harvest - 2033



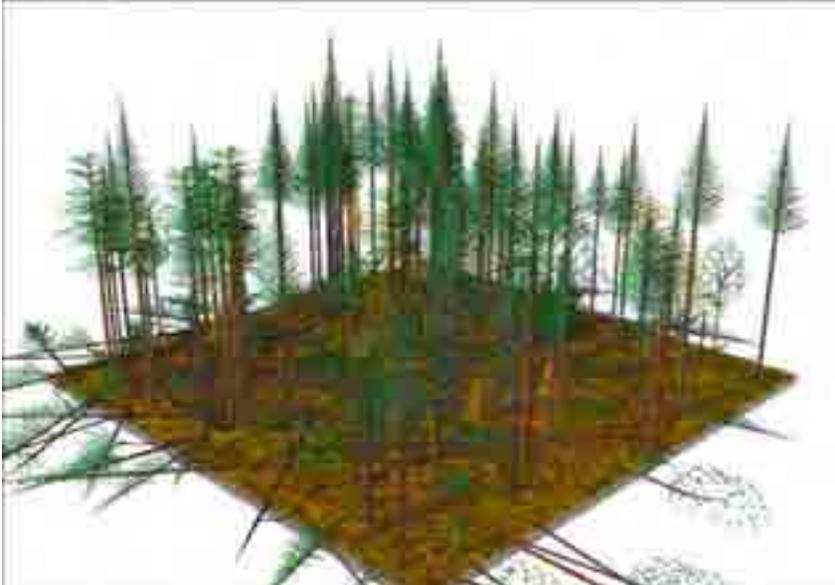
Hemlock - Even Age Management - Overstory Removal with Reserves - 2053



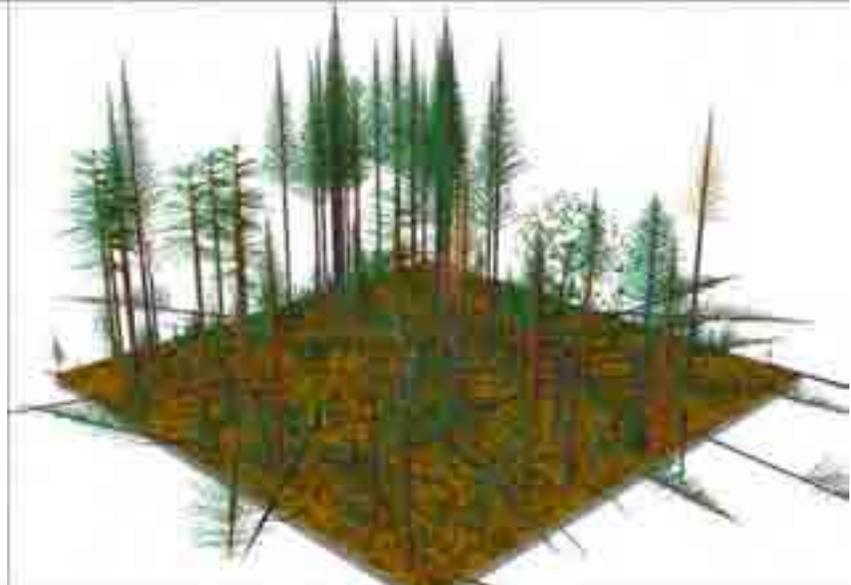
Hemlock - Even Age Management - Regeneration and Growth - 60 Yrs Post Last Harvest - 2113



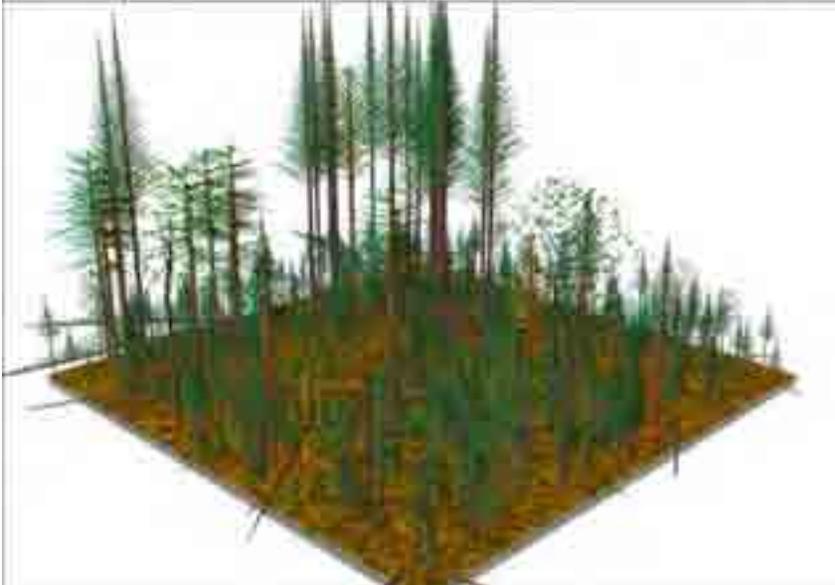
Spruce - Late Successional/Extended Rotation - Post Harvest - 2033



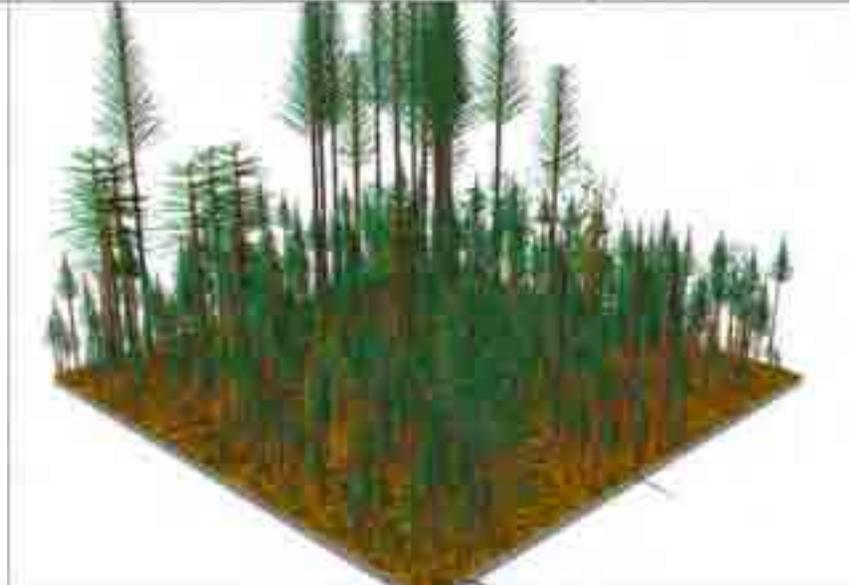
Spruce - Late Successional/Extended Rotation - Post Harvest - 2053



Spruce - Late Successional/Extended Rotation - Post Harvest - 2073



Spruce - Late Successional/Extended Rotation - Four Harvests - Regeneration and Growth - 2113



- 3) Management guidelines for forest type and age class diversity in Woodlands
 - a) Consolidate vegetation management activities where possible to emulate some natural disturbance processes, maximizing treatment effectiveness and efficiencies and if applicable, decreasing the edge effect from harvesting
 - b) Conduct vegetation management activities in accordance with accepted silvicultural practices and guidelines as outlined in the document *Landscape Designation for DCR Parks & Forests: Selection Criteria and Management Guidelines* (referenced earlier)
 - c) Coordinate vegetation management activities where practicable, desirable and feasible with adjacent lands. Consider the surrounding local landscape patterns during the development of project level plans.
 - d) Implement vegetation management on a 20 year planning cycle
 - e) Fulfill “Mission of Woodlands.” Projects selected for vegetation management will be shown to provide one or more ecosystem services provided through active forest management.
 - f) Prioritize vegetation management to meet the following natural resource objectives while incorporating opportunities to demonstrate excellent forest management practices to private forest owners and the general public:
 - i) Meet rare species habitat and biodiversity goals
 - ii) Reduce the risks of forest overstory loss to catastrophic disturbances such as insects, disease and wildfires
 - iii) Restore and maintain native ecosystems
 - iv) Provide a more appropriate balance of age classes for forest successional types, including increasing older and younger age classes
 - v) Reduce the threat and potential area of excessive forest mortality by improving growth and vigor of the forest
 - vi) Enhance future carbon storage and sequestration capacities
 - vii) Restore native species to sites where they have traditionally grown prior to overcutting, the introduction of invasive species and agricultural impacts
 - viii) Provide a sustainable and predictable flow of forest products and appropriate native biodiversity by balancing the age classes for each forest type
 - g) Select stands for meeting the above vegetation management objectives by further prioritization in order of the following criteria:
 - i) Forest stands in which management has previously been conducted, in order to 1) release new forest growth in the understory; 2) conduct a second thinning to continue to improve forest composition and health; and 3) establish new forest growth in the understory
 - ii) Forest stands that are at imminent risk of mortality from insects, disease, fire, etc.
 - iii) Forest stands that are poorly stocked and do not fully occupy the site or in stands that are currently stocked with species that are ill-suited to the site such as non-native red pine and Norway spruce on northern hardwood sites
 - iv) Low quality forest stands where cuttings could improve the quality of the forest

- v) Maturing forest landscapes composed of stands that are homogeneous in age and/or species composition
 - vi) Overstocked forest stands where thinning will restore a diversity of species suited to the site, improve growth and insect/disease resistance and accelerate the growth and maintenance of large tree forests
- h) DCR foresters will coordinate with the Management Program Supervisor and the DCR Park Operations staff, as well as with user groups, when vegetation management is planned. (This process is outlined in Appendix 3 in *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines*).
- i) Silvicultural treatments should generally promote native, diverse, healthy forests and habitats across the landscape of the Woodlands designation. The decision to choose a silvicultural system and practices to implement will be based on analysis and consideration of the forest stand and site condition (see section “4. Assessment and Classification of Forest Stands” discussed earlier). Silvicultural practices on Woodlands will fall into three broad categories summarized in below. For complete guidelines on treatment, timber sales and recreation considerations, refer to Appendix 2 in *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines*.
- j) Silvicultural treatments within a project area will be prescribed by Management Foresters at the mapped stand level. Vegetative management projects may be composed of one stand or multiple stands.
- k) Silvicultural systems, methods and decisions: Each stand within the project will be assessed for its history, ecological and structural characteristics as described in Section 4 – Assessment and Classification of Forest Stands. A district-wide GIS analysis has been conducted, mapped and documented (see **Appendix J**) to provide a guide for foresters implementing this plan and as a predictor for the Output sections of this plan. Three broad approaches to silvicultural decisions will be used recognizing the three ‘level’ approach recommended by the TSC. The three broad approaches will be: 1) exclude/defer harvest; 2) manage for diversity and complexity using generally uneven age systems; and 3) manage less complex or abused forest stands for improvement, with generally even aged systems.
- i) Exclude or defer: Some stands or areas within forestry projects may be excluded or deferred from harvest treatment to protect ecologically or culturally significant areas within Woodlands or because they are areas that are not appropriate for forestry operations due to physical limitation factors such as steep slopes. The decision to exclude or defer harvest in any given stand may be based on the occurrence of wetlands and vernal pools, rare species habitat and communities, areas of historical and cultural significance, old growth forests, riparian and trail buffers or steep slopes. In prescriptions these areas may be called “no cut,” “retention,” or “inoperable” areas. Within Woodlands, large areas of sensitive resources as described above will be not be included in project prescriptions and will be effectively reserved or excluded from harvesting by their exclusion from the silvicultural prescription.

- ii) **Manage for diversity/complexity:** Innovative and complex silvicultural treatments will be used in stands where there is high potential to create and enhance vertical structure, multiple age classes, tree species diversity and large tree size classes. Those forest stands that have the immediate potential for significant diversity and are rated high from a productivity standpoint will be treated with silviculture that enhances diversity and protects productivity. Silviculture will be used to restore late-successional forest structure and characteristics. Where sites are best suited for this silvicultural approach, such as areas adjacent to Reserves or existing high quality late successional stands, trees will be retained to older ages and more downed woody debris will be retained. Silvicultural systems that use uneven-age or multiage methods of regeneration will often be used to create and maintain very diverse forest stands. Opportunities to use these systems will be given greater consideration over even age systems when weighing options for managing forest stands.
- iii) **Manage for improvement:** Silvicultural systems designed to work with forest stands or sites that have been “high graded” or damaged or are identified and classified as being less productive and less structurally diverse, will use intermediate operations such as thinning to improve growing stock and generally even age methods of regeneration. Combinations of even aged and uneven aged methods of regeneration will be considered. Stands where these systems are applied may often be currently even aged and/or on low productivity soils. Approval from the DCR Commissioner will be required for harvest openings greater than 1/3 of an acre designed to harvest all merchantable trees. Overall, there will be less emphasis on regeneration methods that will result in large harvest openings.
- l) Plantation forests may be harvested or removed to achieve results described above. Their harvesting or removal will be constrained relative to the guidelines established in this document (i.e. size of openings, review processes).
- m) Small harvests of standing live or dead or down dead trees, commonly referred to as “Home Fuelwood” will be allowed for sale to individual citizens. Home Fuelwood harvests can be used to achieve results described for the respective levels. Home Fuelwood harvests will be held to the same silvicultural and management guidelines established in this document and subject to the Public Outreach and Consultation on Forest Cutting Plans Policy (see Appendix 3 in *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines*). DCR will continue and expand the current program to help meet the forest management goals within small portions of Woodlands while engaging the public and providing a local market for low quality wood from improvement cuttings. DCR will also strive to include low income families by working with the state’s low income fuel assistance programs, where feasible and look to provide wood on landings where access into the woods is less feasible.
- n) Using the above goals and criteria to choose sites and the guidelines for silviculture regimes, this plan recommends the annual management of approximately 147 acres of Woodlands in this district. The annual harvest estimate is based on:
 - i) Analyzing and determining all Woodland acres for even age or uneven age management regime using the “Forest Productivity and Stand Complexity

Model” (**Appendix J**) as directed by the *Landscape Designation for DCR Parks & Forests: Selection Criteria and Management Guidelines*.

- ii) Buffering reserves, trails, public roads and wetland resources in Woodlands to be allocated as those areas to be managed with the extended rotation or late successional forest structure regime
- iii) Eliminating areas unavailable to harvest such as steep slopes and water resource areas
- iv) Using a 100 year planning term, allocate acres available on an annual basis (acres available / 100 years)

It should be stressed that the annual estimate is averaged over 100 years, based on predicted silviculture approaches. Actual harvested acres will vary each year from the predicted target average. Each 10 year implementation period will have a unique combination of the forest management practices described below. The distribution of forestry activities chosen to make up the approximate annual harvest will be based on forest inventory, resource mapping data and integration of all resources, activities and uses according to the FRMP.

- o) Even-age management on 100 year rotation

Manage approximately 19% (2,896 acres) of the 14,729 acres of forest vegetation in Woodlands (about 10% of all DSPR lands in the district) on an even age rotation of 100 years or roughly 29 acres annually.

Work to add diversity to high graded/damaged stands, lower productivity stands or stands that are currently even aged. Silvicultural practices will be used generally in those stands that are less productive and less structurally diverse. The stands treated with this level of silviculture are generally even aged and are on less developed, less complex soils. Silvicultural systems will often use even age regeneration methods and stand improvement practices.

- i) Advanced regeneration present
 - (a) Irregular shelterwood and overstory removal with openings up to 5 acres with reserves/green tree retention.
 - (b) Two age systems, use on current even age stands with species that have moderate to low shade tolerance
- ii) Advanced regeneration not present – clearcut, shelterwood or seed tree with reserves/green tree retention with openings up to 5 acres
- iii) Conduct thinning in immature stands to promote growth on high quality, desirable trees³⁴
- iv) Promote diversity in size and shape of harvest openings

³⁴ If forest stands considered for treatment in this level are less than approximately 100 years old, thinning should be considered as an intermediate treatment to prepare the stand for regeneration at a later time. Thinning will maintain a cover of trees for an extended period, redistribute the growth potential of the site on more desirable higher quality trees, and allow residual trees to adjust to changing conditions (increased light, and exposure to wind).

- v) Select reserve or legacy trees to be left in harvest openings that exceed 1/3 of an acre (see description below in **Wildlife and Structural Guidelines for Woodlands**)

Even age silvicultural systems will also be used to create habitat conditions for species that require forests in the earliest stages of succession and young forests less than 10 years old. Silvicultural systems that incorporate even-aged harvesting regeneration methods such as clearcut, shelterwood and seed tree (all with reserve trees) will be used to create forest openings of various sizes up to 5 acres using a public and expert consultative process. Openings above 1/3 acre will require approval from the DCR Commissioner. Emphasis will be on regenerating forest habitat in strategically selected areas and allowing the forest habitat to develop through many successional stages. Recently high graded stands adjacent to other open habitat, “pasture pine”, or young forests are some examples of areas to select. The practice should be shifted across the landscape of DCR’s Woodlands.

Stands appropriate for even age silviculture are shown in **Appendix B**, Map 9. These areas will be further evaluated as described above for suitability to develop early seral forest conditions.

- p) Uneven-age management using a 20 year cutting cycle

Manage approximately 55% (8,037 acres) of the 14,729 acres of forest vegetation in Woodlands (about 27% of all DSPR lands in the district) using uneven age management methods or roughly 80 acres annually to create and/or maintain uneven age or multi-aged stands with a high level of structural diversity and/or restore late-successional forest structure and characteristics. Silviculture with this intent will be used to create and enhance vertical structure, multiple age classes, tree species diversity and large tree size classes.

Use regeneration methods that resemble the regeneration results of small scale natural disturbance and manage to create and maintain uneven conditions on many scales of resolution (stand to landscape). Use intermediate operations to enhance late successional characteristics where appropriate.

- i) Single tree and very small group selection – variable size group selection, from single tree to 1/3 of an acre. The model to determine opening size will be species shade tolerance (increasing shade tolerance = smaller gap, decreasing shade tolerance = larger gap).
- ii) Irregular shelterwood - create and maintain irregular gaps up to 1/3 of an acre and create and maintain irregular forest structure and heights of trees at stand level scale. Expand on areas of advanced regeneration reserving individual and groups of large trees.
- iii) Openings will be variably shaped
- iv) Use thinning in addition to selection cutting to improve growth on residual trees, enhance wildlife benefits and light conditions of openings

q) Late successional stand structure (extended rotation)

Manage approximately 26% (3,796 acres) of the 14,729 acres of forest vegetation in Woodlands (about 13% of all DSPR lands in the district) using late successional/extended rotation methods or approximately 38 acres per year that complement Reserves, trail and road corridors, aquatic buffers and/or rare species habitats where possible. Manage for late successional stand characteristics according to even and uneven aged silvicultural principles to promote healthy, multi-age, stand areas with complex structure. Recruit and maintain larger, often older trees while providing for vertical structure and overstory gaps for regeneration.

- i) Thin from below (low thinning) to promote growth on existing large individuals and to promote future large legacy trees
- ii) Single tree and very small group selection - variable size group selection; from single tree to 1/3 of an acre
- iii) Retain $\geq 50\%$ of pre-harvest stocking level (basal area) in corridors and buffers

Establishing a mix of Reserves, 100 year and “extended” rotation forests, DCR forests will in the future be markedly older and have a greater diversity of ages and species than many surrounding private forests, which are typically either not harvested or not selectively harvested and thinned. At the end of the 100 year period, it is anticipated that the amount of very young forest (0-14 years) will increase and become an important component in a wildlife habitat type that is used by 50% of vertebrates and which provides most of the life needs for 20% of vertebrates. Very young forest areas will be selected to maximize their ecological benefits and complement other components of the landscape. Massachusetts’ original forest contained much more age and structural diversity than the current maturing forest landscape of “even-aged” forest. This plan will help restore some of that diversity while strengthening the forests to meet the challenges that lie ahead.

This plan lays out the first 10 years of implementation of a long-term 100 year vision. It will be reviewed through monitoring in year five and year ten as more information is gathered and the effectiveness of its implementation can be assessed. The impacts of climate change and new information evaluated in the course of these reviews may alter the Plan.



Breezy Knoll Timber Sale (2014) in Leyden State Forest – uneven age management in a Norway spruce and white pine plantation, group selection with coarse woody debris

At the end of the 10 year initial plan period, the strategy will again be reviewed and revised based on the current state of science and in response to the concerns of the citizens of Massachusetts.

The **Appendix B** maps (“Property Maps”) show “Anticipated Silvicultural Regimes” under the current forest composition (based on tree species type, tree size class, tree stocking level, output from the “Forest Productivity and Stand Complexity Model”, CFI stand structure, prime forest soils, landscape designation zone, slope, road and trail buffer zones, open water and hydrological buffer zones) for even-age management, uneven-age management, late successional (extended rotation) and no harvesting scenarios. In the same appendix, property level time lapse views are presented showing “Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113.” The views depict the results of using the Forest Vegetation Simulator (Dixon, 2008) modeling forest growth in response to forest management regimes and no harvest regimes.

Wildlife and Structural Guidelines for Woodlands

Where forest vegetation management occurs, the following guidelines apply:

- a. Retain 1 to 3 live, large diameter (where possible > 18” dbh) trees per acre and 4 live, 12” to 18” dbh trees per acre that have the potential to serve as cavity and den trees and future snags. Retention trees should be distributed uniformly, clumped or grouped, providing a random uneven distribution over the entire treatment area leaving an average of approximately 5 live, future snag trees retained per acre. Groups or clumps of future snag retention should coalesce to island patches in even age management systems providing vertical structural diversity and protection to larger legacy trees. A greater number of legacy trees should be left in riparian areas.
- b. Retain all dead snags and stubs in harvest areas as safe operating conditions will allow. Leave a minimum of five snags greater than 10 inches dbh where they exist.
- c. Retain on average one of the oldest, largest diameter, well formed, dominant trees (where possible > 18” dbh) per acre in harvested areas to serve as legacy trees.
- d. Downed woody material (DWM) including coarse woody debris (CWD) should be maintained on site based on forest type and site productivity, generally following the Forest Guild guidelines for DWM retention. All DWM on site prior to the harvest will be retained. Maintain a minimum of at least two cords (256 cubic feet) per acre of down coarse woody debris (material 5” or greater at the tip and at least 4’ long) for ground dwelling amphibians, mammals, insects and nutrient recycling. When available, highest priority will be given to leaving large, cull logs that will remain for long periods of time.
- e. Provide a diversity of horizontal and vertical forest structures by retaining both individual and groups of trees during final release regeneration harvests and by protecting desirable advanced regeneration.

Water and Soil Resources for Woodlands

- a. Present condition of water and soil resources in Woodlands
 - 1) Water resources

- a) The lands in the Western Connecticut Valley District have a variety of water related features such as streams, rivers, ponds, lakes, marshes, wetlands and vernal pools. Rare mussels live in some of the moderately flowing portions of streams where there are firm sands and cobbles. In steeper, more rapid streams, ledge outcrops and cobble-bottoms provide specialized habitat for rare aquatic plants. Fast-flowing cold water supports diverse communities of invertebrates, which in turn support coldwater fish communities. An inventory of invertebrates, vertebrates and vascular plants that are endangered, threatened or of special concern in the district, compiled by the Massachusetts NHESP, is presented in **Appendix E**.

Riparian forests provide a very effective natural buffer that hold soil in place and protect water purity. Trees, understory vegetation and organic material on the forest floor reduce the impact of falling rain and help to insure that soil is not carried into streams and waterways. A properly managed and maintained forested riparian zone can therefore reduce sedimentation and nutrient flow, provide shade to maintain cooler water temperature and spread out peak runoff times during storm events which all help to maintain healthy habitats for plant and animal species.

- b) All municipal watershed areas and 1830 forested lands (assumed to be forested lands that have not ever been cultivated, the logic being that if they were forested in 1830, they were probably never harvested by European settlers) are identified as “High Conservation Value Forest,” according to the Forest Stewardship Council Northeast Standards for sustainable and well-managed forests. The following table shows the acreage of lands within 100 feet of a stream, wetland, lake, pond or other aquatic feature by facility.

Land within 100 feet of streams, wetlands, lakes, ponds or other aquatic features, by facility in the Western Connecticut Valley District

Facility	Acres
Buckland State Forest	9
Catamount State Forest	293
Conway State Forest	253
D.A.R. State Forest	495
Deer Hill State Reservation	43
Florida State Forest (WCV part)	236
H. O. Cook State Forest	333
Kenneth Dubuque Memorial State Forest/Park	1,844
Leyden State Forest	3
Mohawk Trail State Forest (WCV part)	1,035
Monroe State Forest	672
Rowe State Forest	63
Savoy Mountain State Forest (WCV part)	183
Shelburne State Forest	0
South River State Forest	20
Windsor State Forest (WCV part)	266
Total	5,878

2) Soil resources

The soils on the Western Connecticut Valley District lands are grouped into nine forest productivity classes, based on the soil texture, drainage rate, available moisture and slope position. Productivity classes relate to the amount of forest biomass that can be grown on the soils. All class 1, 2 and 3 soils are considered highly productive. Although productivity classes are based on biomass production, studies have also shown that more productive soils also support a higher level of biodiversity. Soil productivity classes are further modified by a wetland or poorly drained “wet” modifier.

These resulting nine classes are defined in the following table:

Forest productivity classes of Western Connecticut Valley District soils

Class	Name	White Pine ft ³ /ac/year	White Pine Site Index	Red Oak ft ³ /ac/year	Red Oak Site Index	Acres in District
0	Non-forested	0	0	0	0	705
1	Prime 1	>155	>70	>55	>65	3,402
2	Prime 2	120-154	60-69	45-54	60-64	4,961
3	Prime 3	85-119	50-59	40-44	55-59	13,873
3W	Prime 3 – Wet	85-119	50-59	40-44	55-59	126
S	Statewide Importance	65-84	45-49	35-39	50-54	5,621
SW	State Importance – Wet	65-84	45-49	35-39	50-54	10
L	Local Importance	<65	<45	<35	<50	620
LW	Local Importance – Wet	<65	<45	<35	<50	120
U	Unique	N/A	N/A	N/A	N/A	0
	Total					29,439

b. Predicted condition of water and soil resources in Woodlands

The predicted condition is a forest that promotes and maintains the integrity of healthy, functioning aquatic ecosystems, vertebrate and invertebrate populations, water chemistry, nutrient input and instream structure.

The predicted condition is a forest where soils are conserved and managed for long term productivity. Practices will be designed to keep as much forested land as possible in a productive status, minimize erosion, displacement, compaction and rutting, and provide for nutrient recycling. The loss of calcium and other limiting nutrients will be monitored on a regional scale.

c. Management guidelines for water and soil resources in Woodlands

- 1) Manage areas around all vernal pools (certified and non-certified) according to the *Massachusetts Forestry Best Management Practices Manual* (Catanzaro, 2013) and further directed by *Guidelines for Timber Harvesting near Vernal Pools*.³⁵
- 2) Maintain soil processes by providing for the recruitment of organic inputs (retain coarse woody debris) and minimizing erosion through the use of Best Management Practices
- 3) Minimize the number of roads, skid trails and landings
- 4) Require that landings and main skid roads be stabilized, graded and planted to appropriate native seed mixtures at the end of any operation

³⁵ Massachusetts Department of Conservation and Recreation – Service Forestry program *Guidelines for Timber Harvesting near Vernal Pools*, unpublished document available by contacting DCR regional offices

- 5) A petrochemical spill management plan will be in place on all districts where active forest management activities take place
- 6) All petroleum products, industrial chemicals and hazardous materials must be stored in accordance with manufacturer's specifications and, at a minimum, in durable sealed containers
- 7) Require that all harvesting machinery carry oil absorbent cloth, shovel and a 5-gallon bucket to mitigate any oil or hydraulic fluid leaks and that any such leaks/spills be reported to the appropriate Management Forester (and to DEP, if appropriate) on the day they occur
- 8) Require that all harvesting machinery be thoroughly cleaned (the exterior, undercarriage and tires/tracks of all equipment) of mud and other debris with a high-pressure washer at a maintenance facility prior to bringing the equipment on site to minimize the introduction of invasive plant seeds and parts. Management Foresters will inspect all equipment prior to unloading at job sites.
- 9) Prohibit the use of harvesting machinery during the typical mud season (March 15 to May 15) or wet periods, unless waived by the DCR forester
- 10) Protect highly sensitive or wet soils by limiting activities to the period when the ground is frozen or dry to prevent a reduction in site productivity and/or requiring equipment that minimizes impacts to these soils
- 11) Manage soils on a sustainable basis by minimizing erosion, compaction and displacement. Management is permitted to control erosion or stabilize soils by closing roads and unauthorized trails or other means, such as stabilizing slopes with water bars or other erosion control structures. Local emergency management officials will be consulted in any road closures.
- 12) Where Woodlands are contiguous with DCR's DWSP lands or local or regional public water supply watershed lands, management should be closely coordinated with the public water supply agency to address water quality protection issues

D. Cultural Resources

1. Present Condition of Cultural Resources

Cultural resources are important artifacts of past human behavior and a wide variety of State and Federal legislation exists to provide for their protection. Cultural resources include historic buildings (e.g., homesteads, mills and churches), structures (e.g., dams, roads, stone walls) and archaeological sites (prehistoric and historic).

DSPR's Cultural Resource Management program is designed to ensure that future generations will have the opportunity to understand, appreciate and learn about the past. The Department is determined to implement the existing preservation laws in a timely manner in order to properly manage the cultural resources within its State and Urban Parks system.

The Western Connecticut Valley District contains numerous examples of the full range of cultural resources. A Cultural Resource Sensitivity Map has been produced for each property within the Western Connecticut Valley District to assist property managers and foresters. Each map is based on what is known as Archaeological Site Location Criteria, which in turn is based on soil drainage characteristics, proximity to a fresh water source and degree of slope. The resulting maps show archeological sensitivity “bubbles” where further review and limitations may be necessary before a project can proceed. Specific information on the cultural resources for each property may be found in **Appendix F** on Cultural Resource Protection and its accompanying tables.

2. Predicted Condition of Cultural Resources

The predicted condition is to identify and evaluate the condition and significance of cultural resources within the properties for which DSPR provides stewardship. Based on this initial set of findings, plans to protect and maintain significant cultural resources within the Western Connecticut Valley District state forest and park lands will be formulated. In some cases, cultural resources may be enhanced through specific management activities or presented to the visiting public through interpretative, educational and programmatic formats.

3. Management Guidelines for Cultural Resources

- a. As per DCR’s regulatory responsibilities, any projects undertaken on DCR land – including forestry cutting plans or other silvicultural prescriptions – must first be reviewed during the planning stage by DCR’s Office of Cultural Resources (OCR) for potential impacts to known and potential historic and archaeological sites
- b. Vegetation management for the protection of historic or archaeological sites is allowed, with some restrictions on the time of year, types of equipment and techniques used to minimize resource disturbance, as guided by OCR staff
- c. When designing a harvest, every effort should be made to identify pathways for equipment that avoid the creation of new (or widening existing) gaps in stone walls. If stone walls are within potential treatment areas, a site walk with OCR staff to review options and assess potential impacts and mitigation measures should take place during prescription and/or cutting plan development.
- d. Upon completion of a vegetation management treatment, all slash will be removed from within any foundation or cellar hole
- e. Maintenance of historic buildings, structures, sites and landscapes within Woodlands is allowed



Beehive charcoal kiln at Kenneth Dubuque Memorial State Forest

E. Forest Health and Protection

1. Present Condition of Forest Health and Protection

- a. Forests are subject to a variety of natural and human-influenced damaging agents that may affect long-term forest health, such as insects, disease, fire, wind, snow, ice and non-native invasive species.
- b. Current major forest health issues in the Western Connecticut Valley District
 - 1) Insects and disease
 - Emerald ash borer
 - Hemlock woolly adelgid
 - Asian long-horned beetle
 - Ash decline
 - Beech bark disease
 - Armillaria fungus
 - Diplodia fungus
 - Gypsy moth and tent caterpillar outbreaks

- Red pine scale
- Sudden oak death (potential future threat)
- Sirex wood wasp (potential future threat)
- Non-native invasive species

2) Invasive exotic/non-native plants

A complete inventory of invasive exotic plants currently does not exist for the Western Connecticut Valley District, but most common invasive plants are present and include:

a) Trees

- Black locust
- Norway maple

b) Shrubs and vines

- Oriental bittersweet
- Japanese barberry
- Black shallow-wort
- Shining (or glossy) buckthorn
- Common buckthorn
- Japanese honeysuckle
- Morrow's honeysuckle and other shrub honeysuckles
- Autumn olive
- Multiflora rose

c) Herbaceous plants and perennials

- Goutweed or bishop's weed
- Yellow iris
- Japanese knotweed
- Purple loosestrife
- Garlic mustard

3) Fire

Most forests including those in the Western Connecticut Valley District are relatively resistant to catastrophic fire and of low fire risk. Historically, Native Americans burned certain forests to improve early successional habitat for hunting. In modern times, fires most often result from careless human actions.

Although not a prime influence in these forests, the risk of unintentional and damaging forest fires can increase as a result of accumulation of naturally dying vegetation in periods of drought and logging activity, if the slash (tree tops, branches and debris) is not treated correctly. Adherence to the Massachusetts slash law minimizes this risk. Under the law, slash is to be removed or modified in buffer areas near roads, boundaries and critical areas and lopped close to the ground to speed decay.

Depending on the fuel types, fire risk and habitat goals for the site-specific area, fire can be a management tool to favor certain species of plants such as oak, provide habitat for wildlife such as ruffed grouse or reduce the risks of hazardous fuel accumulation.

C) Climate adaptation

In *Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers* (Swanston and Janowiak (eds.), 2012), three broad strategies are presented as fundamental options for forest managers to consider when responding to climate change. These strategies could be integrated into forest management in the Western Connecticut Valley District as follows:

Resistance actions improve the forest's defenses against anticipated changes

- a) Sustain fundamental ecological function by maintaining a healthy ecosystem
- b) Reduce the impacts of existing biological stressors such as Emerald Ash Borer by removing host trees
- c) Protect forests from severe fire and wind disturbance - this could be accomplished by maintaining access, reducing fuel loads and using silvicultural techniques that minimize canopy exposure to prevailing winds

An example in the Western Connecticut Valley District would be treating dead and down Norway spruce in the Leyden State Forest. This would include breaking up and scattering piles of dead trees and minimizing the length of downed wood to prevent fire spread by conduction. Another example is the strategy used at the Leyden State Forest to orient group openings perpendicular to prevailing winds and minimizing gap size in the forest canopy.

Resilience actions accommodate some degree of change but encourage a return to prior conditions after a disturbance

- a) Maintain and enhance species and structural diversity - use silvicultural techniques to diversify the forest in age classes, vertical structure and species composition
- b) Increase ecosystem redundancy across the landscape - carry out effective practices at the landscape level in order to offset the effects of large scale disturbances that may damage or destroy habitats present in limited amounts

An example of this in the district would be to use a group-selection regeneration method in Northern hardwood stands to provide multi-structured forest conditions. This has been done in the Kenneth Dubuque Memorial State Forest.

Response actions intentionally accommodate change and enable ecosystems to adaptively respond to changing and new conditions

- a) Plan for and respond to disturbance - salvage areas, where appropriate, after large disturbances; desired species could be replanted, if necessary

An example of this in the district is the creation of group openings in the Kenneth Dubuque Memorial State Forest to salvage ice-damaged trees.

b) Facilitate community adjustments through species transitions; sugar maple and red spruce may eventually have their range shift north due to warmer climate conditions in the district; other species will shift north as well resulting in market and utilization alterations as product/ecosystem services change - this could affect maple syrup producers at some point in the future

An example of this in the district would be in H. O. Cook State Forest where there are significant amounts of Northern hardwood stands. Red oak could be favored as a species to regenerate because it will thrive in warmer conditions as opposed to sugar maple and red spruce that do better in cooler conditions.

According to the Massachusetts Climate Protection Plan (Commonwealth of Massachusetts, 2004), "[c]limate change could have serious impacts on the state's diverse ecosystems, native species and may encourage the spread of non-native species. It would also likely alter the natural range of many different plants and animals. Over the long term, warming could intensify droughts and damage forest ecosystems." The Western Connecticut Valley District FRMP aims to provide a long-term sustainable strategy and short-term (next 10 years) implementation schedule. While the extent of the effects of climate change are not fully understood, many likely effects related to non-native species, damage to forest ecosystems and more droughts, are well known. This plan has been designed to anticipate these and other effects of climate change by:

- Recognizing the carbon sequestration benefits of young, vigorously growing forests, the Plan provides for a more balanced structure of age classes
- Without being able to predict the specific changes in native forest ecosystems that climate change will cause, the Plan focuses on sustainability and ecosystem function rather than species distribution
- The Plan focuses attention on the problem of non-native invasive species, which will likely increase with continued climatic change

The state will continue its efforts to maintain existing forests, increase land conservation areas and give incentives for native (non-invasive) reforestation of previously forested area. The amount of carbon stored or sequestered by these activities will be measured and monitored over time to ensure that real carbon benefits accrue and to better understand the long-term benefits of such programs.

2. Predicted Condition of Forest Health and Protection

The predicted condition is a healthy, diverse, native forest with a reduced occurrence of undesirable, non-native, invasive species. It should have a low threat of catastrophic fire and have the infrastructure to allow efficient response to wildfire and for the application of prescribed fire.

3. Management Guidelines for Forest Health and Protection

- a. Forest insects and diseases

- 1) conduct periodic surveys to identify and quantify forest insect and disease impacts
 - 2) Prescribe integrated pest management approaches that treat high-risk stands, including the development of an Invasive Species Response Plan for invasive species of significant risk to forest resources
 - 3) Implement the draft *Massachusetts Emergency Response Plan for Highly Destructive Invasive Forest Pests* (Massachusetts Department (of) Conservation and Recreation and Department of Agricultural Resources, 2007) for invasive species that pose a significant risk to forest resources
- b. Non-native invasive species
- 1) Conduct periodic surveys to identify, map and quantify impacts of non-native invasive species
 - 2) Prescribe integrated and interdisciplinary approaches that treat existing populations while maintaining desirable native species. Integrate the removal of invasives as a requirement of timber sale contractual operations.
 - 3) Require that all harvesting machinery be thoroughly cleaned (the exterior, undercarriage and tires/tracks of all equipment) of mud and other debris with a high-pressure washer at a maintenance facility prior to bringing the equipment on site to minimize the introduction of invasive plant seeds and parts. Management Foresters will inspect all equipment prior to unloading at job sites.
- c. Carbon sequestration
- 1) Manage for native vigorous vegetative growth that will both increase carbon storage and enable adaptation to climate change over time. For example, use uneven aged silvicultural systems to regenerate northern hardwoods to help maintain this forest type which is at high risk of decline in the future due to climate change.
 - 2) Use extended rotations and forest management techniques to restore late successional forest structure
 - 3) Draw upon and utilize the most current research and science in applying forest management carbon sequestration strategies
- d. Use of pesticides
- 1) Use pesticides only when there are no other practical alternatives
 - 2) Apply pesticides according to product labels and by a licensed applicator
 - 3) Monitor treatments for effectiveness and impacts on non-target species and areas
- e. Salvage of dead and dying forest
- 1) Use salvage operations following standard operating forest management guidelines and the *Massachusetts Forestry Best Management Practices Manual* (referenced previously)

to reduce risk to human health and safety, of fire or to reduce continued forest health threats, when necessary

- 2) Consider pre-salvage operations to reduce risk to human health and safety or address forest health threats

f. Fire

- 1) Inventory and maintain desirable fire roads and water drafting sites
- 2) Meet Massachusetts slash law requirements
- 3) Suppress wildfires to meet the following objectives:
 - a) Provide for the safety and well being of fire fighters and the public
 - b) Protect natural resource investments and private property
 - c) Use minimal impact suppression tactics in fire pre-suppression and suppression actions
 - d) Coordinate suppression tactics with the natural resource predicted conditions
- 4) Use mechanical treatments such as fire breaks, mowing and prescribed fire to:
 - a) Maintain natural communities
 - b) Reduce the buildup of hazardous fuels and catastrophic wildfire
 - c) Enhance conditions favorable to rare species or communities
 - d) Establish desirable regeneration
 - e) Create habitat for early successional species
- 5) Maintain forest health to reduce forest mortality and subsequent build-up of fuels

F. Facilities, Transportation and Boundaries

1. Present Condition of Facilities, Transportation and Boundaries

There are 173 miles of official, legal roads and trails within the Western Connecticut Valley District properties. Generally, roads and trails are minimally maintained, sometimes resulting in unsafe access and degradation of water quality due to soil erosion and sedimentation. Some road and trail maintenance and re-construction is occurring through forest management activities, volunteer efforts and occasionally as part of DCR projects. DCR's goal is to ensure that the transportation network will be safe and environmentally sound. In addition, the network should have a minimum impact on the natural resources of the DCR system while serving public safety needs and allowing visitors to enjoy and experience these resources.

**Type, condition and mileage of roads and trails
in the Western Connecticut Valley District on DCR Property**

Type	Condition	Miles	Percent of Type
Administrative Road	Good	0.2	67%
	Fair	0.0	0%
	Poor	0.1	33%
Forest Road/Trail	Good	12.8	21%
	Fair	29.7	48%
	Poor	19.6	31%
Other	Good	1.1	35%
	Fair	0.0	0%
	Poor	1.1	65%
Public Road	Good	34.7	68%
	Fair	12.6	25%
	Poor	3.3	7%
Trail	Good	23.9	40%
	Fair	30.1	51%
	Poor	5.2	9%

Type, condition and length of legal (official) roads and trails by facility in the Western Connecticut Valley District

Site Name	Administrative Rd			Forest Road/Trail			Other			Public Road			Trail		
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Buckland State Forest	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Catamount State Forest	0.0	0.0	0.0	0.7	0.9	1.5	0.0	0.0	0.0	0.6	0.6	0.6	0.8	2.2	0.6
Conway State Forest	0.0	0.0	0.0	0.0	5.3	1.8	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0
D.A.R. State Forest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	3.3	0.2	7.1	7.4	0.5
Deer Hill State Reservation	0.0	0.0	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0
Florida State Forest (WCV part)	0.0	0.0	0.0	0.0	2.2	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
H.O. Cook State Forest	0.0	0.0	0.0	0.1	3.0	0.2	0.0	0.0	0.0	2.9	0.7	0.0	0.0	0.5	0.7
Kenneth Dubuque Memorial State Forest/Park	0.0	0.0	0.0	5.2	8.9	5.2	0.0	0.0	0.0	0.0	4.2	0.8	8.5	6.6	0.4
Leyden State Forest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mohawk Trail State Forest (WCV part)	2.5	0.2	0.0	2.2	3.2	4.5	0.0	0.0	1.1	7.9	0.0	0.1	4.0	5.1	0.7
Monroe State Forest	0.0	0.0	0.0	2.7	3.6	1.5	0.0	0.0	0.0	4.4	0.0	0.1	2.2	5.7	1.3
Rowe State Forest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Savoy Mountain State Forest (WCV part)	0.0	0.0	0.0	0.4	0.4	0.2	0.0	0.0	0.0	0.8	1.4	0.1	2.8	0.8	0.5
Shelburne State Forest	0.0	0.0	0.0	0.1	0.7	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0
South River State Forest	0.0	0.0	0.1	0.6	0.7	0.9	0.0	0.0	0.0	1.1	0.0	0.0	0.2	0.0	0.0
Windsor State Forest (WCV part)	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	2.5	1.4	1.4	2.1	0.3

There are 186 miles of DSPR property boundaries in the Western Connecticut Valley District (180 miles when boundaries between multiple DCR - DSPR properties are eliminated). DSPR's goal is to locate and post all boundaries and maintain them on a 10 year cycle so approximately 18 miles of boundaries will be posted and maintained each year.

Length of perimeter boundary in miles by facility in the Western Connecticut Valley District

Facility	Perimeter (miles)
Buckland State Forest	1.9
Catamount State Forest	11.2
Conway State Forest	13.7
D. A. R. State Forest	12.7
Deer Hill State Reservation	3.6
Florida State Forest (WCV part)	9.5
H. O. Cook State Forest	10.5
Kenneth Dubuque Memorial State Forest/Park	39.4
Leyden State Forest	1.4
Mohawk Trail State Forest (WCV part)	27.3
Monroe State Forest	17.2
Rowe State Forest	4.8
Savoy Mountain State Forest (WCV part)	9.9
Shelburne State Forest	2.4
South River State Forest	8.5
Windsor State Forest (WCV part)	12.0
Total	186.0

2. Predicted Condition of Facilities, Transportation and Boundaries

The predicted condition of DSPR properties is that they are surveyed and properly maintained to protect the Commonwealth's natural resources and minimize private and public timber trespassing and encroachments by adjacent landowners.

The predicted condition is a transportation network that is safe, effective, efficient and environmentally sound. The network should have the minimum impact necessary on the natural resources of our forest and park system while serving public safety needs and allowing visitors to enjoy and experience these same resources.

3. Management Guidelines for Facilities, Transportation and Boundaries in Woodlands

- a. Roads

- 1) Maintain existing roads in accordance with established road classification systems and maintenance policy
- 2) Minimize the number of truck roads, skid trails and landings
- 3) Staging areas, landings, main skid trails and truck roads must be stabilized and graded at the end of any operation
- 4) Protect highly sensitive or wet soils by limiting activities to periods when the ground is frozen or dry and/or requiring equipment that minimizes impacts to these soils. Use of harvesting machinery during the typical mud season (March 15 to May 15) or wet periods should be prohibited, unless waived by the forester due to drier than normal conditions.
- 5) New truck road construction may be permitted in stable areas only when necessary
- 6) Commercial timber management, including salvage, is allowed within road corridors and will be designed to promote diverse native vegetation, large-diameter trees, multiple age classes and forest structures, forest health, a safe recreation experience and quality scenery
- 7) No slash should remain within 25 feet of roads
- 8) Skid trails and truck roads will be carefully laid out by the forester considering grades, drainage and stream integrity
- 9) Inventory and maintain desirable fire roads and water drafting sites
- 10) Minimize truck road width
- 11) Minimize road shoulder clearing width for safe passage and provide minimal necessary fire breaks
- 12) Minimize adverse effects on wildlife migration through properly designed and maintained roads and structures (cut and fill banks, culverts and ditches)
- 13) Consider the use of in-kind services to provide for skid trail and truck road maintenance during project planning and implementation
- 14) Coordinate and cooperate with municipal officials on the management of roads and ownership of timber within road right-of-ways
- 15) Permanently close (restore to natural condition) roads that are significantly degraded, cannot be economically repaired or serve no feasible or emergency use. Local emergency management officials will be consulted.
- 16) Temporarily close forest roads, using barriers and gates, which will be used minimally for administrative needs only. Local emergency management officials will be consulted.

b. Boundaries

- 1) All boundaries needing formal surveys will be identified. All newly-acquired DCR properties should have their boundaries surveyed and marked. Interior line boundaries should be discontinued.
- 2) Boundaries will be surveyed as needed for project implementation, where trespass is an issue or where there are disputes
- 3) All boundaries will be located and maintained on a 10 year cycle or when needed for project implementation
- 4) All boundaries should be maintained clearly and in a way that is sensitive to adjacent private lands with visible residences.

c. Facilities

Construction of new facilities may occur as necessary for public and administrative use, consistent with Woodland goals.

G. Special Features and Natural Communities

A special feature is an area that contains unique ecological, aesthetic or historic features but is not covered under any of the previously sections. Examples include large rock ledges, research areas, historic agricultural landscapes, gorges, cliffs and rich mesic forests. All rare natural communities are identified as “High Conservation Value Forest” according to the Forest Stewardship Council Northeast Standards for sustainable and well-managed forests. The variety of these areas requires that management options be adaptable to protect, conserve or promote their values.

Special features potentially found in the Western Connecticut Valley District include:

- Natural communities
- Ledges and cliffs
- Gorges
- Open fields
- Agricultural landscapes
- Research areas
- Waterfalls
- Mountaintop habitat

Natural communities are 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 biological and physical features, as done in NHESP’s *Classification of Natural Communities of Massachusetts*. Natural communities tend to be more finely described than are the broad forest types and include non-forested assemblages. Natural communities may be restricted or widespread in their distribution across the state and they may be naturally large or small. NHESP has a ranking system that reflects statewide abundance of the types of natural communities. A ranking system sets criteria for assessing the quality of each type of natural community. NHESP uses the combined ranking systems to

track different types of natural communities for conservation prioritization. Most occurrences of the least common types and the best of the most common types are of interest.

A large, heterogeneous, matrix forest usually contains a mix of natural community types, with multiple occurrences of small patch communities, examples of larger patch types and examples of the surrounding, prevailing, matrix forest. However, the dynamic nature of communities is such that those in individual areas are expected to change over time. In reserves, there should be space for change and movement of community types so that over the long term, all types can continue to occur. Large animals often make use of multiple communities in mosaics as parts of their habitats. This report’s section on Biodiversity addresses the coarse filter approach to protecting appropriate native biodiversity and the sections on Water and Soil Resources focus on the physical features that provide habitat diversity. These sections compliment the ideas of identifying and managing natural communities that in turn supplement the larger view of forest resource management to maintain the state’s appropriate native biodiversity.

1. Present Condition of Special Features and Natural Communities

The lands in the Western Connecticut Valley District support a variety of types of natural communities occurring in the varied conditions of the hills, slopes, valleys, wetlands and waters of the district. While all areas of the district have not been fully inventoried for uncommon natural communities, several types of particular interest are known in the Western Connecticut Valley District, including on DCR lands. Calcium rich wetlands are particularly important statewide and support very uncommon natural communities and rare species. Other natural communities that develop on ridge tops, ledges, cliffs, talus slopes, seeps, floodplains, riparian zones, wetlands and in gorges (some mentioned in the special features section of this report) are often uncommon types of natural communities that NHESP considers priority for conservation. Rich Mesic forest, a particularly species rich type of forest community, has good examples in Western Connecticut Valley District.

The following tables list the NHESP natural communities currently known (2005) from DCR lands in the Western Connecticut Valley District and those known from the entire district, any of which might also occur on DCR lands. NHESP tracks all types of natural communities ranked S1, S2 and S3, as well as exemplary (best) occurrences of S4 and S5 types. Types are defined in the *Classification of the Natural Communities of Massachusetts*, version 1.3, each with its S-rank and the S-ranks are defined there in detail.

Natural communities are not regulated. S (state abundance) ranks are on a 1 to 5 scale, with S1 being considered vulnerable, generally having 1 to 5 good occurrences and S5 being demonstrably secure. Community types ranked S1, S2 and S3 are priority for conservation protection.

