

April 21, 2010

Richard K. Sullivan Jr.
Commissioner
Massachusetts Department of Conservation and Recreation
251 Causeway Street, Suite 600
Boston, MA 02114-2104

RE: Forest Futures Visioning Process Recommendations

Dear Commissioner Sullivan,

We, the members of the Technical Steering Committee (TSC) of the Forest Futures Visioning Process (FFVP), respectfully submit our final report and recommendations.

In the Spring of 2009, you initiated the FFVP and appointed the eleven-member TSC to develop recommendations for a renewed vision for stewardship and management of DCR forest lands. In an effort to fully understand the broad range of issues surrounding the stewardship and management of DCR forest lands, the TSC met several times over the past year and sought advice and input from many outside experts as well as the 23-member Advisory Group of Stakeholders. Also, we feel very fortunate to have received feedback and input from hundreds of private citizens from across the Commonwealth through our public forums, online surveys and through a dedicated website. The visioning process revealed just how deeply Massachusetts citizens care about their state forests and parks and how eager they are to engage issues surrounding their stewardship and management

Although many key on-the-ground details remain to be worked out, it is our hope that the TSC recommendations, particularly the land use zoning system, provide DCR with a broad vision and framework for balancing the public's demand for the full array of ecosystem services from the state forests and parks. We believe that implementation of the TSC's package of land use and organizational recommendations, in parallel with a strong and on-going DCR commitment to public process, will greatly enhance the Department's fundamental stewardship mission and help to guarantee the future availability of a sustainable stream of public benefits. For this to occur, DCR will undoubtedly require additional financial and human resources. Consequently, the TSC strongly encourages you and Secretary Bowles to work closely with the legislature to ensure that DCR's budgets are adequate to implement the recommendations and accomplish the Department's stewardship mission.

We wish to express our appreciation for the leadership that you have provided throughout this process. We would also like to recognize the hard work of the AGS, the staff of EEA and DCR and others who provided ongoing support for this process. Although this report is the most obvious product of our efforts, we believe this intensive

process of collaboration, outreach and engagement with the public and subject matter experts will yield benefits both now and well into the future.

Thank you for initiating and supporting the Forest Futures process.


Sincerely,



Lisa Vernegaard, Chairwoman
Forest Futures Visioning Process
Technical Steering Committee



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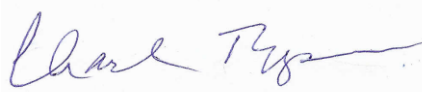
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Conservation and Recreation

**Forest Futures Visioning Process
Recommendations of the
Technical Steering Committee**

April 21, 2010

Final Report

**FOREST FUTURES VISIONING PROCESS
TECHNICAL STEERING COMMITTEE RECOMMENDATIONS**

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LIST OF ACRONYMS

AGS	-	Advisory Group of Stakeholders
ATV	-	All-Terrain Vehicle
BMP	-	Best Management Practice
CFI	-	Continuous Forest Inventory
DAR	-	Department of Agricultural Resources
DCR	-	Department of Conservation & Recreation
DEM	-	Department of Environmental Management
DEP	-	Department of Environmental Protection
DFW	-	Division of Fisheries & Wildlife
DSPR	-	Division of State Parks & Recreation
DUPR	-	Division of Urban Parks & Recreation
DWSP	-	Division of Water Supply Protection
EEA	-	Energy & Environmental Affairs (Executive Office of)
ELU	-	Ecological Land Unit
EOEA	-	Executive Office of Environmental Affairs (Replaced by EEA)
FAC	-	Farmland Advisory Committee
FCPA	-	Forest Cutting Practices Act
FFVP	-	Forest Futures Visioning Process
FIA	-	Forest Inventory & Analysis
FSC	-	Forest Stewardship Council
GIS	-	Geographic Information System
LTEM	-	Long-Term Ecological Monitoring
MAACC	-	MA Association of Conservation Commissions
MESA	-	MA Endangered Species Act
MODR	-	MA Office of Dispute Resolution & Public Collaboration
NEON	-	National Ecological Observatory Network
NHESP	-	Natural Heritage Endangered Species Program
NSF	-	National Science Foundation
OHV	-	Off-Highway Vehicle
ORV	-	Off-Road Vehicle
QSTAC	-	Quabbin Science & Technical Advisory Committee
RNA	-	Representative Natural Area
TNC	-	The Nature Conservancy
TSC	-	Technical Steering Committee
TTOR	-	The Trustees of Reservations
WPA	-	Wetlands Protection Act

I. Executive Summary

The Massachusetts Department of Conservation and Recreation (DCR) initiated the Forest Futures Visioning Process in the spring of 2009 to develop a long-term strategy for managing the 308,000 acres of lands in the State and Urban Parks system, taking into account the attributes of these forests and their place in the overall context of the state's three million acres of public and private forests. An eleven member Technical Steering Committee developed the recommendations in this report. The recommendations were informed by input from an Advisory Group of Stakeholders (AGS) and by an extensive public comment process that included five public forums that collectively attracted over 500 participants, approximately 450 written submissions, and over 250 responses to an on-line survey.

