

Western Connecticut Valley District Forest Resource Management Plan

Executive Summary

Department of Conservation and Recreation Forest Management Framework

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 285,000 acres of State Forests, Parks, and Reservations system lands within DCR's Division of State Parks and Recreation (DSPR). DSPR is comprised of DCR properties outside of the metropolitan Boston area, with the exception of the Quabbin and Wachusett watershed areas, which are managed by DCR's Division of Water Supply Protection.

Forest Resource Management Plans (FRMPs) are designed to guide the management of State Forests, Parks, Reservations, and 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. FRMP are needed to:

- Provide direction for the sustainable and integrated management of all natural and cultural resources by defining standards and guidelines;
- Determine the location and extent of forest lands to be set aside as Forest Reserves and Active Forest Management Areas;
- 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 provide for the health of native species and vigor of forests;
- Help supply locally produced "green" products and energy and support the sustainable viability of local forest economies; and
- 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 over the past four years 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 30 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

¹ For example, within the Western Connecticut Valley District properties, during the 1980s harvesting activities totaled 1,377 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.

mortality from competition for sunlight, water, and nutrients and heavy damage from forest insects, diseases, and windthrow.

- The majority of DCR native forests have progressed from 50 to 80 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 policy makers as part of climate change plans, such as those called for by the Massachusetts Climate Act of 2008.
- For centuries, forest products (such as flooring and furniture) used to be both 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.

In 2004, Massachusetts' publicly-owned forests achieved Forest Stewardship Council "green certification" status as well-managed and sustainable forests through an independent, third-party audit system developed and supported by many national and international environmental organizations. The goals of "green certification" were: to improve forest management and forest management planning; to improve coordination among the three divisions responsible for Massachusetts forest management (the Division of Fisheries and Wildlife within the Department of Fish and Game, and the Divisions of State Parks and Recreation, and Water Supply Protection within DCR); to improve landscape-level forest management; and to improve public involvement in the management of the state-owned forests to ensure they are sustainably managed.

From 2004 to 2006, the Forest Forum—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,

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).

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.

Currently, the Patrick administration has allocated significant resources toward three land conservation goals, one of which is to protect working landscapes. This includes 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.

In 2009, Massachusetts will seek recertification of state-owned forests under the Forest Stewardship Council "green certification" standards. The five-year FSC "green certification" audit will provide an opportunity for DCR to seek additional public input to understand and address the diverse and complex issues involved in forest management decisions on DCR lands. In addition, the DCR FRMPs call for a 5-year interim review and monitoring report to make adjustments as part of the adaptive management strategy—one of the cornerstones of the FRMP approach planning approach.

The DCR FRMPs build upon information from the following:

- 1) The *Landscape Assessment and Forest Management Framework for each of the 14 Massachusetts Eco-regions*. These Assessments provide ecological data on landscape-level natural resource trends and issues that are important to our DCR forests such as the need to increase early and late successional habitat to enhance biodiversity and the need to maintain native forests without invasive species;
- 2) The system of large-scale Forest Reserves, totaling approximately 50,000 acres of state lands, where management will be primarily through natural processes. These reserves were established in 2006 after extensive scientific analysis and public involvement;
- 3) Maintenance of the DCR's "Green Certification" status of well-managed and sustainable forests through FSC independent expert field audits to meet broadly reviewed and accepted criteria; and
- 4) The *Wildlands and Woodlands* report (Harvard Forest, 2004) which lays out a vision that forest reserves (wildlands), surrounded by larger areas of woodlands, be protected from development.
- 5) Extensive public notification, participation and comments resulted in the integration of public input in the final FRMP.

Why Cutting Trees 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 predominantly 80-year forest 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, competitively bid, 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, or windthrow, or snow and ice damage. The decision to use such management will be made only after close evaluation by the Program Supervisor and Chief Forester, 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 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."
- 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 MGL Ch. 21 S. 2F.

The FRMPs include site specific maps (see example on page 11) designating the three land management regimes: Forest Reserves, Intensive Use, and Active Management Areas, which coincide with the RMP zoning principles:

- Zone 1 – Highly sensitive areas designated as Forest Reserves where forest management is primarily by natural processes.
- Zone 2 – Areas where sustainable forest management can be practiced alongside dispersed recreation.
- Zone 3 – Intensive use recreation areas and administrative facilities where forest management is intended to provide for public safety, maintain a diversity of very large trees, and aesthetically pleasing setting.

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 has included nine (9) public presentations and discussions on the Forest Reserves, the Landscape Ecological Assessment, the "green certification" process and the FRMPs including three (3) 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 public comments and DCR responses is contained in Appendix K of the FRMP.