NHESP rare natural communities currently known to exist on DCR lands in the Western Connecticut Valley District (2008)

Natural Community	Group	Year Last Seen	State Rank
High-energy riverbank	Community	2000	S3
Rich, mesic forest	Community	2000	S3

**NHESP rare natural communities known
to exist generally in the Western Connecticut Valley District (2008)**

Natural Community	Group	Year Last Seen	State Rank
Acidic graminoid fen	Community	2000	S3
Black ash-red maple-tamarack calcareous seepage swamp	Community	1992	S2
Black gum-pin oak-swamp white oak “perched” swamp	Community	1993	S2
Circumneutral rock cliff	Community	2000	S3
Circumneutral talus forest/woodland	Community	2000	S3
Cobble bar forest	Community	2000	S2
Hickory-hop hornbeam forest/woodland	Community	2003	S2
High-energy riverbank	Community	2000	S3
High-terrace floodplain forest	Community	2000	S2
Level bog	Community	1998	S3
Rich, mesic forest	Community	2003	S3
Riverside rock outcrop	Community	2000	S3
Riverside seep	Community	1998	S2
Spruce-fir boreal swamp	Community	2001	S3

2. Predicted Condition of Special Features and Natural Communities

The predicted condition is a landscape where special features and natural communities are appropriately valued, protected, conserved and managed where necessary. In addition, DCR staff will work cooperatively with the Natural Heritage and Endangered Species Program to identify areas with possible priority natural community occurrences (for example from aerial photo interpretation, CFI data or ongoing forestry surveys). In addition, restoration and/or maintenance of known priority natural community occurrences will be jointly undertaken where feasible (for example, removing exotic invasive species or conducting prescribed fires in appropriate community types and locations). Removing plantations, as discussed in the “Native Vegetation in Woodlands” section, will generally enhance native communities.

3. Management Guidelines of Special Features and Natural Communities

a. Natural Communities

- 1) Inventory, record, map, evaluate and monitor uncommon or priority natural communities
- 2) Management of priority natural communities should consider ecosystem function, for example, downed wood and old snags will remain and streams that naturally flood will be allowed to do so where possible. Prescribed fire and fire management plans should be instituted to maintain fire-controlled natural communities where appropriate and possible.
- 3) Rich mesic forests and other nutrient-rich communities are highly sensitive to disturbance and the possible introduction of non-native invasives. Management will be restricted to the removal of non-native species and silviculture will be restricted to techniques to promote multi-age, native forests with minimal disturbance.

- 4) Management of the non-forested and low-productivity natural communities within the generally forested landscape should recognize their special habitat values and susceptibility to human disturbance
 - 5) In general, small patch communities should be managed with measures necessary to protect the values of the special features that support the natural communities
- b. Agricultural landscapes
- Agricultural landscapes include old fields, pastures and fencerows. These landscapes will be recognized and promoted through management, such as regular mowing and field restoration where possible. In general:
- 1) Larger fields are more valuable than smaller fields
 - 2) Mowing should be restricted until after July 15 to allow ground nesting birds time to fledge
 - 3) Trees encroaching on fields should be removed or pruned to maintain the historical landscape and field values
 - 4) Fence rows provide valuable habitat but can also be a source of invasive exotics
 - 5) Historic fields should only be cleared and restored when they are large and the value of the new habitat outweighs possible fragmentation
- c. Ledges and cliffs
- Ledges and cliffs provide unique habitat and aesthetic values. Many species use these areas for nesting, feeding or basking sites, and people are attracted to these areas for recreational activities or the views they provide. In general:
- 1) Management in these areas should promote multi-age native forests
 - 2) Ground skidding or other activities that could alter the hydrology or physical structure of these areas should be avoided
 - 3) Clearing of vegetation for views will be allowed where ecological function is not impacted
 - 4) In some cases vegetation may be cleared if it promotes habitat values such as basking sites for reptiles
- d. Research areas
- Research areas are managed under special-use permits and cooperative partnerships are encouraged to further our collective knowledge of ecosystem functions and processes.
- e. Gorges and special water features

Gorges and special water features such as waterfalls provide unique habitat and recreational values. In general, these areas should be managed in accordance with streamside BMPs. There may be cases where more restrictive measures are necessary to protect the values of these special features. In the Western Connecticut Valley District, all sites included in this category are located within Reserves and should be managed only to provide for public safety.

f. Mountaintop habitat

Mountaintop habitats in Massachusetts generally include areas of scrub oak, stunted hardwoods and blueberry/ huckleberry. Also included are small stands of very rare stunted pitch pine. The only known occurrence of this habitat is on Mt. Washington in the Southern Berkshire District. There are no known occurrences in the Western Connecticut Valley District. However, if any mountaintop habitats are identified in this district, the following management guidelines will be followed:

- 1) Generally these stands are self-sustaining and require no management. The stands should be monitored and a variety of interventions including prescribed fire or removal of competing trees will be allowed if necessary.
- 2) Active management of pitch pine stands may be necessary to control competing hardwoods. Any management will be the result of consultation with qualified ecologists.

VII. Measurable Outputs, Revenue and Cost Estimates

The Department of Recreation and Conservation, Bureau of Forestry, partially fulfills its mission of providing income from the sale of forest products through the use of silvicultural practices designed to balance ecological, social and economic considerations. The enabling legislation that created the Bureau of Forestry states that the State Forests shall be “in perpetuity income producing.” This legislation goes on to say that the Bureau shall manage to “improve” these forests. This balance is at the heart of the Bureau’s mandate and its social responsibility. Under M.G.L. Chapter 132, the Commonwealth’s Bureau of Forestry exists to protect the public interest in the both the private and public forestlands of Massachusetts. The public interest includes water conservation, flood and soil loss prevention, wildlife habitat, recreation, protection of water and air quality, and a continued and increasing supply of forest products. The Department provides for forest products in an ecologically and socially responsible and environmentally sensitive manner.

The Department meets its responsibility by focusing on predicted conditions for all resources. A predicted condition is a statement describing the predicted biological, physical and/or social condition or context. The Department will consider silvicultural options to modify existing stand conditions in order to meet predicted vegetative conditions.

The Department fulfills its mission to provide forest products by designing silvicultural operations in which timber products are offered for sale to private contractors. This provides direct income to the Commonwealth and the “value added” results of processing these products benefits many sectors of the Massachusetts economy. All harvesting is done in a manner that meets appropriate native biodiversity needs, is socially responsible and can occur in a long-term sustained manner.

A. Outputs

1. Recent Historic Output Levels

Ten year historic forest product outputs in the Western Connecticut Valley District

Total DSPR land in Western Connecticut Valley District (acres)	29,439
Woodlands (acres)	15,582
Total acres treated FY 1999 – 2008	1,107
Annual average acres treated FY 1999 – 2008	111
Annual average volume harvested FY 1999 – 2008	601.1 mbf ³⁶ 1,015 cords

2. Net Growth and Projected Harvest

For purposes of illustration, the annual growth and mortality (net growth) in terms of the forest products available from the Woodlands in the District are presented in the following net growth table. The illustration is deliberately presented for comparison to the annual and 10 year projected harvest levels for the scope of this plan shown in the “Projected Annual Harvest” following table.

³⁶ MBF is the acronym for “thousand board feet”

It should be noted from this comparison that the predicted average harvest amounts in a thousand board feet (MBF) are approximately 12% of net growth in Woodlands.

Annual Net Growth in Western Connecticut Valley District Woodlands				
MBF Growth/acre	MBF Mortality/acre	MBF Net Growth/acre	Acres ³⁷	Total MBF ³⁸ Net Growth
0.2980	0.1022	0.1957	14,729	2,882.5

Projected Annual Harvest in the Western Connecticut Valley District			
Treatment (Silviculture Regime)	Acres	MBF Volume ^{39*}	Cords ^{40*}
Even Age Management	29	85.886	21
Uneven Age Management	80	180.470	67
Late Successional Management	38	66.458	25
Total	147	332.814	112

B. Revenue

Revenue projections from the sale of standing timber are problematic as the prices paid for standing timber (stumpage) fluctuate with commodity markets. This is especially pronounced with the multiple species harvested in timber sales in Massachusetts. Using an average⁴¹ of stumpage prices paid in this district of \$164/MBF, the projected 10 year revenue for the district is \$545,820.

³⁷ Woodland acres available for harvest

³⁸ Massachusetts CFI plot measurement

³⁹ Volumes calculated and projected with the Forest Vegetation Simulator (FVS) – NE Variant (Dixon, 2008) using Massachusetts CFI plot data

⁴⁰ Ibid

⁴¹ Averaged over the years 1993 to 2013

C. Cost Estimates

**Estimated costs for implementation of recommended management level⁴²
in the Western Connecticut Valley District**

	Number of resources	Annual operating cost
Foresters	1 ⁴³	\$71,000
Contract and/or Seasonal Forester	1	
• Annual Continuous Forest Inventory		\$6,800
• Boundary maintenance		\$7,000
• Annual monitoring		\$5,000
Vehicles	1	\$6,000
Supplies and Equipment		\$2,500
Estimated Bureau of Forestry District annual operating costs		\$98,300
Boundary surveying		\$5,000
Road maintenance		\$45,000
Invasive species control		\$21,000

⁴² Costs are direct costs only; indirect costs are not included

⁴³ Currently there is one full time Forester in the Western Connecticut Valley District

VIII. Summary Discussion of District Forest Management Direction and Projected Results

This Forest Resource Management Plan has incorporated many of the concepts of the *Forest Futures Visioning Process* (FFVP) and the *Landscape Designations and Guidelines* (promulgated by the FFVP). In short, this plan specifies which DCR properties in this district are Reserves, Parklands and Woodlands and how they are to be managed. The Plan has indicated in tables and diagrams within the document the predicted results on the forest structure of not harvesting in Reserves and Parklands, and implementing even age, uneven age, and late successional management regimes over a 100 time period in Woodlands. These are the anticipated results of carrying out, as close as possible, the Landscape Guidelines. The table below indicates predicted age/size class distribution for all of the district lands. The projections were made using the Forest Vegetation Simulator - Northeast Variant (FVS - NE) which is an individual tree, distance-independent forest growth and yield model (previously referenced).

Data from Massachusetts Continuous Forest Inventory plots in this district were used within the structure of the model to project growth of unharvested areas (Reserves, Parklands, steep slopes, forested wetlands) and additionally project the results of even age management, uneven age management and restoring late successional characteristics in Woodlands. Harvesting was simulated over the 100 year scope presented in this plan. The model analyzed the individual forest type conditions and simulated a harvest (or not) if forest structure conditions were suitable at the appropriate time in the planning scope. For instance, a shelterwood could only be implemented in a forest type if the stocking level exceeded 120 ft² of basal area/acre and the average overstory diameter exceeded 14". In the simulations, all subsequent harvests were delayed 20 years. FVS – NE was programmed to report the average forest type conditions post harvesting (or not) that included growth and natural stand mortality. The predictions do not include the effects of large natural disturbance, including those of invasive insects or diseases which, although inevitable, are very unpredictable.

The forest management approach in the district will not have significant effects on the forest structure at a landscape level. Without a large scale disturbance, the forests within the Reserves and Parklands will take on the structure of very old and large trees. The silvicultural methods used in Woodlands; single tree to 1/3 acre openings, relatively small amounts of even age management openings, and retention of large tree structure will create very small pulses of regeneration on the landscape. Forest structure will be diversified significantly but temporally on a stand level or local scale where forestry is practiced in the district. There will be understory herbaceous plant development and tree regeneration resulting from harvesting disturbance and natural stand mortality. Uneven age management will be the dominant forest management approach in the district and will produce multiple age classes on a smaller spatial scale. But complete, three strata, uneven aged stands will not develop over large areas of the district because relatively few acres will be affected. At the extent of the 100 year rotation, the Woodland forests will have a significant amount of developing young and immature forests while still maintaining a majority component of large and old trees. The stylized images that were displayed earlier presented a sample of the average conditions of local (or stand level) diversity of select forest types given certain management regimes. The modeling of forest development in the district indicates that across the landscape of the district, relatively small amounts of regeneration will develop into overstory and create new age classes, thus the average conditions in forest stands across the entire district will move mostly towards even age⁴⁴ or two age conditions.

⁴⁴ Even age stands of trees composed of a single age class in which the range of tree ages is usually ± 20 percent of rotation. Stands that are uneven aged are composed of trees in three or more distinct age classes, either intimately mixed or in small groups. The analysis of structure was based on the occurrence of a preponderance of distinct size class groups to represent age.

Predicted total future condition of all Western Connecticut Valley District lands

Age Classes	Non Forest	Age class and size descriptions					
		0-14 years old	15-59 years old	60-89 years old	90 - 125 years old	125+ years old	Uneven aged
Size Classes		Seedling-Sapling 0-4.5" dbh	Poles 4.6-10.9" dbh	Immature 11-14.9" dbh	Large ≥15" dbh	Very Large ≥26" dbh	All Size Classes
Present Distribution	2%	1%	33%	54%	8%	0%	2%
Present Acres	730	231	9,797	15,539	2,454	0	688
2033 Distribution	2%	0%	3%	11%	83%	0%	0%
2033 Acres	730	0	788	33,494	24,461	111	0
2053 Distribution	2%	1%	0%	3%	88%	6%	0%
2053 Acres	730	276	49	781	25,793	1,810	0
2073 Distribution	2%	1%	16%	1%	72%	7%	0%
2073 Acres	730	373	4,600	317	21,323	2,095	0
2093 Distribution	2%	13%	15%	0%	66%	5%	0%
2093 Acres	730	3,746	4,301	0	19,287	1,375	0
2113 Distribution	2%	6%	15%	2%	70%	5%	0%
2113 Acres	730	1,775	4,325	453	20,541	1,615	0

IX. Inventory, Monitoring and Evaluation

The Department is committed to the principles of adaptive management. Adaptive management uses the best information available to make decisions on the management of the DSPR system lands, monitors the results for effectiveness and uses new information as it becomes available. The following is a summary of adaptive management inventory procedures for the Western Connecticut Valley District:

A. Project Level Management

DCR is already conducting long-term ecological monitoring on various sites throughout the state, in cooperation with the University of Massachusetts. The continuation of these monitoring activities is an important component of this Forest Resource Management Plan.

1. Inventory

- a. Initiate all management projects with a general walk through of areas most likely to meet objectives (see individual property appendices – Management Practices)
- b. Project and silvicultural prescriptions require the quantitative documentation of stocking level, species composition and quality of overstory and regeneration. If necessary, this data should be collected.
- c. Inventory selected area for cultural resources
- d. Inventory selected area for rare landforms, habitats and species
- e. Inventory selected area for invasive species

2. Monitor

- a. During treatment monitor for:
 - 1) Best Management Practices compliance
 - 2) Road and infrastructure condition
 - 3) Natural Heritage requirements
 - 4) Cultural resource protection
 - 5) Silvicultural prescription
 - 6) Forest product accountability
 - 7) Other contractual requirements
- b. Post Treatment (approximately 5 years after treatment) monitor for:
 - 1) Forest health
 - 2) Regeneration success and composition
 - 3) Best Management Practices
 - 4) Invasive species
 - 5) Unauthorized off highway vehicle (OHV) use
 - 6) Road and boundary conditions

3. Evaluate

- a. Contractor performance
- b. Departmental personnel performance

- c. Fulfillment of FRMP and silvicultural objectives
- d. Effectiveness of the treatment

B. District Level Management

1. Inventory

Begin by 2023; after that every subsequent 10 year planning cycle

- a. Re-measure Bureau's Continuous Forest Inventory plots
- b. Road conditions
- c. Boundary conditions

2. Monitor

Begin by 2023; after that every subsequent 10 year planning cycle

- a. Forest health
- b. Biodiversity
- c. Regeneration
- d. Best Management Practices
- e. Invasive species
- f. Unauthorized OHV use
- g. Road and boundary conditions
- h. Forest Reserves
- i. New information
- j. New public issues
- k. Unauthorized digging and collecting around historic archaeological sites and features
- l. Soil productivity including the loss of nutrients such as calcium
- m. Ecological monitoring at the landscape, stand and species level to compare biodiversity in Forest Reserves and active management areas

3. General program management review

To be conducted at the District level every 5 years

- a. Plan implementation
- b. Monitoring and evaluation efforts
- c. Currency of FRMP
- d. Public involvement
- e. Relationships with others

4. Evaluate and report

- a. Monitoring data should be evaluated against the predicted condition of the FRMP to determine the effectiveness of the Plan and the need to update it.
- b. A report should be prepared summarizing the results. This report will consider if:
 - 1) Additional treatments are needed to meet the predicted conditions

- 2) Predicted conditions need to be modified because of survey, inventory or new information
- 3) Existing management guidelines are effective and complete
- 4) Any new information, research or new issues need to be considered

X. Public Involvement

The State Forests and Parks are public resources and must be responsive to societal needs while using the best available science and maintaining options for future generations. Public involvement is critical to Forest Resource Management Planning and implementation. Public involvement is an ongoing process that consists of gathering input, analyzing, evaluating and responding to input and sharing information. The Bureau will be responsible to stakeholders through the public involvement process, implementation, evaluation and reporting. For detailed documentation of public comments and DCR responses, see **Appendix H**.

A. Project Level

1. Meet all regulations for project review. This will include review of all projects by conservation commission and select boards.
2. Consider public comments as they relate to project-level prescriptions

B. Property Level

Berkshire Ecoregional meeting: 11/22/2004
Number attending: 55

Western Connecticut Valley District Draft Forest Resource Management Plan meeting: 2/1/2007
Number attending: 12

Notify the public through the Environmental Monitor if there is a need to update or revise the Western Connecticut Valley District Plan. The notice will include specific FRMP proposed changes with rationale.

Develop and publish for review the Western Connecticut Valley District Stakeholders Report at the interim FRMP implementation periods five and ten years from the approval date of the Plan to track implementation efforts and share the results of monitoring and evaluation.

Appendix A – District Maps

Western Connecticut Valley Management Forestry District - Properties

Western Connecticut Valley District – 2005 Land Use – Land Cover

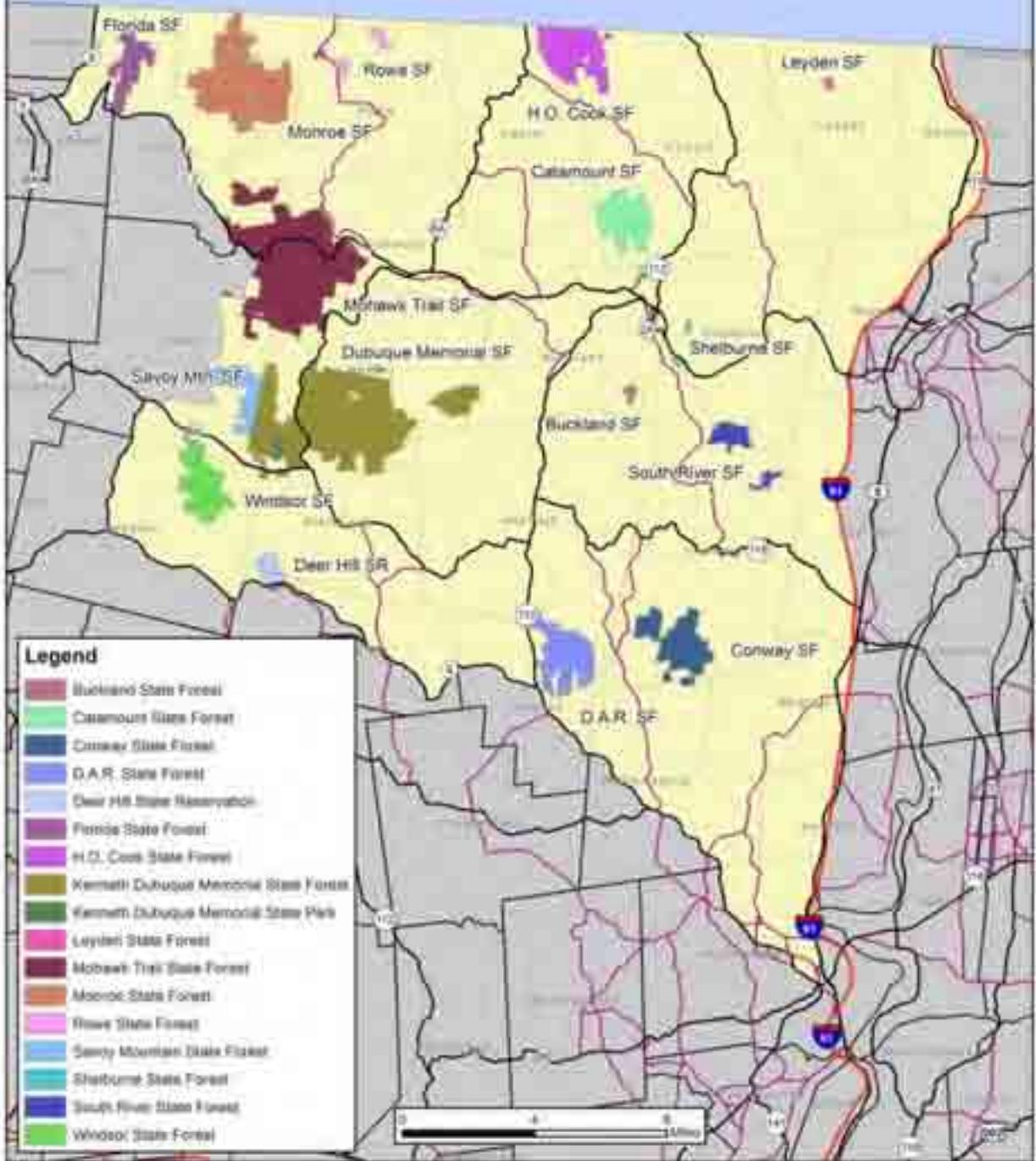
Western Connecticut Valley District – Protected Open Space

Western Connecticut Valley District – Forest Interiors

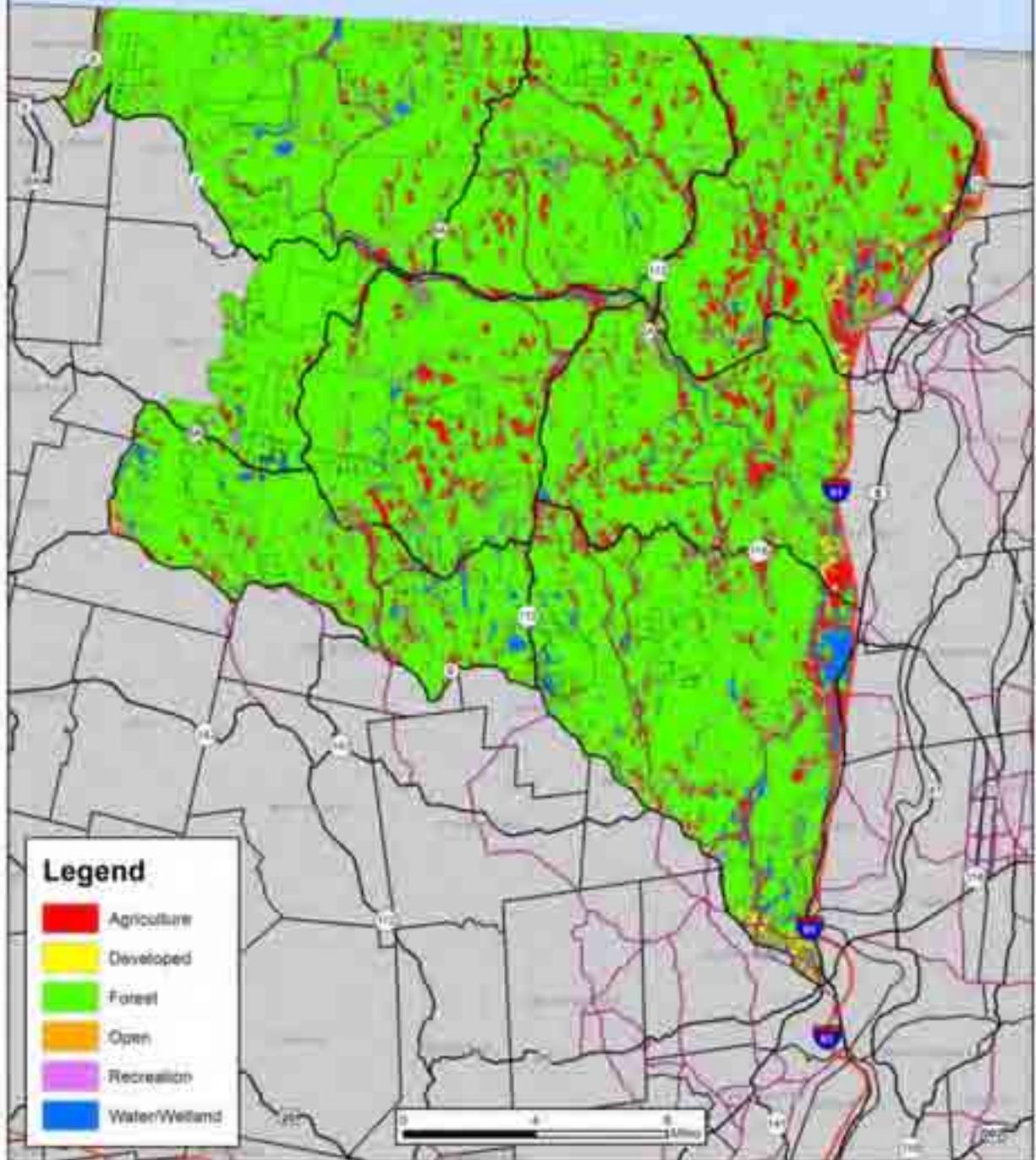
Western Connecticut Valley District – Landscape Zones

Western Connecticut Valley District – Watersheds, Public Water Supply and Surface Water Supply Protection Zones A, B and C

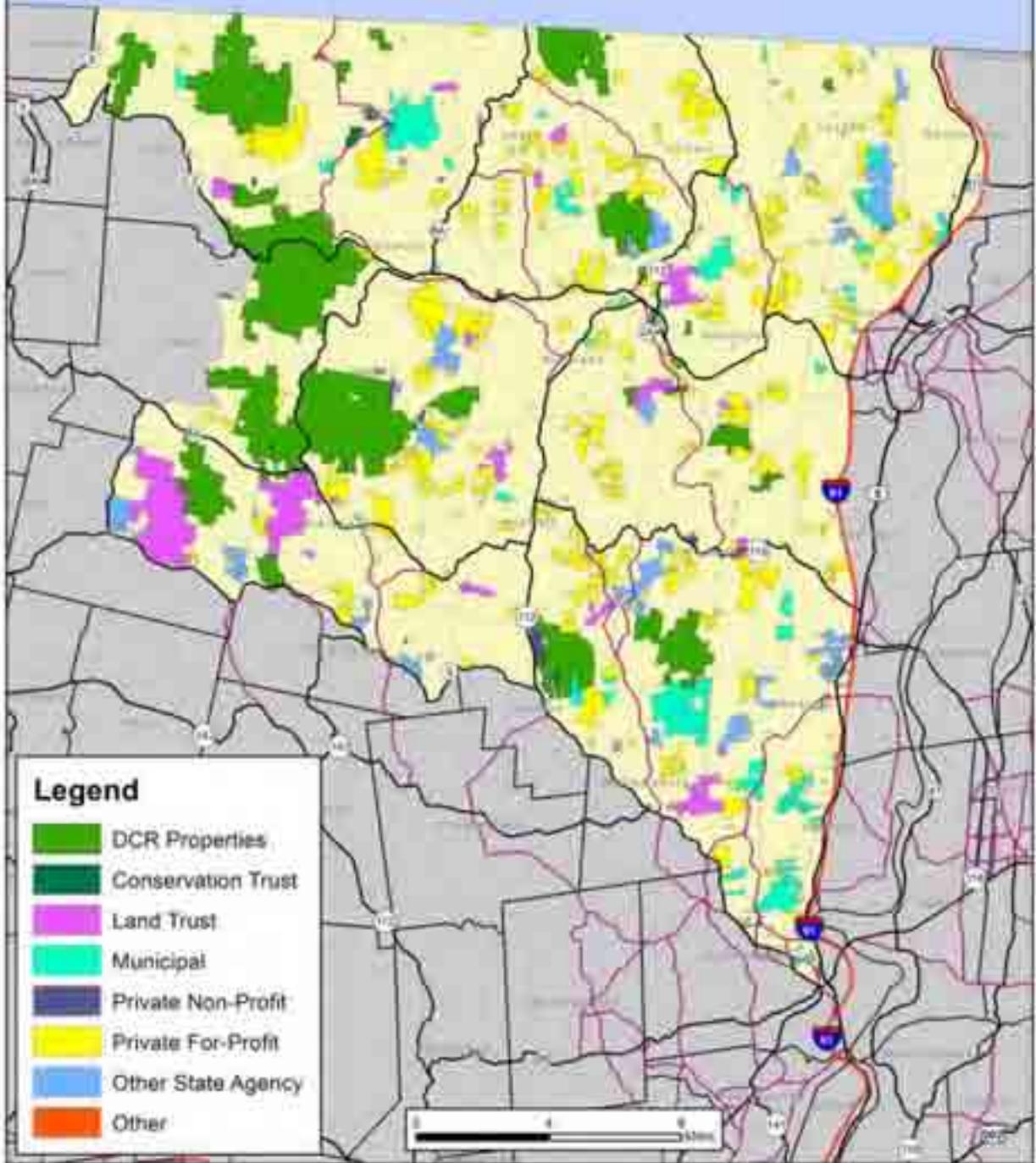
Western Connecticut Valley Management Forestry District



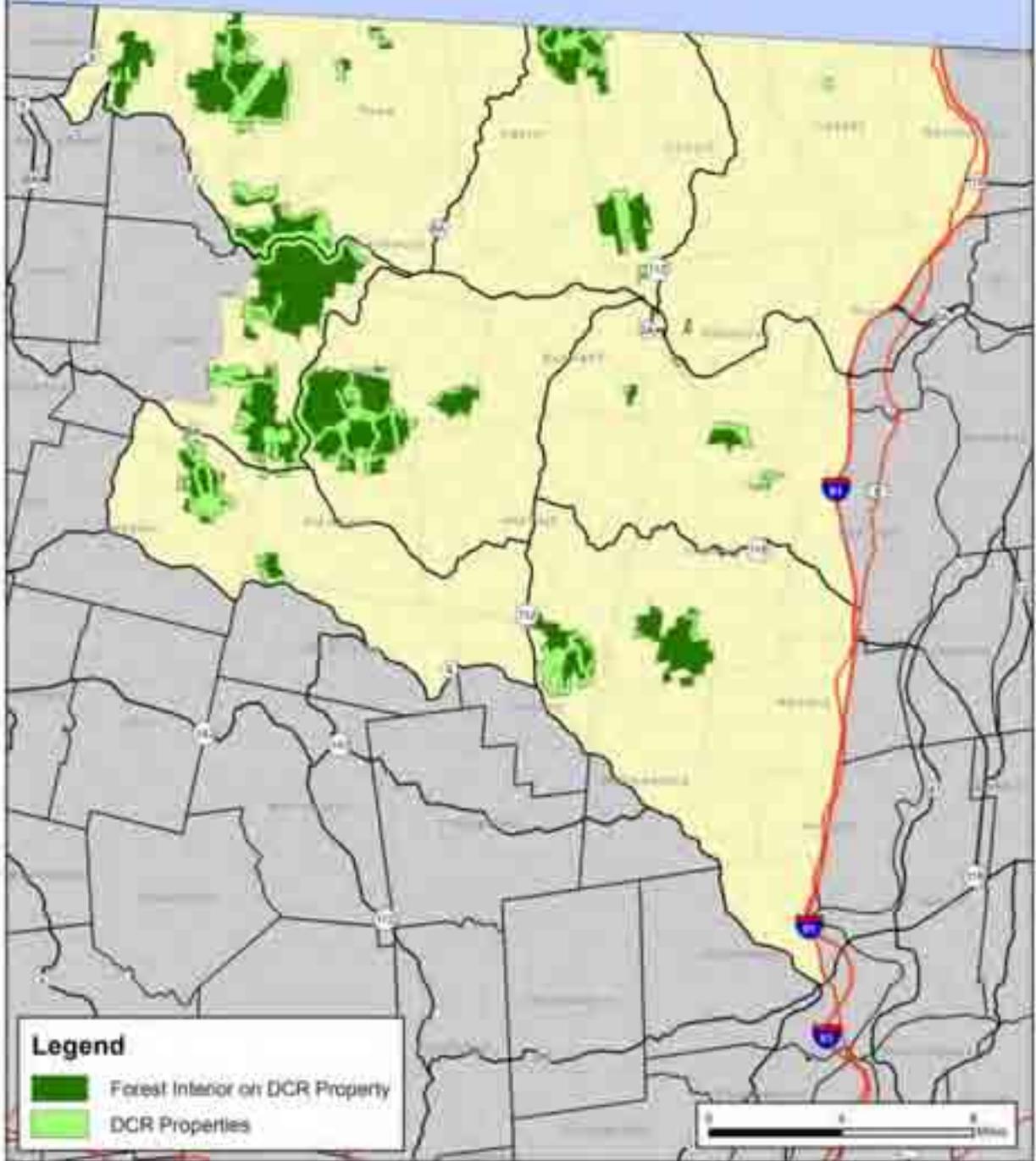
Western Connecticut Valley District - 2005 Land Use - Land Cover



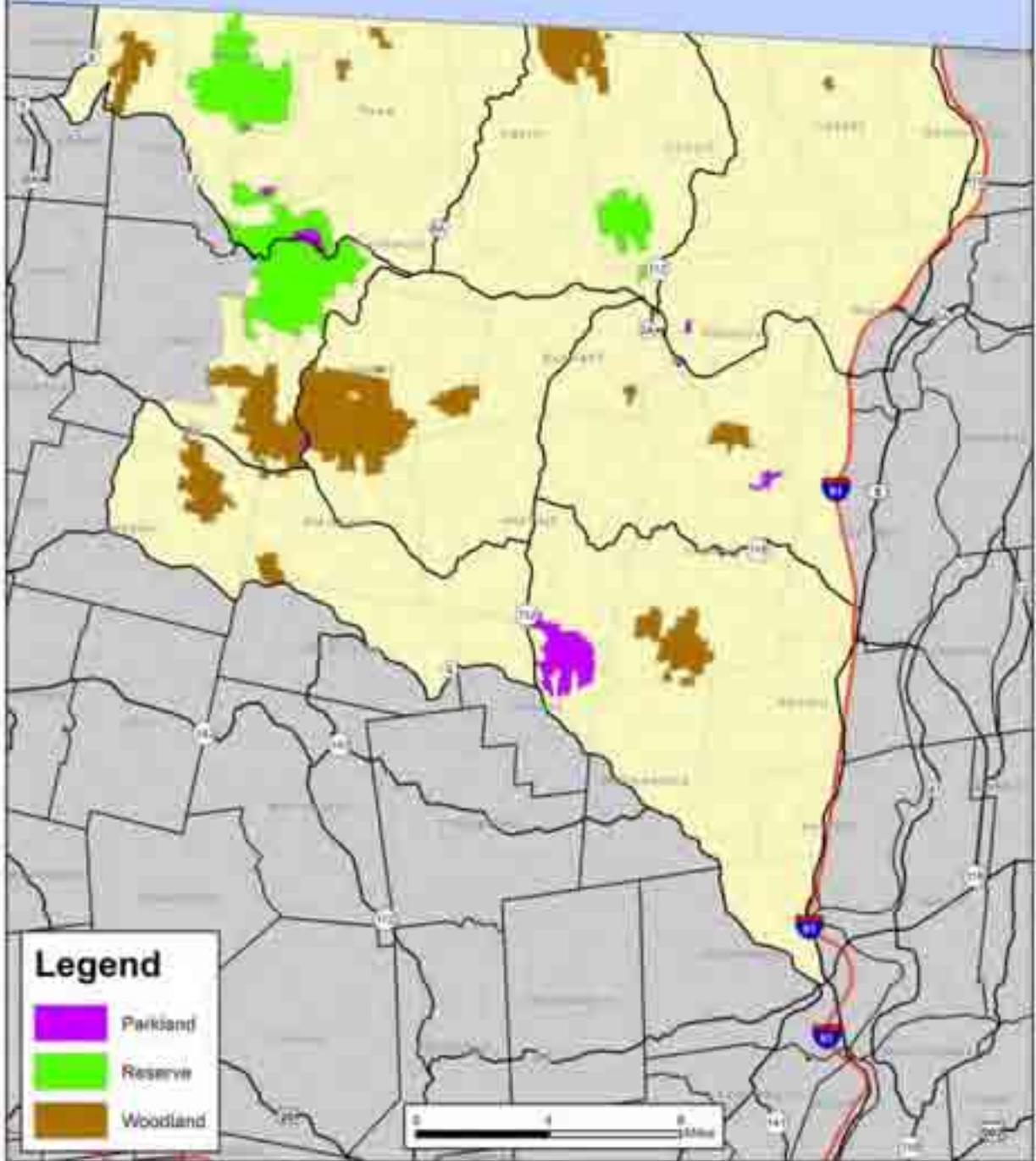
Western Connecticut Valley District - Protected Open Space



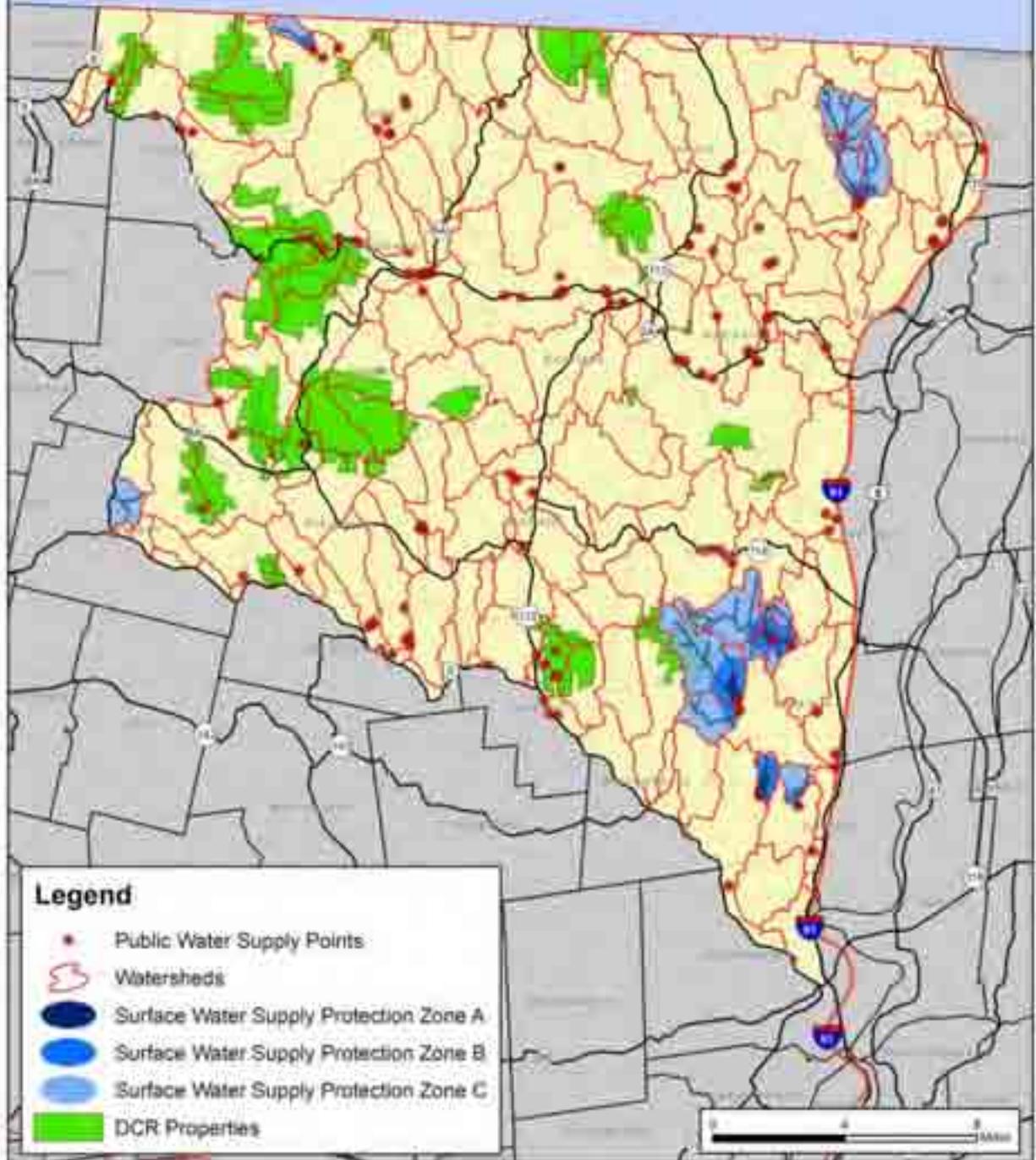
Western Connecticut Valley District - Forest Interiors



Western Connecticut Valley District - Landscape Zones



Western Connecticut Valley District
Watersheds, Public Water Supply and Surface Water Supply Protection Zones A, B and C



Appendix B – Property Maps

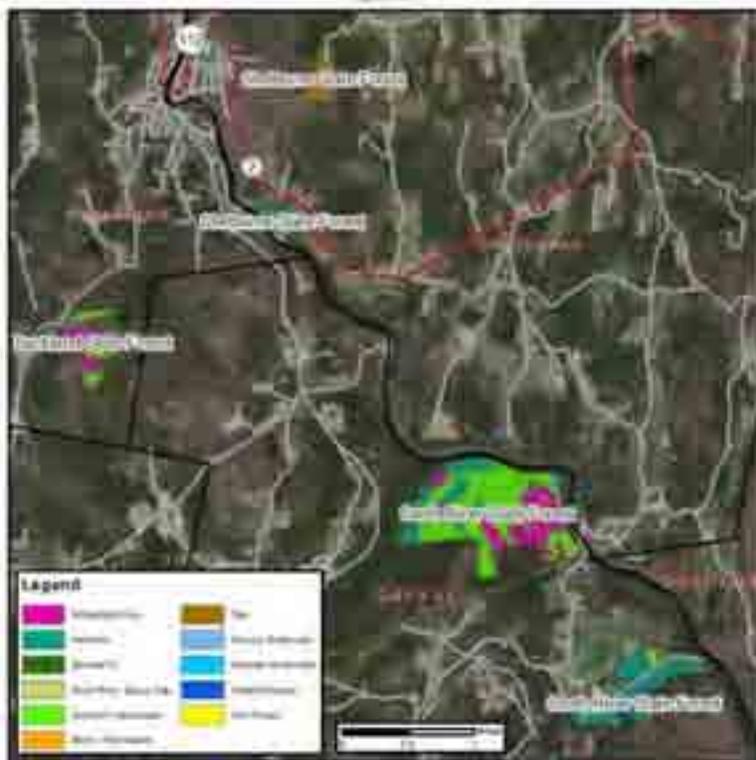
Buckland, Shelburne and South River State Forests
Catamount State Forest
Conway State Forest
D. A. R. State Forest
Deer Hill State Reservation
Kenneth Dubuque Memorial State Forest/Park and Savoy Mountain State Forest (WCV Part)
Florida State Forest (WCV Part)
H. O. Cook State Forest
Leyden State Forest
Mohawk Trail State Forest (WCV Part)
Monroe and Rowe State Forests
Windsor State Forest (WCV Part)

Map 1	DCR Landscape Zones
Map 2	Vegetation
Map 3	Prime Forest Soils
Map 4	100' Hydrology Buffers
Map 5	50'/500' Road and Legal Trail Buffers
Map 6	MA Natural Heritage and Endangered Species Program Rare Species
Map 7	Archeologically Sensitive Areas
Map 8	Landscape Zones with Resource Overlays
Map 9	Anticipated Silvicultural Regimes
Map 10	Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113

Shelton, Shelburne and South River State Forests
 UTR Land Use Zones



Shelton, Shelburne and South River State Forests
 Vegetation



Shelton, Shelburne and South River State Forests
Prime Forest Sites



Shelton, Shelburne and South River State Forests
100' Wetland Buffers



Shelton, Shelburne and South River State Forests
50'500' Road and Legal Trail Buffers



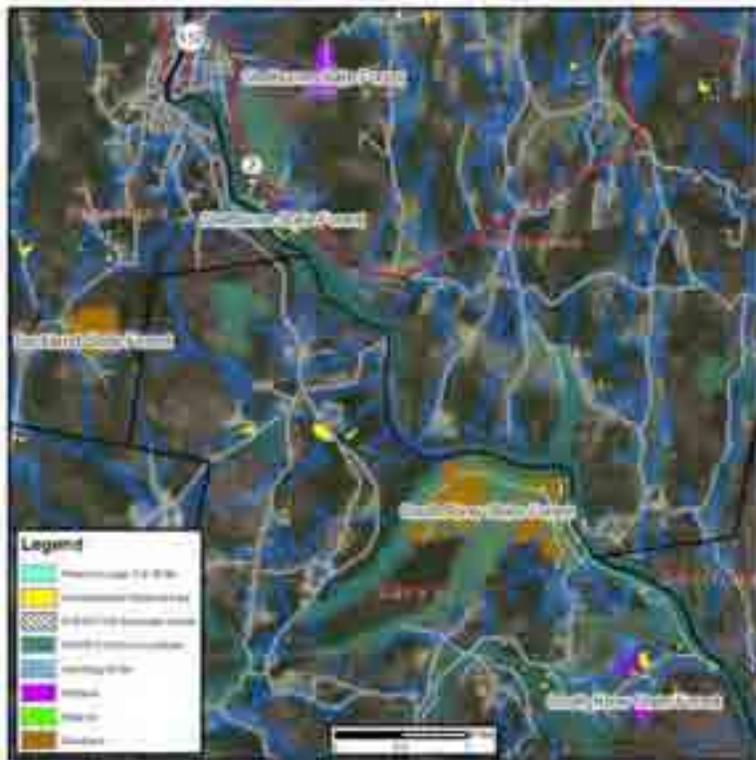
Shelton, Shelburne and South River State Forests
666 Natural Heritage and Endangered Species Program Risk Zones



Bulkard, Sheburne and South River Trout Forests
Archaeological Sensitive Areas



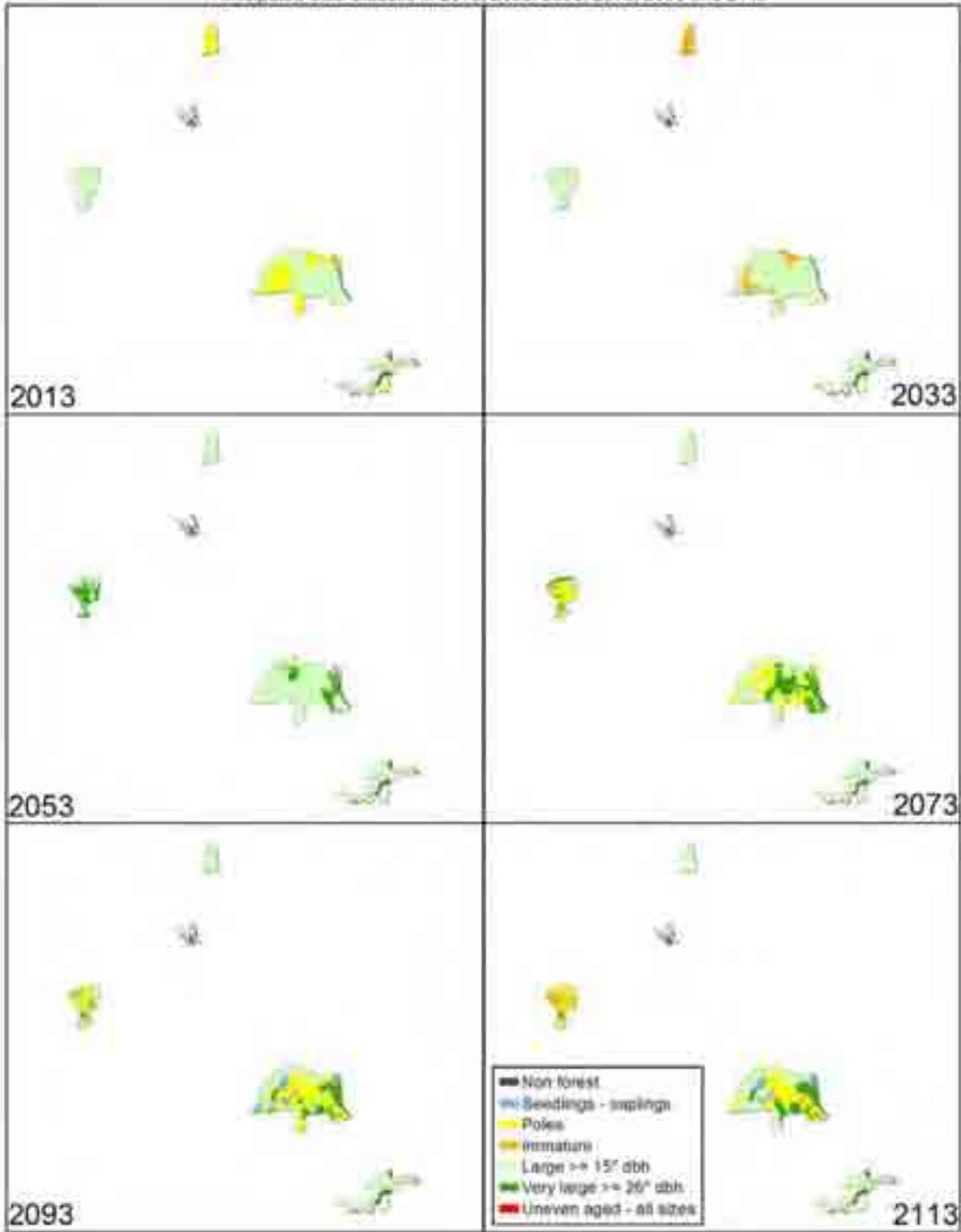
Bulkard, Sheburne and South River Trout Forests
Landcover Zones with Riparian Corridor



Subland Conditions and South River State Forest
Adjacent Silvicultural Regimes



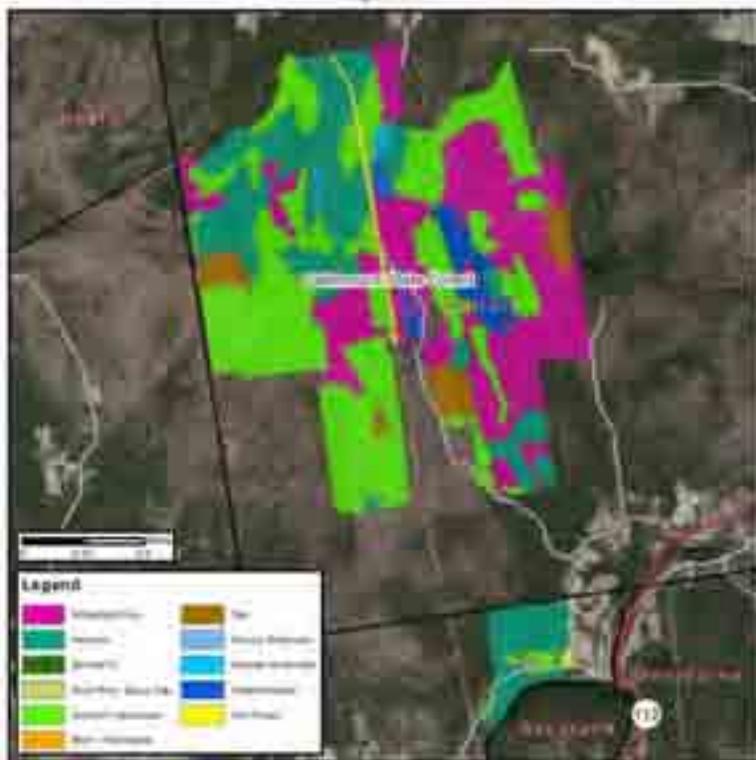
Buckland, Shelburne and South River State Forests
 Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113