Members of the Technical Steering Committee (TSC) were selected by representatives of the stakeholder community for their technical expertise in a wide array of disciplines relevant to managing Massachusetts forests -- climate change, forest conservation, forest ecology, invasive species, landscape ecology, natural resource economics, natural resource law, recreation, silviculture, social policy, visual/aesthetics, watershed management, and wildlife habitat. In this regard, the expert views of the TSC are as members in their individual capacity rather than as representatives of any organization or entity. On the other hand, the AGS was explicitly selected to be a representative body, composed of members from the citizen stewardship, economic development, environmental, forestry, government/municipal, landowner, recreational, and wildlife/habitat stakeholder interest group communities. The role of the AGS was to surface and discuss the issues, develop ideas and suggestions for the TSC, and provide feedback on draft recommendations.

This Executive Summary provides an overview of the vision and ten supporting recommendations from the TSC report. The recommendations focus on near-term changes that DCR can implement and should be viewed as laying out a plan for the next five to ten years, informed by a long-term vision that is grounded in a scientifically rigorous adaptive management approach that anticipates careful on-the-ground monitoring to ensure modification of management approaches when ecosystem service objectives are not met. The full TSC report includes many insights that are beyond the scope of this executive summary; the reader is strongly encouraged to read the recommendations in their entirety for further detail and clarification. In a limited number of instances the TSC did not achieve consensus on elements of a certain recommendation. These differing viewpoints are highlighted in the main body of the report.

Key Elements of the Vision for Massachusetts Forests in 2110

In order to define the role of DCR lands and make near-term recommendations, the TSC needed to consider the role these lands might play within the broader forested landscape of the state -- this is the reason for including a long-term vision for all Massachusetts forests. The vision for the year 2110 contemplates more than half the land area of the Commonwealth will remain in forests, with large blocks of reserves surrounded by parks and woodlands actively managed for a diverse set of ecosystem services. These forests provide numerous economic and social benefits to local communities, the state and nation -- clean air and water, biodiversity, recreation, tourism, climate change adaptation and mitigation, wood products, and a high quality of life for Massachusetts citizens. The protection of these areas will have been accomplished by reducing stresses on the

forests such as: conversion to other uses, ecological and ownership fragmentation, high grading harvest practices, invasive insects and diseases, climate change and atmospheric deposition. State forests will be embedded in a landscape of privately owned forests that will be sustainably managed, and for which many acres will be protected through conservation restrictions. State policies will promote innovative and sustainable management on all forested lands, which will produce a wide array of ecosystem services.

Publicly-owned forests will promote ecosystem services that private landowners are unable or less likely to provide consistently or in sufficient amounts – public recreation, large and small forest reserves, aesthetically pleasing landscapes, and demonstrations of innovative state-of-the-art forest management -- particularly management designed to promote uneven-aged, complex and resilient forests that support the full breadth of biodiversity and natural processes, while maximizing the contribution of our forests to climate change mitigation and adaptation.

Shifting the Forest Management Paradigm

The TSC's recommendations are intended to encourage a land management paradigm shift at DCR -- a process that actually began before the creation of the Forest Futures process with the development of district-level forest resource management plans -- moving the Department's forest management towards a vision based on a more comprehensive suite of ecosystem services and implementation of a more balanced portfolio of management approaches. This reflects the TSC's view that the natural and social sciences underlying several key land management debates continue to evolve with the development of new information and knowledge and consequently the public interest is best served by policies that keep open a range of management options.

A key element of the TSC management paradigm is the concept of ecosystem services that forests provide, including maintenance of important natural processes as well as provision of additional economic and cultural services. Forest ecosystem services include carbon sequestration; soil, air and water quality; biological and ecosystem diversity; nutrient cycling; culture, history and spiritual values; public recreation; and forest products. Forest products are just one among many ecosystem services, and must not dominate or diminish the others. The long-term public ownership of state forests and parks allow these lands to reflect priorities for ecosystem services that are not expected to be provided sufficiently by private lands.

The TSC recommends three land use zones for DCR forests: forest reserves, parklands, and woodlands. This allows a clear articulation and prioritization of the ecosystem service goals for each zone and specification of appropriate management strategies for realizing these goals. The recommendations call for large increases in land set-aside from commercial timber management, either as forest reserves or parklands. Woodlands will serve as examples of sustainable practices, designed to demonstrate sustainable timber production along with other ecosystem services and become models for good stewardship on private forests.