The Western Connecticut Valley District Forest Resource Management Plan

The Western Connecticut Valley District (WCV) 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 15 WCV DCR properties consisting of approximately 29,048 acres of land.

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

Property	Acres
Monroe State Forest	4,001
H. O. Cook State Forest	1,834
Leyden State Forest	61
Savoy Mountain State Forest	963
Windace State Forest	1,508
Florida State Forest	847
Deer Hill State Reservation	350
Mohawk Trail State Forest	6,587
Dubuque Memorial State Forest	7,434
Buckland State Forest	93
Calamont State Forest	1,344
Conway State Forest	1,756
Shelburne State Forest	72
D.A.R. State Forest	1,637
South River State Forest	561
Total	29,048

The WCV FRMP was developed with the best information and data available and focuses on the following areas: biological diversity; recreational uses; forest roads, trails and boundaries; climate change 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 WCV 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 (105 years) with focus on the short-term implementation schedule (next 15 years); and,
- Provides for adaptive management and change by directing and monitoring activities of DCR land managers, including interim 5-year plan reviews (in years 5 and 10 of the plan); 15-year plan revision, if needed; and ongoing long-term ecological monitoring.

The FRMP meets the above goals following a balanced and strategic approach, described in more detail on the following page.

Different strategic management regimes for the WCV Forests

Management Regime	Acres in District	% of District	Management Theme
Forest Reserves	8,490	29%	Dominated by natural processes, set aside from active forestry
Active Management over 150-year period adjacent to recreation areas and forest reserves and in northern hardwood stands	12,073	42%	Thinning to promote growth and health in very large trees and harvesting to stimulate new forest growth with very large trees, wildlife trees, and snags remaining beyond a 150-year period ¹
Active Management over 105-year period for wildlife diversity and in similar, mixed conifer/hardwood and other hardwood stands	7,763	27%	Thinning to promote growth and health in large trees and harvesting to stimulate new forest growth with large trees, wildlife trees, and snags remaining beyond a 105-year period
Intensive Use	221	1%	Administrative and developed recreation sites such as campgrounds and trailhead parking areas. Forest management to provide for public safety, maintain a diversity of very large trees, and an aesthetically pleasing setting ²
Total	29,048 ³	100%	

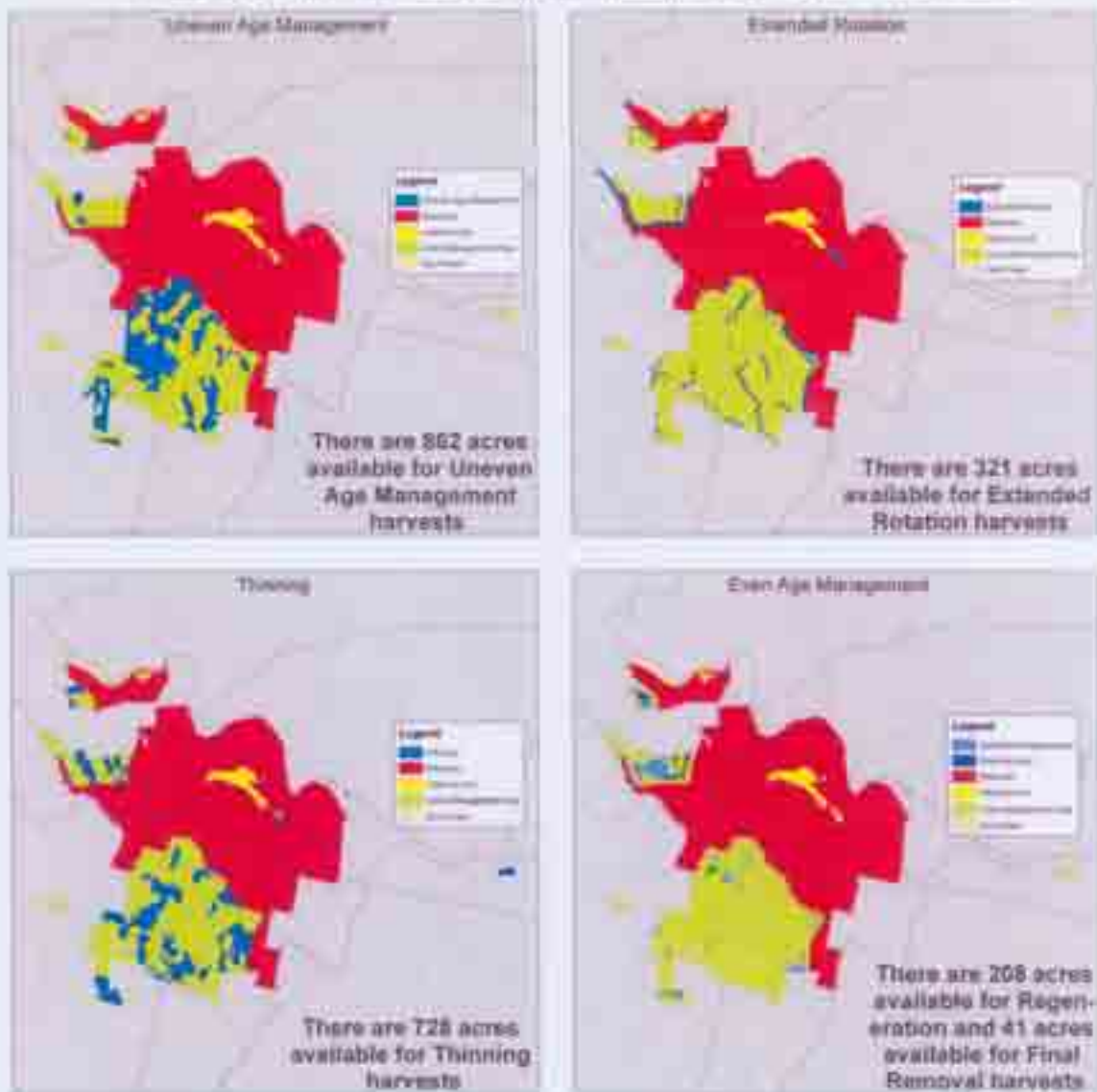
Within the approach described above, the following sections summarize the key components of the Western Connecticut Valley District FRMP. The full description of each section is contained in the main text of the plan.