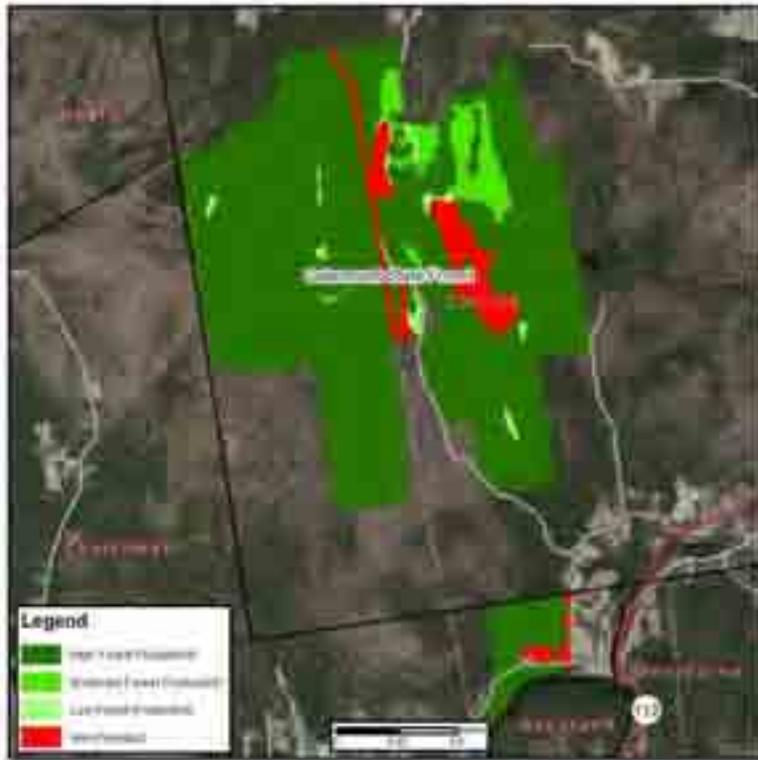
Colmanville State Forest
CIR I Land Use Zones



Colmanville State Forest
Migration



Delaware State Forest
Wild Forest State



Delaware State Forest
112 Hydrology Buffer



Carson State Forest
50' Road and Legal Trail Buffers



Carson State Forest
10A Natural Heritage and Endangered Species Program Base Species



Catsamount State Forest
Acroecological Sensitive Areas



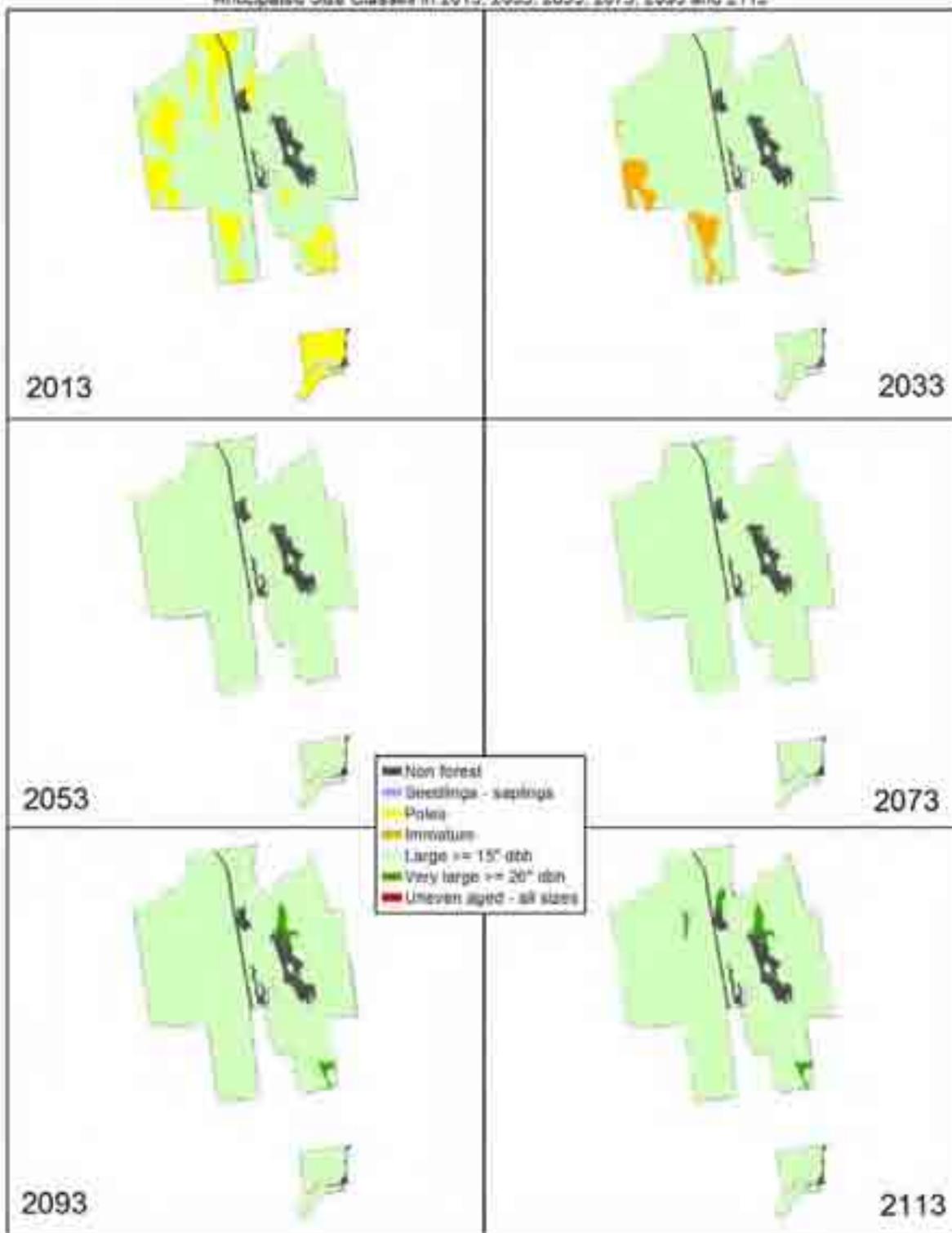
Catsamount State Forest
Landscape Zones With Biological Corridors



Colchester State Forest
Antiquated Agricultural Region



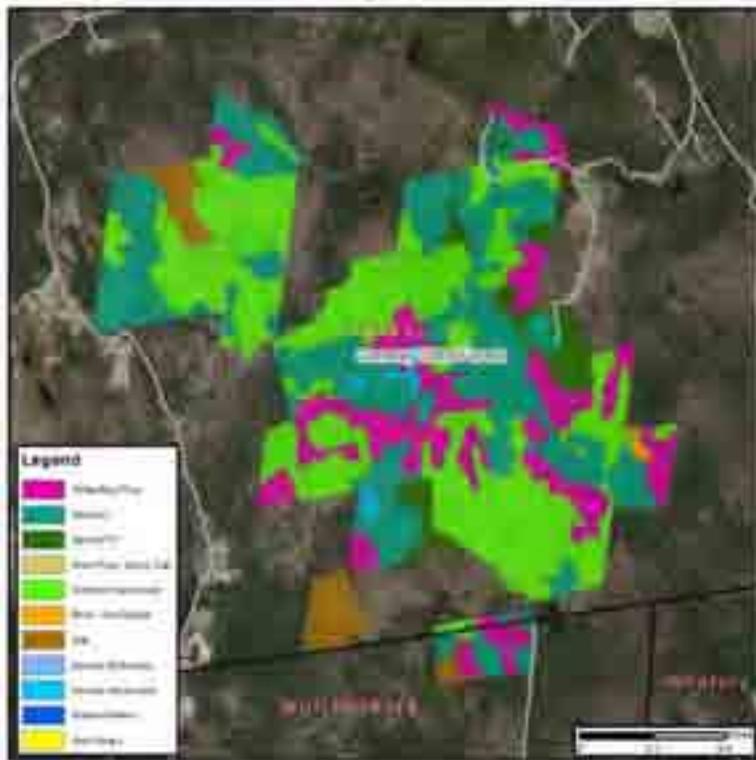
Catamount State Forest
 Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113



Connecticut State Forest
G118 Land Use Zone



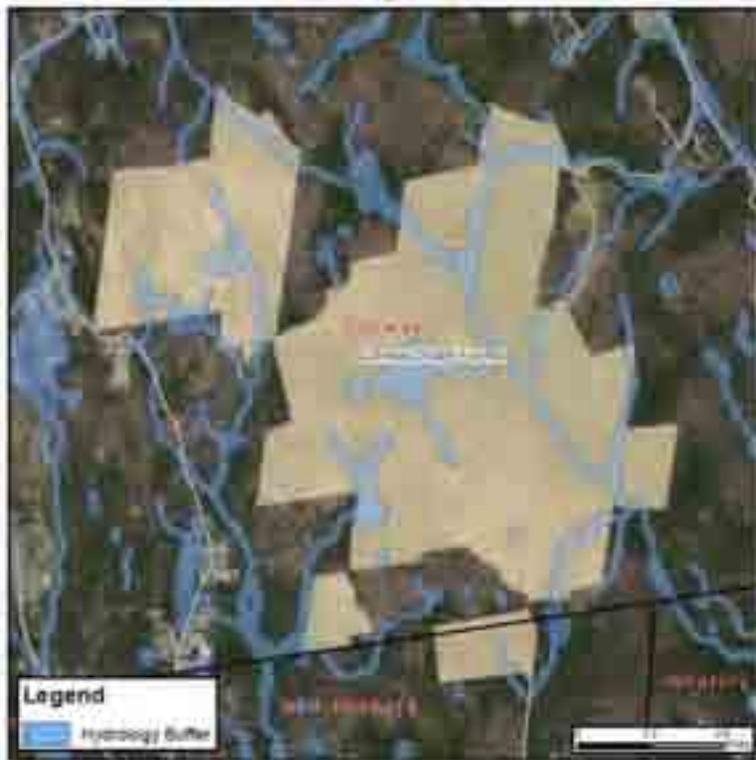
Connecticut State Forest
Vegetation



Corvoss State Forest
Prime Forest Study



Corvoss State Forest
300 Hydrology Buffers



Conway State Forest
50,000' Buffer and Legal Trail Buffers



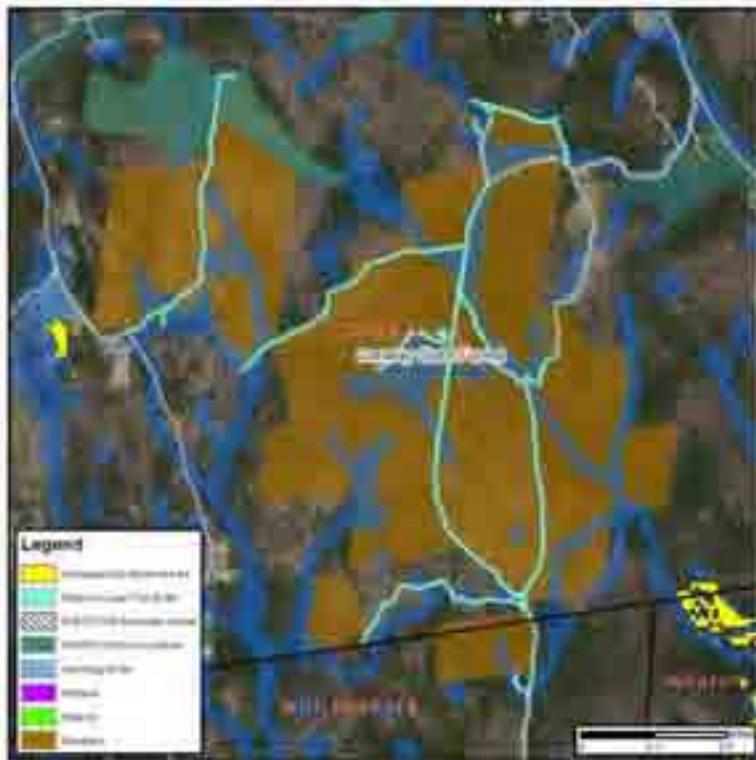
Conway State Forest
Near Species



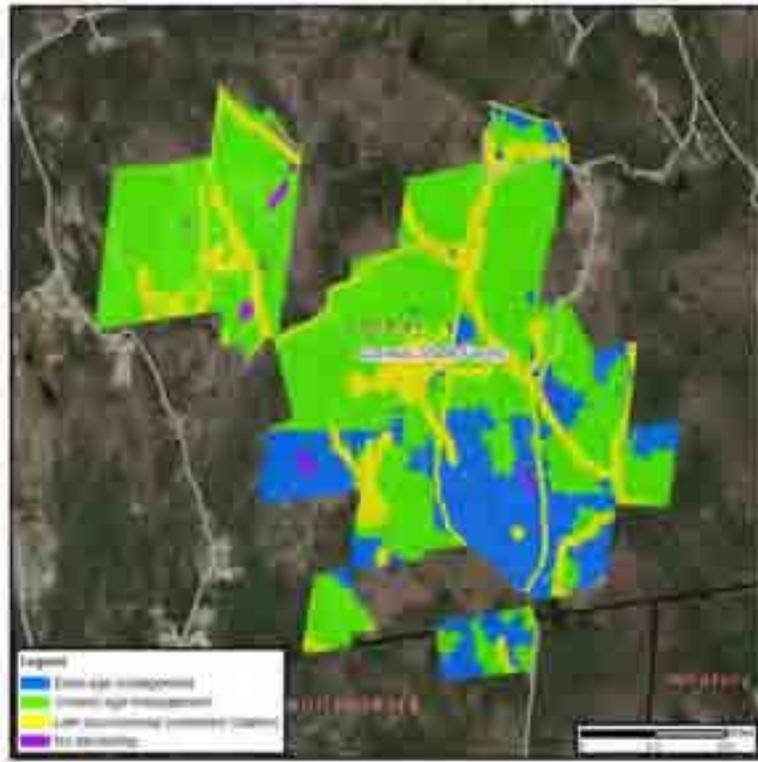
Corner State Forest
Administrative Sensitive Area



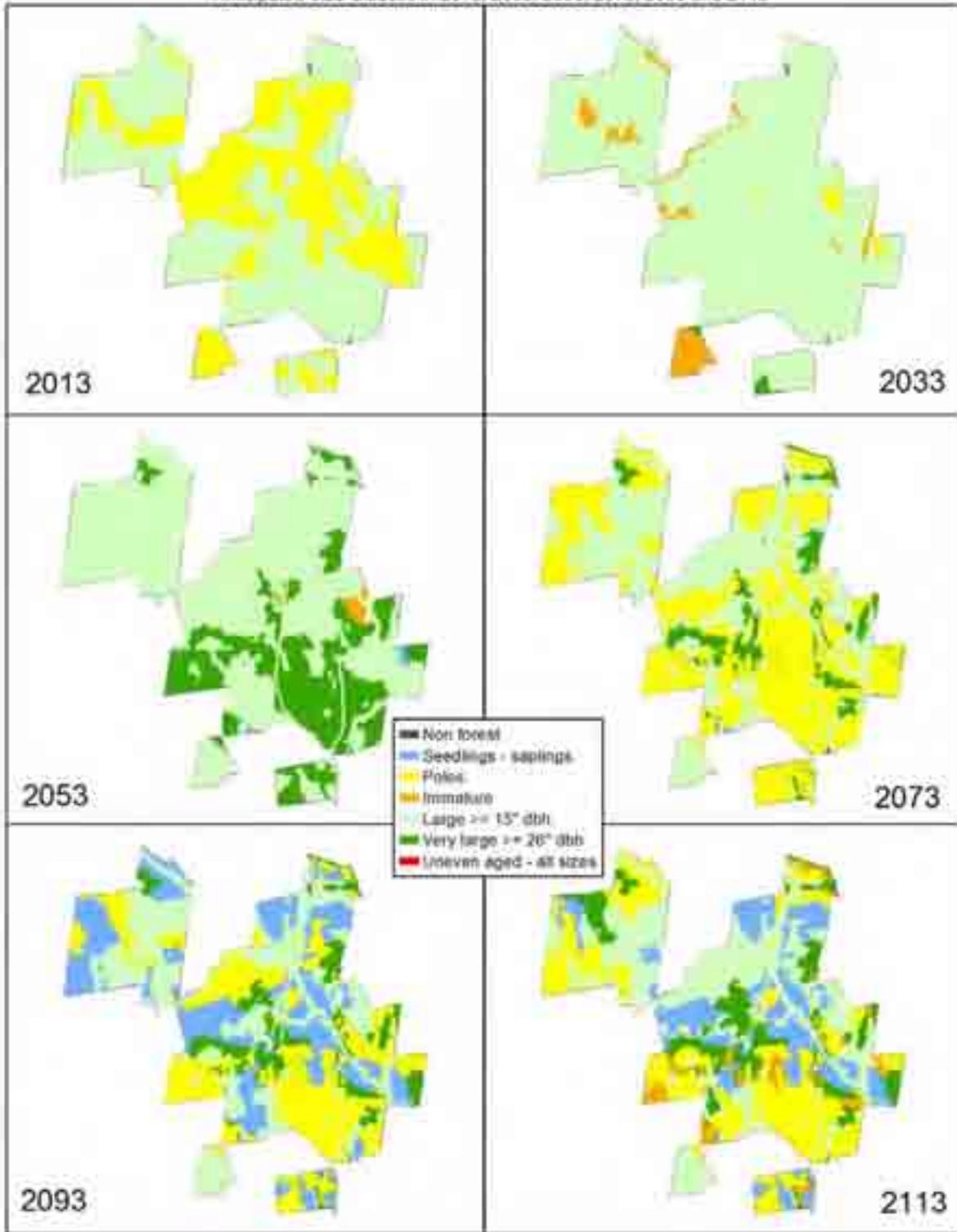
Corner State Forest
Landscape Zones with Resource Overlay



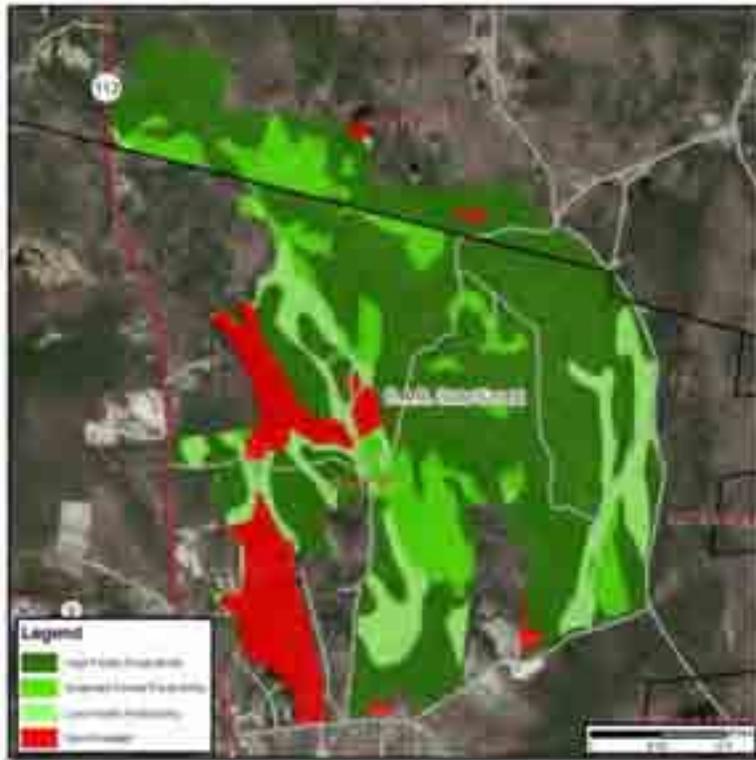
Clayton State Forest
Integrated Silvicultural Regimen



Corway State Forest
 Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113



D.A.R. State Forest
Forest Cover Data



D.A.R. State Forest
100' Hydrology Buffer



U.S.F. State Forest
Special Buffer and Legal Tree Buffers



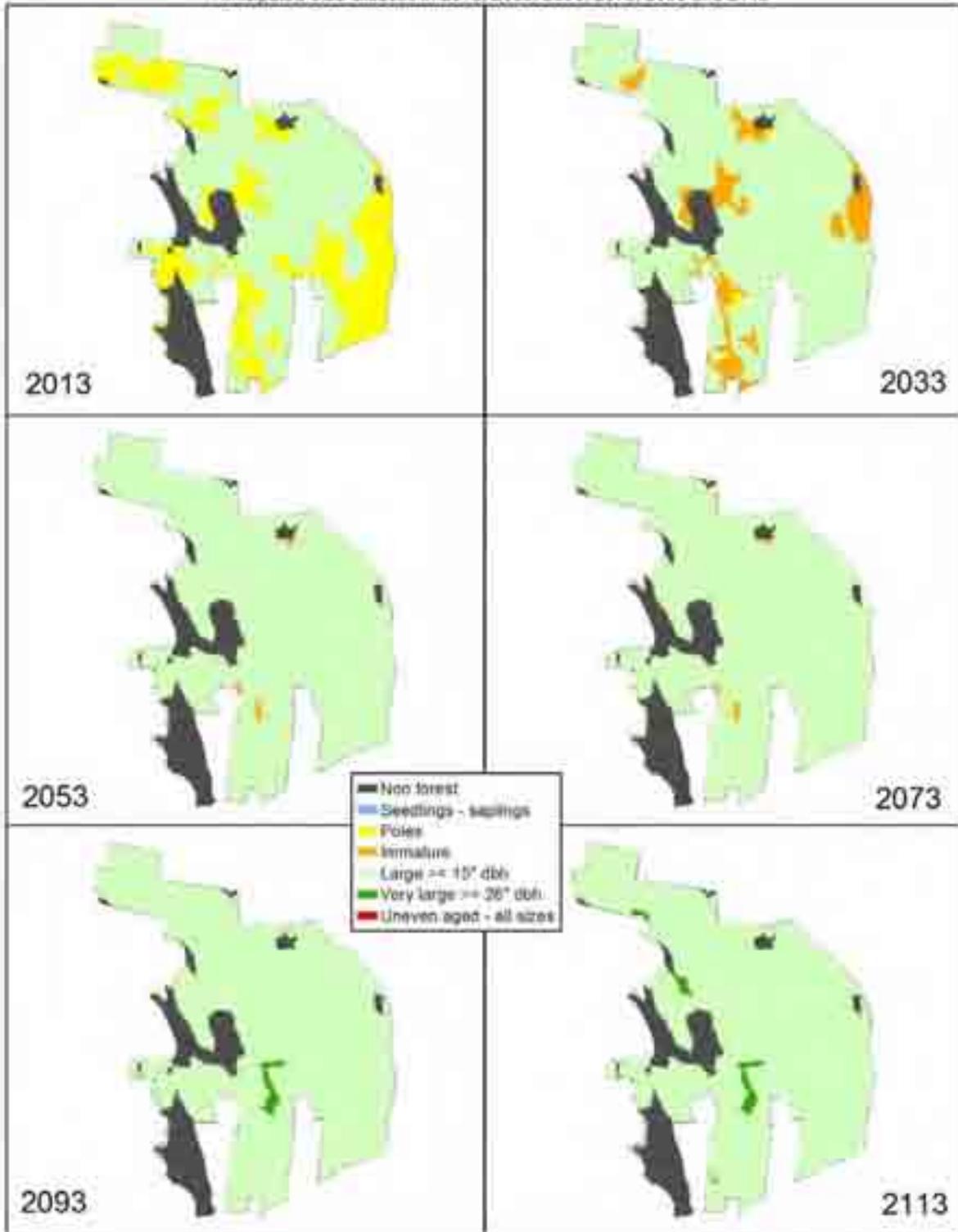
U.S.F. State Forest
Wildlife Habitat and Endangered Species Program Risk Species



U. A. R. State Forest
Integrated Silvicultural Program



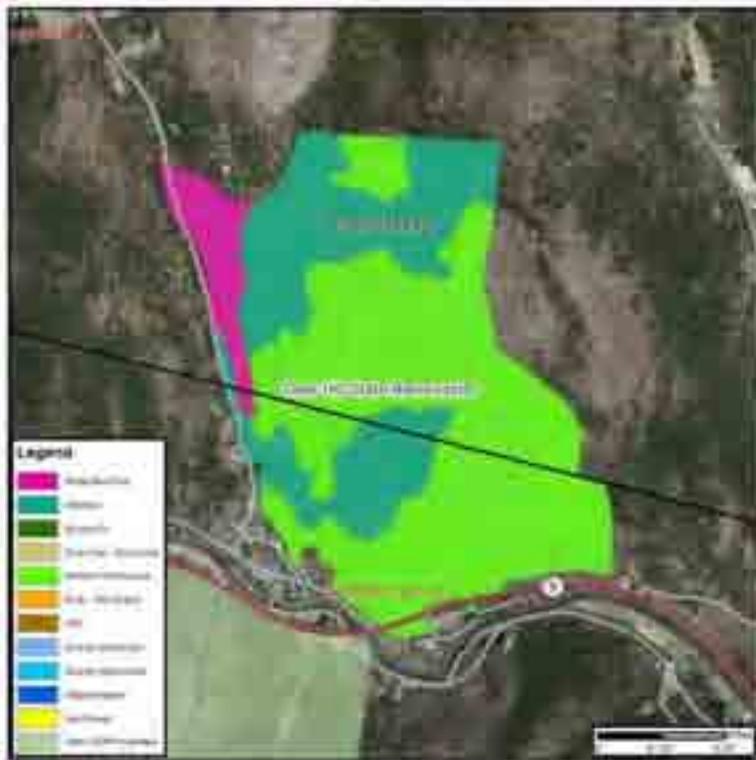
D. A. R. State Forest
 Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113



Over Hill State Reservation
 ODR Landmapge.Zhien



Over Hill State Reservation
 Vegetation



Over 100 State Roadways
From 1980 to 2000



Over 100 State Roadways
100 Footwide Buffers



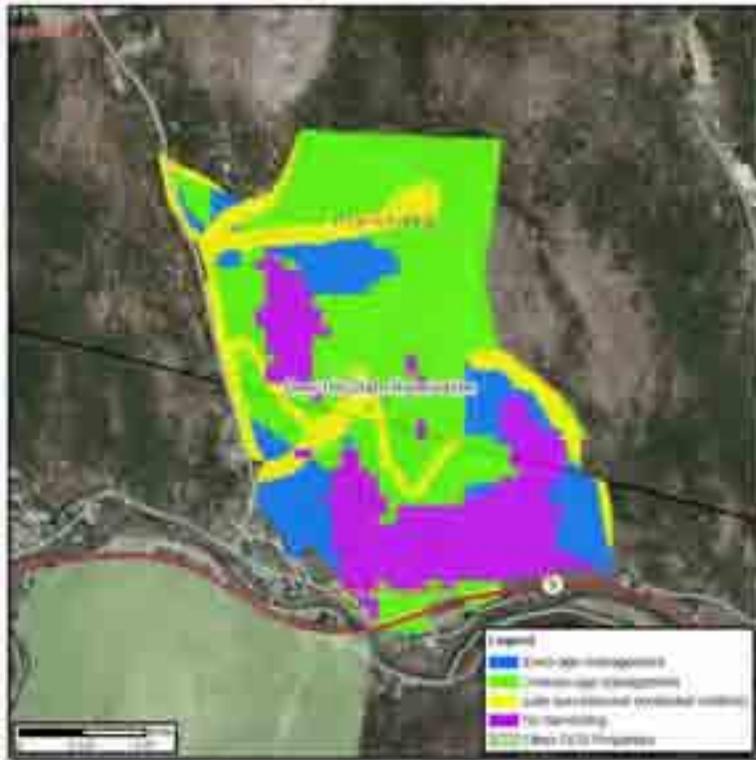
Deep-Hut State Reservation
 1000' Flood and Legal TRM Buffer



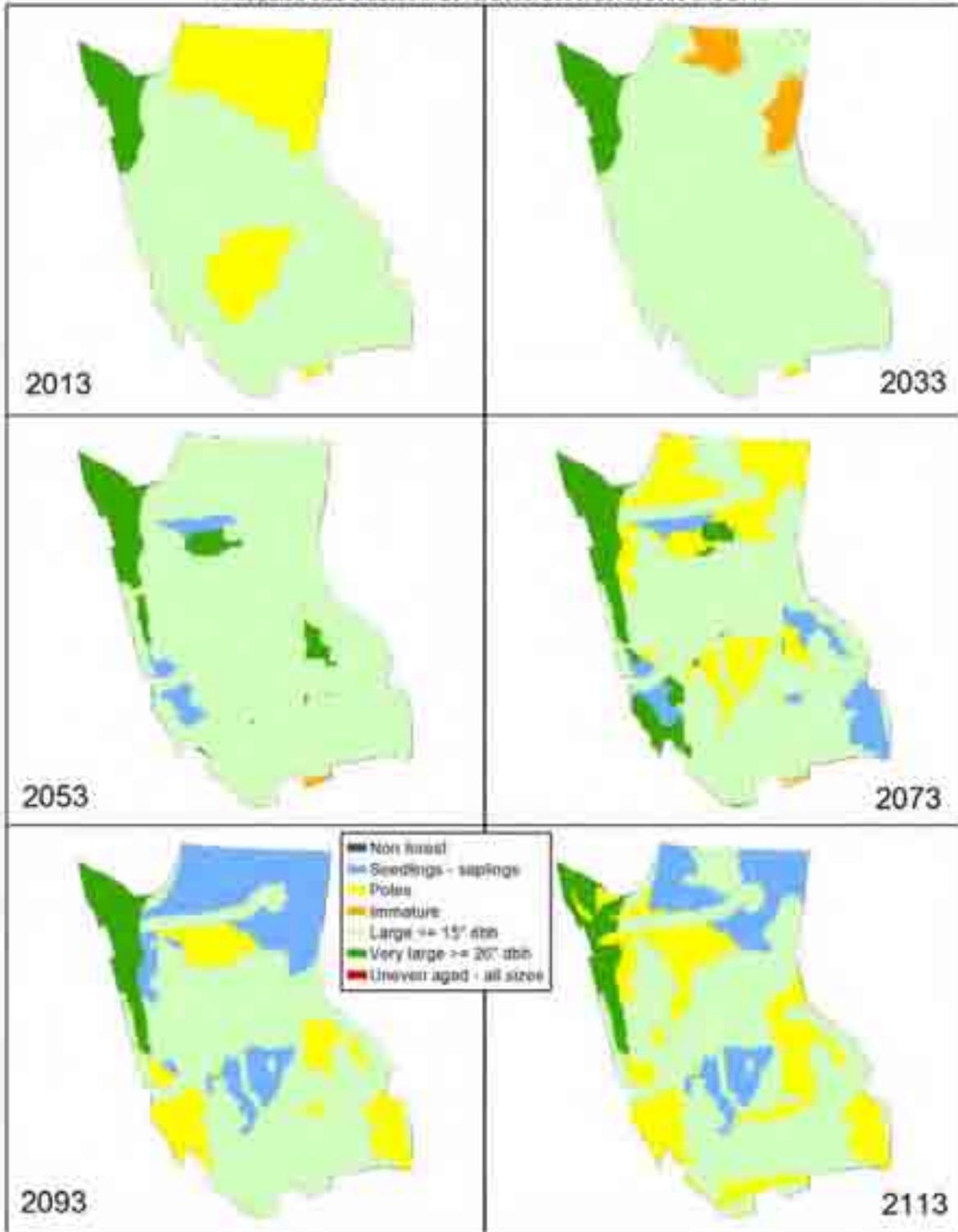
Deep-Hut State Reservation
 100' Natural Heritage and Management Special Program Area Buffer



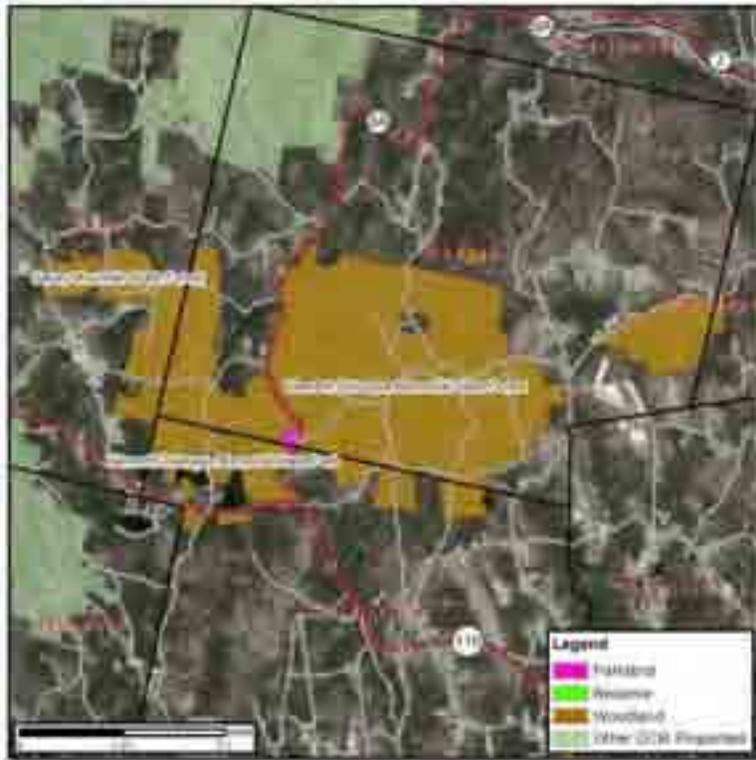
West Hill State Forest
Adaptive Management Program



Deer Hill State Reservation
 Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113



Western Connecticut Valley District Forest Resource Management Plan
 OCR Land Use Zones



Western Connecticut Valley District Forest Resource Management Plan
 Vegetation

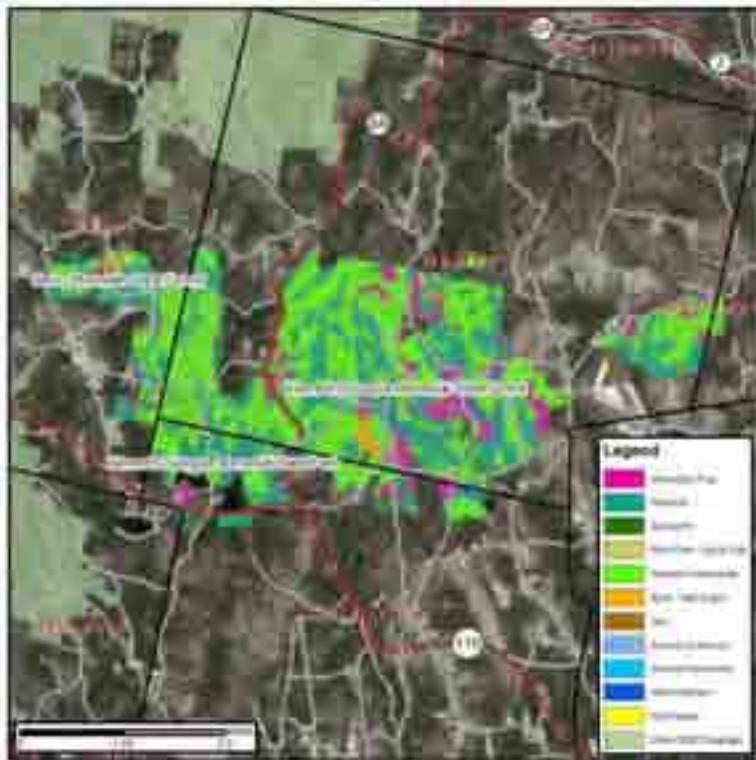


Figure 13: Forest Management Plan for the Western Connecticut Valley District Forest Resource Management Plan

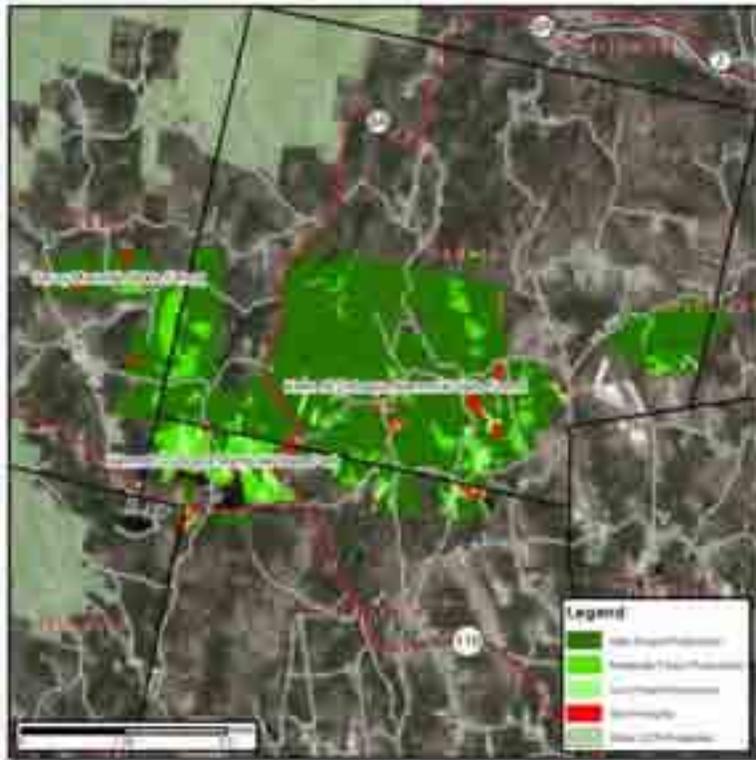
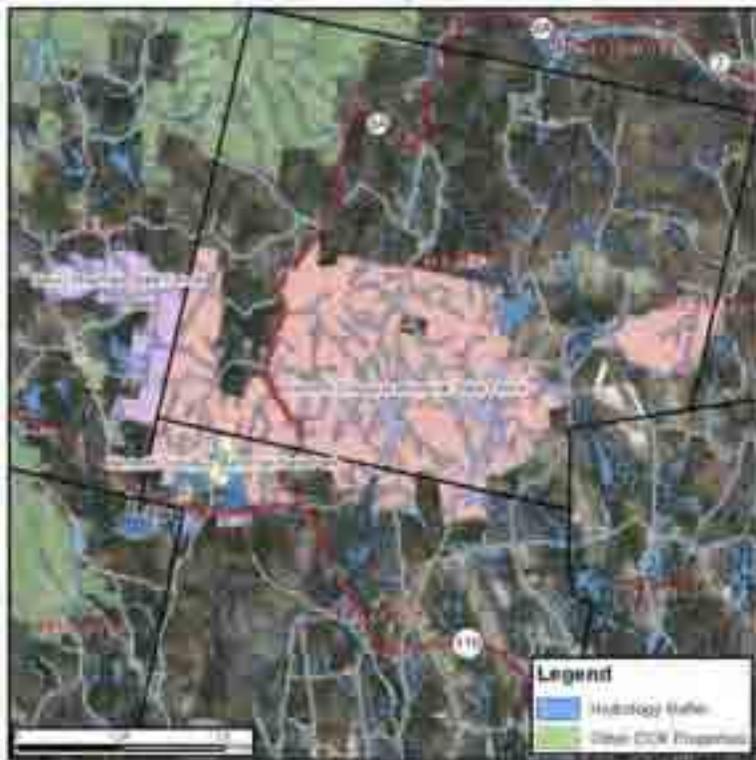


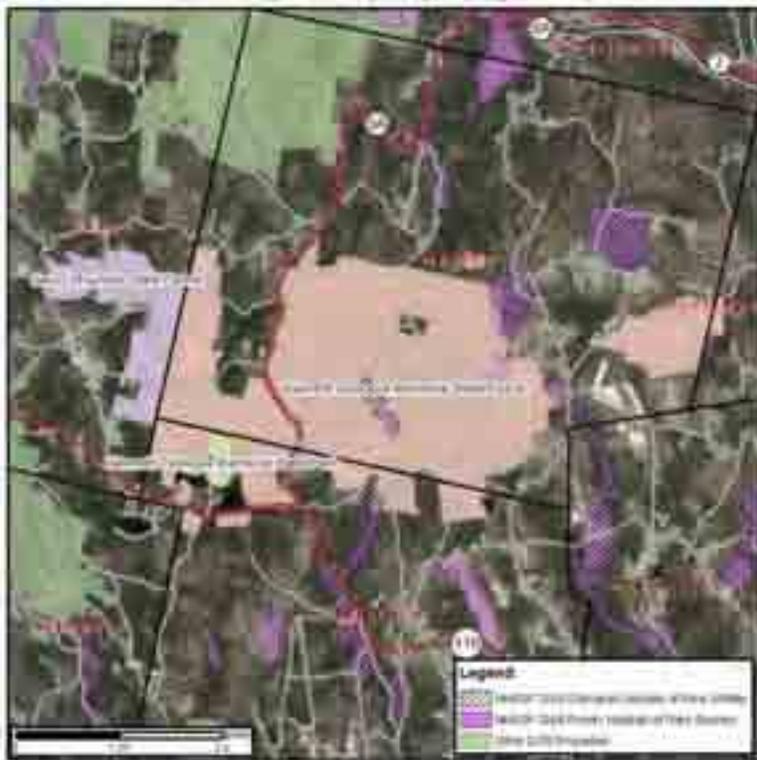
Figure 14: Forest Management Plan for the Western Connecticut Valley District Forest Resource Management Plan



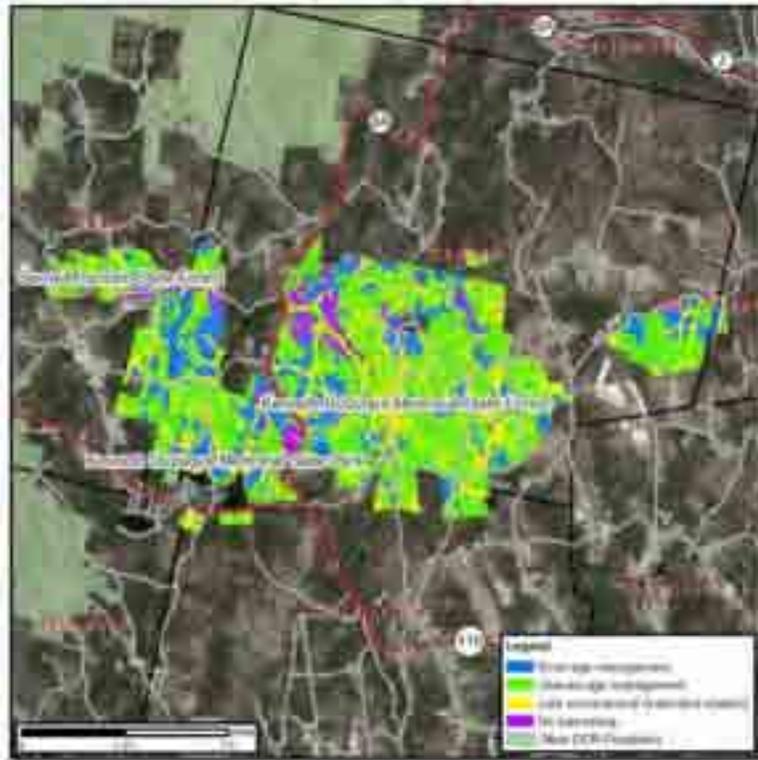
Kennett Coliseum Historical State Forest Park and Devoy Mountain State Forest (WCV Part)
50,000 Foot and Large Tree Buffer



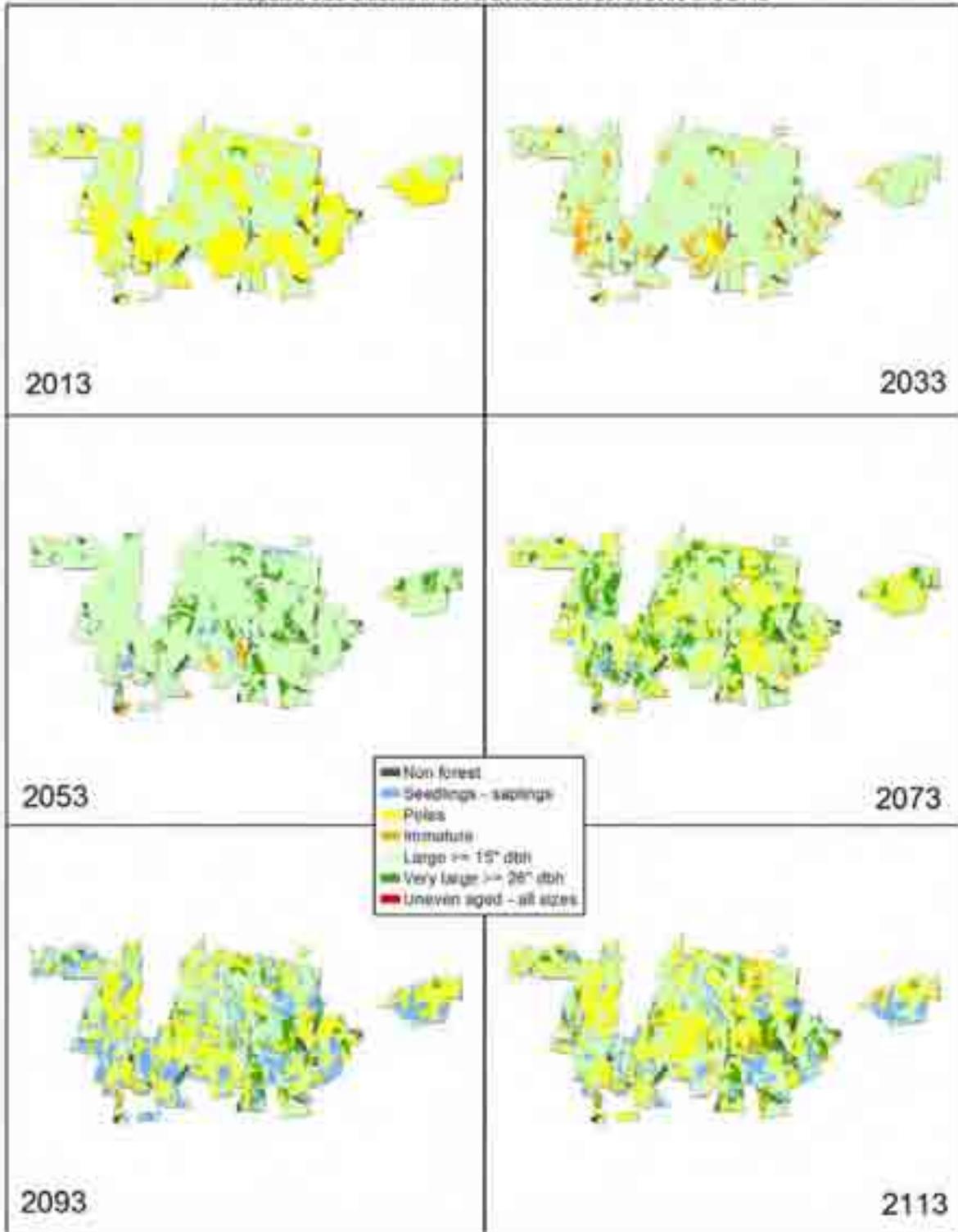
Kennett Coliseum Historical State Forest Park and Devoy Mountain State Forest (WCV Part)
MA Natural Heritage and Endangered Species Program Rare Species



Appendix 2: Strategic Management, State Forests/Park, and State Forests (MDC) Part
Agricultural Substrates Diagram



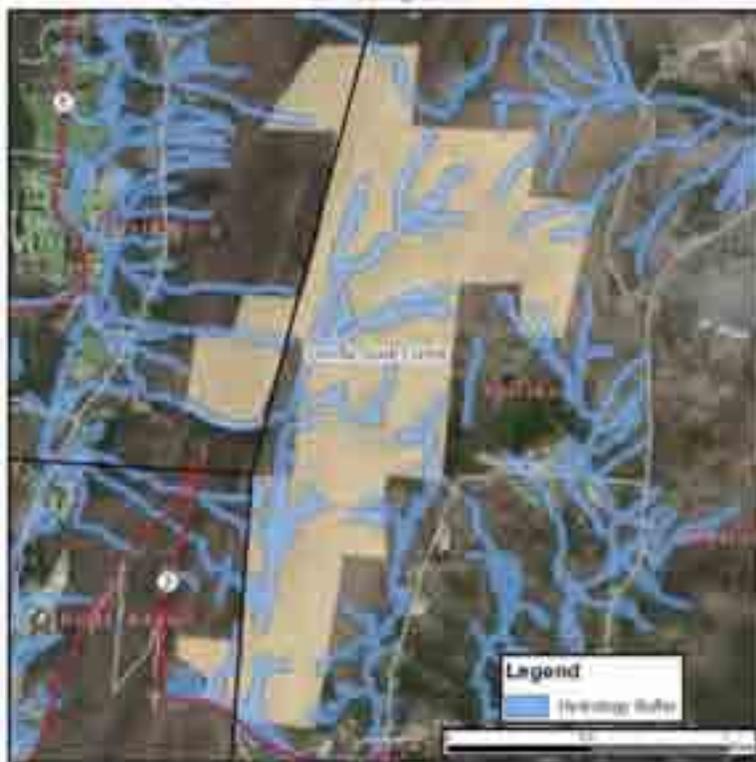
Kenneth Dubuque Memorial State Forest/Park and Savoy Mountain State Forest (WCV Part)
 Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113



Konka State Forest WCV Part
Prime Forest Data



Konka State Forest WCV Part
500 Hydrology Buffers



Florida State Forest (WCV Part)
100' Buffer and Legal Trail Buffers



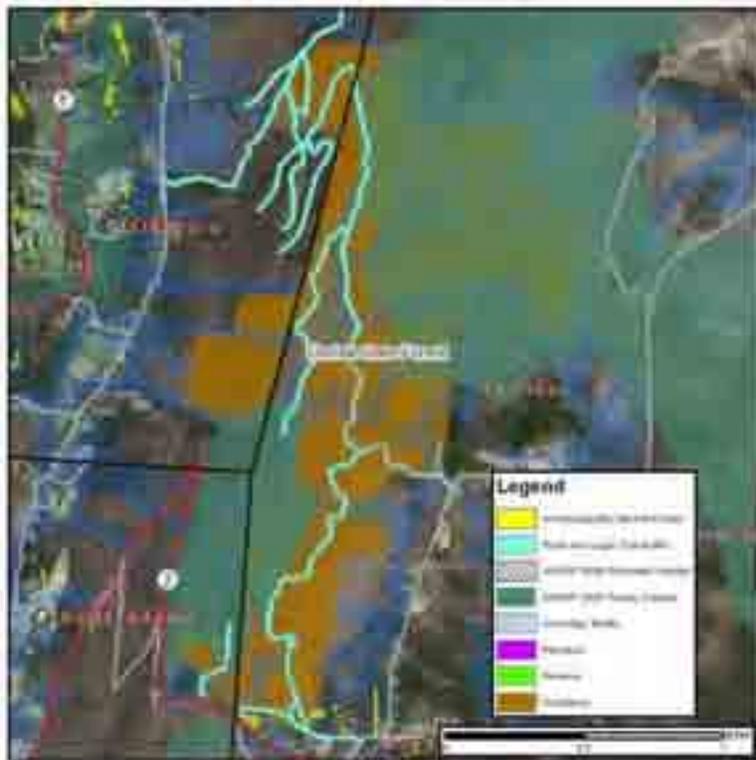
Florida State Forest (WCV Part)
M4 Habitat Ratings and Emerging Species Program Risk Areas