Large permanently protected forest reserves of 15,000 acres or more in the state's major ecological settings will be a prominent feature of the DCR forests. These reserves will ensure long-term ecological integrity and biodiversity values and will be places where natural processes dominate to provide important ecological, educational and cultural services. Large reserves will be supplemented by smaller 'patch' reserves for ecologically and culturally significant areas. The remainder of DCR state forests and parks will be devoted to parklands and woodlands. A primary

goal of the parklands is to deliver high quality and diverse public recreational opportunities that benefit from some active recreation and landscape management, and to provide additional ecosystem services in a manner that is insulated from more intensive silvicultural manipulations and timber harvesting. Managed woodlands will also be a valuable source of ecological services, through the application of silvicultural approaches that emphasize carbon sequestration, wood production, clean water, creation of early successional habitat, and restoration of late successional habitat. The recommendations put forth a range for allocation of acres to each of these types of uses.

The implementation of these recommendations will require changes within DCR to reshape goals and planning processes and ensure implementation of improved forest stewardship, planning from a broad based perspective, and better communication and partnerships with friends groups and the non-profit sector.

Summary of Recommendations

Recommendation 1: Adoption of an Ecosystem Services Model to Guide Forest Protection and Management -- *The fundamental guiding principle for all forest protection and management policies in the Commonwealth should be to ensure the sustainable provision of a comprehensive suite of forest ecosystem services. Moreover, DCR should adopt a planning framework for the state parks and forests that focuses on the provision of key ecosystem services not expected to be provided, or not provided in adequate amounts, from private lands in the Commonwealth.*

The adoption and prioritization of ecosystem services is intended, in part, to address conflicts inherent in competing demands on our forests. *Essential ecosystem services* represent primary management goals for DCR lands. These include biodiversity protection, clean water, carbon sequestration, soil formation and nutrient cycling, and public recreation including wilderness/old growth/spiritual experiences. In addition to these services, some DCR lands will serve to demonstrate how forests can be managed to provide sustainably grown wood products, and others will emphasize quality outdoor recreation experiences.

Recommendation 2: Elevated Role for Massachusetts Forests in the Commonwealth Environmental Decision-making Processes -- *In implementing its environmental priorities, the Commonwealth should focus increased attention on the protection and stewardship of the state's public and private forests through a reorganization that elevates the state's chief forest stewardship official to a more prominent decision-making role.*

Given the enormous importance of public and private forests in providing these critical environmental services to the public, the TSC recommends that the DCR Commissioner consider converting the existing Chief Forester position into a Director of Forest Stewardship, and elevate this position in the DCR organizational structure to be on a par with the Director of State Parks and Recreation. The Director of Forest Stewardship would have primary responsibility for the long term protection of the state's forest resources through implementation of programs to (1) oversee the management of the 308,000 acres currently in the DCR State Park and Forest system, and (2) promote sustainable forestry practices on private lands through DCR's Service Forestry Program and through oversight under the Chapter 132 Forest Cutting Practices Act and other forest regulatory programs.

Recommendation 3: New DCR Landscape Planning Model -- *As an overarching template for organizing its land management activities, DCR should adopt a management structure that subdivides its State and Urban Park lands into three zones: (1) Forest Reserves, (2) Parklands and (3) Woodlands.*

The three zones are intended to enhance the provision of ecosystem services by segregating incompatible activities and allowing for prioritization of goals.

Forest Reserves are areas of 15,000 acres or more, representative of the Commonwealth's diverse forest settings, where the dominant ecosystem service objectives are biodiversity maintenance and the underlying supporting services of nutrient cycling and soil formation, watershed protection, and long-term carbon sequestration; important secondary services include provision of wilderness/spiritual values and recreation. Initial designations of reserves may include areas smaller than 15,000 acres depending upon available land, but it is anticipated that these will be added to at a later time. Large reserves are recommended to receive some form of permanent protection to allow development and perpetuation of late successional forest ('old growth'). Within one or two reserves an area might receive a designation as wilderness. Additional patch reserves based on ecological, social and cultural criteria will also be designated in the two other zones.

Parklands are areas where the primary ecosystem service objectives are provision of public recreational opportunities that depend on natural areas, preservation of ecologically significant areas and 'special places,' and promotion of cultural values (aesthetic, historical, educational and tribal). These goals are also compatible with the maintenance of a wide range of additional important ecosystem services. Parkland management approaches are expected to range from areas where natural processes dominate to highly modified environments where use is intensively managed. Parklands are identified based on density of officially designated trails, campsites and level of recreation use/visitation, unique natural features and surrounding population density.