¹ "Thinning" means partial harvests of about 33% of the forest canopy spread evenly throughout, with a goal of improving health, increasing growth of remaining trees, species diversity, and the compatibility of species to the specific conditions of the site. Creating young forest growth in the understory is not a goal of thinning.

² Most activities described above will generate some revenue, the precise amount of which will be determined by the specific combination of management strategies in any given year.

³ Discrepancy in acreage amounting to approximately 100 acres is due to inconsistencies between Geographic Information Systems (GIS) measurements and historic surveys.

Mohawk Trail State Forest - Potential Timber Harvests Within Next 15 Years By Silvicultural Technique



Example maps. See full plan for a series of maps such as these centered on Mohawk Trail State Forest. Maps indicate areas (in red) that will be set aside as large or small forest reserves, areas that will be managed using uneven-aged management techniques, intensive use areas, and areas where a range of management techniques may be used over time.

Western Connecticut Valley Forest Vegetation Management

The WCV DCR system lands are heavily forested and are primarily composed of forests that are approximately 80 years of age (24,981 acres or 86% of the property in the district). 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 the Active Forest Resource Management Areas 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:

1. 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;

2. Forest stands that are at imminent risk of mortality from insects, disease, fire, etc;
3. 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;
4. Low quality forest stands where cuttings could improve the quality of the forest;
5. Forest stands that are homogeneous in age and/or species composition (generally 80 years old); and,
6. 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 biological surveys 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 Fisheries 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/dfwfs/dfw/nhosp/regulatory_services/forestry/forestry_ump.htm);
- Establishing an approximately 5,804-acre Mohawk Trail/Monroe/Savoy Mountain State Forest large-scale Forest Reserve, and approximately 2,686 acres of small-scale Forest Reserves distributed throughout the rest of the district, 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 12,073 acres of older, 150-year rotation forests managed according to uneven-age and some even-age silvicultural principles to promote

healthy, multi-age, large stand areas with complex structure that complement Forest Reserves, trail and road corridors, aquatic corridors and buffers, and rare species habitat, where possible;

- 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 2,250 acres of young forest across the District in each 15-year planning period, located so as to minimize the fragmentation (break-up) of designated blocks of contiguous forest reserves;
- Improving species and age class diversity of the predominately 80-year-old even-aged forest, including replacing non-native plantation monocultures with diverse native species and age classes;
- Managing all WCV 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; and,
- 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 WCV 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 WCV. 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; and,
- 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.

Climate Change and Carbon Sequestration

Climate change and carbon sequestration are two key forest resource issues emerging on a local, regional, national and global scale. According to the *Massachusetts Climate Protection Plan* (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 WCV 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.

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.

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 (*Massachusetts Climate Protection Plan*).

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 materials⁶ in consumer

⁶ 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 (Architecture 2030). 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.