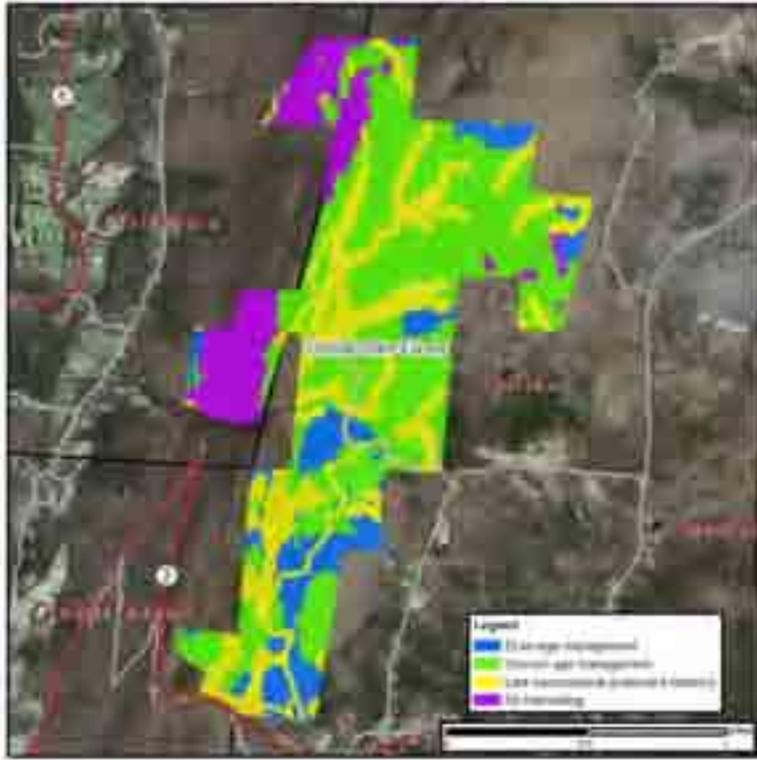
Florida State Forest (RVCV Part)
Archaeologically Sensitive Areas



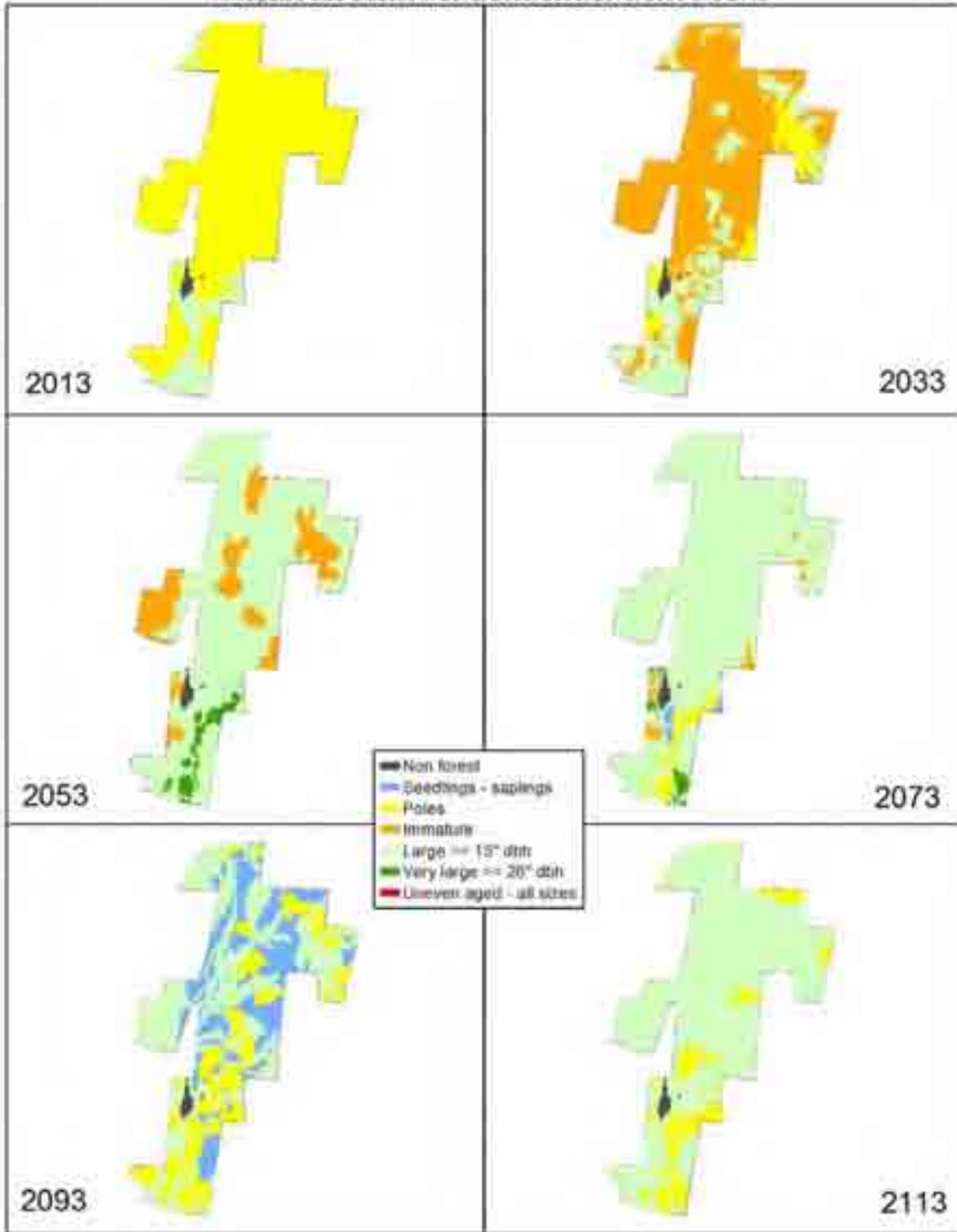
Florida State Forest (RVCV Part)
Landscape Zones With Resource Overlay



Western Connecticut Valley District Forest Resource Management Plan
Antikvaliteti bioloģiskā Reģions



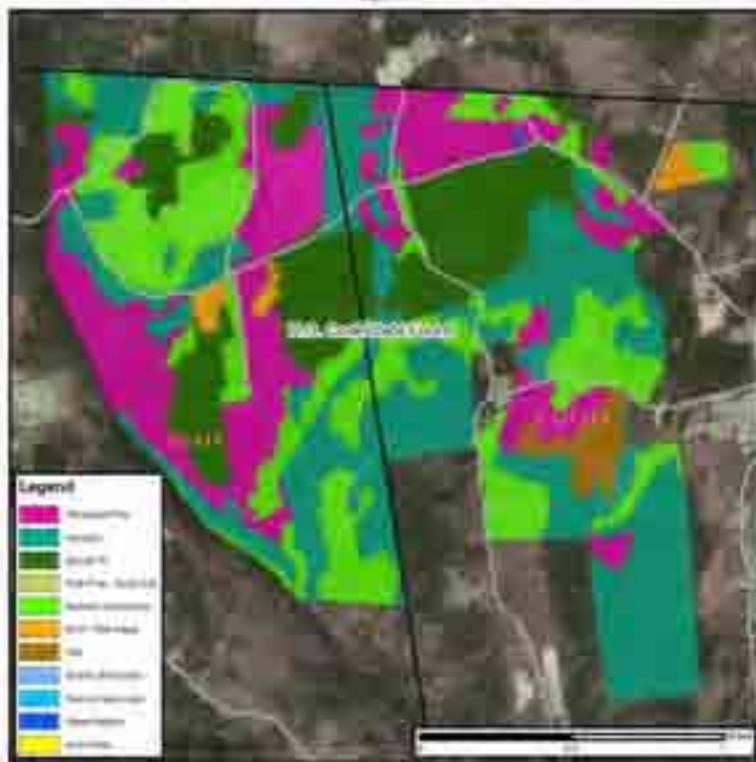
Florida State Forest (WCV Part)
 Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113



44. U. Cook State Forest
OCR Landscape Zones



44. U. Cook State Forest
Vegetation



R. O. Cook State Forest
Prime Forest Area



R. O. Cook State Forest
500 Hydrology Buffer



A. D. Cook State Forest
Wildlife Road and Legal Tree Buffers



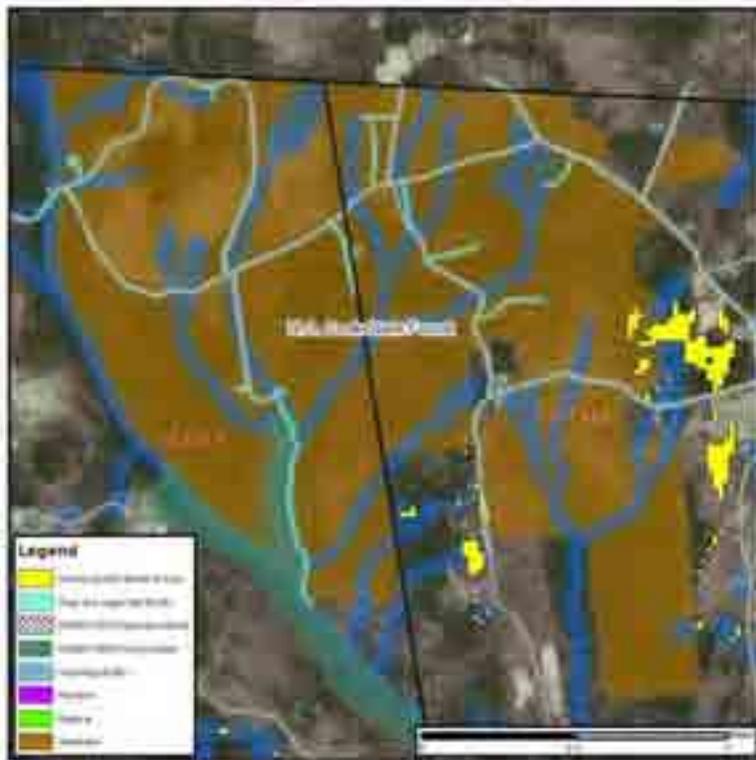
H. G. Cook State Forest
MA Natural Heritage and Endangered Species Program Flow System



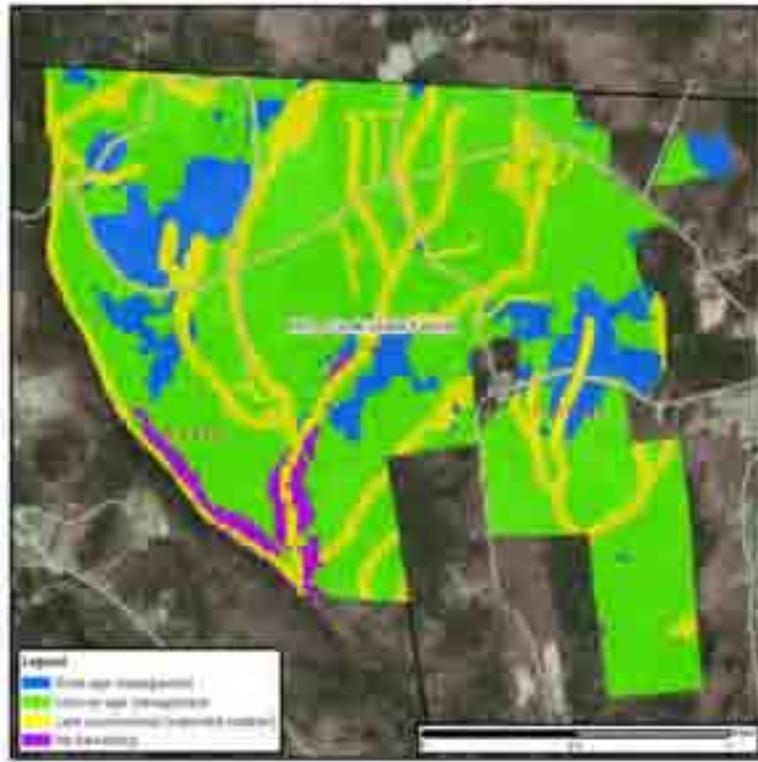
H. D. Cook State Forest
Archaeological Sensitive Areas



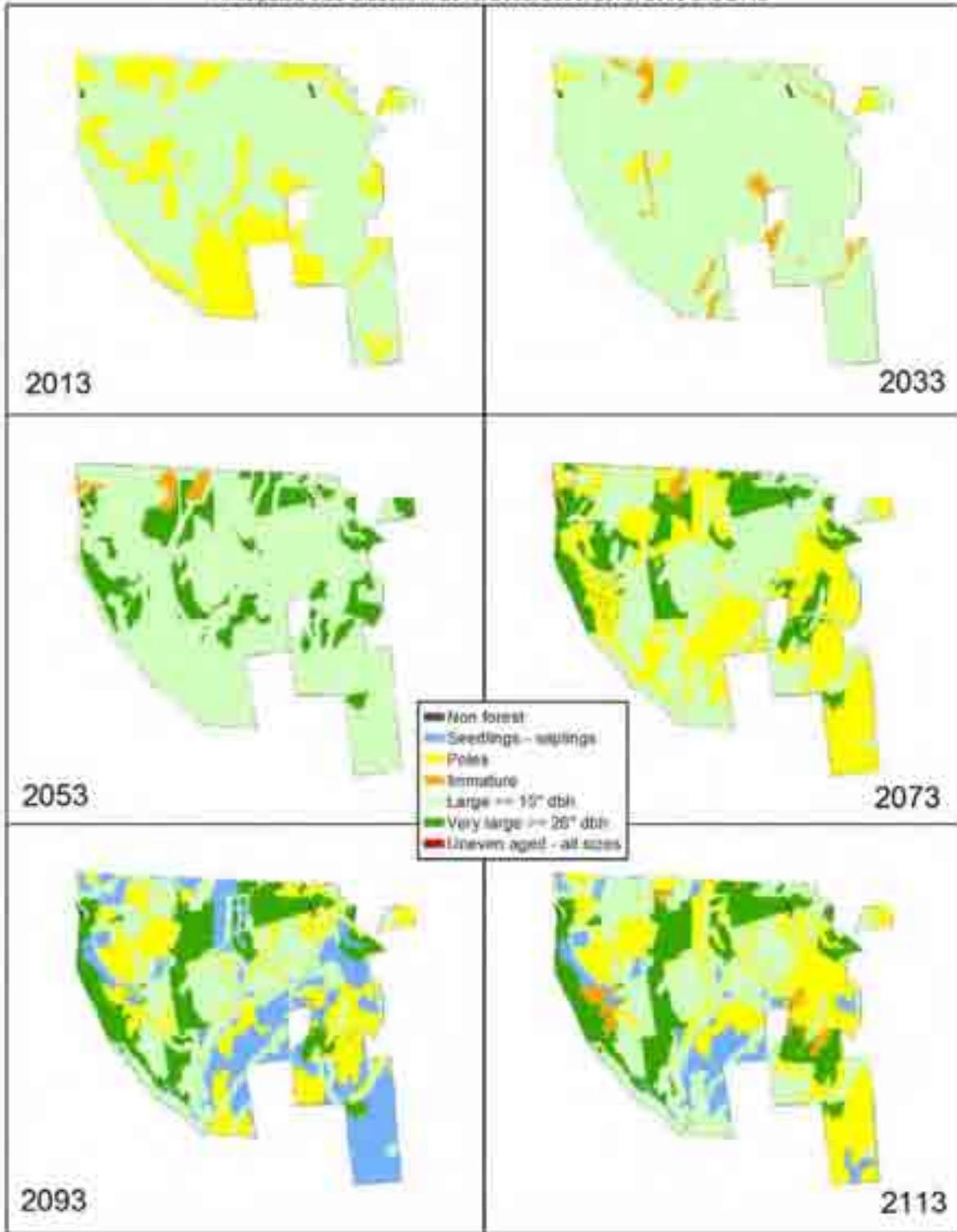
H. D. Cook State Forest
Landscape Zones With Resource Corridors



H. O. Cook State Forest
Antiquated Structural Regener



H. O. Cook State Forest
 Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113



Leitch State Forest
DCH Landtags Zones



Leitch State Forest
Vegetation



Layden State Forest
300m Buffer



Layden State Forest
300 Hydrology Buffer



Levitt State Forest
Wilderness Trail and Legal Trail Buffer



Levitt State Forest
MA Natural Heritage and Endangered Species Program Rare Species



Layer 2: State Forest
Administratively Defined Area



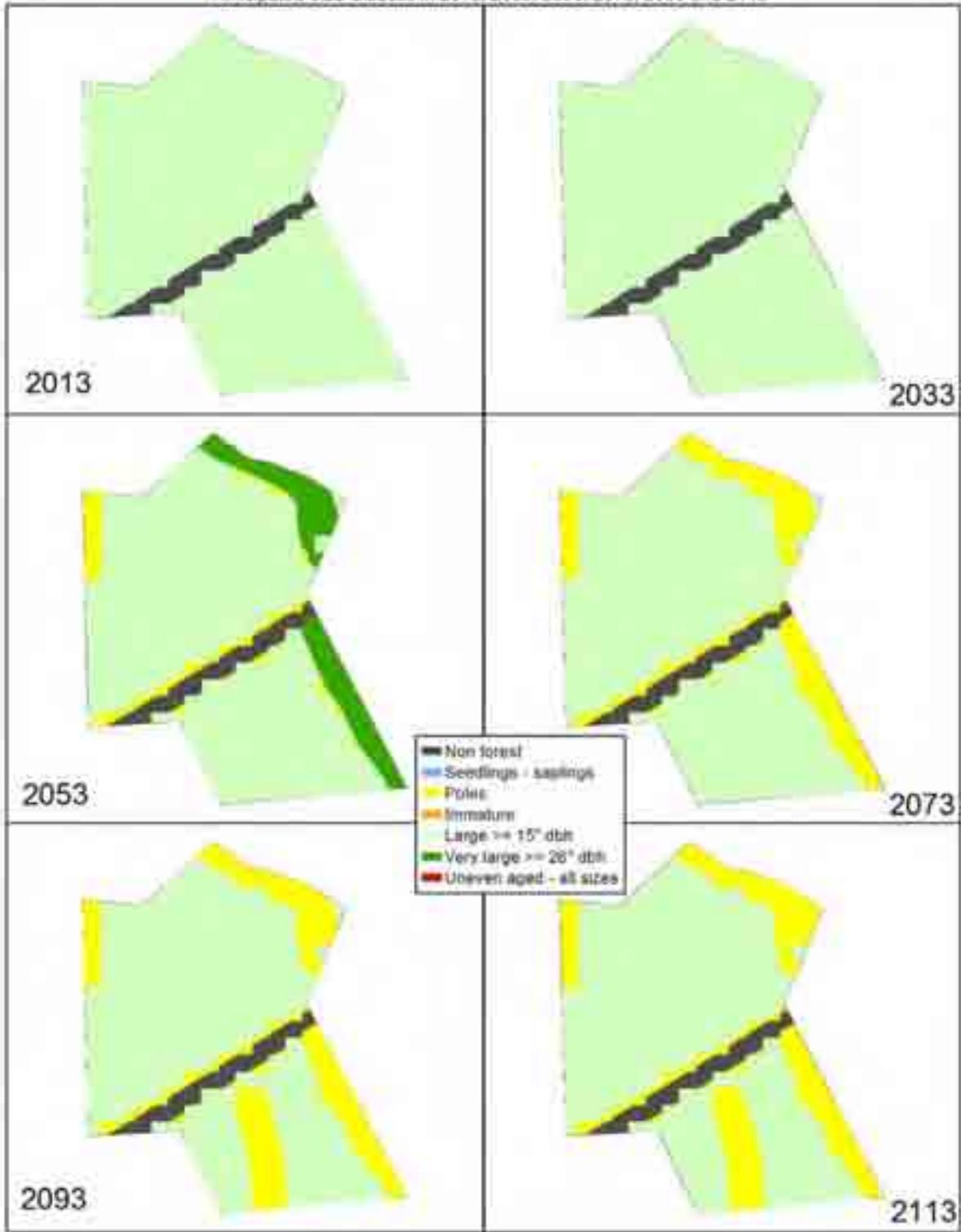
Layer 3: State Forest
Landmark Zones With Resource Conflicts



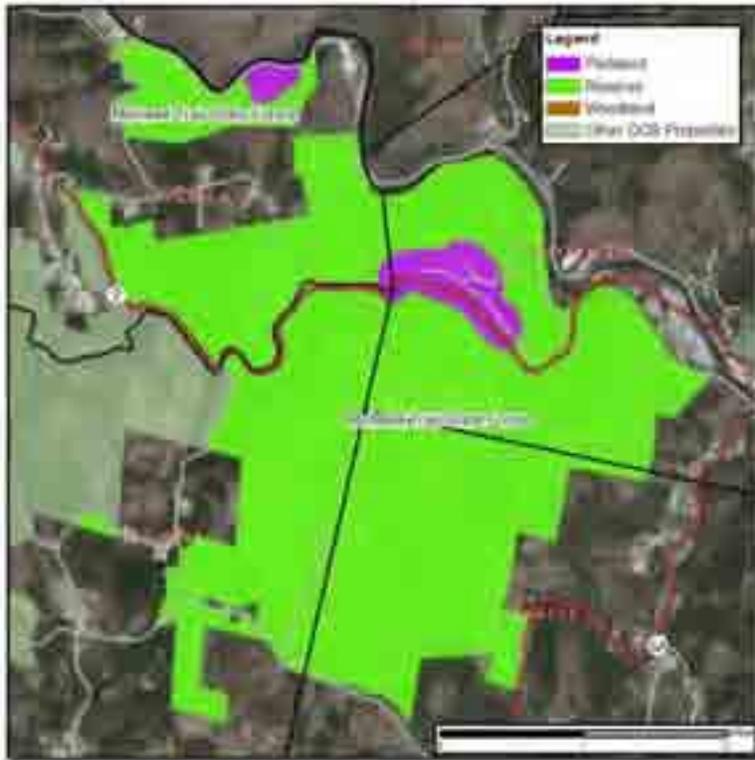
Western Valley District Forest Resource Management Plan
Integrated Silvicultural Program



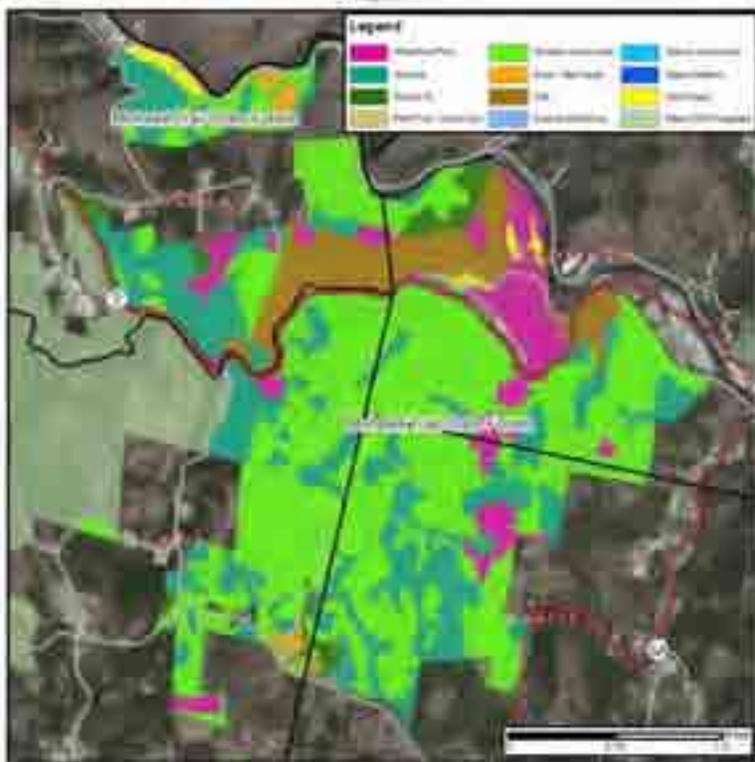
Leyden State Forest
 Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113



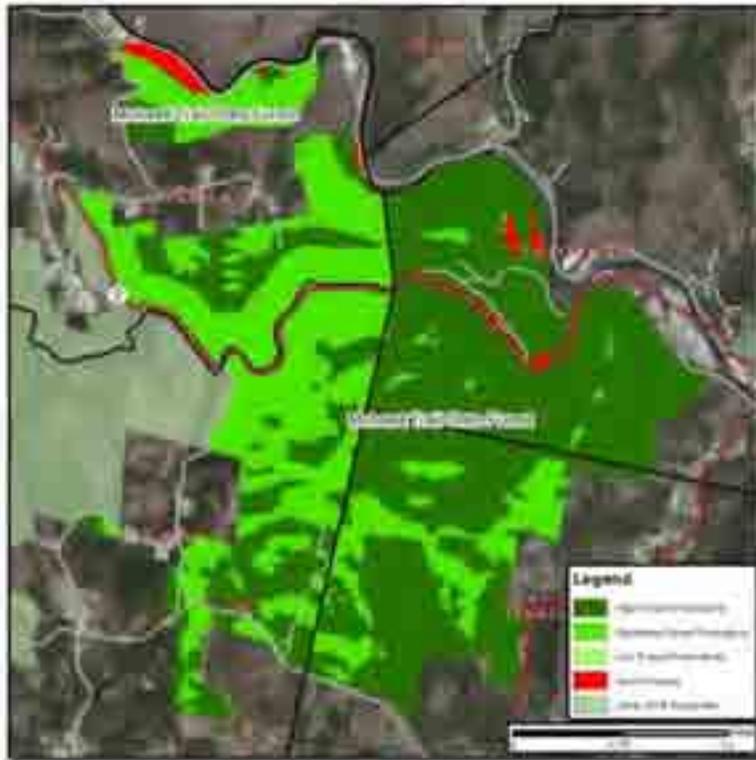
Maravé Trail State Forest (MCF Part)
DCR Landscape Zones



Maravé Trail State Forest (MCF Part)
Vegetation



Attitash Trail State Forest 200' Buffer
From Forest Edge



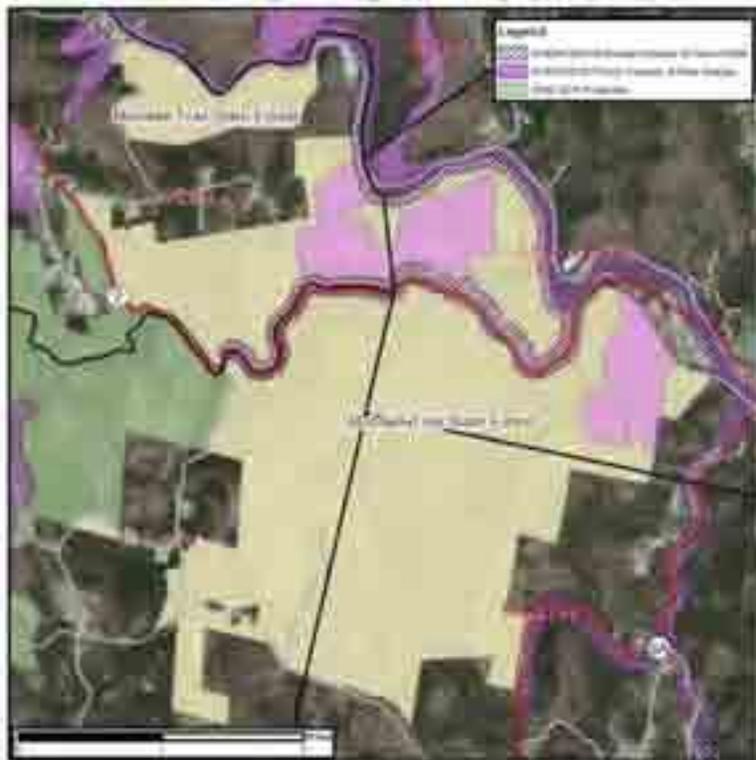
Attitash Trail State Forest 200' Wetlands Buffer



Arrowak Trail State Forest (WCY Part)
30' Road and Large Tree Buffers



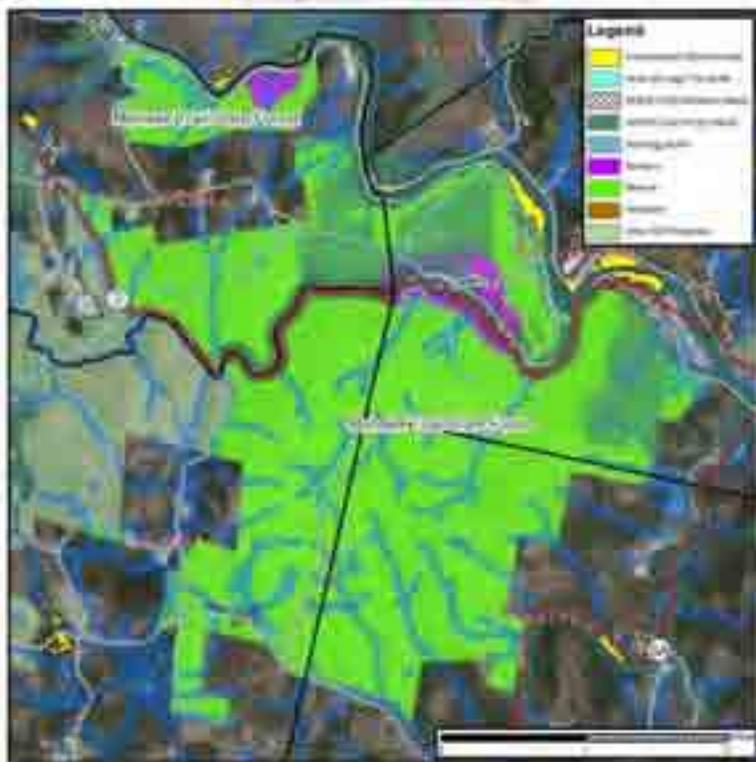
Arrowak Trail State Forest (WCY Part)
MA Natural Heritage and Endangered Species Program Risk Zones



MAKAWI TAD SOWI FOREST (WCV Part)
Archaeological Sensitive Areas



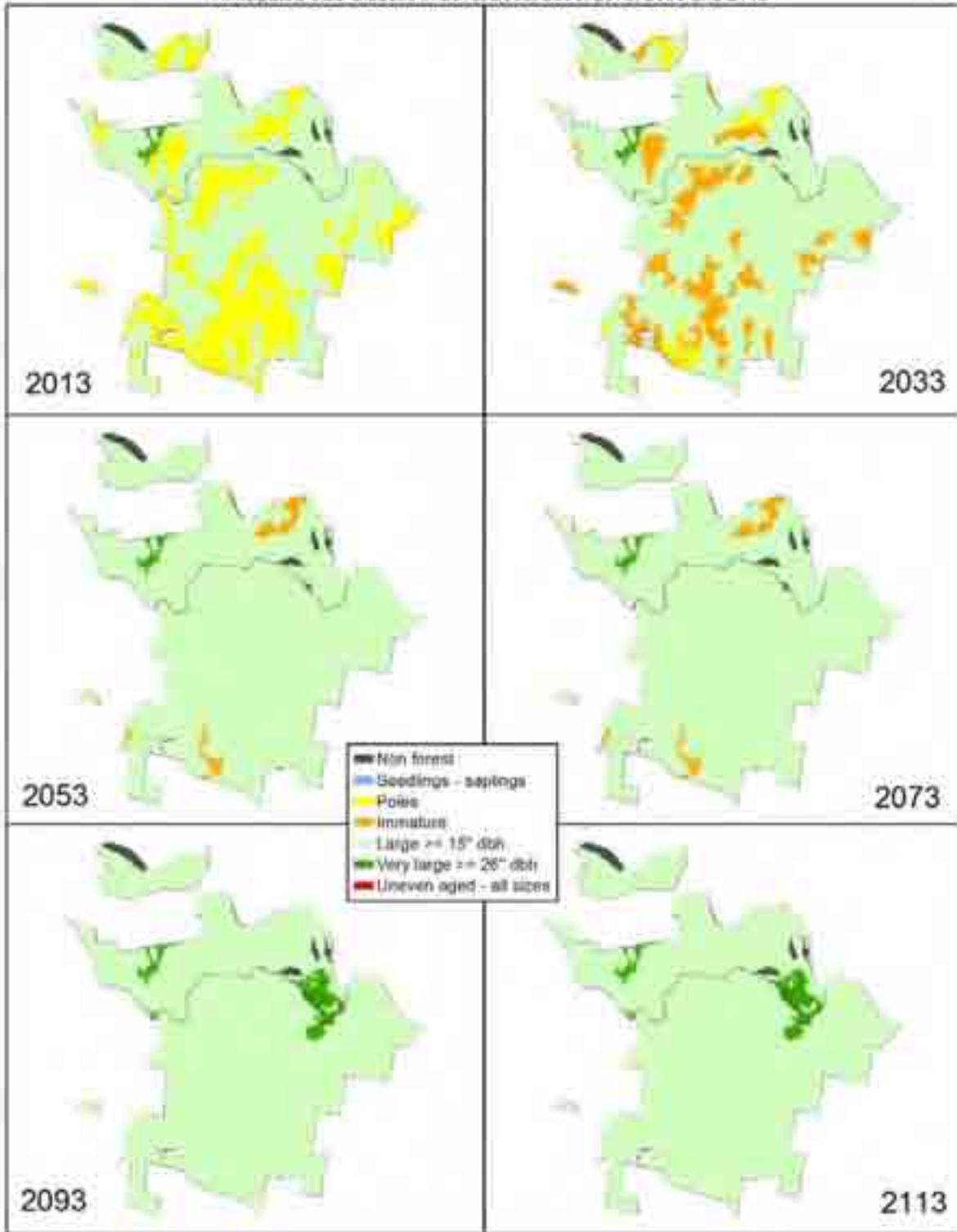
MAKAWI TAD SOWI FOREST (WCV Part)
Landscape Zones With Resource Characteristics



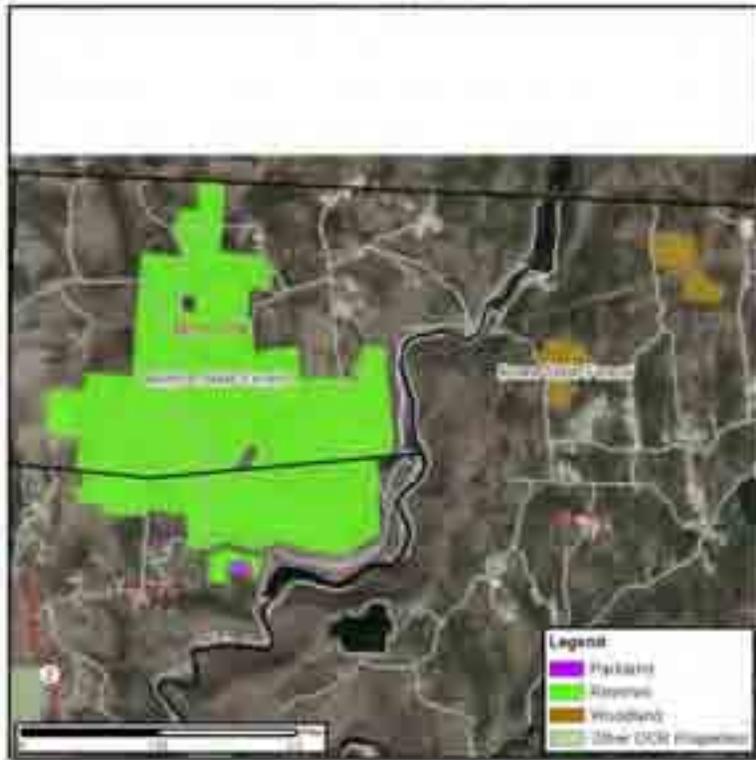
Mt. Ashby Trail State Forest (MTC) Part
Antiquated Structural Features



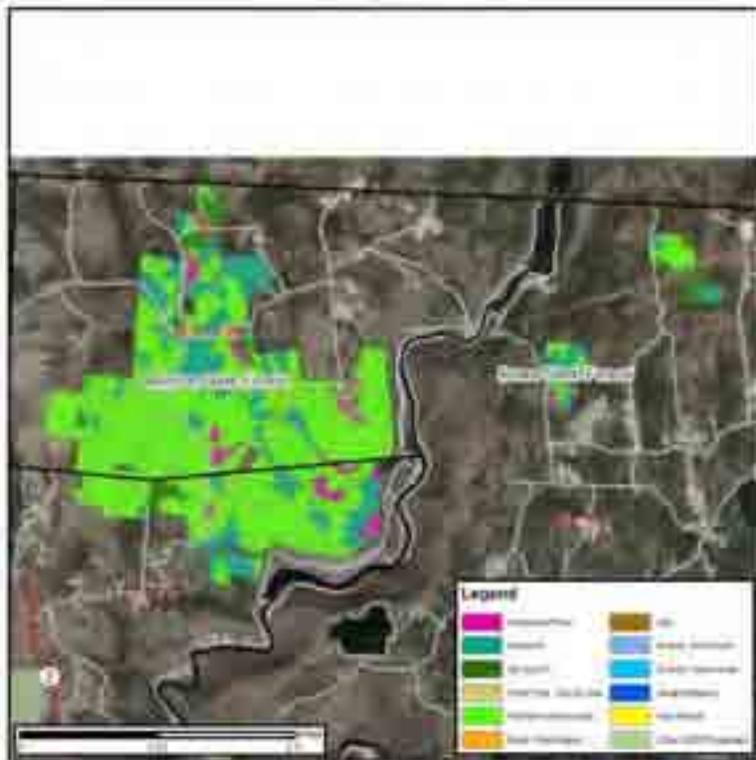
Mohawk Trail State Forest (WCV Part)
 Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113



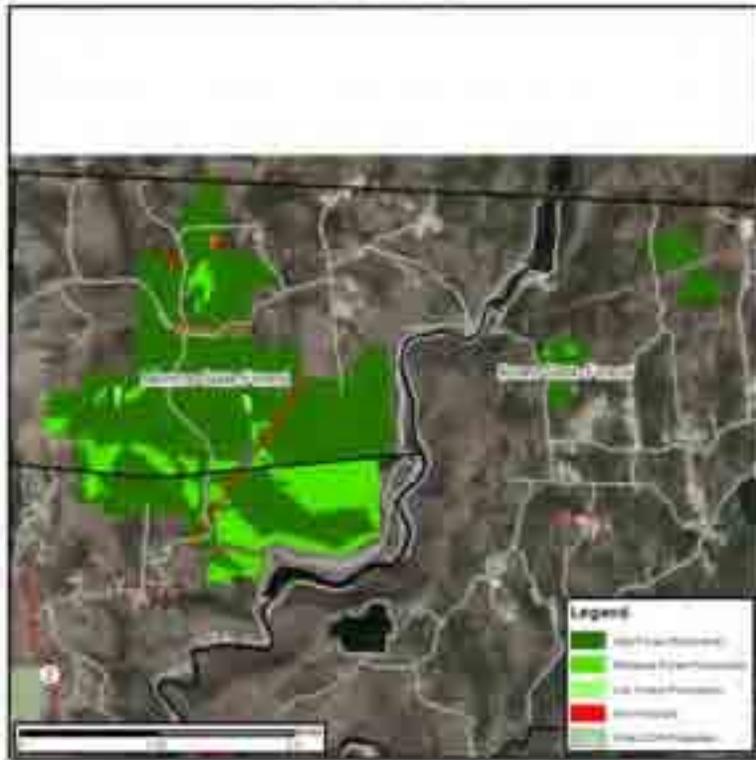
Monroe and River South Forests
DCSR Landscape Zones



Monroe and River South Forests
Vegetation



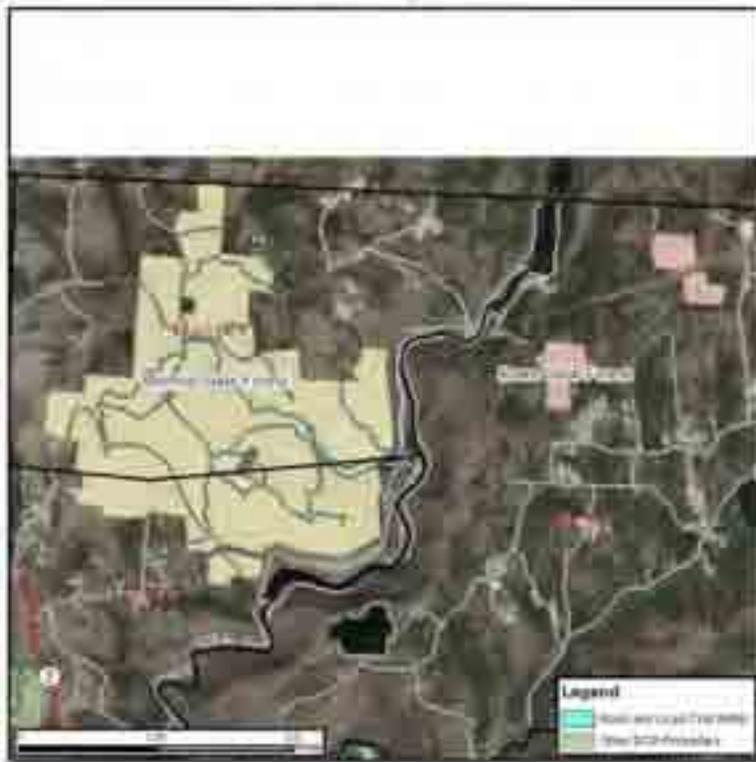
Albion and Rowe State Forests
Prime Forest Sites



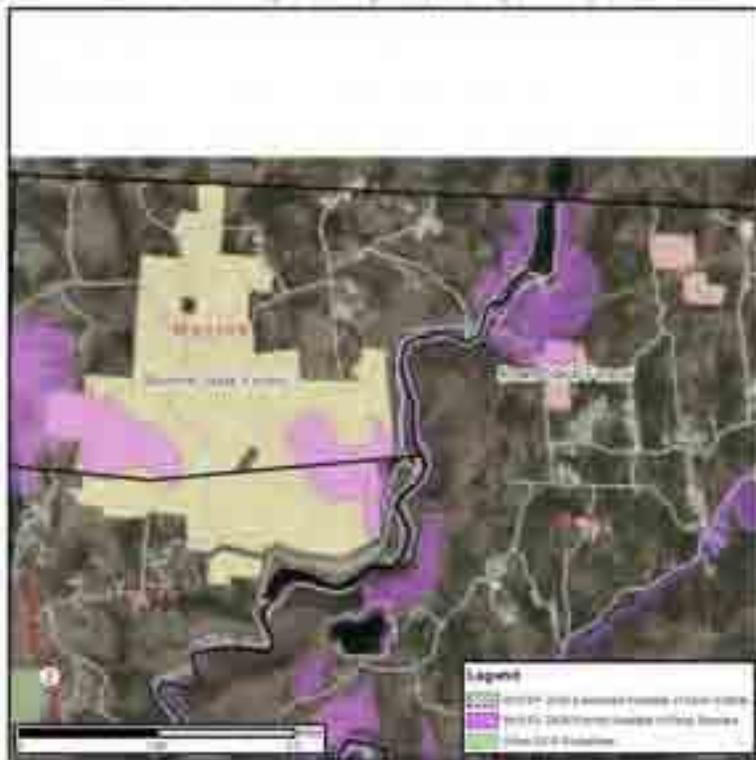
Albion and Rowe State Forests
100' Hydrology Buffers



Maple and White Birch Forests
 10000' Road and Large Tree Buffers



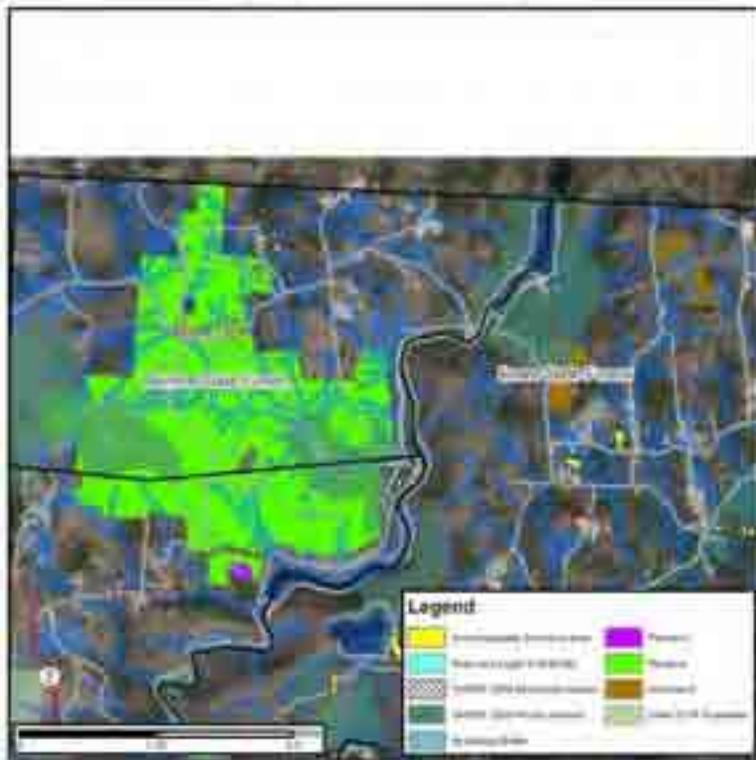
Maple and Red White Forests
 MA Natural Heritage and Endangered Species Program Risk Zones



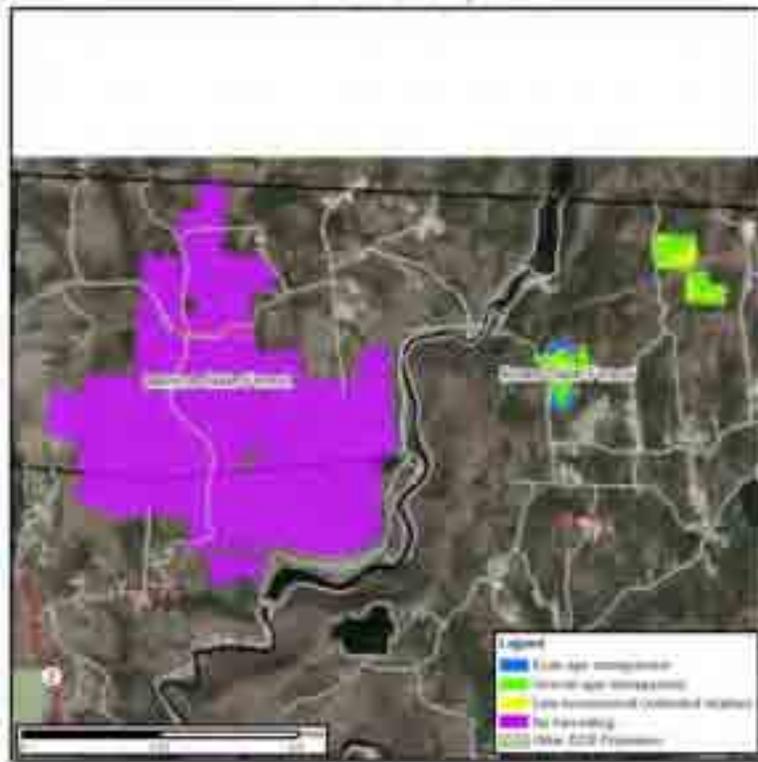
Blount and River State Forests
Archaeological Sensitive Areas



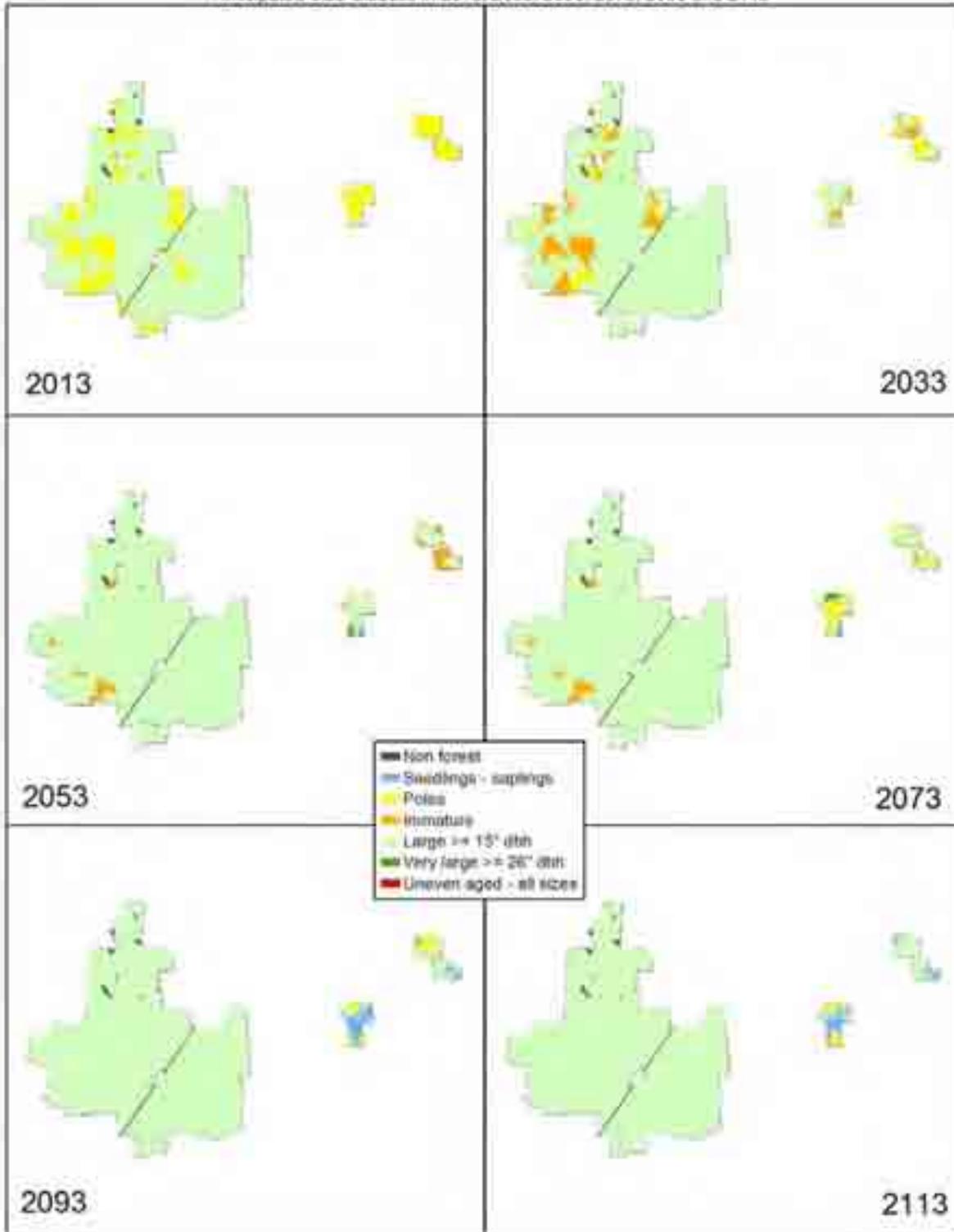
Blount and River State Forests
Landscape Zones With Resource Density