Woodlands would emphasize the provision of ecosystem services that require management prescriptions with intensities that are less compatible with the activities in the parklands or forest reserves. One role for woodlands would be demonstrating, to private and municipal landowners and the general public, the practice of sustainable forestry. This would be done through active forest management targeting sustainable production of timber for local markets, protection of water supplies through active watershed manipulation, management to promote early successional habitat, and carbon sequestration through options that focus on active forest management and lifecycle carbon impacts. Woodlands forest management also has a role to play in the ecological restoration of areas that have been dramatically altered by previous management (e.g., plantations of non-native species) or to restore unproductive woodlands damaged by natural disturbance.

Land Allocation to the Zones. The TSC recommends ranges for the allocation of existing DCR State and Urban Park land to the three zones. DCR currently has approximately 40,000 acres designated as large forest reserves; the TSC recommends increasing this to a total of between 90,000 and 120,000 acres; for parklands, the recommended allocation is 70,000 to 90,000 acres; and for woodlands the TSC finds that 100,000 to 150,000 acres would be appropriate. The TSC is not recommending specific properties for these categories. Instead, DCR should implement a detailed planning process to identify feasible on-the-ground configurations for reserves, parklands

and woodlands, and solicit expert and broad public input before finalizing the designations. Moreover, the TSC finds that in the future an additional 90,000 to 130,000 acres must be added to the forest reserves because current DCR acreage is insufficient for creating an ecologically functional system of representative large reserves. Additional acquisitions of parklands and woodlands are also anticipated to meet increasing public demands for ecosystem services from these zones. A means of ensuring that communities in which DCR lands are located receive appropriate revenues from the State in lieu of taxes must be a high priority.

The TSC recommends that DCR immediately implement a process to finalize the allocation of land to each of the zones. Determining these final allocations will require (1) a spatial analysis using objective criteria for large forest reserves, parklands, and woodlands to guide the layout of the zones across the full set of existing DCR properties; (2) comprehensive delineation of each zone, including optimizing each zone, making difficult decisions for properties identified as important for two or more zones, and ground-truthing characteristics before designating areas; and (3) implementation of a robust public process to vet and finalize the allocations, including discussions with towns where DCR forests account for a large portion of the town's area. Overall, the zoning process should give adequate consideration to economic analyses of potential impacts in those communities that are most dependent on the local forest economy.

The TSC recommends that the current suspension of new timber sales be continued until the zoning process, including public review, is complete. This will be followed by a period when DCR develops revised Forest Resource Management plans including guidelines for each of the zones. During this period, timber sales could be reinstated, but until such time as the guidance and management plans are complete, all timber sales should focus on less controversial silvicultural prescriptions (e.g., uneven-aged management for late successional characteristics).

Recommendation 4: Management Approaches for Large Forest Reserves -- 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.

Ecosystem Management in Reserves: The TSC recommends forest reserve management with the least amount of human intervention. The goal should be to maintain and enhance a full suite of ecosystem services including biodiversity maintenance and the underlying supporting services of nutrient cycling and soil formation, watershed protection, and long-term carbon sequestration; important secondary services include provision of wilderness/spiritual values and recreation. When in doubt, or where there is disagreement among qualified ecologists and foresters, the default management prescription should be to do nothing. The TSC recommends that no sales of wood should occur on forest reserves beyond revenue collected **incidentally** from restoration and management activities directly within the restored or managed area. Some specific situations may call for ecological restoration and vegetation management in reserves. Each reserve will have an operational plan established with opportunities for public input and to determine in advance how managers will coordinate with local officials in response to events. The TSC also recommends that a 'Science Advisory Board' be established to inform, review, and approve all major restoration and management activities in reserves.

Recreation and Infrastructure Management: State land in forest reserves should be accessible and useable by people in keeping with both the original intent of state lands and certain important ecosystem service values associated with them (*i.e.*, aesthetic, recreational, historic and spiritual). Human activities, however, should be managed to minimize their impact on the other intended values of forest reserves (*i.e.*, biodiversity, wildlife, acoustic and visual aesthetics, etc.).

Recommendation 5: Management Approaches for Parklands -- 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.

The parkland zones should be managed in a manner that is similar to what currently occurs at DCR's forested urban park properties so as to optimize quality outdoor recreation and maintain other important ecosystem services. Tree work should be conducted only as needed to support the recreational, aesthetic and cultural uses and values of the property. All recreational use decisions should be made on a property-by-property basis. Production of wood for wood products or energy should not be a management objective on parklands. Management planning and implementation should be coordinated with trail stewards and public 'friends groups.'