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, harvesting was seen to reduce carbon sequestration rates immediately after harvesting is completed, until forest growth or regeneration occupies the site (O'Donnell, 2007). Research at Harvard Forest in central Massachusetts found a middle-aged forest still increasing carbon sequestration rates (Urbanski, 2006). Other research also suggests older forests may still sequester carbon (Bormann and Likens, 1979; Keeton 2007). 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 biological impacts to forests and with a goal of increasing the rates of carbon sequestration, the WCV 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 forest reserve system of 8,490 acres (29% of WCV DCR system lands) that, in their present condition, serve as carbon sinks (meaning they store more carbon than they release);
- Diversify the WCV 80-year old forests into a more complex forest composed of native species with various age classes and structures;
- Continue to provide the opportunity to offset carbon dioxide sources by storing carbon in forest products;
- Adjust the FRMP based on new research forest studies and data from monitoring information as required by the 2008 Massachusetts Climate Act, and climate change adaptation priorities.

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 WCV FRMP calls for the inventory, consultation, protection and interpretation of cultural resources.

Roads, Trails and Boundaries

There are approximately 190 miles of DCR-owned forest roads and trails within the WCV 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. While temporary skid roads and landings are necessary to complete harvests, no new forest roads are anticipated during this 15-year planning period.

There are approximately 181 miles of DCR property boundaries within the WCV district, approximately 160 miles of which were recently maintained (between July 1, 2003 and June 30, 2007). There are about 21 miles of boundary that may require professional surveys. 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 previously mentioned goals and criteria in the Forest Vegetation section to choose sites, **this plan recommends and commits to the annual management of no more than 450 acres—1.5 percent of the 29,048 acres of DCR lands in this District—during the initial 15-year implementation period. Each subsequent 15-year implementation period will have a unique combination of the forest management practices described below.**

While the maximum sustainable ceiling acreage laid out in each of the three categories described below totals 815 acres annually, **the total acreage selected each year from all three categories combined will not exceed the 450 acre limit committed to by this plan**, nor will it exceed the limits established below for each type of management. The distribution of forestry activities chosen to make up these 450 acres per year will be based on forest inventory, resource mapping data, and integration of all resources, activities and uses according to the FRMP.

- **Regeneration harvest openings to create young forest:** No more than 0.5 percent (150 acres per year) of the entire WCV DCR system lands (29,048 acres). No more than 64 of 150 acres will be uneven-aged management consisting of small group (3–4 trees up to 1/2 acre) selection harvesting methods. Selective harvesting creates a balanced forest stand with a range of age classes, an “all aged” forest. No more than 86 of the 150 acres will be even-aged harvests removing residual overstory trees where previous shelterwood harvests have established a new forest of about 10-15 years in age. Both uneven and even aged forest management system will maintain a component of the very largest and most valuable trees (legacy trees); trees that have cavities (wildlife trees); snags; and coarse woody debris for nutrient recycling and wildlife purposes;

- **Preparatory shelterwood treatment:** No more than 0.3 percent (86 acres per year). Preparatory shelterwood treatment is designed to stimulate a young forest of desirable species while maintaining a shelter of mature trees.
- **Thinning of overstocked stands:** No more than 1.5 percent (450 acres per year) of overstocked stands where crowding negatively affects growth and health. Some 8,685 acres (579 acres per year) have been identified as overstocked forest stands within the WCV District. Thinning results in a diversity of native species suited to site conditions and is designed to restore a forest condition that is more resilient to damage, insects, and disease. Thinning also captures imminent mortality to provide opportunity for local forest products that slow the release of carbon, and energy that reduces the burning of fossil fuels.

Establishing now a mix of forest reserves, 105-year, and 150-year 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 105-year period, very young forest (0-14 years) will increase from 3% to 5%—an important increase 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 80-year old "even-aged" forest. This plan will help restore some of that diversity while strengthening the forests to meet the challenges that lie ahead.

Present and Desired Forest Condition

	Age class				
	0-14 years	15-59 years	60-89 years	90+ years	Uneven Age
Present	3%	33%	51%	9%	4%
2110 goal	5%	14%	10%	35%	35%

This plan lays out the first 15 years of implementation of a long-term 105-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. At the end of the 15-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 vegetation, cultural resources, rare species, invasive species, boundaries, roads, recreation and uses, etc. 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 WCV FRMP and "green certification" requirements, effectiveness, and impacts;
- Interim monitoring reports will be completed at year 5 and 10 of the first 15-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 Forest Reserves and areas under active management regimes, in cooperation with the University of Massachusetts and other partners.