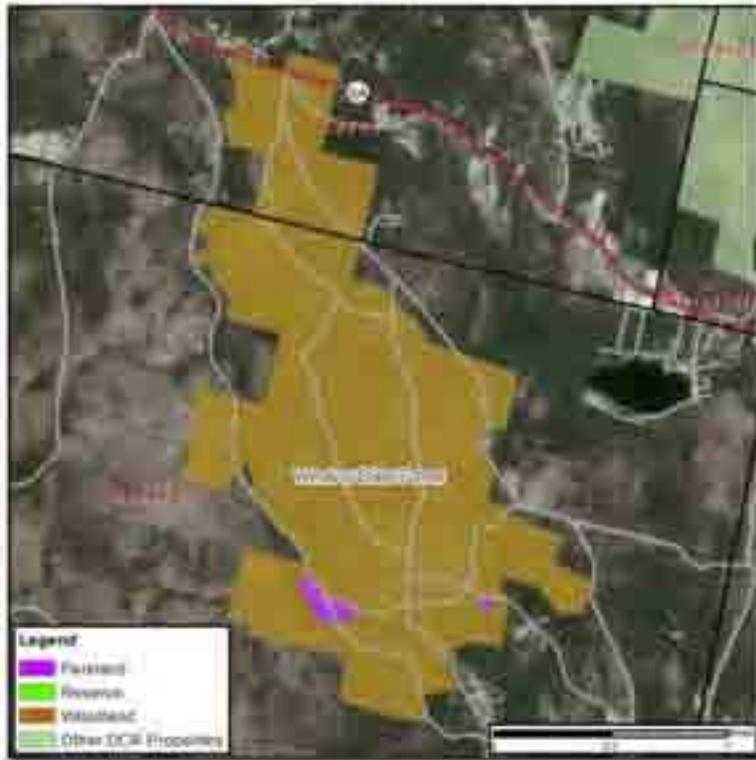
Mount and West Side Forests
Antiquarian Historical Region



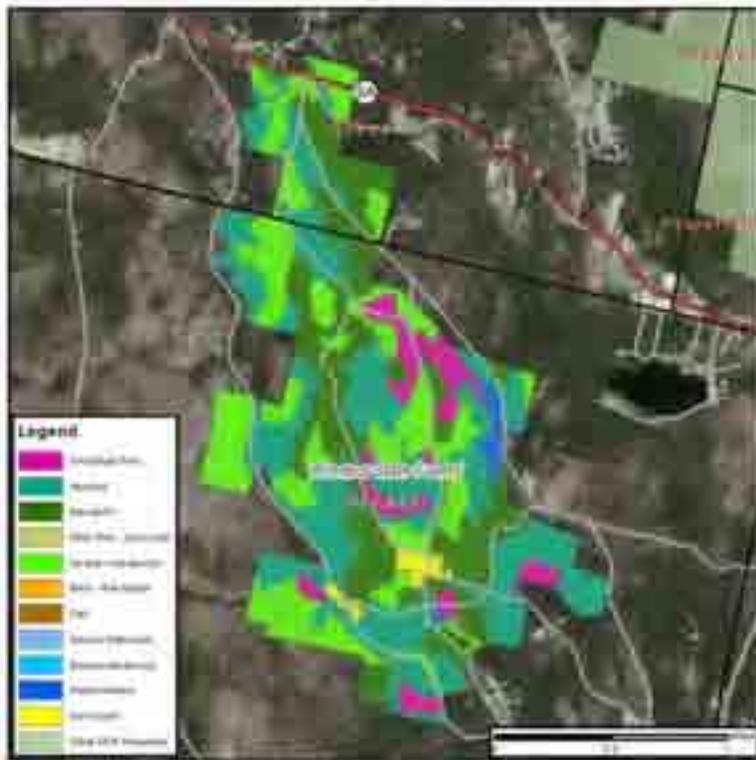
Monroe and Rowe State Forests
 Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113



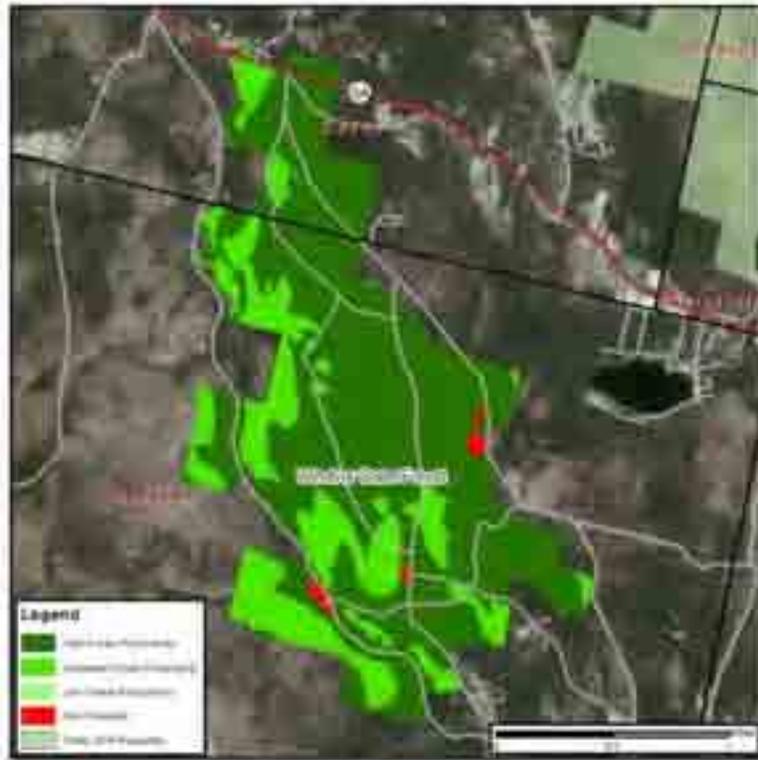
Western State Forest (WCSF Parc)
DCR Landscape Zones



Western State Forest (WCSF Parc)
Vegetation



Western State Forest (WCV Part)
Forest Classifications



Western State Forest (WCV Part)
100' Heritage Buffers



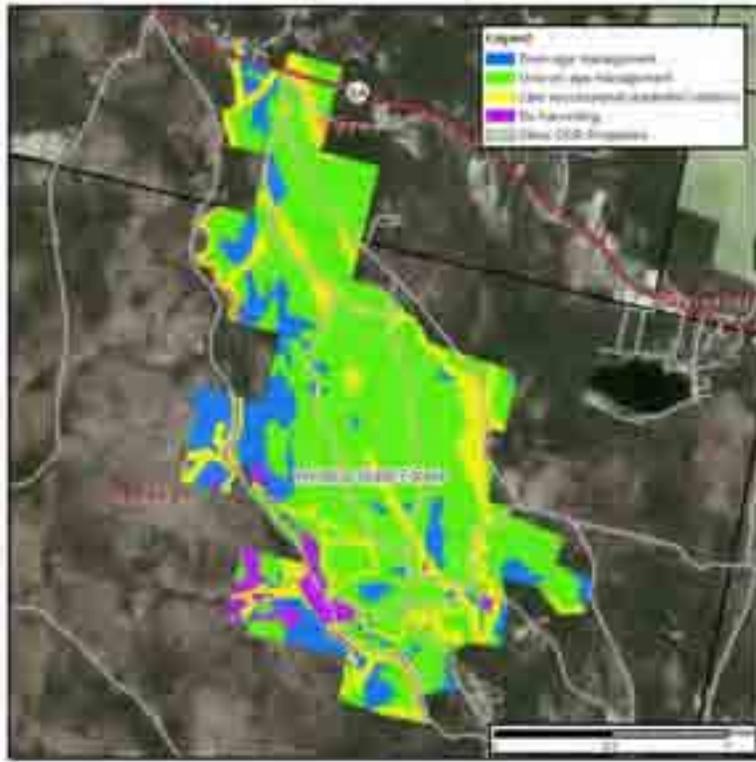
Western State Forest (WCV Part)
30000' Road and Legal Trail Buffers



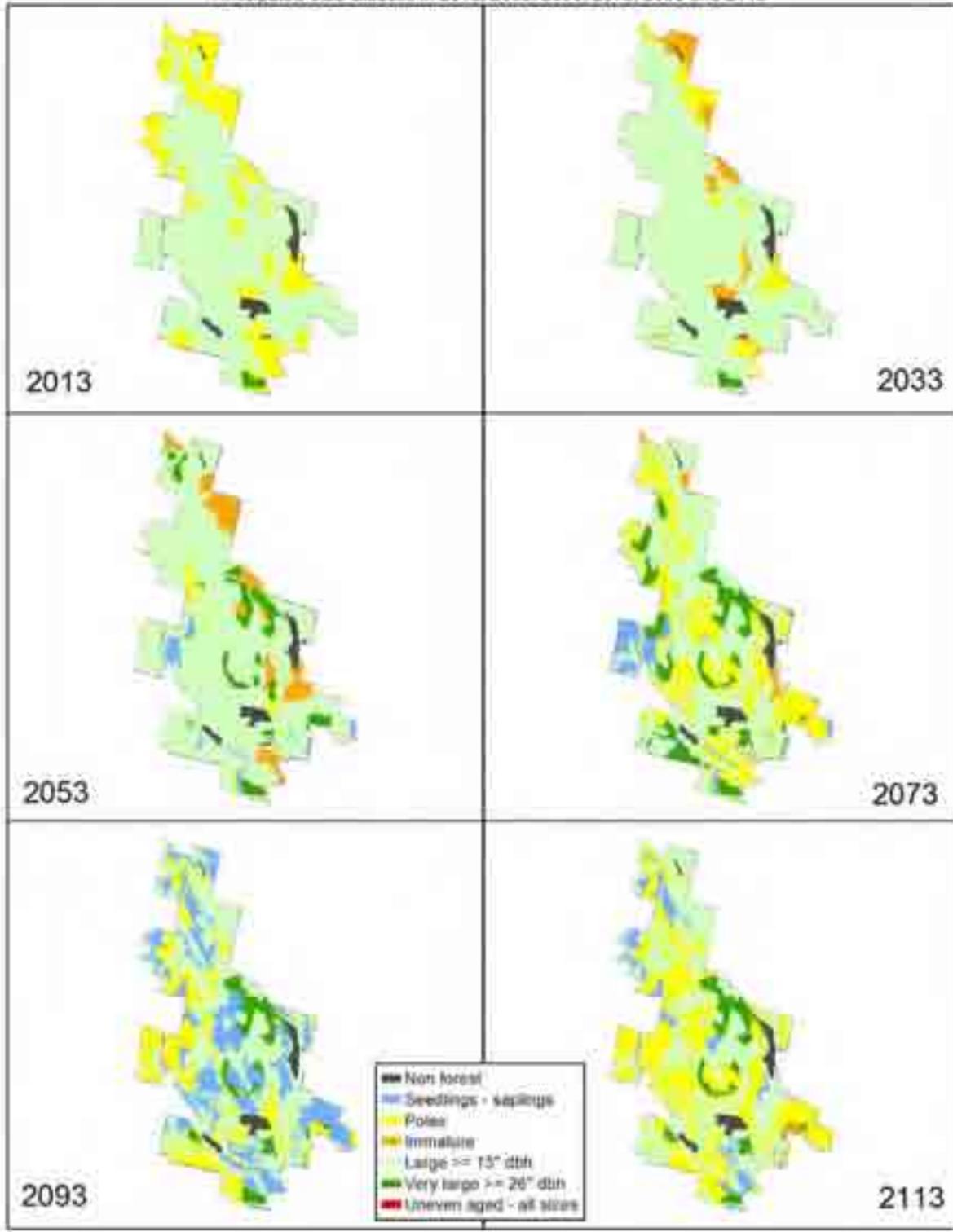
Western State Forest (WCV Part)
MA Invasive Species and Emergent Species Program Risk Zones



Western State Forest
Antiquated Structural Systems



Windsor State Forest (WCV Part)
 Anticipated Size Classes in 2013, 2033, 2053, 2073, 2093 and 2113



Appendix C – Examples of Western Connecticut Valley District Continuous Forest Inventory Data

Table 13a Total Volume Summary over all Types - Thousands of Board Feet
Forest West Franklin 2000 28646.0 Acres. Based on 180. Samples

Species or Species Group	Grade 1	Grade 2	Grade 3	Grade 4	Gro Stk	Rgh Cull	Rot Cull	Total	%
White pine	2882.873	4820.200	12731.531	15339.213				35773.820	11.36
Hemlock				58074.656				58074.656	18.45
Spruce/Fir				26101.477				26101.477	8.29
Pitch pine									
Red pine				1323.921				1323.921	0.42
Other Softwood									
Sugar maple	1939.229	10152.354	15483.250	11356.734				38931.566	12.37
Red maple	467.907	2689.700	14095.758	17432.318				34685.688	11.02
N.Red oak	6031.427	10541.091	13127.825	1016.435				30716.779	9.76
Black oak	336.449	192.824	1512.143	317.365				2358.781	0.75
White oaks			795.111	173.383				968.494	0.31
Yellow birch	541.714	2572.278	7011.791	6527.023				16652.807	5.29
Black birch	705.739	2702.698	5385.937	3491.983				12286.355	3.90
White birch		1092.942	3948.503	1460.098				6501.543	2.06
Beech		124.051	4807.553	12452.286				17383.887	5.52
White ash	5149.284	8073.170	5629.762	5186.605				24038.816	7.63
Poplar/aspens			221.696	167.225				388.921	0.12
Black cherry	909.107	2598.397	2650.475	1746.010				7903.989	2.51
Other hardwoods		216.965	304.277	238.706				759.948	0.24
Totals	18963.729	45776.672	87705.617	162405.438	0.000	0.000	0.000	314851.438	
Percent	6.0	14.5	27.9	51.6	0.0	0.0	0.0		

Table 13b Total Volume Summary over all Types - Hundreds of Cubic Feet
Forest West Franklin 2000 28646.0 Acres. Based on 180. Samples

Species or Species Group	Grade 1	Grade 2	Grade 3	Grade 4	Gro Stk	Rgh Cull	Rot Cull	Total	%
White pine	3066.80	6481.72	17338.44	23583.54	2325.12	1483.11	727.66	55006.38	6.39
Hemlock				102239.73	41845.68	133.56	1768.84	145987.78	16.96
Spruce/Fir				52466.43	18635.22		298.84	71400.48	8.29
Pitch pine									
Red pine				2060.85	44.40			2105.25	0.24
Other Softwood									
Sugar maple	3178.97	17193.63	32256.89	23039.21	23052.90	2692.74	12242.83	113657.16	13.20
Red maple	813.77	5104.15	28510.75	39315.40	34750.88	4890.54	13978.68	127364.14	14.79
N.Red oak	7442.99	15535.80	21531.72	1998.73	3830.05		223.31	50562.59	5.87
Black oak	730.13	301.30	2517.74	547.24	544.87		412.20	5053.49	0.59
White oaks			1481.14	285.17	1311.90		100.00	3178.21	0.37
Yellow birch	1031.42	5372.69	15221.66	14841.96	18787.07	1114.11	6857.39	63226.29	7.34
Black birch	1289.95	5746.63	12721.13	8319.50	10641.62	1255.36	2026.89	42001.08	4.88
White birch		2346.12	9525.76	3609.48	12950.69	431.64	437.69	29301.38	3.40
Beech		262.38	9510.30	26056.03	21969.29	4000.88	12858.27	74657.16	8.67
White ash	7116.21	12394.47	10101.62	7319.47	6614.52	377.20	667.39	44590.88	5.18
Poplar/aspens			399.17	343.00	2051.62			2793.78	0.32
Black cherry	1318.87	4950.68	5855.40	3982.11	4067.65	2109.89	400.95	22685.55	2.63
Other hardwoods		441.32	711.31	521.66	5594.29	54.00	40.58	7363.16	0.86
Totals	25989.11	76130.88	167683.03	310529.47	209017.77	18543.04	53041.51	860934.50	
Percent	3.0	8.8	19.5	36.1	24.3	2.2	6.2		

Table 13c Total Growth Summary All Types MBF, CCF and Change Over Growth Period
Forest West Franklin 2000 All Types Acres 28646.0 Based on 180. Samples

Species or Species Group	Total MBF Now	Total MBF 10yrs*	Change in MBF	Total CCF Now	Total CCF 10yrs	Change in CCF	% MBF	% CCF
White pine	35773.820	46840.855	11067.035	55006.38	67296.27	12289.89	11.4	6.4
Hemlock	58074.656	77671.969	19597.313	145987.78	179325.59	33337.81	18.4	17.0
Spruce/Fir	26101.477	32884.734	6783.258	71400.48	84216.09	12815.62	8.3	8.3
Pitch pine								
Red pine	1323.921	2074.543	750.621	2105.25	2876.00	770.75	0.4	0.2
Other Softwood								
Sugar maple	38931.566	50938.676	12007.109	113657.16	131145.23	17488.08	12.4	13.2
Red maple	34685.688	48239.398	13553.711	127364.14	149539.58	22175.44	11.0	14.8
N.Red oak	30716.779	42116.531	11399.752	50562.59	64104.80	13542.21	9.8	5.9
Black oak	2358.781	2818.213	459.432	5053.49	5651.31	597.82	0.7	0.6
White oaks	968.494	1612.949	644.455	3178.21	3786.90	608.69	0.3	0.4
Yellow birch	16652.807	23325.719	6672.912	63226.29	75122.97	11896.68	5.3	7.3
Black birch	12286.355	16234.916	3948.561	42001.08	48561.86	6560.77	3.9	4.9
White birch	6501.543	9325.919	2824.376	29301.38	34789.35	5487.97	2.1	3.4
Beech	17383.887	23800.234	6416.348	74657.16	86701.20	12044.04	5.5	8.7
White ash	24038.816	30020.395	5981.578	44590.88	51745.44	7154.56	7.6	5.2
Poplar/aspens	388.921	827.873	438.952	2793.78	3405.15	611.37	0.1	0.3
Black cherry	7903.989	11396.217	3492.228	22685.55	26734.51	4048.96	2.5	2.6
Other hardwoods	759.948	1491.994	732.046	7363.16	9261.60	1898.43	0.2	0.9
Totals	314851.438	421621.125	106769.680	860934.50	1024263.88	163329.09		

* or growth period if not 10 years

Table 14a Coarse Woody Debris - Total Oven-dry Tons Over All Types by Status Class and Diameter Class
Forest West Franklin 2000 28646.0 Acres. Based on 180. Samples. All Species

Live Trees		Standing Dead Trees 3-5			Down Dead Trees 6-8			Total Dead
Status 1 & 2	Status 3	Status 4	Status 5	Status 6	Status 7	Status 8	Status 3	
live	Dead Sound	Dead partially decayed	Dead decayed	Dead down Sound	Dead,down partially decayed	Dead down decayed	thru 8	
Diam Class	Number Tons	Number Tons	Number Tons	Number Tons	Number Tons	Number Tons	Number Tons	
4	226.	14.	98.	113.	53.		336.	
6	63488.	1548.	2745.	4427.	1128.	3268.	16003.	
8	128914.	2968.	3303.	7385.	1487.	4699.	24770.	
10	192157.	3016.	5361.	10650.	1743.	6103.	31764.	
12	235344.	3323.	4150.	11751.	2605.	6257.	32878.	
14	264342.	1280.	3333.	14720.	834.	4064.	27985.	
16	209567.	1973.	4514.	7073.		3084.	18956.	
18	174578.	2075.	3247.	5244.	358.	1937.	13724.	
20	125628.	756.	1840.	3461.	1408.	752.	9258.	
22	81139.	1891.	815.	2251.	1640.	1735.	9864.	
24	45914.		1604.			3133.	4737.	
26	39586.						910.	
28	30727.							
30	30260.		2185.				187.	
32				1181.			1181.	
34	9059.					2775.	2775.	
36	11870.							
Totals	1642801.	18843.	33195.	68257.	11255.	37808.	28157.	

Table 14b Coarse Woody Debris - Total Hundreds of Cubic Feet over All Types by Status Class and Diameter Class
 Forest West Franklin 2000 28646.0 Acres. Based on 180. Samples. ALL Species

Live Trees		Standing Dead Trees 3-5			Down Dead Trees 6-8			Total Dead
Status 1 & 2	Status 3	Status 4	Status 5	Status 6	Status 7	Status 8	Status 3	
live	Dead Sound	Dead partially decayed	Dead decayed	Dead down Sound	Dead,down partially decayed	Dead down decayed	thru 8	
Diam Class	Number CCF	Number CCF	Number CCF	Number CCF	Number CCF	Number CCF	Number CCF	
4	111.43	5.18	64.94	54.82	26.96	29.88	181.78	
6	33174.40	919.74	1527.75	2500.54	677.88	1644.91	9186.30	
8	71554.59	1863.59	2037.56	4388.34	1015.48	2869.32	15232.22	
10	106068.27	1854.42	3267.92	6455.40	1120.50	3828.92	19656.48	
12	126800.44	2076.93	2739.85	6916.20	1665.16	3961.22	20554.62	
14	140580.06	852.55	2231.44	8722.40	566.50	2573.99	17304.53	
16	110095.88	1359.68	2818.26	4376.13		1833.33	12022.44	
18	87227.13	1188.31	1961.53	2982.24	307.05	1180.74	8194.66	
20	63295.21	525.42	1003.04	2057.89	576.17	441.89	5236.69	
22	40948.59	1206.20	579.51	1601.34	1184.48	1009.63	6673.91	
24	23093.95		820.05			1949.91	2769.96	
26	20340.55					586.18	586.18	
28	14630.58							
30	14293.17		1188.56			238.82	1427.38	
32				1009.95			1009.95	
34	4211.83					1584.86	1584.86	
36	4508.64							
Totals	860934.75	11852.02	20240.41	41065.25	7140.18	23149.29	121621.99	

Table 14c Coarse Woody Debris - Total Trees Over All Types by Status Class and Diameter Class
 Forest West Franklin 2000 28646.0 Acres. Based on 180. Samples. All Species

Live Trees		Standing Dead Trees 3-5			Down Dead Trees 6-8			Total Dead
Status 1 & 2	Status 3	Status 4	Status 5	Status 6	Status 7	Status 8	Status 3	
live	Dead Sound	Dead partially decayed	Dead decayed	Dead down Sound	Dead,down partially decayed	Dead down decayed	thru 8	
Diam Class	Number Trees	Number Trees	Number Trees	Number Trees	Number Trees	Number Trees	Number Trees	
4	9549.	796.	3979.	5570.	2387.	3183.	15915.	
6	1604180.	37399.	70819.	128112.	29442.	81164.	434465.	
8	1298621.	34216.	39786.	97874.	20689.	51722.	325450.	
10	1008183.	18302.	31033.	81960.	11936.	38990.	233943.	
12	731270.	11140.	18302.	51722.	10344.	24667.	151187.	
14	547459.	3979.	8753.	42969.	2387.	14323.	87530.	
16	320677.	3979.	9549.	17506.		5570.	46948.	
18	190974.	2387.	4774.	8753.	796.	3183.	22280.	
20	114585.	796.	1591.	4774.	796.	796.	10344.	
22	58884.	1591.	796.	2387.	1591.	1591.	11140.	
24	27850.		796.			2387.	3183.	
26	20689.						796.	
28	11936.					796.	796.	
30	10344.		796.				1591.	
32				796.			796.	
34	2387.					796.	796.	
36	2387.							
Totals	5959973.	114584.	190974.	442423.	80368.	225190.	1346363.	

Table 15a Total Value of Volume Over All Types Board Feet and Cubic Feet by Species
Forest West Franklin 2000 28646.0 Acres. Based on 180. Samples

Species or Species Group	Dollar Value		Comp Interest		Dollar Value		Comp Interest	
	Now	10 Years	Value	Volume	Now	10 Years	Value	Volume
White pine	1979729.75	2587696.50	2.71	2.73	275031.91	336481.44	2.04	2.04
Hemlock	871119.88	1165079.50	2.95	2.95	729938.88	896628.00	2.08	2.08
Spruce/Fir	522029.47	657694.69	2.34	2.34	357002.38	421080.47	1.66	1.66
Pitch pine								
Red pine	26478.42	41490.86	4.59	4.59	10526.26	14379.99	3.17	3.17
Other Softwood								
Sugar maple	8008645.50	10354492.00	2.60	2.72	1136571.63	1311452.50	1.44	1.44
Red maple	2402684.50	3279134.50	3.16	3.35	1273641.38	1495396.00	1.62	1.62
N.Red oak	10037874.00	13626983.00	3.10	3.21	505625.91	641048.00	2.40	2.40
Black oak	385657.97	464722.78	1.88	1.80	50534.89	56513.08	1.12	1.12
White oaks	126201.97	206239.89	5.03	5.23	31782.06	37868.99	1.77	1.77
Yellow birch	1550258.13	2162482.25	3.38	3.43	632262.81	751229.75	1.74	1.74
Black birch	1197798.38	1559451.50	2.67	2.83	420010.84	485618.56	1.46	1.46
White birch	456535.41	658317.19	3.73	3.67	293013.81	347893.47	1.73	1.73
Beech	448170.66	619263.63	3.29	3.19	746571.44	867011.81	1.51	1.51
White ash	4292079.50	5293920.00	2.12	2.25	445908.72	517454.38	1.50	1.50
Poplar/aspens	7214.65	14122.82	6.95	7.85	27937.81	34051.50	2.00	2.00
Black cherry	2924556.25	4179629.75	3.64	3.73	226855.47	267345.06	1.66	1.66
Other hardwoods	21387.49	42125.23	7.01	6.98	73631.63	92615.96	2.32	2.32
Totals	35258424.00	46912840.00	2.90	2.96	7236847.50	8574069.00	1.71	1.75

Table 15b Dollar Value on a per Acre Basis by Product within Type
Forest West Franklin 2000 28646.0 Acres. Based on 180. Samples

Type	Grade 1		Grade 2		Grade 3		Grade 4		GoStk+Cull		Total
		%		%		%		%		%	
WP/P/BC	0.	0.0	157.	19.4	468.	57.9	95.	11.8	88.	10.9	807.
WP/S/B	0.	0.0	222.	15.3	752.	51.7	386.	26.6	93.	6.4	1454.
WP/S/CD	0.	0.0	0.	0.0	601.	85.9	71.	10.2	27.	3.9	699.
HK/P/A	69.	8.7	242.	30.5	225.	28.3	155.	19.5	103.	12.9	794.
HK/S/AB	0.	0.0	250.	28.2	271.	30.6	272.	30.7	93.	10.5	887.
SF/P/BC	0.	0.0	0.	0.0	70.	21.7	94.	29.1	158.	49.2	321.
SF/P/D	0.	0.0	0.	0.0	12.	9.0	80.	59.3	43.	31.7	135.
SF/S	65.	8.6	159.	21.1	88.	11.6	390.	51.8	52.	6.9	754.
NH/P/A	22.	2.5	250.	28.0	403.	45.0	89.	9.9	130.	14.6	895.
NH/P/B	52.	7.7	168.	24.9	298.	44.2	69.	10.3	87.	12.9	674.
NH/S/A	496.	20.7	830.	34.7	845.	35.4	140.	5.9	79.	3.3	2390.
NH/S/B	268.	18.2	605.	41.1	454.	30.8	71.	4.8	75.	5.1	1472.
NH/PA/CD	0.	0.0	30.	19.0	73.	45.9	16.	10.1	40.	25.0	158.
OM/P/AB	131.	14.6	251.	27.9	391.	43.5	43.	4.7	83.	9.3	899.
OM/S/AB	2224.	47.3	1319.	28.1	997.	21.2	98.	2.1	59.	1.2	4696.
OT/NOLEV	0.	0.0	0.	0.0	55.	40.3	39.	28.9	42.	30.8	136.
Totals	240.	18.2	404.	30.7	449.	34.1	137.	10.4	86.	6.5	1317.

Table 16 Management Potential by Type Thousands of Board Feet (MBF)
Forest West Franklin 2000 28646.0 Acres. Based on 180. Samples

Type	Potential	Av/Ac	%	Acceptable	Av/Ac	%	Unacceptable	Av/Ac	%	Totals	Av/Ac
WP/P/BC	0.000	(0.000)	0.00	743.683	(2.336)	25.30	2195.796	(6.899)	74.70	2939.479	(9.235)
WP/S/B	634.534	(0.665)	2.98	4716.476	(4.939)	22.18	15912.781	(16.664)	74.84	21263.791	(22.268)
WP/S/CD	47.281	(0.099)	0.84	1499.061	(3.140)	26.68	4072.771	(8.531)	72.48	5619.113	(11.770)
HK/P/A	3556.037	(0.771)	7.13	20434.229	(4.428)	40.96	25899.998	(5.612)	51.91	49890.266	(10.810)
HK/S/AB	1979.862	(0.957)	5.44	14663.629	(7.088)	40.32	19721.439	(9.532)	54.23	36364.930	(17.577)
SF/P/BC	0.000	(0.000)	0.00	775.023	(2.435)	52.90	689.972	(2.168)	47.10	1464.995	(4.603)
SF/P/D	233.068	(0.488)	11.94	588.286	(1.232)	30.15	1129.979	(2.367)	57.91	1951.333	(4.087)
SF/S	4658.259	(4.182)	19.07	10686.769	(9.593)	43.74	9087.630	(8.158)	37.19	24432.656	(21.932)
NH/P/A	1787.515	(0.624)	8.75	5042.435	(1.760)	24.69	13590.345	(4.744)	66.55	20420.295	(7.128)
NH/P/B	663.119	(0.174)	3.60	6171.606	(1.616)	33.49	11591.111	(3.035)	62.91	18425.836	(4.824)
NH/S/A	10630.570	(1.758)	12.23	22980.840	(3.800)	26.43	53336.398	(8.820)	61.34	86947.813	(14.377)
NH/S/B	4351.994	(1.823)	20.16	5597.698	(2.345)	25.93	11639.585	(4.876)	53.91	21589.277	(9.044)
NH/PA/CD	0.000	(0.000)	0.00	305.290	(0.384)	29.45	731.426	(0.919)	70.55	1036.716	(1.303)
OM/P/AB	720.435	(0.905)	22.21	583.394	(0.733)	17.98	1940.051	(2.438)	59.81	3243.880	(4.077)
OM/S/AB	5440.442	(4.884)	29.74	5727.006	(5.141)	31.30	7128.514	(6.399)	38.96	18295.961	(16.424)
OT/NOLEV	0.000	(0.000)	0.00	472.332	(0.989)	48.94	492.765	(1.032)	51.06	965.097	(2.022)
Totals	34703.117	(1.211)	11.02	100987.758	(3.525)	32.07	179160.563	(6.254)	56.90	314851.438	(10.991)

Appendix D – High Conservation Value Forest

**Defining HCVFs on DCR & DFW Lands in
Massachusetts**

**A report to
The Bureau of Forestry
Department of Conservation and Recreation
And
The Forestry Project
Division of Fisheries and Wildlife**

**Prepared by
Patricia Swain, Ph.D.
Natural Heritage & Endangered Species Program
Division of Fisheries & Wildlife**

**Final
January 2008**

**Defining High Conservation Value Forests on DCR & DFW Lands in
Massachusetts**

Abstract:

Defining and identifying High Conservation Value Forests (HCVF) is a condition of Forest Stewardship Council (FSC) 'Green Certification' of sustainable forestry for Massachusetts' state lands. HCVFs are forest areas that need to be appropriately managed in order to maintain or enhance identified High Conservation Values (HCVs). The definition of HCVs encompasses exceptional or critical ecological attributes, ecosystem services, and social functions. Under certification, areas identified as HCVFs may be harvested, but management activities must maintain or enhance the HCVs present.

The FSC Northeastern Region Standards provide guidance on identifying HCVs, and many HCVs are already identified and mitigated under existing Massachusetts regulations and procedures. In addition, when public land managers in Massachusetts held natural resource expert meetings to establish criteria for identifying Forest Reserves in 2004, many of the criteria chosen represented HCVs. However, FSC has issued an *Interpretation FSC Criterion 9-2* (attached as **Appendix D2**) that "requires that the forest manager consult with stakeholders on the identification of the High Conservation Values and the management options thereof." This was accomplished by posting the HCVF draft document on the state forestry websites, alerting experts to its existence and need for review, and presenting the document at public meetings on forest planning on January 31 and February 1, 2007.

Rare Species: FSC principles and criteria state that general forest management should conserve biological diversity and its associated values. In addition to this guidance, FSC identifies "significant concentrations" of rare species as an HCV. In Massachusetts, forest cutting plans for areas in known rare species habitats (Priority Habitats) already undergo review by the Massachusetts Natural Heritage and Endangered Species Program (NHESP); therefore identifying all forested sites on state lands within NHESP Priority Habitats as HCVFs would put no additional burden on forestry operations and would meet and exceed the rare species protection intentions of the Green Certification document.

Rare Ecosystems: HCVFs are intended to include forest areas that are in or contain rare, threatened or endangered ecosystems. The FSC Northeast U.S. region report on HCVF standards recommends using natural communities with abundance ranks of S1, S2 or S3 by the state's Natural Heritage Program as the rare ecosystems. In Massachusetts, most S1-S3 community types are disturbance sensitive, and were included in the areas NHESP recommended as being in Forest Reserves. When sufficient numbers of a type occur on state land, it may make sense to keep only the best as reserves, and identify others as HCVs. Those S1-S3 types that were not recommended for Forest Reserves need some conditioned, occasional management, and thus may be appropriate for designation as HCVF since management that maintains or enhances HCVs is allowed. The Northeast working group suggests that S1-S3 natural communities that are around 500 acres would be a target for HCVF, with smaller occurrences being protected through Principle 6.2 (conservation zones and protection areas) and/or 6.4 (representative areas). Very few of the rare types of natural communities in Massachusetts have occurrences that would approach or exceed 500 acres (although some occurrences of pitch pine scrub oak communities do). Despite their small size, designation of S1 and S2, and good quality examples S3 types outside Forest Reserves as HCVF is warranted for conservation of these unique communities. NHESP has not focused on identifying priority natural communities on existing conservation lands, therefore **further inventory on state lands** and reporting of natural communities would improve NHESP's information about the occurrences of the different types, their condition, and their protection status. Further analysis of protection status of known natural community occurrences would allow identification of the most sensitive for reserve status.

Landscape Level Ecosystems: An additional biodiversity HCV is "large landscape level forests contained within or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance." DCR and the Department of Fish and Game Division of Fisheries and Wildlife (DFW) have already determined that existing Old Growth will be within Forest Reserves. Massachusetts has three sources of information on such large forests.

An important landscape level ecosystem HCV in Massachusetts would be Interior Forest. Interior Forest is areas of extensive, unfragmented forest land buffered from roads and development that provide important habitat for certain native wildlife species that benefit from unbroken forest patches. Interior Forest patches in Massachusetts have been identified using GIS modeling (MassWildlife unpublished data). They include many of the common forest types for their respective ecoregions which could cover at least part of the need for representatives of the large forest types. Because Interior Forest provides important habitat for disturbance sensitive and wide ranging species, it should be a designated HCV itself.

Massachusetts has a second source of information to identify important forest areas: areas that were forested in the 1830s (as shown on old maps) and are currently forested may have been continuously forested since pre-settlement times (commonly referred to as “1830s forest,” although such designation needs to be shown by on-the-ground evaluation of the soils). These areas typically support greater biodiversity than areas that have been tilled. These forest areas should be identified as HCVPs with special forest management considerations.

The third source of information of good examples of common forest types is the NHESP database which contains ‘A’ ranked (excellent) examples of the more common types of natural communities. Including those excellent examples that occur on state land as HCVPs would provide recognition and appropriate management to maintain these communities.

High Quality Cold Water Fisheries Resources: DFW is identifying a sub-set of all streams and rivers in Massachusetts that support cold water fish species where the entire fishery is composed of native species. Forests on state lands that buffer and support habitat associated with these unique stream reaches are of high conservation value. Appropriate filter widths on state lands should be designated, when the research by the DFW Fisheries Section is complete and reviewed by DCR.

Watershed Protection Forest: Forest areas that provide basic services of nature in critical situations, such as watershed protection or erosion control are an additional HCV. Watersheds that contribute to drinking water supplies are a particular HCV that are being addressed by DCR’s Division of Watershed Protection on the Quabbin, Ware River, and Wachusett watersheds. There are other (primarily municipal) water supply areas on DCR lands, and perhaps on DFW lands, that should be identified as HCVPs, with the management of these areas focused on water supply protection, according to regulation and BMPs.

Forest Areas Critical for Subsistence of Local Communities: These are intended to be key hunting or foraging areas for endemic communities for which there is no alternative food sources, and are unlikely to occur in Massachusetts. FSC comments that they do not occur in the United Kingdom, since it is a highly developed area where most of the population has alternative sources of food. The Northeast working group suggests that is true for the northeast U.S. as well.

Forest Areas of Special Cultural or Religious Significance: DCR and DFW need to identify and interact with any local groups, particularly with any indigenous peoples, that have identified culturally sensitive areas on state lands. Areas of potential harvest are already submitted to the Massachusetts Historical Commission (MHC) for review under their regulations and policies concerning historic and archeological sites, for review and comment. In addition, the state archeologist maintains a list of known archeological sites and has modeled areas likely used by Native Americans before European settlement. If those areas are not included as Forest Reserves, they should be included as HCVP until their actual status is determined from studies. Massachusetts forest cutting procedures already cover much for the intent of protecting cultural resources.

Public Review: This HCVP report was made available for public and expert review as part of the Forest Resource Management Planning public involvement process.

Introduction:

Defining and identifying High Conservation Value Forests (HCVF) is a condition of Green Certification for Massachusetts' state lands. Fortunately for land managers, many of the suggested High Conservation Values (HCVs) are already identified and dealt with in existing Massachusetts regulations and procedures. Under Forest Stewardship Council (FSC) certification, areas identified as HCVFs may be harvested, but management activities must maintain or enhance the HCVs present.

Background:

When the Massachusetts state lands were "Green certified" by Scientific Certification Systems (SCS) for the FSC in 2004, a condition of certification was that the agencies develop local definitions of High Conservation Values and apply that to management (Condition 2002.7 for DEM and DFW, 2002.9 for MDC) (SCS, 2004).

Forest Stewardship Council, Northeast (USA) Region Standards - definition of HCVF:

In Principle 9 of the FSC certification standard, forest managers are required to identify HCVs, to manage the forests for HCVs, and to monitor the success of this management. The definition of HCVs encompasses exceptional or critical ecological attributes, ecosystem services, and social functions. High Conservation Value Forests are forests that contain key HCVs. The designation relies solely on the presence of one or more HCVs. While all forests provide environmental and social values, HCVFs encompass exceptional or critical ecological attributes, ecosystem services and social functions. HCVFs are simply the forests where these values are found, or, more precisely, the forest area that needs to be appropriately managed in order to maintain or enhance the identified values (language from Jennings, 2004. ProForest ToolKit: HCVF for Conservation Practitioners, Page 1).

Other protections:

FSC principles and criteria include general forest management requirements. The FSC discussions recommend using protected lands, such as Forest Reserves, and zoning to assure protection of the most sensitive forest attributes. Several of these forest attributes are explicitly discussed in Principle 9, the HCVF section.

As noted in the recommendation discussion of this document (p.12), existing Massachusetts' statutes, regulations, and policies protect pre- and post-settlement historic sites, rare species habitat, water supplies, and Old Growth forest.

Principle 6, Environmental Impact, states that forest management should conserve biological diversity and its associated values. The discussion of HCVFs in the Northeast Regional standards refers back to various parts of Principle 6 (6.2, safeguards for rare and endangered species and habitats through zoning and protected areas and/or 6.4, protection of representative samples of existing ecosystems) and suggests that HCVFs need to be designated only where zoning and existing protected areas (Wildlands/Nature Preserves or Forest Reserves in Massachusetts) don't suffice. Although Forest Reserves may contain HCVs, HCVFs do not need to be designated as protected areas if management does not compromise the HCVs.

Principle 9 Biodiversity Values:

Given the state of knowledge of 'significant concentrations of biodiversity,' there are generally two approaches to conserving it: fine filter and coarse filter.

The *Fine filter* approach relies on identifying rare species (usually state and/or federally listed plants or animals) and protecting them and their habitats. The *Coarse filter* approach uses natural communities, where natural communities are stand-ins for total biodiversity. Natural communities are generally defined as recurring assemblages of plant and animal species, usually found in particular environmental conditions. In this approach, the types of natural communities in a state (or other region) are ranked for abundance throughout the state (S5 types are most abundant, and S1 least, details are given in **Appendix D4**). The occurrences are then ranked for quality, with the best of the most common types (and all their constituent species) identified for conserving, and as many as possible of the least common (and their constituent species) protected. There is a sliding scale between the best of the abundant types and accepting all that remains of the least common.

Fine Filter - Rare Species: One of the HCVs is “significant concentrations” of rare species. However in Massachusetts, known occurrences of rare species listed in the Massachusetts Endangered Species Act (MESA) have a regulatory impact on forestry – forest cutting plans for areas in known rare species habitats already undergo review. Mitigation for the protection of the rare species is provided: therefore the requirements in Principle 9 of maintaining or enhancing the HCV (rare species in this case) is already being met when the recommendations from review of the forest cutting plan are followed (304 CMR 11.00 11(6) and 321 CMR 10.02 (14)). This means that identifying all areas in NHESP Priority Habitats as HCVFs would put no additional burden on forestry operations and would meet and exceed the rare species protection intentions of the Green Certification document.

Coarse Filter - Natural Communities (part 1)

An additional biodiversity HCV is “large landscape level forests contained within or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance” (FSC, 2004, glossary). This definition is very close to the definitions Natural Heritage Programs use for A (the best, on a scale of A-D) ranked occurrences of each type of natural community. Including “A” ranked occurrences of the more common types, abundance ranked S5 (demonstrably secure) and S4 (apparently secure) of natural communities from the NHESP database as HCVFs would be a way to meet this part of the broad definition of HCVFs.

In Massachusetts, Old Growth occurrences are A ranked for whatever type of natural community they represent. Most Old Growth studied to date are examples of relatively common types of natural communities, typically Spruce-Fir-Northern Hardwoods Forest, Northern Hardwoods-Hemlock-White Pine Forest or High Elevation Spruce Fir Forest, with an example of Oak-Hemlock-White Pine Forest. DCR and DFW have already determined that Old Growth will be in Forest Reserves, although DFW has not detected any Old Growth forest on its lands. There are a few non-Old Growth A and B ranked occurrences of common types in the NHESP database, which could be dealt with on an individual basis, by zoning or by calling the A ranked occurrences HCVs. NHESP has records of thirteen occurrences of eight types of common (S5 and S4) upland forest-types on ten DCR properties, with five occurrences of two types of common forested wetlands on five properties. On DFW land there are 28 occurrences of ten types of upland forests on eighteen properties, and one type of forested wetland on one property. As the NE Working Group points out in the notes for the Northeast Regional Standards (p. 32 in Vers. 8.1), there really are not many landscape level (large forests with 25,000 contiguous acres where viable populations of most, if not all, naturally occurring species exist in natural patterns of distribution and abundance) undisturbed forests in the northeast. No such very large unfragmented forests would be expected in Massachusetts, although state forest managers plan to maintain the larger tracts that do occur on public land, with encouragement to private landowners to apply certification standards to large private holdings as well.

As part of the Forest Reserve planning process, interior forest areas (intact forest buffered from roads and developed and open land) on state land were identified on GIS. Interior Forest is considered to be

unbroken blocks of unfragmented forest. Natural features such as wetlands and open water are included in this dataset and were not interpreted as fragmenting forest patches. Roads were buffered at different distances depending on the type and the effects on wildlife. The resulting maps of the blocks of interior forest were made available for planning (unpublished DFW Metadata, copy in **Appendix D4**). Interior forest provides important habitat: for example, songbird nesting success is greater for some species further from forest edge and the disturbances associated with human dominated areas, which have more opportunistic predators such as raccoons, as well as cats and dogs. They also provide habitat to wide ranging species that do not interact well with humans (such as bears and coyotes) or that might be harmed by aspects of development, including by vehicles on highways.

Interior Forest should be a designated as a HCV itself. Interior forests include many of the common forest types for their respective ecoregions which provides good representatives of those forest types.

In addition, a minimum, meaningful, size for interior forest should be established by checking the literature on wildlife habitat needs, particularly that of disturbance sensitive birds. This would allow the most viable areas of interior forest to receive the necessary management attention. It may be that interior forest patches of a few dozen acres do not provide substantial benefit for wildlife, but patches of a few hundred acres may provide substantial benefits for wildlife.

Interior Forest blocks are, by definition, buffered by forest lands that are closer to roads and development. Some of the buffering lands are state (or other) conservation land and so contribute in perpetuity to maintaining the interior forest and its special conditions. In other cases the buffering lands are not designated for conservation, and their long term use as buffers for maintaining the interior forest on the state land is not predictable. Identification of ownerships in the buffers and identification of lands worth protecting for any of the biodiversity values, including as buffers to interior forest, should be undertaken.

Areas larger than the minimum patch size would receive particular focus for identifying ownerships of the buffering lands and for conservation acquisition. The conservation action here should be to identify public lands in the buffers that are not focused on conservation (not under Article 97 of the Massachusetts Constitution), and when possible move them to such protections. Identification of private lands in the buffers would enable discussions of conservation for those lands, including encouragement of sustainable management and forest certification.

Massachusetts has an additional unique data source on forested lands that should be identified as HCVFs. In the 1830s the state mandated that towns make maps showing land use. Most of the forested areas, called '1830s forest' or possible Primary Forest, were untilled woodlots and wooded pastures. These are not Old Growth; they have been harvested and pastured. Although those lands may well have undergone different uses in the time since the maps were made, some areas that were forested in the 1830s won't ever have been tilled. Surveys of the soil structure in the individual sites are necessary to determine whether those sites are actual Primary Forest. Such lands that remain forested have greater biodiversity than areas that have been tilled. 1830s forest areas are shown in a GIS layer (Harvard Forest, 2002) derived from these town wide maps made in the 1830s (not all of the town maps are still available; see the Harvard Forest provisos on their website <http://harvardforest.fas.harvard.edu/data/p01/hf014/1830readme.html>).

1830s forest areas should be considered for HCVF status because they include areas that have never been tilled which have higher biodiversity than tilled lands. However, it should be noted that 1830s forests were identified from old maps, and even restricted to currently forested areas, those are only two points of data in several hundred years - any given parcel may not have been continuously forested since European settlement. Of the areas that were continuously forested, most were woodlots and thinned repeatedly. They can continue to be managed in ways that maintain undisturbed soils and shaded understory layers

and minimize soil compaction, displacement, and erosion. In these older forests, the soil structure with its associated biodiversity is a main attribute to protect: a goal of management should be to avoid the need to mitigate the effects of any harvest when it is done.

Actual current vegetation present can provide indications of undisturbed soil, but examination of the soil structure of each area is necessary to determine actual land use history. Until individual areas are checked, the maps of 1830s/currently forested areas are the best available models of the biodiversity values found in the soils and understories of untilled forests.

Each of the above forest areas supports concentrations of native biodiversity not as widespread in more disturbed parts of the state. Combining these two data sets, areas forested in the 1830s and interior forest, is expected to identify forest lands of particular importance for maintaining native species and ecosystem functioning. Some of the areas that are 1830s forest and interior forest and on state land are included in Forest Reserves. These 1830s/interior forests areas could be considered HCVs, and part of HCVFs. Keeping in mind that some town maps did not report woodland or forest areas on the 1830s maps, and some town maps have been lost or were not made (Harvard Forest 2002; Hall et al., 2002), there are 58,534 acres of interior, 1830s forest on DCR land, out of 2,583,322 acres (about 2% - acres are “GIS acres,” calculated on landuse data in MassGIS). In addition, the planned Forest Reserves already include many of the common forest types for their ecoregions which could cover at least part of the need for representatives of the large types. If the forest types in the Forest Reserves were identified, any types not included in Forest Reserves that do occur in the 1830s/interior areas might be considered for HCVF status. For towns without 1830s forest, interior forest alone might be used. These interior, older forest areas were also identified in the BioMap report (NHESP, 2001), although not to forest type.

Preliminary inventory, at a fairly coarse level, can be done through aerial interpretation of forest cover and use of the existing forest inventory data. Final determination of the forest type requires on the ground surveys. Locations for surveys focused on particular forest types can be modeled from the broader existing information, geology, topography, and site knowledge of the local managers and foresters. DFW has undertaken many of these steps to locate one type of uncommon natural community, Rich Mesic Forest, resulting in many additional acres being identified on state lands. Management of the forest types designated as HCVs should be to encourage the desired conditions, and to minimize disturbance (except focused for regeneration), erosion, and displacement.

Coarse Filter: Natural Communities (part 2)

Principle 9 continues discussing HCVFs to include forest areas that are in or contain rare, threatened or endangered ecosystems. The Northeast region report on HCVF standards recommends using natural communities with abundance ranks of S1, S2 or S3 by the state’s Natural Heritage Program as the rare ecosystems. Massachusetts NHESP considers all types of natural communities ranked S1, S2 or S3 to be Priority Natural Communities. In Massachusetts, most S1-S3 community types are disturbance sensitive, and many were included in the areas NHESP recommended as being in Forest Reserves or patch reserves. Some of the community types included in the forest reserves may need occasional conditioned management to maintain them. Maps of locations of the NHESP natural community occurrences could be provided directly to DCR and most are available on MassGIS. It would be straightforward for maps of those locations on DCR land to be made available to the foresters and property managers. Some S1-S3 communities that were excluded from the Forest Reserves may need more conditioned, usually occasional management (for example Atlantic white cedar swamps might be strip clear-cut (regeneration harvest) on a very long rotation and Pitch Pine/Scrub Oak communities usually need to be managed to maintain the community attributes and the rare species that depend on the community). HCVF guidelines allow management of the forests with HCVs as long as the HCV is maintained or enhanced. The guidelines encourage using management to maintain successional natural communities. The Northeast working group suggests that S1-S3 natural communities that are around 500 acres would be a target for HCVF,

with smaller occurrences being protected through Principle 6.2 (conservation zones and protection areas) and/or 6.4 (representative areas). Very few of the rare types of natural communities in Massachusetts have occurrences that would approach or exceed 500 acres (although some occurrences of pitch pine scrub oak communities do). Despite their small size, designation as HCVs is warranted for protection of all Massachusetts S1 and S2, and the better occurrences of S3 natural community types.

Of the 12 upland forested Natural Community types, out of 29 priority terrestrial natural community types, seven are known from DSPR lands. Of the 17 forested wetland community types, out of 32 palustrine priority types, 9 are known from DSPR lands. For DFW lands, the numbers are: 7 upland types and 20 wetland types. The one type of priority forested natural community that occurs in intertidal estuarine conditions (of 8 priority intertidal types) is not currently documented on state land. It should be noted that in general, state lands have not been targets of natural community surveys. A few focused surveys on DFW land have resulted in increased numbers of records of priority natural communities. In addition, DFW has targeted some properties for acquisition that had known occurrences of priority natural communities, increasing the known occurrences on DFW land. The complete list of NHESP Priority Natural Community types with explanations of the S ranks is in **Appendix D4**. Tables 1, 2, and 3 in **Appendix D4** have the names, state ranks, and acreages on state lands of forested NHESP Priority Natural Community types.