Recommendation 6: Management Approaches for Woodlands -- DCR should develop and implement management guidelines for Woodlands that demonstrate excellent forest management practices for sustainable production of wood, restoration of late successional habitat, active management of drinking water quantity and quality, creation of early successional habitat, and promotion of carbon sequestration and any other ecosystem services that benefit from relatively active manipulation of the forest. Over time, these guidelines should promote a greater emphasis on uneven-aged forests across the DCR system. At the same time, woodlands management should include guidelines to protect rare species habitat and other natural resources, as well as the integrity and scenic quality of trails and scenic roads in the woodlands zone.

The goal is for DCR to have 'model forests' to demonstrate ecologically and economically sustainable practices to private landowners and the public. The recommendations for woodlands management encourage a shift towards greater reliance on uneven-aged silviculture. As a first step, DCR will need to assemble additional information on the origin, age, and condition of the forest stands into three classifications to help in determining how they are managed. **Primary** forests are those areas that have always been in forest growth and never pastured or cleared. **Secondary** forests are those areas that were in agricultural use but have grown back to forest, been harvested once, and have re-grown. **Tertiary** forests are the first stands to grow after agricultural abandonment.

The TSC recommends DCR develop long-term management approaches that are based on silviculture that has as its goal the replication of natural disturbance patterns designed to ensure the regeneration of an age and species diverse forested landscape in Massachusetts. Under such an approach, DCR foresters would implement harvests across the landscape in patterns that are representative of the size and frequency of canopy openings occurring as a result of (non-catastrophic) natural disturbance.

The TSC recognizes the potential for controversy and public distrust when larger openings are created. To reconcile these issues, the TSC recommends that DCR adopt silvicultural guidelines, based on three alternative levels of woodlands management that require a high degree of public consultation and acceptance for harvests that would create larger openings. **Level 1 management** is designed for protecting ecologically sensitive or culturally significant patch reserves. It allows for ecological restoration including control of invasive plants, insects, and herbivores. Hazardous trees along trails and roads could be cut and trees could be removed to maintain rare habitats. Timber management for production of wood and wood products would not be a management objective in these areas. **Level 2 management** applies uneven-aged silvicultural prescriptions – including single-tree and group-patch selection methods – in high productivity primary and secondary forests in order to promote multi-aged and late successional stands (up to 150 to 200 years of age). Harvested patches should not exceed 1/3 of an acre. **Level 3** management is recommended for use in lower productivity and damaged primary, secondary and tertiary stands where a variety of uneven- and even-aged silvicultural prescriptions might be employed. Uneven-aged methods, both those which seek a complete distribution of age and size classes and those that may be more irregular, would be used to harvest single trees, groups of trees and patches up to 1/3 acre in both primary and secondary stands. Irregular shelterwood systems would also be available to restore the structure, composition and function of these lower productivity primary, secondary and tertiary stands. The use of even-aged shelterwood methods would be limited to low productivity and damaged tertiary stands with opening sizes not to exceed five acres, unless after consultation with the interested public (see Recommendation 8), DCR concludes that there is a need to expand this size limit for ecological reasons at a specific site. All Level 2 and 3 harvests would leave tops and branches in the forest, an appropriately conservative approach for ensuring the continued ability of harvested state lands to provide a full suite of ecosystem services.

The highest standards and enhanced best management practices would apply. These include marking of individual trees for harvest, mapping of wetlands, buffers, and full compliance with the Massachusetts Endangered Species Act, in order to continue delivery of multiple additional ecosystem services along with sustainable production of wood products. Harvesting equipment will be specified to minimize damage to remaining trees and soils. The recommendations address management for recreation in the woodlands through collaborative planning, trail buffers and improved practices where recreation and silvicultural areas intersect.

Early Successional Habitat. The TSC, rather than designating a specific acreage target for early successional habitat, recommends that DCR establish a formal ongoing planning and adaptive management process for addressing these habitat needs. This process should include consideration of background levels of early successional habitat creation due to natural disturbance across all DCR forests and close coordination with the Department of Fisheries & Wildlife (DFW), academic experts and the public to address habitat creation needs beyond what will occur via natural disturbance and expected harvests on DCR woodlands. The DCR/DFW plans should configure any habitat creation projects to minimize clearing while addressing DFW goals for state lands, to the extent this is compatible with other ecosystem service objectives for DCR woodlands. Cutting in unfragmented forest should be avoided and to the extent possible priority given to management of overgrown fields and expansion of existing open areas. Essentially, under the TSC's proposal DCR's integrated resource management planning process would be the locus for periodically reviewed decisions about the amount of cutting needed to support early successional species; but this would be informed by better data on current and likely

future levels of natural disturbance on DCR lands and should be divorced from decisions relating to timber production in the woodlands zone.