Other HCVs:

High Quality Cold Water Fisheries Resources: DFW is identifying a sub-set of all streams and rivers in Massachusetts that support cold water fish species where the entire fishery is composed of native species, primarily brook trout. Forests on state lands that buffer and support habitat associated with these unique stream reaches are of high conservation value. Appropriate filter widths on state lands should be designated, when the research by the DFW Fisheries Section is complete and reviewed by DCR.

Watershed protection: Forest areas that provide basic services of nature in critical situations, such as watershed protection or erosion control are an additional HCV. Watersheds that contribute to drinking water supplies are a particular HCV that has been addressed by DCR's Division of Watershed Protection (the watershed portion of the former MDC). There are other water supply areas on DCR lands that should be identified as HCVFs, with the management of them aimed at protecting the water supplies, according to regulation and BMPs.

Forest Areas critical for subsistence of local communities: these are unlikely to occur in Massachusetts. These are intended to be key hunting or foraging areas for endemic communities for which there is no alternative food sources. FSC comments that they do not occur in the United Kingdom, since it is a highly developed area where most of the population has alternative sources of food. The Northeast working group suggests that is true for the northeast U.S. as well.

Forest areas of special cultural or religious significance:

Principle 3, Indigenous People's Rights: Of the concerns for protecting rights of indigenous people, 3.3 appears to have the most relevance to Massachusetts. 3.3 states that "Sites of special cultural, ecological, economic or religious significance to indigenous peoples shall be clearly identified in cooperation with such peoples, and recognized and protected by forest managers." Page 3, FSC Principles, 2004. The Northeast Working Group noted that "*Certification in general, particularly as addressed under Principles 2 through 5, reinforces the social and economic benefits that accrue to local communities.*"

Principle #4: Community relations and worker's rights: part 4.4.d. Significant archeological sites and sites of cultural, historical, or community significance, as identified through consultation with state archeological offices, tribes, universities, and local experts, are designated as special management zones

or otherwise protected during harvest operations (**Appendix D6** has the FSC and NE Standards language on 3.3 and 4.4).

Meetings should be held with any local groups, particularly with any indigenous peoples, that have identified culturally sensitive areas on state lands. This has been done in the area of the SE Bioserve, and maps of sensitive areas, similar to NHESP Priority Habitat maps were produced. To protect them, the actual sensitive areas are seldom publicized. It is likely that the communications and contact methods used in the Bioserve could be used as a model for working statewide, **Appendix D5** includes some information from the Bioserve report on protecting cultural resources.

Appendix D6 includes FSC Principles 3.3 and 4.4 and the comments on them from the Northeast (U.S.) Regional Standards.

Any projects that require funding, licenses, or permits from any state agency must be reviewed by the MHC in compliance with M.G.L. Chapter 9, sections 26-27C. This law creates the MHC, the office of the State Archaeologist, and the State Register of Historic Places among other historic preservation programs. It provides for MHC review of state projects, State Archaeologist's Permits, the protection of archaeological sites on public land from unauthorized digging, and the protection of unmarked burials.

Cultural resources are protected from state and federally funded or approved activities under several laws including, but not limited to (modified from Fleming et al., 2005):

- **M.G.L. Ch. 9 s. 26-27c (to 32) as amended (MHC enabling legislation)**
<http://www.mass.gov/legis/laws/mgl/9-26.htm>; <http://www.mass.gov/legis/laws/mgl/9-27.htm>
- <http://www.sec.state.ma.us/mhc/mhcidx.htm>
- **M.G.L. Ch. 38 s. 6 (Massachusetts Unmarked Burial law)**
<http://www.mass.gov/legis/laws/mgl/38-6.htm>
- **M.G.L. Ch. 30 s 61-62h. Massachusetts Environmental Policy Act (MEPA)**
- <http://www.mass.gov/legis/laws/mgl/30-61.htm> and **301 CMR 11.00**
<http://www.mass.gov/envir/mepa/thirdlevelpages/meparegulations/meparegulations.htm>
- <http://www.mass.gov/envir/mepa/secondlevelpages/aboutmepa.htm>
- **Section 106 of the National Preservation Act of 1966**

To comply with these laws, DCR must consult with the State Historic Preservation Office (SHPO) whenever a state action has the potential to impact historic or archaeological resources. In Massachusetts the SHPO is the MHC. Cultural Resource Management staff members are available to coordinate the consultation process. In planning projects and activities that are subject to MHC review, schedules must allow for a 30 day review process.

Under these regulations and DCR and DFW policies about consultation with the Massachusetts Historical Commission which is responsible for historic and archeological sites, cultural sites including archeological sites, graveyards, cellar holes, stone walls, are reviewed. In addition, the state archeologist maintains a list of known archeological sites and has provided DCR with maps of areas that meet particular modeling criteria for likely use by Native Americans before European settlement. If those areas are not included as Forest Reserves, they should be included as HCVs until their actual status is determined from studies.

Recommendations for HCVF designations:

In the NE Regional Standard, their Appendix C (and attached in **Appendix D3** here) is a guide to the designation of HCVFs. These separate the steps of determining whether various attributes ought to be designated as HCVs or dealt with through other means. Because Massachusetts has existing regulations protecting rare species and cultural areas that DCR and DFW are already complying with and managing for, it would make practical sense to designate these as HCVs. The same would apply to public water supply areas that are on state land where the management already is for maintaining the water quality, and secondarily for timber harvest as such.

Expert meetings are encouraged to determine HCVs (especially if there are no local standards, which do exist for the Northeastern United States). Natural resource expert meetings were held to establish biodiversity value criteria for making Forest Reserves. Most of the recommendations are basically HCVs – acreage of old growth and acreage of valley bottom land, and concentrations of 1830s forest, viable rare communities, BioMap Ambystomid habitat, riparian and wetland forest, forest interior, and Living Waters CSW (Critical Supporting Watershed). Together with the Northeast standards, HCVs for biodiversity have been well defined for Massachusetts forests. However, FSC has issued an *Interpretation FSC Criterion 9-2* (attached as **Appendix D2**) that “requires that the forest manager consult with stakeholders on the identification of the High Conservation Values and the management options thereof.” Posting this document on the state’s forestry web sites for review, calling it to the attention of forestry experts and asking for review, and addressing the HCVF ideas at the various public meetings on the forest management plans where the participants are focused on forests and represent a wide spectrum of interest in forests and forestry should provide important review and feedback on HCVF issues.

Meetings should be held throughout the state to determine areas with cultural or spiritual values to local communities. This information would supplement information from MHC and the state archeologist. Some of those areas have been established as Forest Reserves, some might be managed as HCVFs.

Recommended HCVs and likely effects on forestry operations:

Rare Species:

NHESP Priority Habitats should be designated as HCVs: forest cutting plans for such areas are already being reviewed and responses provided that maintain or enhance the species and their habitats, which meets HCV criteria. These Priority Habitats are in regulation and information exists on maps in the *Natural Heritage Atlas* and as public GIS datalayers. Effects on state lands management: Using existing regulations and policies would result in no additional constraints on forestry operations.

Rare ecosystems:

All Priority natural communities in NHESP’s database should be HCVs under the Northeast Standards. This includes all occurrences of types ranked S1 and S2, and good quality examples S3 types that are in the NHESP database as tracked Priority Natural Community occurrences. These can be provided to DCR and DFW as a GIS datalayer. NHESP has not focused on existing conservation lands for inventory, therefore **further inventory on state lands** and reporting of natural communities on them would improve NHESP’s information about the occurrences of the different types, their condition, and their protection status. For example, DFW Forestry Project has focused on identifying Rich Mesic Forest that occurs on DFW lands, that has so far resulted in more than doubling the known acreage of Rich Mesic Forest on DFW lands. Those areas will be designated as HCVFs.

Locating and identifying Priority types of forested natural communities is time consuming. Because they are not randomly located in the landscape, it is possible to do some preliminary focusing. Models that

incorporate information on habitat conditions provide some possibilities of locations for specific community types, but need to be checked on the ground. Interpreting aerial photographs again tends to provide broader possibilities than most of the specific natural communities occur in (for example, most oak forests types look about the same from aerials, but the specific types generally need to be determined on-site). Existing information, such as CSI plot information should also be reviewed for indications of presence of the uncommon types or to assist in planning site visits.

Effects on state lands management: Consultation before harvesting. For example, expectations would include protections for soil integrity (such as requiring use of forwarders wherever feasible, limiting or excluding skidding of logs, seasonal restrictions on mechanized equipment operation, and careful location of landing areas outside of the HCVF area), procedures to avoid introducing invasives, and possibly restrictions on canopy openings to maintain shade on the forest floor. Since the forest trees are part of the natural community, and affect all the other species present, it might be important to retain particular proportions of tree species. Or, as in the case of early successional communities, opening the canopy might be encouraged. Creation of Conservation Management Practices (CMPs) by NHESP and the DCR and DFW Forestry Programs for different types of forested priority communities would likely be useful (an individual CMP may be applicable to multiple priority communities).

Landscape level ecosystems:

DCR has placed known Old Growth in Forest Reserves. and much of the likely Primary Forest (also called 1830s Forest after the date of maps made throughout the state, as discussed on p. 8 of this document), that occurs on state land was placed in Forest Reserves. Interior Forest (unfragmented forest blocks, also discussed on p. 8 of this document) was also considered in setting up the Forest Reserves. Any remaining large areas that are both Primary Forest and Interior Forest that are not in Forest Reserves should be designated as HCVF. As mentioned earlier, records of 1830s woodlands are missing from some towns, in which case interior forest alone may need to be used until/unless other determinations of undisturbed soil can be made.

Exemplary (A – ranked) occurrences of common types of communities from NHESP GIS should be included as HCVFs. There has not been a systematic inventory for these types of occurrences. Large Forest Reserves likely include examples of most the common types of natural communities in an area, but this **needs to be verified by inventory**. Such an inventory can be approached through existing information, such as CFI plots, and landcover maps made from interpretation of aerial photographs. These methods tend to provide guidance on where to look, rather than affirming the presence of particular types of natural communities.

Effects on state lands management: Consultation before harvesting. For example, expectations would include protections for soil integrity (such as requiring use of forwarders where feasible, limiting or excluding skidding of logs, seasonal restrictions on mechanized equipment operation, and careful location of landing areas outside of the HCVF area), and procedures to avoid introducing invasives. Management foresters should make every effort possible to avoid the need for mitigating the effects of the harvest equipment at the end of a job. The goal is to minimize the impact. With widespread forest types, including interior forests, small openings would be normal, and areas of harvest that otherwise would not fragment the forest would be compatible. Forestry operations might be used to improve degraded examples of primary or widespread forest types. Creation of Conservation Management Plans for different types of widespread forested communities would likely be useful.

Ecosystem Services - Critical Watersheds for drinking water supplies:

Drinking water supply areas are known to management foresters and are on maps from DEP, and available from MassGIS. DCR GIS has them mapped. Effects on forestry operations: Using existing regulations and policies would result in no additional constraints on forestry operations.

High Quality Cold Water Fisheries Resources:

In an analysis of all streams and rivers in Massachusetts, a subset that support cold water fish species where the entire fishery is composed of native species is being identified. Forests associated with these unique stream reaches are of high conservation value, and appropriate widths on state lands should be designated as HCVF when sites are known. Effects on state lands management: Consultation before harvesting. Appropriate width enhanced buffers on state land, with no or reduced harvest will need to be identified on the ground from maps when the streams have been identified and protocols developed.

Cultural areas:

MHC and State Archeologist have maps, models, and site review. Meetings should be held during the regional or property specific planning with any local groups, particularly with any indigenous peoples, that have identified culturally or spiritually sensitive areas on state lands. Efforts to involve Massachusetts based tribes need to be actively pursued. If there is a state-wide intertribal council, it would provide good initial contacts for identifying appropriate local leaders. DCR planners have experience, for example in the SE Bioreserve, with identifying and contacting individual local groups that have interests in the state lands. Effects on forestry operations: Using existing regulations and policies would likely result in no additional constraints on forestry operations.

Public Review: This draft HCVF report was made available for public review as part of the Forest Resource Management Planning public involvement process. It was posted on the DCR web pages, with a link from the MassWildlife forestry pages, and was made available in written copy upon request to the DCR Bureau of Forestry. Possible expert reviewers were notified of the existence and location of the document, with requests for review. In addition, HCVF ideas and the draft document were introduced at public meetings on ecoregional planning and DCR Management District and DFW Forest Management Zone plans on January 31 and February 1, 2007. Meetings in the forest management planning series were well attended by a wide spectrum of private and public sector stakeholders who are keenly interested in forests and forestry in Massachusetts, and who provided good input to the planning process.

References, High Conservation Value Forests

Anderson, M.G., Comer, P., Grossman, D., Groves, C., Poiani, K., Reid, M., Schneider, R., Vickery, B., and A. Weakley. 1999. Guidelines for representing ecological communities in ecoregional conservation plans. The Nature Conservancy. 74 pp. Available from:

<http://conserveonline.org/docs/2000/11/ecguide.pdf> URL checked 6-20-06

Anonymous. 2003. Southeastern Massachusetts Bioreserve Management Plan. Written by staff from TTOR, DFW, DCR and City of Fall River. With GIS mapping support from Epsilon Associates, Inc. August 2003.

Doherty, J.M., H. Herbster, S. Cherau, V.M. Adams. 2001. Working Draft, technical memorandum: Cultural resource planning, southeast Massachusetts Bioreserve. PAL Report No. 1276-1. PAL, Pawtucket, RI in: Cultural Resource Information, Southeastern Massachusetts Bioreserve Project. Draft July 24, 2001. Epsilon Associates, Inc. for the Executive Office of Environmental Affairs.

Forest Stewardship Council. 2004. FSC principles and criteria for forest stewardship. FSC reference code: FSC-STD-01-001 (April 2004). Forest Stewardship Council, AC.

http://www.fsc.org/keepout/en/content_areas/77/71/files/FSC_STD_01_001_FSC_Principles_and_Criteria_for_Forest_Stewardship_2004_04.PDF checked 6-16-06

http://www.fsc.org/en/about/documents/Docs_cent/2.14 interpretation of Principle 9.2, URL checked 6-16-2006

Forest Stewardship Council, U.S. Initiative, Northeast Region Working Group. 2005. Revised final forest stewardship standard for the Northeast region (USA) v. 9.0. URL checked 6-16-06

http://www.fscus.org/images/documents/2006_standards/ne_9.0_NTC.pdf .

Hall, B., G. Motzkin, D. R. Foster, M. Syfert, and J. Burk. 2002. Three hundred years of forest and land-use change in Massachusetts, USA. *Journal of Biogeography* 129: 1319-1135. URL checked July 2006, available from:

<http://harvardforest.fas.harvard.edu/publications/pdfarticles.html>

Harvard Forest. 2002. 1830 Map Project. Harvard Forest Archives, Petersham, MA. URL checked July 2006 available from

<http://harvardforest.fas.harvard.edu/data/p01/hf014/1830readme.html>

High Conservation Value Resource network. 2007. <http://hcvnetwork.org/> (url checked 1-26-07)

Jennings, S. 2004. HCVF for conservation practitioners. ProForest, Oxford, UK. In HCVF Final Package from <http://www.proforest.net/publications/hiconvf> . downloaded 11-2-2005, URL checked 6-16-06

Jennings, S., R. Nussbaum, N. Judd, & T. Evans and others. 2003. High Conservation Value Forest Toolkit. ProForest. Oxford, UK. With WWF and IKEA. From <http://www.proforest.net/publications> . downloaded 11-2-2005, checked 6-16-06

Natural Heritage & Endangered Species Program. 2001. BioMap: Guiding Land Conservation for Biodiversity in Massachusetts. Massachusetts Division of Fisheries and Wildlife. Westborough, MA

Seymour, R., D. Capen, J. Furnish, D. Wager. 2004. Certification Evaluation Report for the Natural

Forests Managed by the Commonwealth of Massachusetts. A Natural Forest Management Operation Prepared By Scientific Certification Systems, 2000 Powell Street, Suite 1350, Emeryville, CA 94608, USA. Conducted under auspices of the SCS Forest Conservation Program As Accredited by the Forest Stewardship Council. Certification Registration Number SCS-FM/COC-00048N. Available at: http://www.scs-certified.com/PDFS/forest_mass.pdf. URL checked 6-20-06

WWF. No date. High conservation value forests. <http://www.panda.org/downloads/forests/hcvffinal.pdf>. A pamphlet about HCVFs, URL checked 6-20-06.

Appendix D1

From Certification report: Scientific Certification Systems, Final FSC Certification Report EOEI updated 5-4-04, certification registration number SCS-FM/COC-00047N, p. 22 for DEM and DFW and p. 23 for MDC:

Condition DEM/DFW 2002.7: Within 2 years of award of certification, DEM and DFW must designate and delineate HCVF⁵ areas and develop a plan for management of these areas.

⁵ Guidance on defining High Conservation Value Forests can be found in the document "Identifying High Conservation Values at a national level: a practical guide" available from www.proforest.com.

Condition MDC 2002.9: Within 1 year of award of certification, MDC must determine what percentage of MDC lands falls under HCVF category 4 for watershed values and then prepare an amendment to management plans that formally designates HCVF areas and describes how management of these lands is consistent with maintaining or enhancing HCVF attributes.

Appendix D2. FSC Principle 9

From:

http://www.fsc.org/keepout/en/content_areas/77/71/files/FSC_STD_01_001_FSC_Principles_and_Criteria_for_Forest_Stewardship_2004_04.PDF

FSC-STD-01-001 FSC Principles and Criteria for Forest Stewardship (April 2004)

- 9 Principle #9: Maintenance of high conservation value forests³**
Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach.
- 9.1 Assessment to determine the presence of the attributes consistent with High Conservation Value Forests will be completed, appropriate to scale and intensity of forest management.
- 9.2 The consultative portion of the certification process must place emphasis on the identified conservation attributes, and options for the maintenance thereof.
- 9.3 The management plan shall include and implement specific measures that ensure the maintenance and/or enhancement of the applicable conservation attributes consistent with the precautionary approach. These measures shall be specifically included in the publicly available management plan summary.
- 9.4 Annual monitoring shall be conducted to assess the effectiveness of the measures employed to maintain or enhance the applicable conservation attributes.

From FSC Appendix A, Glossary

High Conservation Value Forests: High Conservation Value Forests are those that possess one or more of the following attributes:

- a) forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g., endemism, endangered species, refugia); and/or large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance
- b) forest areas that are in or contain rare, threatened or endangered ecosystems
- c) forest areas that provide basic services of nature in critical situations (e.g., water-shed protection, erosion control)
- d) forest areas fundamental to meeting basic needs of local communities (e.g., subsistence, health) and/or critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities). 2

Appendix D2 (continued, FSC Principle 9)

From: http://www.fsc.org/en/about/documents/Docs_cent/2,14

FSC Policy and Standards Unit Advice Note

Subject:	Interpretation of FSC Criterion 9-2
File name	FSC-ADV-30-901 Interpretation of Criterion 9-2
Advice sought on	What consultation requirements does FSC Criterion 9-2 imply for forest managers and certification bodies?
PSU Advice	1. FSC Criterion 9-2 requires that the forest manager should consult with stakeholders on the identification of the High Conservation Values, and the management options thereof. During evaluation for certification the certification body should consult to confirm whether the manager's consultation was adequate.



FOREST STEWARDSHIP COUNCIL International Center

Goerresstr. 15 / II a, 53113 Bonn, Germany
Tel: +49 (228) 367 66 0, Fax: +49 (228) 367 66 30
www.fscoax.org fscoax@fscoax.org

FSC Policy and Standards Unit Advice Note

Subject:	Interpretation of FSC Criterion 9-2
File name	FSC-ADV-30-901 Interpretation of Criterion 9-2
File master location	[new server at FSC-IC – location to be specified]
Advice note written by:	M.G.Wenban-Smith
Date:	28-APR-2003
Status	Approved by Head of PSU
References	FSC Principles and Criteria for Forest Stewardship (2000) Board paper BM28-17 FSC Criterion 9-2
Advice sought on	What consultation requirements does FSC Criterion 9-2 imply for forest managers and certification bodies?
PSU Advice	<ol style="list-style-type: none">1. FSC Criterion 9-2 requires that the forest manager should consult with stakeholders on the identification of the High Conservation Values, and the management options thereof. During evaluation for certification the certification body should consult to confirm whether the manager's consultation was adequate.
Basis for advice	<ol style="list-style-type: none">1. FSC Criterion 9.2 states: <i>"The consultative portion of the certification process must place emphasis on the identified conservation attributes, and options for the maintenance thereof"</i>.2. Different FSC members currently interpret this criterion in two rather different ways, relating to their understanding of the expression 'certification process' – either that it puts the obligation on the certification body to carry out consultation, or that it puts the obligation on the forest manager to carry out consultation.3. At the request of the FSC Board the Policy and Standards Unit sought the advice of the members of the original Principle 9 working group in order to confirm the intention of the Criterion. The consultation clarified that the intention of the Principle 9 working group was i) that the forest manager should consult with stakeholders on the identification of the HCVs, and the management options thereof, and ii) the cb should

FSC Trademark © 1996 Forest Stewardship Council A.C.
FSC-SECR-0002

subsequently evaluate whether the consultation was adequate.

4. The FSC Board has agreed that henceforth this shall be considered the correct interpretation of this FSC Criterion.

5. Further background information regarding the consultation is contained in the board paper BM28-17 FSC Criterion 9-2.

Appendix D3. North East United States, Regional Standards, Principle 9

available on line from http://www.fscus.org/images/documents/2006_standards/ne_9.0_NTC.pdf

PRINCIPLE #9: MAINTENANCE OF HIGH CONSERVATION VALUE FORESTS

Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach.

Note: Appendix C includes an overview to the designation of HCVF under the Northeast Standards.

High Conservation Value Forests are those that possess one or more of the following attributes:

- a) **Forest areas containing globally, regionally or nationally significant concentrations of biodiversity values (e.g., endemism, endangered species, refugia); and/or large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance**

Notes:

Forests with globally, regionally, or nationally significant concentrations of biodiversity

The forests of the northeast contain globally, regionally, or nationally significant concentrations of biodiversity value that are rare and widely dispersed; most have been identified by state Natural Heritage Programs. Examples include the riverbank areas of the St. John's River in Maine, the "Yellow Bog area" within the Nulhegan watershed of northeastern Vermont, and the Southeastern Massachusetts Bioreserve. More common in the northeast are discrete areas of biodiversity value (i. e., they generally contain one rare natural community or an endangered species or two) that are not part of a network of isolated but interconnected habitats that would lead to HCVF status at the landscape scale.

The Northeastern Working Group recommends a stepwise approach to identification of HCVF with significant concentrations of biodiversity. First: identify and protect discrete areas of biodiversity importance as required by Criteria 6.1, 6.2, and 6.4. Second: maintain, enhance, or restore the ecological functions and values of the surrounding stands and landscapes in accordance with Criterion 6.3 and protect other ecological values as required under Criteria 6.5-6.9 and Principle 10. Third: if steps one and two are inadequate to protect the overall biodiversity values of the forest or if the values are considered to be of exceptional significance, then the forest may warrant designation as an HCVF.

Appendix D3. NE Regional Standards, Principle 9 (continued)

Forests with natural patterns of species distribution and abundance

The forests of the northeast have been manipulated by Euro-Americans for the past three hundred years. Much of the region that is now forested was cleared for agriculture, and that which was not has been harvested several times. As a result of this human intervention there are few large landscape-level forests where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance. The best examples are in public and/or private conservation ownership such as the Big Reed Preserve in Maine, parts of the White Mountain National Forest in New Hampshire and Maine, and parts of the Adirondack and Catskill Parks in New York.

There are areas of a few thousand acres in northern Maine where species composition and structure closely approach natural conditions due to light harvest history and a relatively long time (30-50 years) since the last harvest. However, the Maine Forest Biodiversity Project noted that in northern and eastern Maine forest landscape planning units average roughly 25,000 acres in size (C.A. Elliott, ed. 1999. Biodiversity in the Forests of Maine, Guidelines for Land Management. University of Maine Cooperative Extension, Orono, Maine). Thus, there are likely very few areas that meet the definition of a “large landscape-level forest” adopted by regional experts.

b) Forest areas that are in or contain rare, threatened or endangered ecosystems

Note: Rare, threatened, or endangered (hereafter collectively referred to as “rare”) ecosystems belong to a subset of natural communities state-ranked as S1, S2, or S3 or G1, G2, or G3 by state Natural Heritage programs. Rare ecosystems may also include outstanding examples of more common (ranked S4 or S5) community types. Rare natural communities that are not extensive in area may be adequately protected under Criterion 6.2 and/or 6.4. Communities or assemblages of communities that are extensive in area are best protected as HCVF.

- *In the Northeast, rare communities or assemblages of communities dominated by a rare community that approach or exceed 500 acres (200 ha) in area are normally delineated and managed as rare ecosystems under HCVF.*
- *Other factors that may be considered include, but are not limited to,*
 - *Relative rarity of S3-ranked communities (which may range from 21 to 100 examples in a state),*
 - *Distinctiveness in terms of size (a smaller or larger threshold than 500 acres might be appropriate, depending on the size range of the community type), quality (particularly lack of human disturbance), or location within the community’s geographic range,*
 - *Vulnerability to degradation, and*
 - *Proximity to protected examples of the same ecosystem type.*
- *Due to their rarity in the Northeast, intact old growth forests (see glossary), which represent an extremely rare stage of what may be a common natural community type, normally qualify as “rare, threatened, or endangered ecosystems” under the HCVF definition.*

Appendix D3. NE Regional Standards, Principle 9 (continued)

- c) **Forest areas that provide basic services of nature in critical situations (e.g., watershed protection, erosion control)**

Note: Examples of forest areas that provide basic services of nature in critical situations in the northeast are watersheds that supply water for municipalities (examples may

include Quabbin Reservoir in Massachusetts, the Croton Reservoir in New York and Sebago Lake in Maine). There are few areas within the forest regions of New York and New England that provide basic services of nature in critical situations above and beyond the ecosystem services provided by all forests.

- d) **Forest areas fundamental to meeting basic needs of local communities (e.g., subsistence, health) and/or critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).**

Note: While important to the social and economic well being of local communities, the northeast contains few, if any, areas where the cultural identity and fundamental subsistence of local communities have been critically linked to a particular forest area. Certification in general, particularly as addressed under Principles 2 through 5, reinforces the social and economic benefits that accrue to local communities.

The region's forests are important to the social identity and economic well being of local communities, especially across the "Northern Forest." This is a region of New England and New York where forest industries and forest-based recreation have long been a dominant economic force (the Northern Forest includes much of northern and eastern Maine, northern New Hampshire, northern Vermont, as well as the Adirondack and Tug Hill regions of New York.) While HCVF designation could be generally applied to much of the Northern Forest region, the region's large size (one of the largest areas of continuous forest in the United States) and complexity of markets for forest products (especially long distance hauling of different species and grades of logs and chips to different communities, states, and into nearby Canada) makes it difficult to associate a particular forest with a specific community's well being. Maintaining socially beneficial, economically healthy, and ecologically viable forests in accordance with FSC Principles will help maintain the strength and vitality of forest-dependent communities across the region.

Appendix D3. NE Regional Standards, Principle 9 (continued)

9.1. Assessment to determine the presence of the attributes consistent with High Conservation Value Forests will be completed, appropriate to scale and intensity of forest management.

9.1.a. Appropriate to scale and intensity of forest management, a comprehensive assessment to determine the presence of attributes consistent with High Conservation Value Forests is conducted.

9.1.b. As part of the assessments and consultations required in Criteria 3.3, 4.4, 6.1, 6.2, and 8.2, the forest owner or manager has identified, mapped, established protection measures, and evaluated the social impacts of management for the appropriate HCVF attributes.

9.2. The consultative portion of the certification process must place emphasis on the identified conservation attributes, and options for the maintenance thereof.

Note: FSC understands that Criterion 9.2 is an instruction to FSC-accredited certification bodies and that no indicators are required.

9.3. The management plan shall include and implement specific measures that ensure the maintenance and/or enhancement of the applicable conservation attributes consistent with the precautionary approach. These measures shall be specifically included in the publicly available management plan summary.

Applicability Note: The applicability of the precautionary principle and the consequent flexibility of forest management vary with the size, configuration, and tenure of the HCVF;

- a) *More flexibility is appropriate where HCV forest is less intact, larger in area, has a larger area-to-perimeter ratio, and its tenure is assured over the long term.*
- b) *Less flexibility is appropriate where HCV forest is more intact, covers a smaller area, has a smaller area-to-perimeter ratio, and future tenure is uncertain.*

9.3.a. Areas designated as HCVFs are managed over the long term to assure that both the quality of their HCVF attributes and their area are not reduced.

9.3.b. Where the high conservation value crosses ownership boundaries or where the maintenance of the conservation value(s) depends on the proximity of or connectivity with other HCVFs, forest owners or managers coordinate conservation efforts with owners and managers of other HCVFs in their landscape.

9.3.c. The precautionary approach (see Glossary) is adopted when the forest owner or manager has determined that potential management actions are capable of degrading the high conservation values identified.

9.4. Annual monitoring shall be conducted to assess the effectiveness of the measures employed to maintain and enhance the applicable conservation attributes.

Note: The Working Group considers this Criterion sufficiently explicit and measurable. Indicators are not required.

APPENDIX C

A GUIDE TO THE DESIGNATION OF HCVF WITHIN THE NORTHEAST STANDARD

- 1) Assessment of HCVF attributes.
 - a) Ecological elements: Indicators 6.1a, 6.2, 8.2
 - b) Cultural elements: 3.3, 4.4
 - c) Synthesis of all elements/HCVF determination. P9, definition of HCVF, 9.1
- 2) Protection of individual elements that may contribute to HCVF designation:
 - a) Rare, threatened, and endangered (R, T, and E) species and natural communities: 6.2.a
 - i) For extensive (> 500 ac.) R, T, and E natural communities, presumption is that these should be protected as HCVF under P9, attribute B.
 - ii) See also Note under HCVF attribute A.
 - b) Old Growth Stands:
 - iii) Presumption is that there is protection as representative sample area under 6.4. See applicability note under criterion and 6.4.b.
 - iv) If protection as a sample area is not warranted, ecological functions and values are maintained (see 6.4) on these forests.
 - c) Old Growth Forests:
 - v) Presumption is that these forests are protected as HCVF. See applicability note under 6.3, applicability note under criterion and 6.4, and indicator 6.4.b.
 - vi) If HCVF designation is not warranted, old growth forests are protected as a representative sample area under 6.4.
- 3) HCVF
 - a) Attribute A: significant concentrations of individual elements of biodiversity/natural patterns of distribution and abundance.
 - i) If protection of individual elements under 6.2 and 6.4 and management of the surrounding forest matrix according to 6.3 will not conserve the landscape value, then HCVF designation is warranted.
 - ii) Presumption is that old growth forests are also protected as HCVF.
- 4) Attribute B: Threatened or endangered ecosystems
 - i) Defined as S1-S3 natural communities > 500 ac, consistent with old growth forest threshold
 - ii) Presumption is that these sites are protected as HCVF, smaller areas are covered by 6.2.
- 5) Attribute C: Basic services of nature in critical situations.
 - i) Municipal watersheds given as primary examples.
- 6) Attribute D. Fundamental to local communities
 - i) The interconnectedness of many communities and across the landscape makes the direct link between one forest and one community difficult. NEWG emphasizes maintenance of social and economic benefits under Principles 2-5 as key to protecting this attribute.

Appendix D4. NHESP Priority Natural Communities in Massachusetts and their ranks

Terrestrial	Provisional Rank	Palustrine	Provisional Rank
Maritime Juniper Woodland/Shrubland	S1	Calcareous Basin Fen	S1
Maritime Oak - Holly Forest/Woodland	S1	Coastal Interdunal Marsh/Swale	S1
Maritime Pitch Pine On Dunes	S1	Estuarine Intertidal: Sea-Level Fen	S1
Sandplain Grassland	S1	Alluvial Atlantic White Cedar Swamp	S2
Sandplain Heathland	S1	Atlantic White Cedar Bog	S2
Scrub Oak Shrubland	S1	Black Ash Swamp	S2
Serpentine Outcrop Community	S1	Black Ash-Red Maple-Tamarack Calcareous Seepage Swamp	S2
Calcareous Forest Seep Community	S2	Black Gum Swamp	S2
Calcareous Rocky Summit/Rock Outcrop Community	S2	Black Gum-Pin Oak-Swamp White Oak "Perched" Swamp	S2
Dry Riverside Bluff	S2	Calcareous Pondshore/Lakeshore	S2
Hickory - Hop Hornbeam Forest/Woodland	S2	Calcareous Seepage Marsh	S2
High Elevation Spruce - Fir Forest/Woodland	S2	Calcareous Sloping Fen	S2
Maritime Dune Community	S2	Coastal Atlantic White Cedar Swamp	S2
Maritime Erosional Cliff Community	S2	Coastal Plain Pondshore	S2
Maritime Rock Cliff Community	S2	Cobble Bar Forest	S2
Pitch Pine - Scrub Oak Community	S2	High-Terrace Floodplain Forest	S2
Ridgetop Pitch Pine - Scrub Oak Community	S2	Inland Atlantic White Cedar Swamp	S2
Yellow Oak Dry Calcareous Forest	S2	Kettlehole Level Bog	S2
Circumneutral Rocky Summit/Rock Outcrop Community	S2S3	Major-River Floodplain Forest	S2

Calcareous Rock Cliff Community	S3	Northern Atlantic White Cedar Swamp	S2
Calcareous Talus Forest/Woodland	S3	Riverside Seep	S2
Circumneutral Rock Cliff Community	S3	Small-River Floodplain Forest	S2
Circumneutral Talus Forest/Woodland	S3	Spruce-Tamarack Bog	S2
Coastal Forest/Woodland	S3	Transitional Floodplain Forest	S2
Maritime Beach Strand Community	S3	Acidic Graminoid Fen	S3
Maritime Shrubland Community	S3	Acidic Shrub Fen	S3
Rich, Mesic Forest Community	S3	Alluvial Red Maple Swamp	S3
Riverside Rock Outcrop Community	S3	High-Energy Riverbank	S3
Black Oak - Scarlet Oak Forest/Woodland	S3S4	Kettlehole Wet Meadow	S3
		Level Bog	S3
		Riverine Pointbar And Beach	S3
		Spruce-Fir Boreal Swamp	S3

Estuarine		Estuarine	
Estuarine Intertidal: Brackish Tidal Marsh	S1		
Estuarine Intertidal: Fresh/Brackish Tidal Shrubland	S1	Estuarine Intertidal: Coastal Salt Pond Marsh	S2
Estuarine Intertidal: Fresh/Brackish Tidal Swamp	S1	Estuarine Subtidal: Coastal Salt Pond	S2
Estuarine Intertidal: Freshwater Tidal Marsh	S1	Marine Intertidal: Rocky Shore	S2
Estuarine Intertidal: Fresh/Brackish Flats	S2	Estuarine Intertidal: Salt Marsh	S3
Estuarine Subtidal: Fresh/Brackish Flats	S2	Estuarine Intertidal: Saline /Brackish Flats	S3

NHESP

Natural Community Ranks

Each type of natural community is assigned an “element rank”, based on the species element ranking developed for the Natural Heritage system by The Nature Conservancy and maintained by NatureServe. The state rank (S) reflects the rarity and threat within Massachusetts. Every state assigns its own “S” rank based on the rarity and threat within that state, with regard to regional conditions. Global ranks for communities are not included because each state has its own classification system and the U.S. National Vegetation Classification system uses a different system.

State Ranks

S1 = Typically 5 or fewer occurrences, very few remaining individuals, acres, or miles of stream or especially vulnerable to extirpation in Massachusetts for other reasons.

S2 = Typically 6 - 20 occurrences, few remaining individuals, acres, or miles of stream or very vulnerable to extirpation in Massachusetts for other reasons.

S3 = Typically 21 - 100 occurrences, limited acreage, or miles of stream in Massachusetts.

S4 = Apparently secure in Massachusetts.

S5 = Demonstrably secure in Massachusetts

SU = Status unknown in Massachusetts.

SH = No extant sites known in Massachusetts, but it may still exist.

Table 1. Forested Terrestrial Priority Community occurrences on state land

Terrestrial	State Rank	NHESP Recommended Designation	NHESP acres on DSPR property	Number of DSPR properties	NHESP acres on DFW property	Number of DFW properties
Black Oak - Scarlet Oak Forest/Woodland	S3S4				52	2
Calcareous Forest Seep Community	S2	Zone 1				
Calcareous Talus Forest/Woodland	S3	Zone 1	34	2	34	1
Circumneutral Talus Forest/Woodland	S3	HCVF	83	3	29	4
Coastal Forest/Woodland	S3		34	3	306	2
Hickory - Hop Hornbeam Forest/Woodland	S2	HCVF	25	3	6	1
High Elevation Spruce - Fir Forest/Woodland	S2	HCVF	268	1		
Maritime Juniper Woodland/Shrubland	S1	Zone 1				
Maritime Oak - Holly Forest/Woodland	S1	Zone 1	90	3	1	1
Maritime Pitch Pine On Dunes	S1	Zone 1				
Rich, Mesic Forest Community	S3	HCVF	120	4	237	6
Yellow Oak Dry Calcareous Forest	S2	Zone 1				

Table 2. Forested Wetland Priority Community occurrences on state land

Palustrine	State Rank	NHESP Recommended Designation	NHESP acres on DSPR property	Number of DSPR properties	NHESP acres on DFW property	Number of DFW properties
Alluvial Red Maple Swamp	S3	HCVF	35	1	3	1
Atlantic White Cedar Bog	S2	HCVF			44	1
Black Ash Swamp	S2	HCVF	3	1	2	1
Black Ash-Red Maple-Tamarack Calcareous Seepage Swamp	S2	HCVF	3	1	118	3
Black Gum Swamp	S2	HCVF			3	1
Black Gum-Pin Oak-Swamp White Oak "Perched" Swamp	S2	Zone 1			408	1
Cobble Bar Forest	S2	Zone 1				
High-Terrace Floodplain Forest	S2	Zone 1			19	1
Major-River Floodplain Forest	S2	Zone 1	22	1	80	5
Small-River Floodplain Forest	S2	Zone 1			2	1
Spruce-Fir Boreal Swamp	S3	HCVF	7	1	24	1
Spruce-Tamarack Bog	S2	HCVF	125	1		
Transitional Floodplain Forest	S2	Zone 1			26	2

Alluvial Atlantic White Cedar Swamp	S2	HCVF			33	2
Coastal Atlantic White Cedar Swamp	S2	HCVF	494	2	1339	4
Inland Atlantic White Cedar Swamp	S2	HCVF	50	2		
Northern Atlantic White Cedar Swamp	S2	HCVF	84	1		

Table 3. Forested Estuarine NHESP Priority Natural Community Type

Estuarine	State Rank	NHESP Recommended Designation	NHESP acres on DSPR property	Number of DSPR properties	NHESP acres on DFW property	Number of DFW properties
Estuarine Intertidal: Fresh/Brackish Tidal Swamp	S1	Zone 1	0	0	0	0

Appendix D5. From Interior Forest Metadata: (unpublished, MA Division of Fisheries & Wildlife)

Massachusetts Division of Fisheries and Wildlife, Forestry Program
June, 2004
Interior Forest Land of Massachusetts Based on Land Use Data

interior_forest describes unbroken blocks of unfragmented forest within forested areas of the Commonwealth of Massachusetts. Other natural features such as wetlands and open water are included in this dataset.

There are no legal constraints to accessing these data, however credit to the Massachusetts Division of Fisheries and Wildlife Forestry Program should be given

The dataset was developed to facilitate the selection of forest reserves in Massachusetts as part of Green Certification by the Forest Stewardship Council on lands owned by Massachusetts state agencies.

Fragmenting buffer widths were based partially on done by The Nature Conservancy, Boston Office according to work by: Forman, R.T.T., and R.D. Deblinger. 2000. The Ecological Road-Effect Zone of a Massachusetts (U.S.A.) Suburban Highway. *Conservation Biology* 14:36-46. Source datasets were obtained from MassGIS, <http://www.mass.gov/mgis/massgis.htm>

Jeremy Bell GIS Specialist/Habitat Analyst Massachusetts Audubon Society under contract to MassWildlife Forestry Program, 2004 1 Rabbit Hill Road Westborough, MA 01581 <http://www.mass.gov/dfwele/dfw/>

Users should bear in mind that these data represent land use current as of 1999, and the data could soon become obsolete.

interior_forest was created using the Massachusetts Highway Department Roads data (2003), MassGIS Land Use data (1999), and Boston Transportation Planning Organization's Trains data (2004). Land use classes considered natural features from the Land Use 1999 lu21_code were extracted and converted to a new coverage. Codes 3 (forest), 4(wetland), and 20(open water) were included. Although wetlands and open water are not considered interior forest, in most cases they were considered non-fragmenting natural features in a landscape context and were left in for the initial analysis. Roads were separated into three classes: class 1 roads were buffered at 1000m, classes 2,3,4,7 were buffered at 300 m, and classes 5 and 6 were buffered at 100 m. Trains were buffered at 300 m. All land use categories considered fragmenting (all but 3,4, and 20) were extracted and converted to a new coverage. These features were buffered at 300m. The road, trains, and fragmenting land use buffers were then merged into the non-fragmenting natural features. Once complete, the buffers were extracted and deleted from the coverage, leaving polygons considered to be "interior natural features." Clean and build functions were then run to eliminate sliver polygons and artificial boundaries, such as town lines, that split areas of interior natural areas. Wetland and open water polygons were left in the dataset to keep data analysis flexibility for conservation uses. The coverage was then converted to shapefile format for distribution.

interior_forest was created using the Massachusetts Highway Department Roads data (2003), MassGIS Land Use data (1999), and Boston Transportation Planning Organization's Trains data (2004). Land use classes considered natural features from the Land Use 1999 lu21_code were extracted and converted to a new coverage. Codes 3 (forest), 4(wetland), and 20(open water) were included. Although wetlands and open water are not considered interior forest, in most cases they were considered non-fragmenting natural features in a landscape context and were left in for the initial analysis. Roads were separated into three classes: class 1 roads were buffered at 1000m, classes 2,3,4,7 were buffered at 300 m, and classes 5 and 6 were buffered at 100 m. Trains were buffered at 300 m. All land use categories considered fragmenting (all but 3,4, and 20) were extracted and converted to a new coverage. These features were buffered at 300m. The road, trains, and fragmenting land use buffers were then merged into the non-fragmenting natural features. Once complete, the buffers were extracted and deleted from the coverage, leaving polygons considered to be "interior natural features." Clean and build functions were then run to eliminate sliver polygons and artificial boundaries, such as town lines, that split areas of interior natural areas. Wetland and open water polygons were left in the dataset to keep data analysis flexibility for conservation uses. The coverage was then converted to shapefile format for distribution.

Appendix D6. Cultural Values

5.2.3 Historical and Archeological Resources

MHC is the State Historic Preservation Office and is responsible for administering State Register properties and other historic and archaeological assets. The MHC is also the office of the State Archaeologist, whose duties are to compile and maintain an inventory of archaeological sites, to issue permits for archaeological investigations on lands in which the Commonwealth has an interest, and, in accordance with M.G.L.s, Chapter 38, Section 6, notify the Commission on Indian Affairs if a possible Native American burial site has been identified.

5.2.3.3 Issues and Recommendations

Management of the resources within the Bioreserve should incorporate the appropriate protection procedures to insure that the cultural resource base is not adversely affected by daily operations and visitor use. The cultural resources including archaeological remains and historic buildings and remnants are finite resources. They represent unique records of past events and behavior that are part of our communal heritage. Typically, prehistoric sites resulted from short-term sporadic occupation. There is seldom much material left, and under the best of circumstances sites are difficult to excavate and interpret properly. They are extremely fragile and easily damaged. Archaeological sites cannot be repaired or fixed, and their loss is analogous to the extinction of a plant or animal species. Once these resources are gone, they are gone forever.

The preservation of cultural resources within the Bioreserve can easily be accomplished through continued cooperation and teamwork. Good planning and early communication about proposed projects will insure smooth project implementation. Beyond the dictates of legal compliance and resource protection, the cultural history of the Bioreserve should be explored, developed and offered to the public.

In general, good management of the cultural resources will include:

- Planning of projects, both capital and normal operations, that takes into account the potential effects on historic and archaeological resources
- Partners should (state agencies must) notify the MHC of any project that has the potential for impacting the historical, architectural, archaeological or cultural qualities of a property. Should partners undertake a project under federal funding or requiring federal oversight and/or permits, Section 106 of the National Historic Preservation Act of 1966 as amended (16 USC 470 et seq.) also requires consultation with the MHC.
- For projects planned at the Bioreserve on state lands, staff should consult with DPR's archaeologist and preservation planners in the Planning, Design and Development of Historic Resources.
- For most projects, the DCR Project Planning, Design and Development staff will require a project description, a site plan and photographs for review. No physical work can occur until one of the following outcomes has been achieved:
- Determination by DCR Project Planning, Design and Development staff that the project constitutes a categorical exemption and is consistent with DEM preservation standards
- Determination of "no effect" or "no adverse effect" from the MHC
- Successful completion of any mitigation outlined in the Memorandum of Agreement (MOA) between DCR and MHC (in cases of determination of "adverse effect"). If

Project Planning, Design and Development or the MHC determines that the project will result in an “adverse impact” to cultural and/or archaeological properties, the project proponent will work with OHR and the MHC to avoid, minimize or mitigate the impact. The Office of Project Planning, Design and Development will initiate and manage those activities that will minimize or mitigate adverse impacts to cultural and archaeological resources on the state properties.

- Reporting of discoveries of artifacts or soil anomalies, observing the effects of active recreation to sensitive areas, and monitoring for looting of known archaeological sites (as identified by appropriate staff)
- Prohibition of the use of metal detectors on Commonwealth lands
- Maintenance of confidentiality regarding the specific locations of prehistoric sites (the Freedom of Information Act does not apply)
- Improvements to National Register listed or eligible properties in accordance with the Secretary of the Interior’s Standards for the Treatment of Historic Properties
- Continued recognition of significant historic buildings, objects and landscapes through their nomination to the National Register of Historic Properties

Appendix E – Rare Species

Summary of Western Connecticut Valley District Acreage of Rare Species Habitat and Natural Communities

Site Name	Acres of Rare Species Habitat	Acres of Natural Communities
Buckland State Forest	0.0	0.0
Catamount State Forest	205.1	0.7
Conway State Forest	195.1	0.0
D.A.R. State Forest	0.0	0.0
Deer Hill State Reservation	63.5	13.7
Florida State Forest	329.3	0.0
H.O. Cook State Forest	25.3	0.0
Kenneth Dubuque Memorial State Forest	1,619.0	0.0
Kenneth Dubuque Memorial State Park	0.0	0.0
Leyden State Forest	0.0	0.0
Mohawk Trail State Forest	1,555.0	324.6
Monroe State Forest	494.7	57.3
Rowe State Forest	54.1	0.0
Savoy Mountain State Forest	10.2	0.0
Shelburne State Forest	48.2	0.0
South River State Forest	382.9	17.2
Windsor State Forest	54.0	13.4
Totals	5,036.4	426.9

Summary of Rare Species Habitat by Western Connecticut Valley District Property

Site Name	Scientific Name	Common Name	Category	MESA Status	Data Sensitivity
Catamount State Forest	<i>Adlumia fungosa</i>	Climbing Fumitory	Vascular Plant	SC	N
Catamount State Forest	<i>Alnus viridis ssp. crispa</i>	Mountain Alder	Vascular Plant	T	N
Catamount State Forest	<i>Ambystoma jeffersonianum</i>	Jefferson Salamander	Vertebrate Animal	SC	N
Catamount State Forest	<i>Mimulus moschatus</i>	Muskflower	Vascular Plant	E	N
Catamount State Forest	<i>Panax quinquefolius</i>	Ginseng	Vascular Plant	SC	Y
Catamount State Forest	<i>Symphyotrichum prenanthoides</i>	Crooked-stem Aster	Vascular Plant	SC	N
Conway State Forest	<i>Ambystoma jeffersonianum</i>	Jefferson Salamander	Vertebrate Animal	SC	N

Conway State Forest	<i>Panax quinquefolius</i>	Ginseng	Vascular Plant	SC	Y
Deer Hill State Reservation	<i>Agastache scrophulariifolia</i>	Purple Giant Hyssop	Vascular Plant	E	N
Deer Hill State Reservation	<i>Carex hitchcockiana</i>	Hitchcock's Sedge	Vascular Plant	SC	N
Deer Hill State Reservation	<i>Geum fragarioides</i>	Barren Strawberry	Vascular Plant	SC	N
Deer Hill State Reservation	<i>Ophiogomphus carolus</i>	Riffle Snaketail	Invertebrate Animal	T	N
Florida State Forest	<i>Amelanchier bartramiana</i>	Bartram's Shadbush	Vascular Plant	T	N
Florida State Forest	<i>Solidago macrophylla</i>	Large-leaved Goldenrod	Vascular Plant	T	N
H.O. Cook State Forest	<i>Ribes lacustre</i>	Bristly Black Currant	Vascular Plant	SC	N
Kenneth Dubuque Memorial State Forest	<i>Ambystoma jeffersonianum</i>	Jefferson Salamander	Vertebrate Animal	SC	N
Kenneth Dubuque Memorial State Forest	<i>Arceuthobium pusillum</i>	Dwarf Mistletoe	Vascular Plant	SC	N
Kenneth Dubuque Memorial State Forest	<i>Botaurus lentiginosus</i>	American Bittern	Vertebrate Animal	E	N
Kenneth Dubuque Memorial State Forest	<i>Catostomus catostomus</i>	Longnose Sucker	Vertebrate Animal	SC	N
Kenneth Dubuque Memorial State Forest	<i>Cicindela duodecimguttata</i>	Twelve-spotted Tiger Beetle	Invertebrate Animal	SC	N
Kenneth Dubuque Memorial State Forest	<i>Cypripedium reginae</i>	Showy Lady's-slipper	Vascular Plant	E	Y
Kenneth Dubuque Memorial State Forest	<i>Glyptemys insculpta</i>	Wood Turtle	Vertebrate Animal	SC	N
Kenneth Dubuque Memorial State Forest	<i>Notropis bifrenatus</i>	Bridle Shiner	Vertebrate Animal	SC	N
Kenneth Dubuque Memorial State Forest	<i>Platanthera dilatata</i>	Leafy White Orchis	Vascular Plant	T	N
Kenneth Dubuque Memorial State Forest	<i>Somatochlora elongata</i>	Ski-tipped Emerald	Invertebrate Animal	SC	N
Mohawk Trail State Forest	<i>Alnus viridis ssp. crispa</i>	Mountain Alder	Vascular Plant	T	N
Mohawk Trail State Forest	<i>Ambystoma jeffersonianum</i>	Jefferson Salamander	Vertebrate Animal	SC	N
Mohawk Trail State Forest	<i>Boyeria grafiana</i>	Ocellated Darner	Invertebrate Animal	SC	N
Mohawk Trail State Forest	<i>Catostomus catostomus</i>	Longnose Sucker	Vertebrate Animal	SC	N
Mohawk Trail State Forest	<i>Cicindela duodecimguttata</i>	Twelve-spotted Tiger Beetle	Invertebrate Animal	SC	N
Mohawk Trail State Forest	<i>Panax quinquefolius</i>	Ginseng	Vascular Plant	SC	Y
Mohawk Trail State Forest	<i>Pyrrhia aurantiago</i>	Orange Sallow Moth	Invertebrate Animal	SC	N
Mohawk Trail State Forest	<i>Ribes lacustre</i>	Bristly Black Currant	Vascular Plant	SC	N
Mohawk Trail State Forest	<i>Triphora trianthophora</i>	Nodding Pogonia	Vascular Plant	E	N

Monroe State Forest	<i>Ribes lacustre</i>	Bristly Black Currant	Vascular Plant	SC	N
Monroe State Forest	<i>Solidago macrophylla</i>	Large-leaved Goldenrod	Vascular Plant	T	N
Rowe State Forest	<i>Ribes lacustre</i>	Bristly Black Currant	Vascular Plant	SC	N
Savoy Mountain State Forest	<i>Ambystoma jeffersonianum</i>	Jefferson Salamander	Vertebrate Animal	SC	N
Shelburne State Forest	<i>Boyeria grafiana</i>	Ocellated Darner	Invertebrate Animal	SC	N
Shelburne State Forest	<i>Glyptemys insculpta</i>	Wood Turtle	Vertebrate Animal	SC	N
Shelburne State Forest	<i>Gomphus abbreviatus</i>	Spine-crowned Clubtail	Invertebrate Animal	SC	N
Shelburne State Forest	<i>Neurocordulia yamaskanensis</i>	Stygian Shadowdragon	Invertebrate Animal	SC	N
Shelburne State Forest	<i>Rhionaeschna mutata</i>	Spatterdock Darner	Invertebrate Animal	SC	N
South River State Forest	<i>Alnus viridis ssp. crispa</i>	Mountain Alder	Vascular Plant	T	N
South River State Forest	<i>Boyeria grafiana</i>	Ocellated Darner	Invertebrate Animal	SC	N
South River State Forest	<i>Carex hitchcockiana</i>	Hitchcock's Sedge	Vascular Plant	SC	N
South River State Forest	<i>Catostomus catostomus</i>	Longnose Sucker	Vertebrate Animal	SC	N
South River State Forest	<i>Celastrus scandens</i>	American Bittersweet	Vascular Plant	T	N
South River State Forest	<i>Cryptogramma stelleri</i>	Fragile Rock-brake	Vascular Plant	E	Y
South River State Forest	<i>Equisetum scirpoides</i>	Dwarf Scouring-rush	Vascular Plant	SC	N
South River State Forest	<i>Glyptemys insculpta</i>	Wood Turtle	Vertebrate Animal	SC	N
South River State Forest	<i>Hypericum ascyron</i>	Giant St. John's-wort	Vascular Plant	E	N
South River State Forest	<i>Neurocordulia yamaskanensis</i>	Stygian Shadowdragon	Invertebrate Animal	SC	N
South River State Forest	<i>Ophiogomphus carolus</i>	Riffle Snaketail	Invertebrate Animal	T	N
South River State Forest	<i>Panax quinquefolius</i>	Ginseng	Vascular Plant	SC	Y
Windsor State Forest	<i>Carex baileyi</i>	Bailey's Sedge	Vascular Plant	T	N
Windsor State Forest	<i>Couesius plumbeus</i>	Lake Chub	Vertebrate Animal	E	N
Windsor State Forest	<i>Panax quinquefolius</i>	Ginseng	Vascular Plant	SC	Y

Summary of Natural Communities by Western Connecticut Valley District Property

Site Name	Natural Community Name
Catamount State Forest	Riverside Seep
Deer Hill State Reservation	Rich, Mesic Forest Community
Mohawk Trail State Forest	High-energy Riverbank
Mohawk Trail State Forest	Northern Hardwoods - Hemlock - White Pine Forest
Monroe State Forest	Northern Hardwoods - Hemlock - White Pine Forest
Monroe State Forest	Red Oak - Sugar Maple Transition Forest
Monroe State Forest	Spruce - Fir - Northern Hardwoods Forest
South River State Forest	Rich, Mesic Forest Community
Windsor State Forest	Hemlock Forest

Table Notes

- **MESA Status:** This is the state protection rank for a species. It can be one of three codes. An “E” means the species is endangered, a “T” means it is threatened, and an “SC” means the species is of special concern. If the species is delisted it can be unofficially given a “WL” code, which means the species is on the watch list. This is not legal protection, and is merely a way to keep track of the species.
- **Data Sensitivity:** “Data Sensitivity” of a species; species names denoted with a “y” are particularly vulnerable, due to potential for collection or other activity.

This information was provided to us by staff from the Massachusetts Division of Fisheries and Wildlife, Natural Heritage & Endangered Species Program

Appendix F – Cultural Resource Protection

The Commonwealth of Massachusetts is heir to a rich legacy of cultural resources; its historic buildings, structures, archaeological sites and landscapes are reminders of the important role that the State has played since long before the Pilgrims landed at Plymouth. These resources are milestones in the course of history and teach us about how people lived during prehistoric, pre-and post-Colonial times. They inform us about the industrial and technological changes of the 19th and 20th centuries and even give us a glimpse of life during the Great Depression and two World Wars.

Combined, these diverse historic resources document the human experience in Massachusetts. Scattered across the landscape, this ensemble of buildings, structures and sites tell the story of our common heritage – our Commonwealth – and their protection and preservation has become a vital component of DSPR’s mission and policy for resource stewardship.

At the time of writing, DSPR’s Office of Historic Resource’s staff has had the opportunity to make only a cursory inspection of the archaeological record of the fifteen Parks and Forests that comprise the Western Connecticut Valley District (Note: there is no CRI file for Buckland or Shelburne State Forests). It was known from the outset that the DSPR’s Site Inventory that was performed in 1985 was in need of updating. It was also known that western Massachusetts is the only part of the State that was not studied as part of the Massachusetts Historical Commission’s (MHC) Statewide Survey, which culminated in 1984 with the completion of the Connecticut River Valley. Therefore, it was known from the beginning that the information available for developing cultural resource preservation strategies was incomplete and only preliminary in nature. The following section is offered with these shortcomings in mind.

The western portion of Massachusetts consists of rough, hilly terrain and low river valleys. Although archaeological information on Native American activities in the Berkshires is limited, it is likely that the region was occupied throughout prehistory, i.e., from Paleo Indian times 12,000 years ago to early historic times only 450 years ago.

While it is doubtful that Native American populations in the hills of the Berkshires ever approached the numbers of those in the eastern part of the state, particularly in the coastal and estuarine zones, or the nearby Connecticut River Valley, the existing archaeological record must be considered artificially low. This bias has been induced by a number of factors and, as suggested below, actually creates great promise and opportunity for resource preservation and protection. A principal cause of bias, other than the lack of comprehensive research, is the relative lack of amateur collecting activities due to limited development and farming which the region has experienced.

A site inventory based on the archaeological site files of the MHC was performed in preparation of this section. Only eight prehistoric archaeological sites exist within the Western Connecticut Valley District and five of these are in the South River State Forest where they cluster on the South River itself (19-FR-166, 167, 169, 205, 206); 19-FR-167 is recorded as a rockshelter. Three other sites (19-FR-158, 73, 72) are within the Mohawk Trail State Forest. There is no information regarding when these sites were occupied or what activities occurred at them.

The Western Connecticut Valley District includes a diverse landscape that contains some very

important ecological differences throughout. However, these differences cannot explain the presence of Native American occupation in one area and the lack of occupation in another. To the contrary, some of the ecological characteristics of the areas where there are no sites are very favorable, even if within limited areas. One must surmise from this that archaeological sites exist but they simply haven't been found. Over the years, archaeologists have developed a model for identifying locations where sites are likely to occur. By evaluating *Site Location Criteria*, which takes into account several geographical and ecological characteristics, areas of *high archaeological sensitivity* can be identified. By employing this model we can make reasonable predictions about the presence or absence of sites within the Western Connecticut Valley District and this will become an invaluable tool in the in-house evaluation of impacts to archaeological resources from the implementation of the Bureau's silviculture program.

A. Prehistoric Overview & Archaeological Resources

Existing archaeological data combined with historic records and oral tradition indicates that the Native inhabitants of western Massachusetts, particularly the Berkshires, but also including the middle Connecticut River Valley, had strong ties and cultural affinities to the peoples of the Hudson Valley, more so than to their eastern relatives. It also appears that these ties extend far back into antiquity, and did not just develop in late prehistoric or early historic times.

Presumably the first humans to occupy this region would have been Paleo Indian hunters and gatherers (ca. 12,000 – 9,000 B.P.) While no Paleo sites are known specifically in the Western Connecticut Valley District, a number have been identified a short distance west on the Hudson River, to the north in Vermont, New Hampshire and Maine, in Connecticut, and several in central, eastern, and southern Massachusetts. Significantly, the Deerfield Economic Development and Industrial Corporation site in Deerfield, which is between 9,000 to 12,000 years old, is located a short distance east of Goshen and northeast of Williamsburg.

From approximately 12,000 years ago to the present, warming climatic trends have resulted in marked landscape changes i.e., forests evolved from tundra-like conditions to Spruce Woodland, to Mixed Spruce and Hardwood Forests, and finally to the Eastern Deciduous Forest of today. These changes included a broad spectrum of commensurate adjustments in associated flora and fauna as well -- with each presenting its own challenges and opportunities to the local human populations. Indeed, although the current archaeological record is uninformative regarding temporal associations in the district, one would predict that the Western Connecticut Valley District was occupied through the ensuing Early, Middle, and Late Archaic periods (ca. 9,000 – 3,000 B.P.), as well as Early Middle and Late Woodland periods (ca. 3,000 – 500 B.P.)

In order to place the Western Connecticut Valley District within a broader temporal and spatial context, a model of settlement in the Western Highlands of the Commonwealth has tentatively been formulated based on research in New York (Funk and Ritchie 1973) and Connecticut (Wadleigh 1983). When applied to the Western Connecticut Valley District, this model predicts that sites located within the highland and upland portions of the region would often be special purpose sites such as quarries, kill sites, and rock shelters. Such sites would tend to be small in area because they were occupied only briefly during the seasonal rounds of small foraging groups or nuclear families. In this model, the Berkshire highlands or uplands are viewed as marginal hinterlands, only used seasonally by peoples who otherwise spent most of the year elsewhere, presumably at lower elevations adjacent to rivers and streams, lakes, ponds and wetlands.

Conversely, the alluvial plains associated with the region's many major rivers such as the Housatonic, Deerfield, Westfield rivers, and as we've seen in the WCV, the South River, and their tributary streams, would generally be expected to contain larger sites because they would have been occupied by more people for longer periods of time than those of the upland/highland regime. Similarly, elevated well-drained locations around naturally occurring lakes, ponds, and wetlands may also tend to be larger because they attracted diverse animal and plant species, which in turn were capable of supporting larger and more diverse human populations.

Two important changes that occurred in New England may also have important implications for Native American occupation of the Berkshires in general from at least 8,000 to 2,500 years ago: one of these was natural and the other was cultural. First, approximately 8,000 years ago, scientists believe that the spawning behavior of anadromous fish became reestablished after having been disrupted by the Wisconsin Glacial (Dincauze 1975). From that time on, throughout New England, locations situated adjacent to falls and rapids along the region's major rivers became important for the seasonal harvest of this fishery. Indeed, this fishing activity may have become critical to group survival throughout the rest of prehistory. Therefore, those rivers which retain, or at least before historic damming, had outlets to the sea (Long Island Sound) may be expected to yield higher site densities than those that did not. Secondly, by at least 2,500 years ago, alluvial terraces became particularly attractive to local horticulturalists who had just learned to domesticate corn, beans and squash. Thus, it is predicted that riparian zones in general and particularly those with well developed floodplains, will contain late archaeological sites (i.e., Early, Middle, and Late Woodlands sites ca. 3,000 to 500 years ago).

B. Historic Overview & Archaeological Resources

Town histories written in the 19th century provide reasonably good documentation of Native American activities and sites throughout the Berkshires, although by the time they were written they were already second hand accounts. Perhaps the most obvious remnant of the Early Historic Period is a system of trails, which are believed to be derived from trails created during prehistoric times.

The Mohawk Trail, which roughly corresponds to portions of present Route 2, was a major east-west corridor between the Hudson and Connecticut valleys. From Deerfield, this important trail went over King Arthur's Seat and crossed the uplands to Shelburne Falls and then it proceeded along the north bank of the Deerfield from the North River Ford in Colrain through Charlemont and over the Hoosac Range. Another important east-west trail connected the Connecticut and Housatonic rivers via the Mill River from Northampton through Williamsburg and up into the Goshen uplands. From there it continued west paralleling the Swift River gorge through Cummington, toward Plainfield Pond and eventually to Pittsfield (MHC, 1984). The most southerly of the major east-west trails followed the north bank of the Westfield from the Connecticut River to the Woronoco ford in Westfield and along Munn Brook to the Berkshire foothills. From here the trail climbed over Westfield Mountain to Russell Pond, where it looped across the Blandford highlands to Big Pond in Otis and continued west to the Housatonic Valley (MHC, 1984).

It isn't easy, or perhaps even not possible, to make broad generalizations about the history of an area as diverse and large as the Berkshires, as almost by definition the diversity precludes generalizations. Nevertheless, in the interest of brevity, certain salient or underlying characteristics do stand out that make the Berkshire's history distinct, if not unique, within the state.

Due largely to its rugged topography characterized by high elevations dissected by a maze of steep stream and river valleys; much of the land within the Berkshires was not settled until the mid 18th century. Ecological conditions created a formidable barrier to Colonial settlement, which first focused on the broad river basins of the Connecticut and Hudson rivers. Only after these areas were filled in did settler's attentions turn to the highlands and here too, the bottomlands surrounding the larger rivers tended to be settled first. National and inter-colonial friction also hampered settlement of this frontier region. The disruption of traditional Native American cultural systems brought about by the fur trade and being drawn into colonial wars, resulted in unrest and antagonism between the indigenous people and the aspiring settlers. Further complicating matters was the fact that New York, Connecticut and Massachusetts each held claim to the land between the Hudson and the Connecticut rivers.

Slowly, as population pressures increased, even the highlands began to fill-in as "hill towns" increasingly took root in the most advantageous locations. In these early years, the Native American trail system proved vital to the colonial development of the Berkshires because of its dependency on available transportation routes. The Greenfield, Westfield and Hoosac rivers played an important role in the establishment of early European settlements. This role was enhanced as the Industrial Revolution found its way to the Berkshires and small family owned and operated industrial and commercial businesses were transformed into large highly competitive corporate entities such as the woolen mills in North Adams.

While farming was a primary activity in the early years of historic settlement throughout most of the region, in the highlands this provided a marginal subsistence at best and its occupants often supplemented their livelihood by undertaking a wide range of endeavors. Sawmills and gristmills sprang up along the riverbanks in many communities in the early years of each community's settlement. Railroad construction was to have a profound impact to the landscape of the western region, when in 1876 a major engineering feat was completed; the construction of the Hoosac Tunnel.

Besides its impact on industry, the development of rail lines throughout Berkshire County opened up the region for a new industry – tourism. Writers and artists began to flock to the Berkshire Hills for summer respite, and the late 1800s saw development of tourist related industries such as grand hotels, sumptuous inns, and summit houses. In the early 19th century, wilderness and the natural beauty of the new United States was a romantic ideal. Outdoor recreation became a popular tourist activity, and the ridges and mountaintops of Berkshire County enjoyed increasing visitation. This was also the era of the "rustic cabin" or lodge which were becoming popular with the wealthy from the northeast's urban centers. This helped New York's Catskills and Adirondack Mountains, and the forests of Maine become the center of the summer's social circuit. In the Berkshires, this era is represented by the former mountain retreat of Alfred C. Douglas (Bash Bish Falls) and the grand Whitney estate (October Mountain).

Thus, as an accident of the development of the Commonwealth's Forest and Parks system, virtually every type of historic archaeological site imaginable has been preserved in one form or another within the Western Connecticut Valley District. Over the years, as park and forest lands were acquired, the buildings and structures that formerly occupied those lands were often removed, creating a series of historic archaeological sites scattered across the landscape. In some cases these sites are isolated occurrences, such as the remains of a small self-sufficient farmstead. While in other cases, a cluster of sites such as several mills along a stream may represent a former mill village, each individual site of which is related to the other in time and space. In addition, the loss of population and the abandonment of entire "hill towns"

have resulted in the creation of a series of related historic archaeological sites that were once churches and meetinghouses, schools, stores, banks, hotels, cemeteries and homesteads.

The existing historic site inventory for the Western Connecticut Valley District is outlined below:

Domestic sites:

Remains of farmhouses together with their associated barns, chicken coops, ice and milk houses, granaries and fenced in fields and pastures may be informative regarding regional land-use and farming practices. The stone foundations and cellar holes of this class of historic sites are found in virtually every property within the Berkshires. Within the Western Connecticut Valley District: 52 domestic sites are recorded in Windsor, 20 domestic sites are located in Dubuque, 9 in Catamount and H.O. Cook, 7 in Monroe, 5 in D.A.R., and Florida, 2 in South River, and a single site in Conway.

Industrial sites:

Among the industrial sites recorded within the Western Connecticut Valley District are the remains of saw-mills and gristmills (Dubuque, H.O. Cook, Florida, Savoy, Mohawk Trail and Windsor), unspecified mills in Conway, South River, Monroe and D.A.R., a rifle manufacturer in Florida, iron works in Windsor and Dubuque, a charcoal kiln in Dubuque, spruce oil stills in Savoy and Windsor, and a blacksmith and tannery are recorded on the Mohawk Trail.

Commercial sites:

Less common, or at least less easily identified than industrial sites are those classified as commercial sites. Typically, such sites were small rather obtuse buildings and operations that cannot easily be differentiated from many domestic sites. Indeed, these were often small shops or stores (general provisions, tools and hardware, post offices were often within general stores etc.) which were either within a house or were otherwise identical to it in appearance. In Dubuque SF a shop is identified within a private residence, as is a tavern/inn.

Civic sites:

Because of the manner in which the Forest and Park system was created, often with land takings, sometimes abandoned land, but other times viable and operational land, it is not surprising that the remains of many civic sites have survived in the archaeological record. Recorded civic sites in the Western Connecticut Valley District include schools (4 in Dubuque, one each in Catamount, Conway, Windsor and two in Savoy). Cemeteries exist in H.O. Cook and Monroe, 16 cemeteries are recorded within Savoy alone, three in the Mohawk Trail, and four in Dubuque SF. It should be noted that many of these cemeteries are simple family plots, with only a few interments as opposed to large community cemeteries. The most ubiquitous civic sites are old roads, which, like homesteads, exist within most of the State Forests and Parks in the Western Connecticut Valley District.

The Civilian Conservation Corps (CCC) sites:

Since many of the early parks were cutover forest or isolated natural features, the citizens of the

Commonwealth had limited access to outdoor recreation. It was not until the 1930s that the parks of the Berkshire County region were transformed into premier recreational facilities under the direction of the Civilian Conservation Corps (CCC). From 1933 through 1938, the CCC worked in over one dozen forests and reservations in Berkshire County, expanding roads, trails, campgrounds, swimming areas and scenic areas in the state forests. Many of these improvements remain the cornerstones of the DCR facilities within the Berkshire region.

The remains of CCC headquarters can be found in D.A.R., Savoy, Windsor, Mohawk Trail and H.O. Cook. CCC camp grounds, day use areas, and overlooks exist at D.A.R., Savoy, Windsor, Florida and Mohawk Trail.

Other Archaeological Sites:

The Western Connecticut Valley District contains the remains of other structures that do not fall within any of the broad categories noted above i.e., the foundation of an observatory in Savoy , a R.R. Trestle Abutment on the Mohawk Trail, a section of a trolley bed in South River, and sections of the Mohawk Trail itself.

HISTORIC BUILDINGS, STRUCTURES & LANDSCAPES

National Register of Historic Places Resources

The National Register of Historic Places is the nation's list of significant buildings, districts and sites which are worthy of preservation. Serving as the State Historic Preservation Office, the Massachusetts Historical Commission administers the National Register program for the state and maintains the State Register of Historic Places. The State Register includes National Register properties and properties included in local historic districts, local landmarks and properties protected by preservation easements. A single property in the Western Connecticut Valley District is listed on the National Register:

Mohawk Trail (Florida, Savoy, Charlemont)

The many CCC related buildings structures and landscape features have been determined ***eligible for listing on the National Register of Historic Places:***

CCC resources (individual buildings, thematic resources)

This designation means that these resources are to be treated and managed as if they were in fact listed and the repair, rehabilitation and stabilization of National Register properties should be consistent with *The Secretary of the Interior's Standards for the Treatment of Historic Properties.*

Historic Landscapes

A number of specific areas within Western Massachusetts were identified in the Massachusetts ***Landscape Inventory*** (DEM 1982). The WCV largely comprises the Berkshire Hills Unit and to a lesser extent the Taconic Unit. The Berkshire Hills contains the Deerfield Valley Unit (U.S.G.S. Colrain, Ashfield, Shelburne Falls, Greenfield, Williamsburg) and the Cummington Unit (U.S.G.S. Worthington, Goshen). The Deerfield Valley Unit is described as including "probably the finest hill country scenery in

the Berkshires with many small working farms, fine vistas and a pleasing mix of agricultural land and woodland.” The Cummington Unit contains the Chesterfield Gorge “one of the most dramatic in the state” and the many hillside farms, historic structures and small villages in Worthington and Cummington.

Abandoned hills towns create a remarkable ensemble of archaeological remains and attest the difficulties that many 18th, 19th and 20th century farmers faced in trying to eke out a living in the rugged Berkshire and Taconic hills. These remains - stonewalls that partitioned off land for pasture and tillage, the archaeological vestiges of many former farms and mills, together with those still in operation - create significant *vernacular landscapes* for the Berkshire Ecoregions and to the Commonwealth in general. Likewise, the combination of these vernacular landscapes and the varied topography create a collection of significant *scenic landscapes* that are critical to preserve.

SUMMARY

The relatively low archaeological visibility of the Western Connecticut Valley District has extremely important implications for property managers, foresters and students of archaeology and history alike. The existing archaeological record of the WCV is largely a result of sample error as opposed to systematic survey. Because of limited modern population and development pressures, less open and tilled land and fewer artifact collectors, there is potential that relatively intact archaeological sites remain to be discovered here. Thus, sites with good integrity, -- that is, sites with limited disturbance and which have a high degree of scientific research value -- are likely to exist in the Berkshires. These potential conditions make the preservation of archaeological sites within the Western Connecticut Valley District of paramount importance and place an additional burden on the property manager and forester.

Appendix G – Statutory Policy and Guiding Principles

PART I. ADMINISTRATION OF THE GOVERNMENT

TITLE XIX. AGRICULTURE AND CONSERVATION

CHAPTER 132A. STATE RECREATION AREAS OUTSIDE OF THE METROPOLITAN PARKS DISTRICT

Chapter 132A: Section 1F. Duties of bureau of forestry

Section 1F. The bureau of forestry shall, under the supervision of the director, with the approval of the commissioner perform such duties as respects forest management practices, reforestation, development of forest or wooded areas under the control of the department, making them in perpetuity income producing and improving such wooded areas. It shall be responsible for such other duties as are now vested in the division of forestry by the general laws or any special laws and shall be responsible for shade tree management, arboricultural service and insect suppression of public nuisances as defined in section eleven of chapter one hundred and thirty-two, subject to the approval of the director and, notwithstanding the provisions of any general or special law to the contrary, the bureau may require all tree spraying or other treatment performed by other departments, agencies or political subdivisions to be carried out under its direction. The bureau may promulgate rules and regulations to carry out its duties and powers. It shall assume the responsibilities of section one A of chapter one hundred and thirty-two and shall be responsible for such other duties as are not otherwise vested in the division of forestry; provided, however, that all personnel of the forest, fire, shade tree and pest control units in their respective collective bargaining units at the time of this consolidation to the bureau of forestry shall remain in their respective collective bargaining units.

M.G.L. 132A Sec 1D enacted 2003 c. 26 Sec 393 effective July 1, 2003

Chapter 132, Section 40, provides a framework within which the Bureau of Forestry operates and defines its mission.

*It is hereby declared that the **public welfare requires the rehabilitation, maintenance, and protection of forest lands** for the purpose of conserving water, preventing floods and soil erosion, improving the conditions for wildlife and recreation, protecting and improving air and water quality, and providing a continuing and increasing supply of forest products for public consumption, farm use and for the wood-using industries of the commonwealth,*

*Therefore, it is hereby declared to be the policy of the Commonwealth that all lands devoted to **forest growth shall be kept in such condition as shall not jeopardize the public interests**, and that the policy of the Commonwealth shall further be one of **cooperation with the landowners and other agencies** interested in forestry practices for the proper and profitable management of all forest lands in the interest of the owner, the public and the users of forest products.*

GUIDING PRINCIPLES (Sustainable Forest Management)

Ecosystem Management: The principles of Ecosystem Management (EM) guide the Bureau of Forestry in carrying out its mission. In contrast with traditional, production-oriented resource management, ecosystem management is "...a philosophical concept for dealing with larger spatial scales; longer time frames; and in which management decisions must be socially acceptable, economically feasible and ecologically sustainable". Rather than setting commodity-based targets, EM defines desired conditions and develops strategies that lead to achieving them. Although some have put forth more complex definitions, EM can be considered to have three main elements: biodiversity, a social component and adaptive management.

Conserving Biodiversity: Biodiversity is the variety of life and its processes; and includes the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur. Biodiversity may be sought on any scale: an entire landscape, an urban neighborhood or an aggregation of microscopic organisms. Generally speaking, the more diverse an ecosystem is, the more stable and resilient it is in the face of disturbance. In EM, three types of diversity are considered. Structural diversity can occur within a small group of trees (stands) where multiple age and/or size classes may be present. The term can also relate to a landscape with an aggregation of even-aged stands or a mixture of forest and other types of open space such as farmland and water. Compositional diversity relates to a mix of organisms, across a variety of scales, from the landscape to the stand level. Functional diversity relates to the genetic diversity within a population and also to the ability of an ecosystem to support processes necessary for its functioning and perpetuation.

Social Component: EM considers humans to be an integral component of the ecosystem, with the ability to meet many of their needs through the thoughtful application of EM principles. EM is collaborative and public participation is a part of the decision-making process. Like all democratic processes, effective EM requires that participants be well-informed and willing to compromise to achieve consensus. When ownerships are complex, some issues can only be brought to resolution by involving all of the stakeholders and creating partnerships through which desired conditions can be achieved.

Adaptive Management: Learning by this process occurs from the results of past actions. It is circular in nature and its components are: plan, act, monitor and evaluate. If the desired results of an action have not been achieved, the actions are modified when the process begins anew. Monitoring and evaluation are accomplished through: resource inventories and their analyses and deliberate and efficient record keeping.

The Role of Working Forests: To achieve its mission of balancing social needs with ecosystem health, the Bureau uses silviculture and other management tools to create a desired condition. Because the removal of trees is an extremely labor-intensive activity, current markets for wood products have a significant impact on the cost-effectiveness of creating desired conditions; some objectives will generate revenue and others will require an investment of revenue.

Action through Programs: The Bureau carries out its mission by managing the state forest and park system and by providing education, technical assistance, technology transfer, resource assessment, monitoring, regulatory oversight and outreach. It organizes and conducts this business through five program areas: Service Forestry (private lands), Management Forestry (state lands), Urban Forestry, Forest Health, and Marketing & Utilization. In the delivery of these programs, it cooperates with federal and other state agencies, municipalities, the business community, non-governmental organizations, academia and individual landowners.

Appendix H – Public Comments

Responses to Public Comments

The Draft Western Connecticut Valley District Forest Management Plan (FRMP) was presented to the public on January 31, 2007 at the Western Gateway Heritage State Park in North Adams, MA. Eight public participants attended the meeting, which was designed to present the key finding and results of the proposed forest management plan and solicit comments. Notices were posted in the *Environmental Monitor* and the DCR Forestry Program web pages encouraging the public to comment on the draft plan. It should be noted that the general feedback by the public at the September 29th meeting and personal contact by others is one of general agreement with the proposed plan.

The Bureau of Forestry received comments from 71 all terrain vehicle (ATV)/off highway vehicle (OHV) supporters concerned about forest reserves, the Massachusetts Forest Landowner Association, The Nature Conservancy, the Sierra Club, Susan Benoit and Alexandra Dawson of Massachusetts Audubon, Environment Massachusetts and the Appalachian Mountain Club. A “content analysis” was conducted to identify areas of support, concerns, and suggestions. Each respondent’s specific comments were coded and combined where there was commonality. The results of the “content analysis” were further sorted by Forest Management Plan topics. All comments were assessed for change and incorporation into the Plan. The following are the support, suggestions, concerns of the public and their disposition.

The following comments were received during the public comment period (January-February 2007) concerning the *Draft Southern and Northern Berkshire and Western Connecticut Valley District’s Forest Resource Management Plans*.

A. Forest Reserves:

1. Amount of forest reserves issues: Public comments were received concerning the amount of forest reserves (large and small-scale) proposed in the Draft Plans. Public comments ranged from support for the proposed amount; complete opposition to delineating any forest reserves; a call to reduce the amount; and, conversely, support for increasing the amount of forest reserves. It should be noted that this public issue is a continuation of comments received during the Forest Reserve and Berkshire Ecoregional development comment period and it is expected that over time the issue will continue to persist.

Bureau’s response to amount of forest reserve issues: Approximately 27% of the State Forest and Park system lands have been delineated as forest reserves for the multiple purposes of providing late successional habitat, interior forests, biological, genetic and ecological diversity, and back-country recreation values. The Bureaus, in cooperation and coordination with internal and external partners, devoted much time and effort identifying the proposed location and amount of forest reserves. The Bureaus assessment of public comments has resulted in the conclusion that the proposed forest reserve system meets the scientific and publicly developed criteria and purpose of forest reserves. It should also be noted that the Bureaus, together with the University of Massachusetts, DCR Division of Water Supply and Protection, and the MA Department of Fish and Wildlife, Division of Fisheries and Wildlife has initiated a Long-term Monitoring system that will address many of the public issues related to forest reserve and actively managed forests.

2. Tolland State Forest reserve issues: A large number of public comments suggested that the Tolland State Forest forest reserve should be removed from the forest reserve design because it is a long-term special and unique place (this issue also relates to the public comment on special places) for ATV-OHV

use. The public suggested that ATV-OHV use be allowed in forest reserves. Some public specifically commented that the Tolland State Forest forest reserve was correctly identified and support the delineation of the forest reserve.

Bureau's response to Tolland State Forest reserve issues: The Bureaus recognize that the Tolland State Forest forest reserve has existing trails that have had long-term ATV-OHV use. These trails are very important to the sector of the public who recreates using ATVs-OHVs. The trails and associated use has become a very special and unique place over time for generations of users. New information related to forest ecology, watershed management, and biodiversity, and the need and desire that forests, including recreation, be managed for long-term sustainability through GIS analysis, applying the small-scale forest reserve criteria and combining with local knowledge of the forest ecology of the area, a portion of Tolland State Forest was identified as a proposed small scale forest reserve.

In response to public comment, Bureau and DCR staff conducted a field review of the Tolland State Forest small-scale forest reserve. As a result of the field review, it was determined that the forest reserve meets the criteria, purpose, and need for forest reserves. The Tolland State Forest forest reserve will remain as a forest reserve. Furthermore, it was determined that ATV-OHV use is not consistent with the criteria, purpose, and need of forest reserves. Therefore, ATV-OHV use and activity will not be included in this forest reserve areas as well as other reserve areas. In summary, the environmental impact observed during this field trip (and where the use is occurring elsewhere) is considerable and beyond the threshold established for forest reserves.

Field observation concerning the use of the ATV-OHV trail included:

- The trail is located in close proximity to the Farmington River
- The trail has considerable damage and is causing erosion and degradation of water quality
- The trail and use has adverse impacts to ecological functions and biodiversity (important species and habitats)
- The trail leaves the Farmington River riparian zone and ascends a steep hillside which is approximately 30% in slope or greater
- Substantial erosion is occurring on this steep trail (a portion has been abandoned and relocated)
- As the relocated trail erodes, the users are widening the trail (in some cases wider than 20 feet) causing additional erosion and site degradation.

The Bureau and DCR understand the importance of ATV-OHV use and activity by the public who enjoy this type of outdoor recreation. Until the Tolland State Forest is evaluated for ATV-OHV use using DCR's "Motorized Trail Recreation Facility Assessment Policy," the use may continue. As soon as the Tolland State Forest ATV-OHV evaluation has been completed, the ATV-OHV trail will be closed to the use. Pedestrian use may occur, however, some portions of the trail will be relocated away from the river. Depending on the outcome of the evaluation, a new ATV-OHV trail may be established (relocated), consistent with ATV-OHV trail guidelines that are publicly safe, environmentally sound, and maintained over time.

3. Expansion of forest reserves issues: Public comments were received concerning the expansion of large-scale forest reserves including increasing the size to a minimum 15,000 acres. It was also suggested that forest reserves in general may be expanded through fee acquisition, conservation restrictions and/or private landowner agreements who intend to manage their forest lands as forest reserves.

Bureau's response to the expansion of forest reserve issues: The issue of expanding forest reserves and, in particular, expending large-scale forest reserves to a minimum size of 15,000 acres is partially related to the public issue concerning the amount of forest reserve. The large-scale forest reserve design is consistent with the September, 2006 Secretary of the Executive Office of Energy and Environment Affairs *Large-Scale Forest Reserve Announcement* and the 4 years of forest reserve study and field review in the context of the existing inventory of State Forest and Park system lands. The Bureaus recognize that, over time, additional lands may be added to the State Forest and Park system and fully support the increase of forest reserve areas where the evaluation criteria, purpose, and need of forest reserves are met. The Bureaus also support private landowner's choice to manage their lands as forest reserves consistent with the standards and conditions that pertain to the management of State Forest and Parks forest reserves.

4. Management of forest reserves issues: Public comments were made that support the management guidelines as written and also to limit the management of forest reserves to ecological restoration and enhancement. A specific comment was made supporting the continued management of open fields within the forest reserve.

Bureau's response to the management of forest reserve issues: The Bureaus do not intend to alter the proposed management standards and guidelines for the forest reserves. It should be noted that all forest reserves are intended to have as little forest management as possible with a few exceptions. These are: ecological restoration and enhancement where non-native and unnatural conditions (such as off-site and non native plantations) are included in the design. Also included are significant emergency situations that threaten the public interests, such as a highly destructive invasive species forest pest or extreme fuels build-up.

Open fields can and should be maintained primarily through prescribed fire. The prescribed fire prescription should contain the optimum timing of the use of fire to improve habitat and minimize adverse impacts such as disrupt nesting season, wildfire risks, recreation, air quality, etc. Use of mechanized equipment may occur if prescribed fire opportunities are not available.

5. Miscellaneous forest reserve issues: The public commented that forest reserve references should be cited and that the full suite of criteria used to select small scale forest reserves should be disclosed including the identification of the natural community types or rare species occurrences used in the selection process.

Bureau's response to the miscellaneous forest reserve issues: The Bureau has added the citing of references concerning the identification and delineation of forest reserves consistent with the Division of Fish and Wildlife. The small-scale forest reserve evaluation criteria, which are consistent with the large-scale forest reserve evaluation, are included in the FRMPs. The forest reserve evaluation criteria analysis is presented on individual State Forest resources maps and in methodologies found in the appendix of the FRMPs. Maps include the general rare species and natural community vegetation types used to identify and delineate forest reserves.

6. Forest Stewardship Council (FSC) Certification Program issues: A public comment was made in support of the FSC sustainable and well-managed forest certification program and the Bureaus efforts to meet the conditions of this "green certification" program.

Bureau's response to the FSC Certification Program issues: The Bureau will continue to meet FSC conditions to the highest level possible in consideration of available resources.

B. Forest Resource Management Planning:

1. New definitions suggestions: A public comment was made seeking to clarify and define the purpose of sustainable forest management, commercial forest management, ecological forest management and forest health forest management on state forests, parks, and reservations, including the suggestion that DCR should decouple the management of forests from the parks.

Bureau's response to the new definitions suggestions: Definitions of commercial forest management, ecological forest management, and forest health forest management have been included in the FRMPs.

Sustainable forest management has been defined as management that considers environmental (ecological), social and economic variables. Sustainable forest management is a long-term planning process and philosophy that carefully balances the environmental, social and economic needs with a comprehensive strategy that provides for native forests, biodiversity; high quality water, air, and climate standards; cultural resources; aesthetics, activities, and uses; renewable forest products and by-products; and the economics associated with employment, revenue, taxes, etc. DCR system lands are managed by sustainable forest management principles, which are annually audited by the Forest Stewardship Council: *Northeast Conditions*.

Commercial forest management has been defined as management that is intensive and designed primarily to focus on the long-term optimization of forest products and revenue within the environmental and harvesting laws and regulations of Massachusetts. It should be noted that private tree farms, industrial forest lands, etc. may be examples of lands managed under commercial forest management. DCR system lands are not managed by commercial forest management principles.

Ecological forest management has been defined as management that is based on ecological principles such as working within site condition constraints and managing for native and natural species and communities, natural disturbance patterns, and forest composition, structure, and function. Included in ecological forest management is ecological restoration and maintenance, resulting in a forest where non-native species may occur but will be managed for native species or habitats such as early successional or exemplarily vegetation communities. Although DCR does not manage the forest solely by forest ecological principles, DCR supports the principles of ecosystem management (ecological, social, and economic considerations) which includes many of the principles of ecological forest management.

Forest health forest management has been defined as management that is the result of managing the forest based on species composition, age, structure, growth, vigor, and mortality. Although DCR does not manage the forest solely by forest health forest management, DCR supports the principles of managing the forest in consideration of forest health considerations.

Legislatively there is no difference in the definitions of State Forests, Parks, and Reservations. Over time, Massachusetts acquired properties and arbitrarily named them either as a State Forest, Park, or Reservation. DCR recognizes that the public perceives that each name (Forest, Park, or Reservation) means that a different purpose, activity, or use occurs. DCR has a long history and knowledge of each property and their associated activities, uses, and issues. We seek public input and comments on their future management. Regardless of the property name, DCR manages according to the larger landscape characteristics, site and environmental factors, appropriate uses and activities, and natural resources needs with a high level of sensitivity. In summary, high use areas (known as intensive use) are managed for

public safety, use and activity in the context of environment laws and regulations, and in partial consideration of biodiversity and forest health (as defined by DCR).

The suggestion of decoupling forest and parks is a consideration worthy of exploration but beyond the scope of this analysis. The issue of first defining state forests and parks as separate entities, establishing evaluation criteria to identify potential forest and parks by the “new definition”, applying the evaluation criteria, and assessing the analysis will be forwarded to DCR leadership for consideration.

2. *New planning zone issues:* A public comment was made to develop a new zone that splits Zone 2. This new zone would emphasize dispersed recreation with no “commercial” timber harvesting.

Bureau’s response to the new zone issues: The forest reserve system was established primarily to incorporate “unfragmented landscapes”, backcountry areas, and larger landscape level forest blocks that serve well as dispersed recreation areas. Further analysis (appendix maps) indicate that the Bureaus identified and proposed forest reserve areas that either meet or partially meet the suggestion of emphasizing dispersed recreation where forest management, unless for the purpose of ecological restoration and maintenance, should not occur. It should also be noted that Massachusetts DCR system lands are proportionally similar to the White Mountain National Forest and Maine Bureau of Parks and Lands; small in parcel size, dispersed within the landscape, and much more developed by roads, housing, other structures, and facilities such as utility lines. The feasibility of delineation DCR system lands (property sizes ranging from 100 acres to 12,000 acres) into multiple zones like National Forest System Lands (property sizes ranging from 700,000 to millions of acres) might be cumbersome, difficult to administer, and pose unnecessary complexities to the public users.

3. *Forest and natural resource management unit planning issues:* Public comments were made supporting the development of unit plans and to stop all cutting until the unit plans are completed. Other comments were made in support of the Southern and Northern Berkshire and Western Connecticut Valley Districts FRMPs. These comments included the support for the Plan’s hierarchical approach emphasizing biodiversity conservation, rare species habitat, maintaining native ecosystems, maintaining forest health, long term planning and adaptive management.

Bureau’s response to the forest and natural resource management unit Plan issues: DCR supports the development of unit Plans that include natural and cultural resources, activities and uses, infrastructure guidance and direction, and operational and monitoring procedures. The Southern and Northern Berkshire and Western Connecticut Valley District FRMPs contain many of the attributes and site specific information that can be readily used in the development of unit Plans (see appendix maps). DCR’s Resource Management Planning process will be developing unit Plans across the state as staffing allows. The Plans will incorporate information from the District FRMPs and then serve as the guiding planning document for the park, forest, reservation, or pathway.

DCR does not agree that all harvesting (cutting) should not occur until unit Plans are completed. DCR system lands have been managed over time with minimal written guidance in the form of any management plans. An example is Mount Greylock Reservation which has been under the supervision and management of professional foresters since 1904 when the office of State Forester was established. The Southern and Northern Berkshire and Western Connecticut Valley Districts FRMPs contain a wealth of the most current information, the short and long-term desired condition of the forest (up to 105 years from now), clear guidance for the prioritization and management of the natural resources, information on where forest management activities may take place, resource needs to implement the Plan, and monitoring strategies. DCR also complies with all environmental and harvesting laws and regulations and is annually audited by a third party under Forest Stewardship Council Northeast standards and conditions for

sustainable and well-managed forests.

4. Forest Resource Management Plan criteria and limitations issues: Some public comments suggested that the FRMPs have clear criteria and limitations for the type and location of forestry operations (defining where and when management practices will occur) pending completion of property level resource management plans. Other public comments supported the Bureau's efforts to do good forest management in the context of the FRMPs.

Bureau's response to Forest Resource Management Plan criteria and limitations issues: As stated above, the FRMPs have clear criteria and limitations for the type and location of forestry operations. The Plans should be carefully examined to understand the management philosophy, direction, emphasis and priorities, and conditions upon which management may occur, as well as maps of each unit visually depicting the forest resource management process, philosophy and outcome.

5. Habitat and rotation issues: Some public comments suggested that the 105 year rotation is an economic rotation and that extended rotations will not provide for late successional habitat. Other public comments supported early successional habitat on state land. Another public comment encouraged maximizing uneven age management located adjacent to forest reserves and described the frequency and intensity of harvesting in extended rotation management including, if possible, mapping uneven age management to show how they complement forest reserve areas.

Bureau's response to habitat and rotation issues: The 105 year rotation was selected based on forest health, forest biological, aesthetics, activities and use conditions and considerations. The biological basis for selecting the 105 year rotation is that this is the "normally accepted" culmination point where the mean and average annual incremental (growth) cross and depart. The economic rotation is generally based on two concepts 1) maximizing the financial returns from an "operating" or "commercial" forest and 2) maximizing the rate of return. Clearly, an economic rotation or financial orientation to the management of DCR lands was not a consideration since DCR does not manage their forest land within this framework.

Two rotation ages (105 and 150 years) for even aged forest management system were selected because of all the biological, cultural, social, and economic values associated with DCR system lands. It should be noted that where forest management occurs, additional site specific measures such as the retention of wildlife trees, legacy or standard trees and down and coarse woody debris are planned to enhance and simulate natural processes, biological considerations, and social expectations at the expense of revenue (this is the same as revenue) and value.

A 150 year even age forest management rotation system was selected to complement the forest reserve systems, increase forest ecological value and biodiversity, and address public aesthetic concerns near and adjacent to special places, activities, and high use areas. It is DCR's thinking that a 150 year rotation may provide components of late successional habitat as stands develop over time. The intent of the 150 year rotation is to provide late successional habitat which is one of the major goals of the forest reserve system.

The providing of modest amounts of early successional habitat, according to the ecological conditions of the Berkshire Ecoregion Ecological Assessment, is an important part of the District FRMPs strategy to provide for biodiversity and habitat for a large number of species. It should also be noted and recognized that many small games species that are traditionally hunted rely primarily on early successional habitat. In addition, these areas also are especially important to non-game wildlife and plant species.

Where possible, extended rotation and uneven age forest management systems will be identified through preliminary GIS analysis and mapped adjacent to forest reserves as will important aesthetic, activity, and use areas. It should be noted that the GIS data is an approximation and field verification and adjustment over time will be necessary.

The District FRMPs provide further description of the frequency and intensity of harvesting in extended and uneven age rotation forest management.

6. *Rare species issues:* Some public comments suggested the need to improve resource inventories (including rare species inventory); a question about how biodiversity goals were set given the lack of detailed information about rare species and the need to specifically include spotted turtle habitat on state land and how it should be managed in accordance with the spotted turtle conservation management practices. Other comments complimented and supported the DCR biodiversity strategy including rare species conservation management, the removal of non-native plantations, age class diversity (including late successional stages), and uneven age structural features.

Bureau's response to rare species issues: The District FRMPs were developed with the best available scientific information. The Core Forest Resource Planning Team included a scientist from the MA Natural Heritage and Endangered Species Program (NHESP) who served two primary functions: 1) direct input and participation in all aspects of the planning process and 2) coordinated the input and review by NHESP specialists throughout all phases of the preparation of the Plans. NHESP and DCR have considerable information on rare species and their habitat as well as an understanding that the data set may never be completed. It should be noted that an extraordinary effort has been made to prioritize and complete formal, publicly reviewed rare species Conservation Management Practices. The spotted turtle, although not presently considered a rare species at this time, Conservation Management Practices has been included as a requirement in the District Forest Management Plans.

DCR's biodiversity strategy was predicated on establishing: 1.) a goal that all DCR system lands should be managed for native species, 2.) delineation of forest reserves to serve as late successional habitat, 3.) rare species and vegetative community conservation, and 4.) diversity in species composition and structure.

7. *Forest health issues:* Some public comments suggested that there should be a complete list of major forest health issues; there was objection that the sole management of hemlock woolly adelgid is removing affected trees; that the population of invasive species along skid trails and soil disturbance associated with forestry should be addressed; and that Plan should differentiate between natural mortality and unnatural mortality associated with introduced pests and diseases and air and water pollution.

Bureau's response to forest health issues: The revised Plans have incorporated the entire list of presently known major forest health issues. The hemlock woolly adelgid section includes a number of measures that address the management of eastern hemlock trees and forests.

Invasive species, which are recognized as a major threat to native Massachusetts species, are dealt with through a number of measures. The Plan included direction on the prevention of introducing invasive species while conducting harvest operation by requiring clean logging equipment. The measure is designed to reduce potential seed dissemination from equipment. It is fully recognized that skid trails and exposed soils present potential opportunities for the establishment of invasive species. Past experience has indicated that rapid regeneration of vegetative native species, in most cases, has resulted in the establishment of predominately native vegetation. Project level monitoring that includes

identification and treatment of newly established herbaceous invasive species is included in the Plans monitoring strategy.

Differentiating between natural mortality and unnatural mortality associated with introduced pests and diseases and air and water pollution may occur through a number of ways recognizing there will be a number of limitations and uncertainties concerning specific and accurate assessment of the exact causes and relationships of introduced pests and diseases, water pollution and other factors such as natural disasters, vegetative successional processes, climate change, etc. Landscape inventories such as the U.S. Forest Service's Forest Inventory and Analysis, the Bureau's Continuous Forest Inventory, and efforts such as a cooperative University of Massachusetts Long-term Ecological Monitoring Program should provide important information on broad changes and trends in vegetation that could be further analyzed for cause and effect relationships with their change agents. The Bureaus routinely seek and cooperate on scientific studies which will include the emerging issues of changes in vegetation including mortality.

It should be noted that Massachusetts forests, in general, are becoming mature and in many cases overstocked. It is widely known that this situation increases the basic competitive stresses for sunlight, water, and nutrients (basic components of survival needs) and as environmental stress increases and becomes limiting factors, forests become more susceptible to damaging agents and catastrophic changes. The Bureau's staff and scientists (primarily the U.S. Forest Service Forest Health Specialist) are dispatched to assess forests where wide-spread mortality has occurred and prepare formal reports on the cause of the mortality, damaging agents, and integrated approaches to managing the affected forest and forest that may be affected in the future.

8. Forest economic issues: Some public comments supported the balanced economic benefits through the production of forest products with other ecological and social benefits, the Plans create new sources of funding to deal with infrastructure maintenance and invasive species, and increased harvesting on state land will increase forest trust fund payments to towns. Other public comments suggested that the FRMPs should be economically sustainable.

Bureau's response forest economic issues: The Plan was carefully and thoughtfully (with all of the public's input considered) developed in a manner that balances the ecological, social, and economic considerations over time (105 years). It equally considers and is predicated on ecological, social, and economic sustainability (Forest Stewardship Council definition of a well-managed forest), stands the chance of being accepted by the public and implemented over the long-run. The public acceptance and long-term resilience of State Forest, Park, and Reservation system lands is one of the Bureau's primary goals. Constantly changing forest resource management plan strategies, where there are wide imbalances in the ecological, social, and economic factors, have not withstood the challenges of time, failed, and resulted in mismanaged forests.

The Plan will provide a number of ecological, social, and economic benefits because of its design. Some public comments recognized that environmental, administrative, and recreational improvements will occur, such as improved roads and trails, public access with reduced erosion and improved water quality; identification and treatment of known invasive species; closing of unauthorized ATV and OHV trails; picking up of trash and abandoned junk; increased forest trust fund payments to towns; etc.

The Plan is not economically sustainable from a stand alone "business" or "commercial" sense nor was there a goal to manage the State Forest, Parks, and Reservation in a manner where the costs and revenues balance. The enabling legislative mandate for our forests includes a multiple resource and use mission, including providing forest products and revenue. Society has placed high values on forests landscape values such as: water quality, rare species, cultural resources, aesthetics, recreational activities, uses, and

lands where no forest management occurs (forest reserves). It should be noted that these values were addressed first during the forest resource management process. To be economically sustainable, a higher percentage of forestlands suitable for forest management would need to be allocated in the Active Management Area than currently proposed and the levels of harvesting would need to be increased from the presently planned modest level (that addresses the entire suite of ecological, social, and economic considerations) to one that focuses more on an “industrial” or “commercial” approach.

9. Important and sensitive natural resource issues: Some public comments were concerned that increased harvesting may unintentionally harm undocumented but important resources or undermine public support for the Green Certification process. DCR should avoid cutting in areas likely to be of high sensitivity, unless and until a site specific management plan clearly identifies overriding justifications for such work. Comments also questioned whether the aesthetics of “special places” for people who have long used the forest for special recreation may be unacceptably altered.