Green Certification. While acknowledging general concern about certification of public lands – a program designed to provide the state with independent, third-party audits and evaluations of its forest management practices -- the TSC finds that FSC certification is a potentially valuable tool for advancing the ecosystem service goals outlined for DCR woodlands in these recommendations. Third-party verification provides additional impetus for public input, has an overlay of additional standards which aid in protection of ecosystem services, provides impetus for planning, helps educate staff on the broader array of approaches, and makes wood products more marketable/valuable. But this will require that DCR’s goals for forest management be developed through a robust public process that provides legitimacy for the plans that FSC auditors are asked to review.

Biomass. The TSC finds that the expansion of biomass energy facilities in the state could pose a potentially significant risk to the ecosystem services that are so important to maintain within DCR forests. The woodland zone recommendations reflect a conservative approach for avoiding adverse impacts of biomass removals through a general requirement that tops and branches be left in the woods. In light of the many uncertainties about the potential ecosystem impacts of wood production for biomass fuel, a cautious approach -- requiring that ‘forestry residues’ be left in place to build soil carbon and protect nutrient stocks and habitat -- is called for to ensure the sustainable delivery of ecosystem services from DCR’s woodlands.

Recommendation 7: DCR Organizational Structure, Decision-making, and Planning -- The DCR Commissioner should establish a fully integrated planning and management structure focused on long-term stewardship and adaptive management for the complex and inter-related set of ecosystem service priorities established for DCR parks and forests.

The recommendations intend to make clear that long-term stewardship of the forest resource is the fundamental purpose of DCR’s land management. Further, based on the observation that DCR forest planning is not adequately integrated across the Department, the TSC recommends creation of a single, unified planning and adaptive management system that addresses the full suite of ecosystem service priorities across the three zones. DCR needs to expand current efforts and formalize methods for incorporating into its planning and land management activities: (1) information collected from forest resource data; (2) advances in scientific knowledge; (3) alternatives analysis; and (4) a means to gauge the success of its activities and make changes based on results of a formal feedback mechanism.

Recommendation 8: Improving Public Process -- Create a robust process that gives members of the public an opportunity for their concerns and values to be addressed and incorporated throughout the planning and implementation of management of the publicly owned land under DCR’s care.

The TSC recognizes that no management decision will be universally accepted by the public. Broad public acceptance of DCR’s management will therefore need to acknowledge and address the full range of public views, and DCR must enlist a broader cross-section of society in its work to ensure that the full range of views is represented in the decision making process. There is a need for open, transparent, authentic and broad based public participation in decision making for

allocation of land to large forest reserves, parklands and woodlands, and at the full range of planning scales for forest management and implementation - from the broadest, state-wide and district-level forest resource management planning, down to the much finer-scale, stand-level forest cutting plans. There is also a need to address internal processes to improve public participation and better address the concerns of those engaged in the decision making process. The recommendation calls for implementation of best practices for public participation, dedication of management staff to improving participation, clear timelines for projects and policy decisions, and improved tools for reaching the public. Measurement and feedback loops and incorporation of public engagement in project and performance management reviews will ensure better processes.

Recommendation 9: Policies for Privately Owned Forests in the Commonwealth – A prominent part of DCR’s mandates include oversight of all forests in Massachusetts. Due to the importance of private forests to public forest function and integrity, and the high level of public benefits provided by private forests in Massachusetts, the Commonwealth should adopt measures to prevent further forest fragmentation and conversion to other land uses, and promote better stewardship of private forests, including the implementation of a requirement that all forest harvesting plans be prepared by a licensed forester.

Conservation and protection of the public values provided by private forests in Massachusetts requires increased leadership, education, public investment and alignment of incentives to ensure that these forests will continue to exist in the future and that private landowners make informed decisions about the stewardship of their forest lands. To accomplish these goals, the Commonwealth should support programs and policies that prevent forest conversion. These should include further evaluation of cost share and conservation finance programs, as well as further evaluation of measures to improve stewardship on private lands -- including promulgation of the revised Chapter 132 regulations; better tabulation and dissemination of information collected from harvests in Massachusetts forests (including analysis of and access to GIS data); improved public/private partnerships; legislation concerning tax credits and support for local wood products; and requirements that all cutting plans required under M.G.L. 132 be prepared by a licensed forester.

Recommendation 10: Resources Needed to Implement the TSC Recommendations -- The DCR Commissioner should develop and implement strategies for funding the specific recommendations from the Forest Futures process.