Bureau’s response to important and sensitive natural resource issues: The Plan portion of the rare species and communities and High Conservation Value Forests was developed by the Division of Fisheries and Wildlife, NHESP staff based on the best information available. These plans will be amended or revised when and if new information becomes available and are predicated on “adaptive management” principles. FRMPs during the implementation are required to meet the Forest Cutting Practices Act and associated Massachusetts environmental legislation such as Endangered Species Act, Wetlands Protection Act, etc. The Bureau’s Service Forestry and NHESP staff review and approve all proposed harvesting plans, again with the best information available. The Bureau has also begun, as necessary by priority and with available funding, to initiate rare species and vegetative community searches to further ensure the identification of important and sensitive natural resources. The Bureau’s staff routinely attends professional training on rare species, plant identification, wetlands delineation, vernal pool management, visual management and conduct frequent field trips to review management forestry staff’s work and “lessons” learned. Over time, there is a possibility that rare species are being disturbed. However, due to the Plan’s modest forest management strategy and commitment to silvicultural systems, impact to species and alterations of habitat should be slight or even beneficial over the long-run.

A site specific management plan (unless 100% of the area is completely inventoried by resource specialists with 100% accuracy) might be expected to have similar risks as the District FRMPs.

The Plans identify sensitive resource sites as well as the process of identifying “special places” and call for forest management consistent with their associated values. Avoiding these sites over the long-term avoids and defers present and future public safety, biodiversity, forest health, and aesthetic issues. Often “special places” are associated with holding onto the present “snap-shot” of what the forest looks and feels like today. Forests are biologically-based entities and change, sometimes rapidly and abruptly over time. Forest management is considered and scheduled for the purpose of maintaining forests, partially to provide to the public recreational opportunities that are safe, healthy and biologically diverse. The costs of deferring forest management to the point where widespread forest mortality has occurred is astronomical economically, it can potentially change the aesthetics in a more dramatic manner than forest management, and is ecologically far more intrusive than the modest approach currently planned. The Bureau recognizes that the desired level of public satisfaction for State Lands Forest Management will be achieved through providing for a wide range of values. Forest management that is planned and implemented with the balance of Commonwealth interests through public participation and input and according to the principles of sustainable ecological, social, and economic forest management will in the long run result in the public support and appreciation of how state public lands are managed.

In summary, all expected adverse impacts to important sensitive and natural resources are expected to be short term in means of intensity, impact, and duration.

10. Plan omissions: The following omissions were reported by the public:

a. The FRMPs do not include maps according to FSC standards and property maps are excellent, should include non DCR protected land.

b. The list of intensive use areas needs to be completed.

c. WCV: On page 51, 24% of the forest is over 90 years of age, however, in the description of current conditions, it is reported that we have 15% over 114 years old, this needs to be reconciled.

d. Confirm page 18 WCV listing that 49.87% of protected OS has unknown ownership.

e. Develop a chart breaking down the management areas, recreation corridors, stream/wetland corridors, extended rotation forests and early succession forests, including a breakdown by town.

Bureau's response to Plan omission issues:

a. Maps meet the FSC standards, as the list of maps included in the Northeast Certification Standards are "recommended" vs. required. The revised final Plan included a map with non DCR protected land.

b. The revised final Plan included a current completed list of intensive use areas

c. Page 51 has been reviewed and revised to reconcile conflicting and different percentages of forest in the 90 and above and 114 year old age classes.

d. This comment is in error, this percentage refers to all Chapter 61 lands, not "unknown ownership."

e. The revised Plan has a new chart breaking down the management areas, recreation corridors, stream/wetland corridors, extended rotation forests and early succession forests, including a breakdown by town.

11. Active Forest Management issues: Some public comments were concerned that salvage logging, if improperly applied, may excessively remove downed woody debris and future nutrients. They suggest that salvage logging be limited to prevent further damage to the forest on non-threatened forest regeneration. Other public comments supported the DCR Active Forest Management Program emphasizing native biodiversity as the underlying silvicultural and vegetation management goal on all state forest and park lands including restoration of native forest conditions maintaining a diversity of native forest types and age classes, removing nonnative plantations and emphasizing ecosystem function.

Bureau's response to Active Forest Management issues: All forest plan standards and guidelines apply to salvage operations, therefore it is highly unlikely that salvage would be improperly applied resulting in excessive removal of downed woody debris and loss of future nutrients. The Plan calls for all treatment areas to provide for horizontal and vertical structure as a means of providing coarse woody debris for the purposes of habitat and nutrient recycling. Forest salvage operations are scheduled in consideration of all resources and forest plan goals. In Forest Reserve areas, there are no plans to conduct salvage operations unless they meet the strict exception criteria established in the Plan.

The support for the Plan's Active Forest Management Program emphasizing native biodiversity as the underlying silvicultural and vegetation management goal on all state forest and park lands including restoration of native forest conditions, maintaining a diversity of native forest types and age classes, removing nonnative plantations, and emphasizing ecosystem function is appreciated. Providing for a diversity of biological conditions (biodiversity) is one of our principle and underlying forest management goals. Implementation, over time, will prove invaluable from an ecological, social and economic standpoint especially if global climate change and catastrophic damage to our forest occurs as expected. Providing for biodiversity and advancing a pro-active forest management philosophy is our insurance and assurance that forests will support a high level of species and habitats over time. The alternative is low biodiversity because of very similar, non-diverse habitats.

12. Global climate change issues: Some public comments were concerned about an over-emphasis on early successional forest management and not providing carbon sequestration benefits. Other comments supported the anticipation of global climate change and the management for biodiversity.

Bureau's response to global climate change issues: global climate change, including effects of carbon sequestration in relationship to forest management, is an important emerging area of concern and consideration. The Plan does not rely heavily of the creation of early successional habitat as a strategy to increase the rates of carbon sequestration. The Plan focuses the following forest management techniques that can help to sequester carbon: a.) reduce forest densities by thinning to keep trees healthy as a way to minimize forest health problems (dead, decaying trees and wildland fires emit carbon at high rates), b.) encourage the rapid reforestation that is relatively free to grow after natural disasters or forest management regeneration practices, and c.) utilization of wood products and energy generated from wood (sustainably and locally grown) in lieu of the production of fossil fuel-intensive products such as steel and concrete, energy from fossil fuels, and all products transported from afar.

C. Public Input Issues:

Some public comments suggested that the public input for planning and timber sales should be improved and that the state should engage the public in a process to understand what the residents in MA value in their state forest and park system.

Bureau's response to public input issues: DCR has had 9 public meetings and 4 open public comment periods associated with the development of the plans. The public has had multiple opportunities to provide their input into the Ecoregional Ecological Assessment; Forest Reserve systems and the FRMP process in the Berkshire area. DCR has developed a number of measures to inform the public of future planned vegetation management projects and has developed a more expansive public notice policy.

D. High Conservation Value Forest Issues:

A public comment suggested that DCR forest interior areas > 500 acres be designated as High Conservation Value Forest.

Bureau's response to High Conservation Value Forest issues: The Bureau has conducted a GIS analysis of interior forest areas > 500 acres both within and outside of the Forest Reserve systems. Interior forests > 500 acres in size and not in the Forest Reserve systems will be designated as High Conservation Value Forests and managed according to extended rotation (150 years) and uneven age (150 year) silvicultural systems.

E. Forest Monitoring Issues:

Some public comments supported the development of the long- term ecological monitoring program and suggested that the monitoring report contain progress concerning the implementation of the Plan.

Bureau's response to forest monitoring issues: The Long-Term Ecological Monitoring Program is designed to provide agency and public answers concerning forest reserve and active management over long periods of time. This is one of the most important aspects of the Plan and is the first priority for funding within various DCR Bureaus. The Plan monitoring report includes a summary comparison of what was planned, implemented and their effectiveness.

Appendix I - Glossary

Acceptable Growing Stock (AGS) - see **Management potential**

Aesthetics - forest value, rooted in beauty and visual appreciation, affording inspiration, contributing to the arts, and providing a special quality of life

Allowable harvest - the calculation of the amount of forest products that may be harvested, annually or periodically, from a specified area over a stated period, in accordance with the objectives of management

Aspect - the orientation of a slope with respect to the compass; the direction toward which a slope faces; north facing slopes are generally cooler than south facing slopes

ATV – abbreviation for “all terrain vehicle”

Basal area - a measurement of the cross-sectional area of a tree trunk, in square feet, at breast height. Basal area (BA) of a forest stand is the sum of the basal areas of the individual trees, and is reported as BA per acre

Biological diversity - the variety of plants and animals, the communities they form, and the ecological functions they perform at the genetic, stand, landscape, and regional levels

Biological legacy - an organism, a reproductive portion of an organism, or a biologically derived structure or pattern inherited from a previous ecosystem — note: biological legacies often include large trees, snags, and down logs left after harvesting to provide refuge and to structurally enrich the new stand

Biological maturity - the point in the life cycle of a tree at which there is no net biomass accumulation; the stage before decline when annual growth is offset by breakage and decay - see **Financial maturity**

Biomass - the total weight of all organisms in a particular population, sample, or area; biomass production may be used as an expression of site quality

BMP – abbreviation for forestry “Best Management Practices,” these are techniques that forestry operations should use to minimize the overland speed and volume of water carrying sediment and nutrients

Board foot - see **Volume, tree**

Bole - the main trunk of a tree

Broad-based dip - an erosion control structure similar to and having the same purpose as a waterbar, structurally, broad-based dips differ in that they are generally longer, less abrupt, often are paved with stone and are more appropriately used on truck roads - see **Waterbar**

Browse - portions of woody plants including twigs, shoots, and leaves used as food by such animals as deer.

Buffer strip - a forest area of light cutting where 50% or less of the basal area is removed at any one time (Ch. 132 regs.).

Canopy - the upper level of a forest, consisting of branches and leaves of taller trees. A canopy is complete (or has 100 percent cover) if the ground is completely hidden when viewed from above the trees.

CAR – abbreviation for “Corrective Action Request”, a requirement to qualify for forest certification

Catastrophic risk - high health and safety risk factors to people, high damage to human structures, or high destruction of forest conditions

CCF - hundreds of cubic feet. See **Volume, tree**

CFI – abbreviation for “Continuous Forest Inventory”; a sampling method using permanent plots that are visited periodically to inventory large forest properties. Its purpose is to ascertain the condition of the forest as regards health, growth, and other ecosystem dynamics. With this information, long-term forest management policy is formulated to serve the needs of its owners.

Cleaning - see **Intermediate cuttings**

CMP – abbreviation for forestry “Conservation Management Practices,” specific science-based guidelines for conservation of rare species during forest harvesting so that rare species listed under the Massachusetts Endangered Species Act are not impacted in a way that jeopardizes long-term viability of local populations

CMR – abbreviation for “Code of Massachusetts Regulations”

Coarse Woody Debris (CWD) - dead and down woody material that is generally greater than 3” in diameter - see **Biological legacy**

Coastal Zone Management (CZM) – abbreviation for the Massachusetts Office of Coastal Zone Management in the Executive Office of Energy and Environmental Affairs

Cord - See **volume, tree**

Compartment - a subdivision of a forest property for administrative convenience and record keeping purposes

Community - a collection of living organisms in a defined area that function together in an organized system through which energy, nutrients and water cycle

Conservation - the wise use and management of natural resources

Coppice cutting - see **Regeneration cutting**

Corridor -a strip of wildlife habitat, unique from the landscape on either side of it, that links one isolated ecosystem “island” (e.g., forest fragment) to another. Corridors allow certain species access to isolated habitat areas, which consequently contributes to the genetic health of the populations involved.

Critical habitat - uncommon habitat of great value to wildlife such as abandoned fields, orchards, aspen stands, blueberry barrens, cliffs, talus, caves, etc.

Crop tree - a term traditionally reserved to describe a tree of a commercially desirable species, with the potential to grow straight, tall, and vigorously. However, a crop tree can be one selected for non-timber purposes (varying with landowner objectives), such as mast production or den tree potential - see **Management potential**

Crown class - an evaluation of an individual tree’s crown in relation to its position in the canopy and the amount of full sunlight it receives. The four recognized categories are: dominant (D), codominant (C), intermediate (I), and overtopped or suppressed (S).

Cull tree - a live tree of commercial species that contains less than 50% usable material. *Rough cull*: a tree whose primary cause of cull is crook, sweep, etc. *Rotten cull*: a tree whose primary cause of cull is rot.

Danger tree - a standing tree that presents a hazard to employees due to conditions such as, but not limited to, deterioration or physical damage to the root system, trunk, stems or limbs, and the direction and lean of the tree - OSHA 1910.266, Logging Operations

Daylight - verb; to cut vegetation adjacent to a road or other open area to increase solar insulation to its surface

DBH – abbreviation for “diameter at breast height,” the diameter at breast height of a standing tree measured at 4.5' above the ground

DEM – abbreviation for the Massachusetts Department of Environmental Management which became the Department of Conservation and Recreation in 2003

Den tree - living hollow trees that are used for shelter by mammals or birds - a synonym is “cavity tree”

DEP – abbreviation for the Massachusetts Department of Environmental Protection

DFG – abbreviation for the Massachusetts Department of Food and Game

DFW – abbreviation for the Massachusetts Division of Fisheries and Wildlife that is a part of the Massachusetts Department of Fish and Game

Diameter-limit cut - a timber harvesting treatment in which all trees over a specified diameter may be cut - see **High grading**

Disturbance - a natural or human-induced environmental change that alters one or more of the floral, faunal, and microbial communities within an ecosystem. Timber harvesting is the most common human disturbance. Windstorms and fire are examples of natural disturbance.

DSPR – abbreviation for the Massachusetts Division of State Parks and Recreation that is a part of the Massachusetts Department of Conservation and Recreation

DWSP – abbreviation for the Massachusetts Division of Water Supply Protection that is a part of the Massachusetts Department of Conservation and Recreation

Ecological Land Unit (ELU) – areas of land and water having similar characteristic combinations of physical environment – elevation, geology and land form (a measure of topography) – and as a result, similar vegetation and habitats

Ecology -the study of interactions between living organisms and their environment

Economic maturity - see **Financial maturity**

Ecosystem - a natural unit comprised of living organisms and their interactions with their environment, including the circulation, transformation and accumulation of energy and matter

Ecosystem management - forest management that is applied with emphasis on 1.) maintaining biodiversity, 2.) addressing societal or social needs, and 3.) being adaptive - see **Forest management**

Ecotype - a genetic subdivision of a species resulting from the selective action of a particular environment and showing adaptation to that environment. Ecotypes may be geographic, climatic, elevational, or soil-related.

Edge - the boundary between open land and woodland or between any two distinct ecological communities. This transition area between environments provides valuable wildlife habitat for some species, but can be problematic for some species, due to increased predation and parasitism. A synonym is “ecotone.”

EOEEA – abbreviation for the Massachusetts Executive Office of Energy and Environmental Affairs

Endangered species - see **Rare species**

Even-aged stand - see **Stand structure**

Featured resource - the resource that is the primary focus of management activities

Financial maturity - the point in the life cycle of a tree or stand when harvesting can be most profitable, i.e., when the rate of value increase of an individual tree or stand falls below a desired alternative rate of return. A synonym is “Economic Maturity.”

Forest land - land that is at least 10% stocked with trees

Forest interior dependent species - animal species that depend upon extensive areas of continuous, unbroken forest habitat to live and reproduce and are susceptible to higher rates of predation and population decline when interior forest habitat is fragmented or disturbed - see **Fragmentation**.

Forest management - the practical application of biological, physical, quantitative, managerial, economic, social and policy principles to the regeneration, management, utilization and conservation of forests to meet specified goals and objectives while maintaining the productivity of the forest.

Forest road - a road owned by and under the jurisdiction of the Department of Conservation and Recreation, Division of Parks and Recreation

Forest type - aggregations of tree species that commonly occur because of similar ecological requirements. Four major forest types in Massachusetts are northern hardwoods, oak/hickory, white pine and oak/pine. A synonym is “forest association.”

Filter strip - an area of forest land, adjoining the bank of a water body, where no more than 50% of the basal area is harvested at any one time (Ch. 132 regs.)

Fragmentation, forest - the segmentation of a large tract or contiguous tracts of forest to smaller patches, often isolated from each other by non-forest habitat, results from the collective impact of residential and commercial development, highway and utility construction, and other piecemeal land use changes

Ford - a stream crossing using a stable stream bottom as the roadbed

FRSAC – abbreviation for “Forest Reserves Science Advisory Committee,” this committee was created as a result of the Forest Futures Visioning Process

FSC – abbreviation for “Forest Stewardship Council,” an independent, non-governmental, not for profit organization established to promote the responsible management of the world’s forests

FVS – abbreviation for “Forest Vegetation Simulator,” a family of forest growth simulation models developed by the U. S. Forest Service

Fuel management - the act or practice of controlling flammability and resistance to control of wildland fuels through mechanical, chemical, biological or manual means, or by fire in support of land management objectives

Girdling - a method of killing unwanted trees by cutting through the living tissues around the bole, can be used instead of cutting to prevent felling damage to nearby trees. Girdled trees can provide cavities and dead wood for wildlife and insects.

GIS – abbreviation for “Geographic Information System,” a computer-based system for collecting, storing, updating, manipulating, displaying and analyzing geographically referenced data

GPS – abbreviation for “Global Positioning System,” a satellite-based navigation system

Grade - the angle of an inclined surface as expressed in terms of percent slope: vertical rise per 100' of horizontal run

Grade, tree - a classification system for standing trees that is based on their potential for yielding high value lumber

Growing stock - for inventory purposes, all live trees that are between 5.0" dbh to 10.9" dbh and are greater than 50% sound - see **Management potential**

Growth, net - the average annual net increase in the volume of trees expressed either as a per acre value or total value for a given unit of land. Mathematically it is expressed as follows: ([growth of the existing trees at the beginning of the period]+ [ingrowth the volume of trees that have reached merchantability during the period]) – ([the volume of trees that have died during the period] + [the volume of trees that have become cull during the period]).

Habitat - the geographically defined area where environmental conditions (e.g., climate, topography, etc.) meet the life needs (e.g., food, shelter, etc.) of an organism, population, or community

High-grading -a type of timber harvesting in which larger trees of commercially valuable species are removed with little regard for the quality, quantity, or distribution of trees and regeneration left on the site; often results when a diameter limit harvest is imposed - see **Diameter limit cutting**

Herbaceous - a class of vegetation dominated by non-woody plants known as herbs; (graminoids [grass], forbs and ferns)

Incidental taking - the taking of a rare species that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity

Intermediate cuttings - operations conducted in a stand during its development from regeneration stage to maturity. These are carried out to improve the quality of the existing stand, increase its growth and provide for earlier financial returns, without any effort directed at regeneration.

Cleaning: a cutting made in a stand, not past the sapling stage, to free the best trees from undesirable individuals of the same age that overtop them or are likely to do so - see *weeding*

Thinning: a cutting whose purpose is to control the growth of stands by adjusting stand density

Salvage cutting: a harvest whose primary purpose is to remove trees that have been or are in imminent danger of being killed or damaged by injurious agents

Weeding: a cutting made in a stand not past the sapling stage that eliminates or suppresses undesirable vegetation regardless of crown position

See **Cleaning**

Landing - any place where round timber is assembled for further transport, commonly with a change in method, generally, a cleared area where log trucks are loaded

Legacy tree - a tree, usually mature or old-growth, that is retained on a site after harvesting or naturally disturbance to provide a biological legacy - see **Biological legacy**

Management plan - a document prepared by natural resource professionals to guide and direct the use and management of a forest property. It consists of inventory data and prescribed activities designed to meet ownership objectives.

Management potential - for forest inventory purposes, a classification method in which a tree is rated based on the likelihood that it will develop into a tree that will be structurally sound, vigorous and yield products of high value. The three classes are as follows:

Preferred Crop Tree: the highest class; a tree with a dominant crown and no or minimal sweep or crook and no or few limbs in the butt 16' log.

Acceptable Growing Stock: a tree of codominant or greater crown class with moderate sweep or crook and a moderate number of limbs in the butt 16' log

Unacceptable Growing Stock: any tree not meeting the above criteria

Also see **Growing stock**

Mast - seed produced by woody-stemmed, perennial plants, generally referring to soft (fruit) or hard (nut) mast

Matrix, Forest - the most extensive and connected landscape element that plays the dominant role in landscape functioning

MBF – abbreviation for a “thousand board feet” - see **Tree volume**

Merchantable - trees, crops or stands of a size, quality and condition suitable for marketing under given economic conditions even if so situated as not to be immediately accessible for logging - see **Operable**

MESA – abbreviation for “Massachusetts Endangered Species Act”

MHC – abbreviation for the “Massachusetts Historical Commission”

Multiple use and value - a conceptual basis for managing a forest area to yield more than one use or value simultaneously, common uses and values include aesthetics, water, wildlife, recreation, and timber

NGO – abbreviation for “non-governmental organization”

NHESP – abbreviation for the Massachusetts “Natural Heritage and Endangered Species Program”

Niche - the physical and functional location of an organism within an ecosystem; where a living thing is found and what it does there

OCR – abbreviation for the DCR’s “Office of Cultural Resources”

OHV – abbreviation for “Off Highway Vehicle”

Old growth stand - a stand that has been formally designated as an old growth stand. These areas must meet a preponderance of the following four criteria: 1.) be of a size that is large enough to be self sustaining. 2.) show no evidence of significant post-European disturbance. 3.) should have a component of trees that are greater than 50% of the maximum longevity for that species. 4.) shall be made up of trees that are self-perpetuating.

Old growth attributes - attributes often associated with old growth forests such as large amounts of coarse woody debris and large trees that are achieved through deliberate actions in a managed forest - see **Biological legacy**

Operable - trees, crops or stands that are both merchantable and accessible for harvesting - see **Merchantable**

Patch - a small area of a particular ecological community surrounded by distinctly different ecological communities, such as a forest stand surrounded by agricultural lands or a small opening surrounded by forestland

Poletimber - see **Size class**

Population - a group of individuals of one plant or animal taxon (species, subspecies, or variety)

Preservation - a management philosophy or goal which seeks to protect indigenous ecosystem structure, function and integrity from human impacts. Management activities are generally excluded from “preserved” forests.

Raptor -a bird of prey such as an eagle or hawk

Rare species -a collective term used to describe species listed under the MA Endangered Species Act as *endangered, threatened, or of special concern*

Endangered: 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

Threatened: 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

Special concern: 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

Recreation, outdoor - outdoor recreation is generally considered to be of two types. *Extensive recreation* is that which occurs throughout a large, dispersed area and is not confined to a specific place or developed facility (e.g., hunting, fishing, hiking, horseback riding, snowmobiling, cross-country skiing, etc.). *Intensive recreation* includes high density recreational activities that take place at a developed facility (e.g., camp and picnic grounds and swimming beaches).

Regeneration - the renewal of a tree crop, whether by natural or artificial means - may be broken down into those treatments that produce stands originating from seed (high forest) or from vegetative regeneration (coppice or sprouts) and create even-aged or uneven-aged stands. A synonym is “reproduction.”

Regeneration cutting - any removal of trees intended to assist regeneration already present or to make regeneration possible. The operation creates either an even-aged stand or an uneven-aged stand.

Clearcutting: (even-aged) removal of the entire stand in one cutting with reproduction obtained artificially or by natural seeding from adjacent stands or from trees cut in the clearing operation

Seed-tree: (even-aged) removal of the old stand in one cutting, except for a small number of seed trees left singly or in groups

Shelterwood: (even-aged) removal of the old stand in a series of cuttings which extend over a relatively short portion of the rotation, by means of which the establishment of essentially even-aged reproduction under the partial shelter of seed trees is encouraged

Selection: (uneven-aged) removal of trees, throughout all size classes, either as single, scattered individuals or in small groups at relatively short intervals, repeated indefinitely, by means of which the continuous establishment of reproduction is encouraged and an uneven-aged stand is maintained

Coppice: (even-aged or uneven-aged) any type of cutting in which dependence is placed mainly on vegetative reproduction

Regeneration interference - an impediment to regeneration due to competing vegetation, or soil/site limitations

Release - removal of overtopping trees to allow understory or overtopped trees to grow in response to increased light

Reproduction – see **Regeneration**

Reserve tree - a tree, pole-sized or larger, retained in either a dispersed or aggregated manner after the regeneration period under the clearcutting, seed tree, shelterwood, group selection or coppice methods. A synonym is “Standard, legacy tree.”

Residual stand - trees remaining following any silvicultural operation

Riparian area -an area in close proximity to a watercourse, lake, swamp or spring

RMP – abbreviation for “Resource Management Plan”

Rotation - the planned number of years between the formation or regeneration of a crop or stand and its final harvest at a specified stage of maturity

Rotation, extended - a rotation longer than necessary to grown timber crops to financial maturity or size and generally used to provide habitat or nontimber values

Salvage cutting - see **Intermediate cutting**

Sapling -see **Size class**

Sawtimber - see **Size class**

Seed tree cutting - see **Regeneration cutting**

Seedling - see **Size class**

Seep (Seepage) - groundwater (as opposed to surface flow) escaping through or emerging from the ground along an extensive line or surface, as contrasted with a spring where water emerges from a localized spot

Selection cutting - see **Regeneration cutting**

Selective cutting - a cutting that removes only a portion of trees in a stand. Note - selective cutting is a loose term that should not be confused with cutting done in accordance with the selection method, is not a recognized silvicultural system and is often synonymous with or associated with high grading.

Shelterwood cutting - see **Regeneration cutting**

SHPO – abbreviation for the Massachusetts “State Historic Preservation Office”

Silviculture - the theory and practice of controlling forest establishment, composition, structure and growth

Silvicultural prescription - a detailed, quantitative plan, at the stand level of resolution, for conducting a silvicultural operation

Silvicultural system - a program for the treatment of a stand throughout a rotation. An even-aged system deals with stands in which the trees have no or relatively little difference in age. An uneven-aged system deals with stands in which the trees differ markedly in age.

Site - the combination of biotic, climatic, topographic and soil conditions of an area; also, the environment at a location

Site index – see **Site quality**

Site preparation - hand or mechanized manipulation of a site designed to enhance the success of regeneration

Site quality - the inherent productive capacity of a specific location (site) in the forest affected by available growth factors (light, heat, water, nutrients, anchorage); often expressed as site index – the height of the average tree in an even-aged stand at a given age. In New England 50 years is generally used as the base age.

Size class:

Seedling: a young tree, less than sapling size of seed origin

Sapling: a tree greater than 1" dbh and less than 4.9" dbh

Poletimber: a tree greater than 4.9" dbh and less than sawtimber size

Sawtimber: a tree greater than 11.0" dbh having at least 8' of usable length and less than 50% cull

Slash - tops, branches, slabs, sawdust or debris resulting from logging or land clearing operations

Slope, steep - an area where the average sustained slope is greater than 50% - see **Grade**

Snag - a standing dead tree, greater than 20' tall, which has decayed to the point where most of its limbs have fallen; if less than 20' tall it is referred to as a *stub*. A hard snag is composed primarily of sound wood, generally merchantable and a soft snag is composed primarily of wood in advanced stages of decay and deterioration - see **Biological legacy**.

Special concern, Species of - see **Rare species**

Species - a subordinate classification to a genus; reproductively isolated organisms that have common characteristics, such as eastern white pine or white-tailed deer.

Stand - a community of trees possessing sufficient uniformity as regards composition, constitution, age, spatial arrangement or condition to be distinguishable from adjacent communities, so forming a silvicultural or management entity

Standard - a tree (or trees) which remain after the harvest in the coppice with standard regeneration methods to attain goals other than regeneration - see **Reserve trees**

Stand condition - stand condition is based on species age, size, quality, and stocking of the trees making up the main stand.

Non-stocked: stands less than 10% stocked with commercial tree species

High risk: stands which will not survive the next ten years, or in which, due to decay, insects, disease, mortality or other factors, will have a net volume loss in the next ten years

Sparse: stands that are not high risk but which have less than 40 sq. ft. of basal area/acre

Low quality: stands which are not sparse or high risk, but have less than 40 sq. ft. of basal area/acre in poletimber or sawlog trees that are classified as either acceptable or preferred growing stock

Mature: an even-aged stand within 5 years of rotation age or beyond rotation age which does not fit into any of the above categories or an uneven-aged stand that exceeds the stocking and size criteria for that type

Immature: any stand more than 5 years from rotation age which does not fit into any of the above categories

In process of regeneration: a stand in which work has been done to establish regeneration; site preparation, planting, seeding, shelterwood cutting, etc.

Stand structure - a description of the distribution and representation of tree age and size classes within a stand

Even-aged, single-storied: theoretically, stands in which all trees are one age. In actual practice, these stands are marked by an even canopy of uniform height characterized by intimate competition between trees of approximately the same size. The greatest number of stems are in a diameter class represented by the average of the stand. The ages of the trees usually do not differ by more than 20 years.

Even-aged, two-storied: stands composed of two distinct canopy layers, such as an overstory and understory sapling layer possibly from seed tree and shelterwood operations. This may also be true in older plantations where tolerant hardwoods may become established as management intensity decreases (burning and other means of understory control). Two relatively even canopy levels can be recognized in the stand. Both canopy levels tend to be uniformly distributed across the stand. The average age of each level differs significantly from the other.

Uneven-aged (sized): Theoretically, these stands contain trees of every age on a continuum from seedlings to mature canopy trees. In practice, uneven-aged stands are characterized by a broken or uneven canopy layer. The largest number of trees is in the smaller diameter classes. As trees increase in diameter, their numbers diminish throughout the stand. Generally, a stand with 3 or more structural layers may be considered as uneven-aged.

Mosaic: at least two distinct size classes are represented and these are not uniformly distributed, but are grouped in small repeating aggregations, or occur as stringers less than 120 feet wide, throughout the stand. Each size class aggregation is too small to be recognized and mapped as an individual stand. The aggregations may or may not be even-aged.

Stewardship - the wise management and use of forest resources to ensure their health and productivity for the future with regard for generations to come

Stocking - the degree of occupancy of an area by trees. In even-aged stands, stocking levels are expressed as different levels (A, B and C) based upon stocking guides that use tree diameter, basal area and number of trees per acre. The A level represents the density of undisturbed even-aged stands. The B level represents the minimum density for maximum basal area and cubic foot growth. The C level represents both the minimum stocking of acceptable growing stock to make a stand suitable for management for timber products and represents 10 years growth below the B level.

Overstocked: stands above the “A” level of stocking for their forest type, tree density and size class

Fully stocked: stands between the “A” and “C” levels of stocking for their forest type, tree density and size class

Understocked: stands below the “C” level of stocking for their forest type, tree density and size class

In uneven-aged stands, stocking is based on residual basal area, maximum tree size and a ratio known as “Q” which is a mathematical expression of the desired diameter distribution.

Structure, horizontal - the spatial arrangement of plant communities; a complex horizontal structure is characterized by diverse plant communities within a given geographic unit

Structure, vertical - the arrangement of plants in a given community from the ground (herbaceous and woody shrubs) into the main forest canopy; a complex vertical structure is characterized by lush undergrowth and successive layers of woody vegetation extending into the crowns of dominant and co-dominant trees - see **Crown class**

Stumpage value - the commercial value of standing trees

Succession - the natural series of replacements of one plant community (and the associated fauna) by another over time and in the absence of disturbance

Sustained yield - historically, a timber management concept in which the volume of wood removed is equal to growth within the total forest, the concept is applicable to nontimber forest values as well

Thinning - see **Intermediate cuttings**

Threatened species - see **Rare species**

Tolerance - a characteristic of trees that describes the relative ability to thrive with respect to the growth factors (light, heat, water nutrients, anchorage), usually used to describe shade tolerance: the ability of a species to thrive at low light levels

TSC – abbreviation for “Technical Steering Committee,” this committee was created during the Forest Futures Visioning Process

T.S.I. – abbreviation for “Timber Stand Improvement,” a loose term comprising all intermediate cuttings made to improve the composition, constitution, condition and increment of a timber stand. The practice may be commercial; yielding net revenues or precommercial or noncommercial; where the cost of accomplishing the work exceeds the value of the products removed.

Unacceptable Growing Stock (UGS) - see **Management potential**

Understory - the smaller vegetation (shrubs, seedlings, saplings, small trees) within a forest stand, occupying the vertical area between the overstory and the herbaceous plants of the forest floor

Uneven-aged stand - see **Stand structure**

U.S.F.S. – abbreviation for the “United States Forest Service”

Vernal or autumnal ponds - a class of wetland characterized by small, shallow, temporary pools of fresh water present in spring and fall which typically do not support fish but are very important breeding grounds for many species of amphibians. Some species are totally dependent upon such ponds such as spring peepers and mole salamanders.

Volume, tree - the contents of the merchantable portion of a tree, expressed either as 1.) board foot volume, where a board foot is equivalent to a piece of wood 12” x 12” x 1” thick, excluding the waste inherent in processing; 2.) Cubic foot volume with no waste attributed to processing; 3.) Cord volume, where 80 cubic feet of solid wood are equivalent to one cord (one cord of wood contains 128 cubic feet of air, bark and wood) or 4.) tons of oven-dried wood

Water bar - a shallow depression, 12" to 36" wide, cut across a dirt road or skid trail at approximately a 30 degree angle to its alignment, for the purpose of diverting the overland flow of water from the surface of the road - see **Broad-based dip**

WCV – abbreviation for the Massachusetts DCR “Western Connecticut Valley” District

Wetland - an area meeting the criteria for a wetland under M.G.L.s, Chapter 131 (the Wetlands Protection Act)

Wildlife tree - a live or dead tree designated for wildlife habitat or retained to become future wildlife habitat

Appendix J – Forest Productivity and Stand Complexity Model

The purpose of this model is to rank forest productivity and stand complexity on DCR - DSPR lands as outlined in *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines*, (see section 4.4 *Assessment and Classification of Forest Stands*) to help broadly guide various silvicultural options. The assumption is that "...more productive, more complex forest conditions will require more complex silviculture." The GIS model uses both vector and grid-based input datasets to produce this relative ranking of forest productivity and complexity.

DATA SOURCES:

1. Prime Forest Soils

Assumption – forest soils with higher potential forest productivity have higher forest productivity

Value:

- 10 - Prime 1 (highest)
- 8 - Prime 2
- 6 - Prime 3 and 3W
- 4 - Statewide and SW
- 2 - Local and LW
- 0 – Unique and Non-Forest (lowest)

Output: PFGRID

2. Potential Vegetation Complexity

Assumption – certain forest types of different size, stocking classes and species variety have higher levels of complexity or potential for enhanced complexity

Value of 10 for:

MajorGroups 2 Hemlock
5 Northern Hardwoods
8 Swamp Softwoods

or SubTypes SR Red Spruce
SF Spruce-Fir

Value of 5 for:

Everything else that isn't a value of 10, 1 or 0

Value of 1 for:

MajorGroups 4 Pitch Pine – Scrub Oak
Except SubTypes HE Heath and SG Sandplain Grassland
6 Birch – Red Maple
9 Swamp Hardwoods

or SubTypes WL White Pine Plantation
RP Red Pine Plantation
SP Scots Pine Plantation

SN Norway Spruce – White Spruce Plantation
 RC Red Cedar
 LA Larch Plantation

Value of 0 for:

SubTypes HE Heath and SG Sandplain Grassland
 or Stocking 0
 or Size 0

Output: [COMPLEXGRID](#)

3. Late successional

Assumption – forest management can best encourage late successional characteristics in certain forest stands that currently have dense stands of large trees

Value 10 - forest areas appropriate for late successional characteristic restoration
(inverse of below)
 Non-plantations and
 Stocking (1 – high) and
 Size (5 – large Sawtimber) and
 MajorGroups (1 – 3, 5, 7)

Value 0 – forest areas not appropriate for late successional characteristic restoration
 Plantation SubTypes (LA, RP, SN, SP, WL) or
 Stocking (2 – medium, 3 – low, 4 – sparse) or
 Size (1 – seedling, 2 – sapling, 3 – pole, 4 – small sawtimber, 9 – uneven aged) or
 MajorGroups (0 – non-forest, 4 – pitch pine – scrub oak, 6 – birch – red maple, 8 –
 swamp softwoods, 9 –swamp hardwoods, 10 – water/non-forested wetlands)

Output: [LATEGRID2](#)

4. Forest Type Diversity

Assumption – forests with lower type diversity are generally less complex – this dataset uses species types, predominance, size class, stocking levels and past disturbance regimes as a measure of forest type diversity

Value 1 1 forest type polygon within analysis area (lowest level of complexity)
 2 2 forest type polygons within analysis area
 3 3 forest type polygons within analysis area
 4 4 forest type polygons within analysis area
 5 5 forest type polygons within analysis area
 6 6 forest type polygons within analysis area
 7 7 forest type polygons within analysis area
 8 8 forest type polygons within analysis area
 9 9 forest type polygons within analysis area
 10 10 forest type polygons within analysis area (highest level of complexity)

Output: DIVERSITY3

5. Early Successional

Assumption – non-forested areas and certain types of forest stands are more suitable for the creation of early successional habitat and have lower forest productivity

- Value 0 - forest areas appropriate for early successional habitat creation
Plantation SubTypes (LA, RP, SN, SP, WL) or
Size (1 –seedling, 2 – sapling, 3 – pole) and
MajorGroups (1 – 7)
- 0 – non forest areas appropriate for early successional habitat creation
Crop (1), Pasture (2), Open (6), Transitional (17), Powerline/Utility (24) or
Brushland/Successional (40)
- Value 10 – forest areas not appropriate for early successional habitat creation
(inverse of above)
- 10 – areas not appropriate for early successional habitat creation
(inverse of above)

Output: EARLYGRID

6. CFI Site Index

Assumption – site index is a good indication of forest productivity since it is used to measure tree productivity and the forest management options at a particular site using species specific information. This value, last measured statewide in 2000, is calculated for each CFI plot and is therefore great empirical data.

Value 10	Site Index 81 – 99
8	Site Index 61 - 80
6	Site Index 41 - 60
4	Site Index 21 - 40
2	Site Index 0 – 20

Output: CFI_SII

7. CFI Stand Structure

Assumption – stand structure is a good indication of forest complexity since it assesses tree age, size classes, stocking conditions and structure within forest stands at each CFI plot. This value, last measured statewide in 2000, is calculated for each CFI plot and is therefore great empirical data.

Value 10	Stand Structure 4
8	Stand Structure 3
3	Stand Structure 2
1	Stand Structure 1

Output: CFI_SSI

Creating the Final Forest Productivity – Stand Complexity Grid:

1. All 7 grids are added together using the Raster Calculator and each grid is given equal weight
 - a. Prime Forest Soils (PFGRID)
 - b. Potential Vegetation Complexity (COMPLEXGRID)
 - c. Late Successional (LATEGRID2)
 - d. Forest Diversity (DIVERSITY3)
 - e. Early Successional (EARLYGRID)
 - f. CFI Site Index (CFI_S11)
 - g. CFI Stand Structure (CFI_SS1)

to create the grid **ForestProGrid** (values from 5 to 56):

This grid was classified into 3 quantiles as follows:

High Forest Productivity – Stand Complexity	5 - 25
Moderate Forest Productivity – Stand Complexity	26 - 32
Low Forest Productivity – Stand Complexity	33 – 56

This grid was also reclassified into 10 quantiles and converted to the dissolved shapefile **PRODUCT_COMPLEX** as follows:

Value 1 (lowest productivity/complexity)	5 - 18
Value 2	19 -23
Value 3	24 -25
Value 4	26 -27
Value 5	28 - 29
Value 6	30 - 31
Value 7	32 - 34
Value 8	35 - 37
Value 9	38 - 40
Value 10 (highest productivity/complexity)	41 – 56

The raw values 5 – 56 are in the field called “GRIDCODE”

The 3 quantile values are in the field called “Quantile3” – Low, Moderate, High

The 10 quantile values are in the field called “Quantile10” – 1 through 10

Appendix K - Bibliography

- Berlik, M.M., D.B. Kittredge, D.R. Foster. 2002. *The Illusion of Preservation: A Global Environmental Argument for the Local Production of Natural Resources*. Harvard Forest Paper No. 26. Harvard Forest, Harvard University, Petersham, MA.
- BioMap, Guiding Land Conservation for Biodiversity in Massachusetts*. 2001. Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries and Wildlife.
- Bormann, F. H and G. E. Likens. 1979. *Catastrophic disturbance and the steady state in northern hardwood forests*. Amer. Sci. 67(6):660-669.
- Burns, Russell M. *Silvicultural Systems for the Major Forest Types of the U.S.* U.S.D.A. Forest Service Ag. Handbook No. 445.
- Burns, Russell M. and Barbara Honkala. *Silvics of North America*, U.S.D.A. Forest Service. Ag. Handbook 654.
- Catanzaro, P., J. Fish and D. Kittredge. 2013. *Massachusetts Forestry Best Management Practices Manual* (2nd Edition). Massachusetts Department of Conservation and Recreation. Available at: <http://www.mass.gov/eea/docs/dcr/stewardship/forestry/response-plan-invasive.pdf>.
- Commonwealth of Massachusetts. 2004. Massachusetts Climate Protection Plan. Available at: <http://www.newamerica.net/files/MAClimateProtPlan0504.pdf>
- Commonwealth of Massachusetts, Executive Office of Environmental Affairs. 2003. *An Ecological Assessment and Forest Management Framework for the Lower Worcester Plateau Ecoregion in Massachusetts*. 2nd Draft. Available at: <http://www.mass.gov/eea/docs/eea/lf/lworchester/lworchester-toc.pdf>
- Commonwealth of Massachusetts, Executive Office of Environmental Affairs, Massachusetts Division of Fisheries & Wildlife, Natural Heritage and Endangered Species Program. 2003. *Living Waters: Guiding the Protection of Freshwater Biodiversity in Massachusetts*.
- Cresko, J. W. and T. M. Kaarsberg. 2009. *Impacts of Increased Energy Efficiency in Buildings and Transport on Energy Intensive Materials Industries*. 2009 ACEEE Summer Study on Energy Efficiency in Industry. Available at: https://www.aceee.org/files/proceedings/2009/data/papers/5_119.pdf
- Davis, S. C., A. E. Hessler, C. J. Scott, M. B. Adams and R. B. Thomas. 2009. *Forest carbon sequestration changes in response to timber harvest*. *Forest Ecology and Management*. 258: 2101 – 2109.
- DeGraaf, R.M., M. Yamasaki, W.B. Leak, J.W. Lanier. 1992. *New England Wildlife: Management of Forested Habitats*. U.S.D.A. Forest Service General Technical Report NE144. Northeast Forest Experiment Station, Radnor, PA. 271 pp.
- Dixon, G. E.; C. E. Keyser, comps. 2008 (revised March 16, 2012). *Northeast (NE) Variant Overview – Forest Vegetation Simulator*. Internal Rep. Fort Collins, CO: U.S.D.A., Forest Service, Forest Management Service Center. 40p.
- Fernholz, K. 2012. Dovetail Commentary: *Beyond Certification*. Dovetail Partners, Inc. Available at: http://www.dovetailinc.org/commentaries_pdfs/2012/beyond-certification-may-2012.pdf
- Foster, D.L., D.H. Knight and J.R. Franklin. 1998. *Landscape patterns and legacies resulting from large, infrequent forest disturbances*. *Ecosystems* (1998)1:497-510.
- Foster, D., J. Aber, C. Cogbill, C. Hart, E. Colburn, A. D'Amato, B. Donahue, C. Driscoll, A. Ellison, T. Fahey, et al. 2010. *Wildlands and Woodlands: A Vision for the New England Landscape*. Cambridge, MA; Harvard University Press.

- Frank, Robert M. and John Bjorkbom. 1973. *A Silvicultural Guide for Spruce-Fir in the Northeast*. U.S.D.A., Forest Service General Technical Report NE-6.
- Hall, B., G. Motzkin, D. R. Foster, M. Syfert, and J. Burk. 2002. *Three hundred years of forest and land-use change in Massachusetts, USA*. Journal of Biogeography 129: 1319-1335.
- Helms, John; Ed. 1998, *The Dictionary of Forestry*. Society of American Foresters. Bethesda, MD.
- Hibbs, D. E. and W. R. Bentley. *A Management Guide for Oak in New England*. Connecticut Cooperative Extension Publication #8312.
- Howe, J. 2012. Dovetail Commentary: *Beyond Certification II – Reducing it to a stronger Solution*. Dovetail Partners, Inc. Available at: http://www.dovetailinc.org/commentaries_pdfs/2012/beyond-certification-ii---reducing-it-to-a-stronger-solution-june-2012-.pdf
- Hunter, M. 1990. *Wildlife, Forests and Forestry Principles of Managing Forests for Biological Diversity*. Prentice Hall Career and Technology, Englewood Cliffs, N.J.
- Hunter, M.L. Jr. 1996. *Fundamentals of Conservation Biology*. Blackwell Science, Cambridge, MA. 482pp.
- Janowiak, M., C. Swanston, L. Nagel, L. Brandt, et. al. 2014. *A Practical Approach for Translating Climate Change Adaptation Principles into Forest Management Actions*. Journal of Forestry. 112(5): 424 – 433.
- Keeton, W. S. 2007. *Role of managed forestlands and models for sustainable forest management: perspectives from North America*. George Wright Forum 24(3):38 – 53.
- Lancaster, Kenneth. 1985. *Managing Eastern Hemlock, A Preliminary Guide*. U.S.D.A. Forest Service, NA-FR-30.
- Lancaster, Kenneth. 1984. *White Pine Management, A Quick Review*. U.S.D.A., Forest Service, NA fr-27.
- Lancaster, Kenneth and William D. Leak. 1978. *A Silvicultural Guide for White Pine in the Northeast*. U.S.F.S. General Technical Report NE-4 1.
- Lancaster, Kenneth, et. al. 1974. *A Silvicultural Guide for Developing a Sugarbush*. U.S.D.A. Forest Service. Research Paper, NE-286.
- Leak, William and Staley Filip. 1975. *Uneven-Aged Management of Northern Hardwoods in New England*. U.S.D.A., Forest Service Research Paper NE-332.
- Leak, William, D. Solomon and P. S. DeBald. 1987. *Silvicultural guide for northern hardwood types in the Northeast (revised)*. U.S. Dept. Ag., Forest Service, Research Paper NE-143.
- Marquis, D. A. 1994. *Quantitative Silviculture for Hardwood Forests of the Alleghenies*. U.S.F.S. GTR-NE-183.
- Marquis, D., Ernst, R. and Stout, S. 1990. *Prescribing Silvicultural Treatments in Hardwood Stands of the Alleghenies (revised.)* Gen. Tech. Rep. NE-96 U.S.D.A.-Forest Service.
- Massachusetts Department (of) Conservation and Recreation and Department of Agricultural Resources. 2007. *Draft Massachusetts Emergency Response Plan for Highly Destructive Invasive Forest Pests*. Available at: <http://www.mass.gov/eea/docs/dcr/stewardship/forestry/response-plan-invasive.pdf>.
- Massachusetts Department of Conservation and Recreation. 2010. *Forest Futures Visioning Process Recommendations of the Technical Steering Committee: Final Report*. Available at: <http://www.mass.gov/eea/docs/dcr/news/public-meetings/forestry/finalwannexes.pdf>

- Massachusetts Department of Conservation and Recreation (1). 2012. *Landscape Designations for DCR Parks & Forests: Selection Criteria and Management Guidelines*. Available at: <http://www.mass.gov/eea/docs/dcr/ld/management-guidelines.pdf>
- Massachusetts Department of Conservation and Recreation (2). 2012. *Trails Guidelines and Best Practices Manual*. Available at: <http://www.mass.gov/eea/docs/dcr/stewardship/greenway/docs/dcrguidelines.pdf>
- Massachusetts Department of Environmental Management. 1998. *Manual for Continuous Forest Inventory Field Procedures*. Massachusetts Dept. of Env. Mgmt., Div. of Forests and Parks, Bureau of Forestry. Amherst, MA.
- Mawson, J.C., W.H. Rivers. 1994. *A Forest Land Classification System for Massachusetts*. Department of Forestry and Wildlife Management, University of Massachusetts, Amherst MA.
- Natural Heritage & Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife and the Massachusetts Program of The Nature Conservancy. 2011. *BioMap2 Technical Report – Building a Better BioMap, A supplement to BioMap2: Conserving the Biodiversity of Massachusetts in a Changing World*. Available at: <http://www.mass.gov/eea/docs/dfg/nhesp/land-protection-and-management/biomap2-tech-report-full.pdf>
- Miller, G. W., T. M. Schuler, H. C. Smith. 1995. *Method for applying group selection in central Appalachian hardwoods*. U.S.F.S. RPNE-696.
- NED/SIPS User's Manual, Version 1.0*. U.S.F.S. GTR-NE-205.
- Nowak, C. A. and D. A. Marquis. 1997. *Distribution-of-cut guides for thinning in Alleghany hardwoods: a review*. U.S.F.S. RNNE-362.
- Norton, D. 1999. "Forest Reserves" section in *Maintaining Biodiversity in Forest Ecosystems*. M. L. Hunter, Jr. (ed.) Cambridge University. Press. New York, NY. 667p.
- Nunery, J. S. and W. S. Keeton. 2010. *Forest carbon storage in the northeastern United States: net effects of harvesting frequency, post-harvest retention, and wood products*. *Forest Ecology and Management*. 259: 1363 – 1375.
- Oregon Forest Resources Institute. 2007. *Forests, Carbon and Climate Change*.
- Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs – All map data comes from this source unless otherwise noted.
- Roach, B. A. and S. F. Gingrich. 1968. *Even-aged Silviculture for Upland Central Hardwoods*. U.S.F.S., Agriculture Handbook 355.
- Safford, L. O. 1983. *Silvicultural Guide for Paper Birch in the Northeast*. U.S.F.S. RP-NE-535.
- Sampson, T.L., J. P. Barrett and W.B. Leak. 1983. *A Stocking Chart for Northern Red Oak in New England*. New Hampshire Agricultural Experiment Station, University of New Hampshire.
- Scientific Certification Systems. 2009. *Forest Management and Stump-to-Forest Gate Chain-of-Custody Certification Evaluation Report for the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs*. Available at: <http://www.mass.gov/eea/docs/eea/lf/green-certification-report-2009.pdf>
- Seymour, R. S., A. S. White and P. G. deMaynadier. 2002. *Natural disturbance regimes in northeastern North America – evaluating silvicultural systems using natural scales and frequencies*. *Forest Ecology and Management*. 155 (2002) 357 – 367.
- Smith, D. M., B. C. Larson, M. J. Kelty and P. M. S. Ashton, 1996. *The Practice of Silviculture: Applied Forest Ecology*. Ninth edition. John Wiley and Sons, Inc., N.Y.

Smith, C. H. and N. I. Lamson. 1982. *Number of Residual Trees: A Guide for Selection Cutting*. U.S.F.S. GTR-NE-80.

Swanston, C. and M. Janowiak (eds.). 2012. *Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers*. U.S.F.S. GTR-NRS-87.

Tubbs, C. H., R. M. DeGraff, M. Yamasaki and W. M. Healy. 1987. *Guide to Wildlife Tree Management in New England Northern Hardwoods*. U.S.F.S. GTRNE-118.

Urbanski, S., C. Barford, S. Wofsy, C. Kucharik, E. Pyle, J. Budney, K. McKain, D. Fitzjarrald, M. Czikowsky and J. W. Munger. 2007. *Factors controlling CO₂ exchange on timescales from hourly to decadal at Harvard Forest*. *J. Geophys. Res.*, 112, G02020, doi: 10.1029/2006JG000293.

Walters, C.J. and C.S. Holling. 1990. *Large-scale management experiments and learning by doing*. *Ecology*. 7(16):2060-2068.