Implementing the Forest Futures recommendations will require both reprogramming of existing resources and development of new revenue streams. While it would be convenient to assume that all the proposed changes could be put in place through reallocation and re-assignment of existing DCR staff, this is simply not the case. Increases in DCR staff are needed to support creation of the three zone system, development of new management guidelines and plans, implementation of expanded public participation process, and for both short and long-term management and monitoring of forest reserves, parklands and woodlands. The recommendations in this report form an integrated package of changes that are needed to assure effective management of DCR lands. Many of the recommendations address areas that have been severely under-funded or not funded at all in the past (e.g., preparation of integrated resource management plans, collection and analysis of data to support adaptive management). Consequently, it is critical that the Executive Office of Energy and Environmental Affairs (EEA) and DCR seek additional funding from the

legislature to support implementation of the recommendations in this report. Absent new funding, major portions of the recommendation package cannot be implemented. This includes not only funding for DCR staff but also funds for acquisition of the additional lands needed to (1) ensure the future build-out ecologically functional system of large forest reserves and (2) provide adequate parkland and woodlands to meet the public's future ecosystem service demands.

Finally, although beyond the original charge of the Committee and therefore not included as one of our ten recommendations, the TSC urges the Secretary of Energy and Environmental Affairs to consider the potential benefits of adapting and applying the recommendations and insights from our work more broadly to all forest lands owned by the state. This would result in a more fully integrated vision and management approach for state lands, consistent with the TSC's long-term vision for the forests of the Commonwealth.

II. Introduction

The Massachusetts Department of Conservation and Recreation (DCR), an agency of the Executive Office of Energy and Environmental Affairs, oversees 450,000 acres of parks and forests, beaches, bike trails, watersheds, and dams, in addition to approximately 150 pedestrian and roadway bridges and miles of roadways. Led by Commissioner Richard K. Sullivan Jr., the agency's mission is to protect, promote, and enhance our common wealth of natural, cultural, and recreational resources.

At the February 2009 monthly meeting of the Stewardship Council, the legislatively established oversight board for DCR, Commissioner Sullivan presented a plan for the Forest Futures Visioning Process -- a public involvement initiative to be undertaken by the agency to develop a renewed vision for stewardship and management of DCR forests. The proposed plan was prepared in response to a recommendation from the Stewardship Council -- included as part of its fall 2008 approval of the Berkshires and Western Connecticut Valley forest resource management plans -- to develop a vision for DCR forests based on insights from an outside group of experts, as well as stakeholders and the broader public, including citizen stewards, 'friends groups' associated with a number of DCR parks, and several environmental organizations.

These groups expressed serious concern and disappointment with management practices on DCR lands and the manner in which DCR interacted with and responded to the interested public. The complaints and concerns were rooted not only in silvicultural practices but also in the perception that the culture of the organization did not value public participation and collaborative efforts, and in differing interpretations of mandates and responsibilities. Most of these disaffected individuals and organizations felt that a mindset of land management for timber production was the lens through which responsibilities and mandates were interpreted and decisions were made. The critics also recognized that limited resources were hampering planning at a site-based level that might have addressed the potential controversies in advance. Additional concerns arose over the intensity of cutting, particularly the use of clearcuts and similar management methods, and some stakeholders felt this would continue under DCR's new Forest Resource Management Plans. At the same time some private forest landowners felt that the negative public image associated with some DCR actions was affecting the way the management of their lands was perceived. As the controversies continued, DCR suspended some planned timber harvests causing timber sale contractors to become frustrated with the agency's actions.

The concerns arose around a number of issues including the justifications for timber harvesting; the size of openings created by harvesting ('clearcuts'); the location of harvests; the choice of silvicultural methods and aesthetic impacts (including clear-cutting and cutting of plantations); lack of enforcement of, or insufficiently strong, best management practices (BMPs) resulting in negative impacts on vernal pools and other sensitive environmental and cultural resources; the limited manner in which cutting plans and information were available; insufficient public participation; the potential availability of significant portions of DCR lands for harvesting for biomass energy production; and concerns that Forest Stewardship Council (FSC) certification has increased timber extraction as a primary underlying goal. The concerned stakeholders felt that DCR was not acknowledging or correcting errors in its management practices and that there was no accountability within the agency when errors were made. As a result, some members of the public expressed very low levels of trust and a lack of respect for the agency. Strenuous objections were voiced to what were seen as commercial levels of timber harvests or

inappropriate decisions at parks and forests including, among others: Beartown State Forest, Boxford State Forest, Chester-Blandford State Forest, Chicopee State Park, Georgetown-Rowley State Forest, Mount Holyoke Range State Park, Mt. Grace State Forest, October Mountain State Forest, Robinson State Park, Savoy Mountain State Forest, Rutland State Park, and Windsor State Forest. DCR commissioned a report that provided more detailed analysis of forestry and management practices that led to many of these disputes, and recommendations for changes to DCR practices aimed at improving practices and ensuring the best possible stewardship in the future (a summary of the report's key findings is included as Annex 1).

To implement the Forest Futures Visioning Process, DCR established a Technical Steering Committee (TSC) tasked with developing a long-term strategy for managing lands in the 308,000 acre State and Urban Parks system and formulating recommendations for addressing issues raised by the public. DCR also established an Advisory Group of Stakeholders (AGS) to provide input to the TSC as it developed its recommendations.

This report, beginning with a brief overview of the parks and forests in the DCR system, presents the recommendations of the TSC. The recommendations were informed by input from the AGS and from an extensive public comment process that included five public forums that collectively attracted over 500 participants, approximately 450 written submissions, and 253 responses to an on-line survey. To guide the recommendation process, the TSC first developed a vision for all Massachusetts forests in the year 2110. *The Committee finds that only in this broader context is it possible to define the role of forests owned and managed by the state.* The 2110 vision is followed by an overview of the major changes that DCR must make if the Department is to implement the land management changes that the TSC is recommending. This overview is followed by ten detailed recommendations for change.

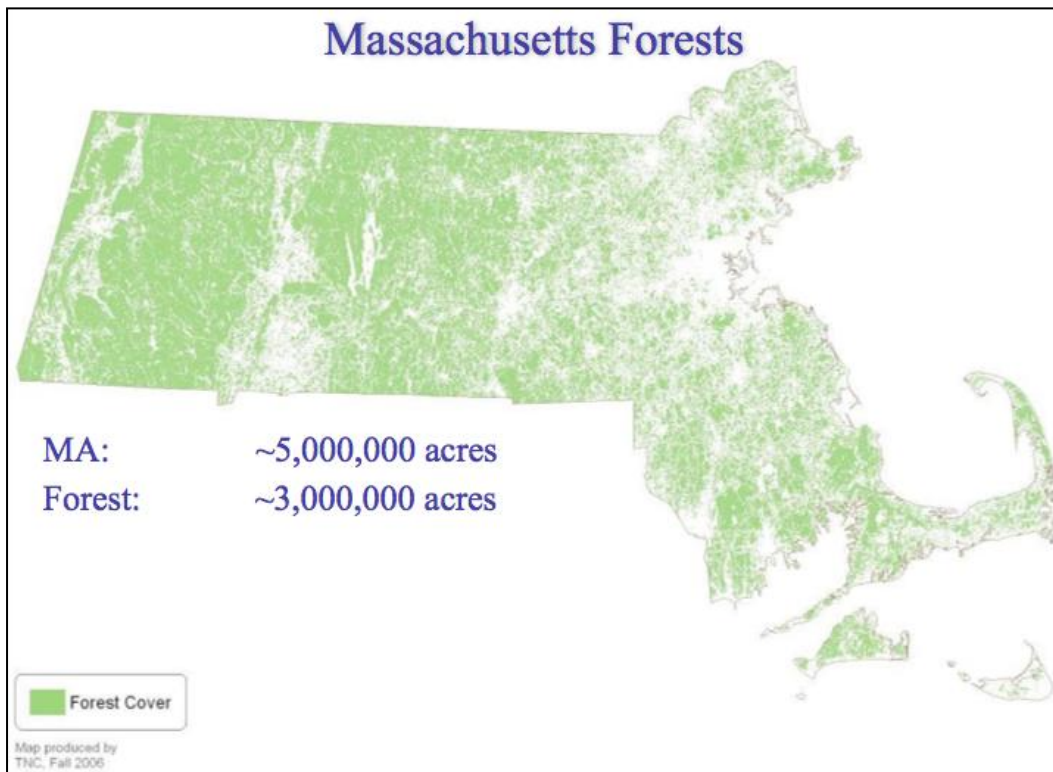
- Recommendations 1 and 2 focus on the broader state-wide forest policy issues and the DCR Commissioner's role as State Forester, both of which set the context for DCR's activities on public lands.
- Recommendations 3 through 6 provide specific guidance on managing the 308,000 acres of DCR's State and Urban Park lands.
- Recommendation 7 discusses changes needed to DCR's organizational and planning structure to facilitate implementation of the land management recommendations.
- Recommendation 8 provides the TSC's suggestions for improving DCR policies for involving the public in its planning and land management decision-making processes.
- Recommendation 9 discusses additional forest protection and stewardship policies for private lands that are a primary focus of the DCR Commissioner in his/her capacity as State Forester and that are necessary to ensure that the public lands remain embedded in a connected system of well-managed private forests, largely protected from fragmentation and conversion to other uses.

- Recommendation 10 discusses the budgetary implications of Recommendations 1 through 9 and suggests possible strategies for mobilizing the additional resources that DCR will need in order to implement the TSC recommendations.

Each recommendation is followed by implementation guidance and brief discussion. In a limited number of instances the TSC did not achieve consensus on elements of a recommendation. These differing viewpoints are highlighted in the final section of the main report. The report also includes nine annexes that provide more detailed background information on the recommendations. Annexes 2 through 4 provide more detailed background on the Forest Futures Visioning Process itself.

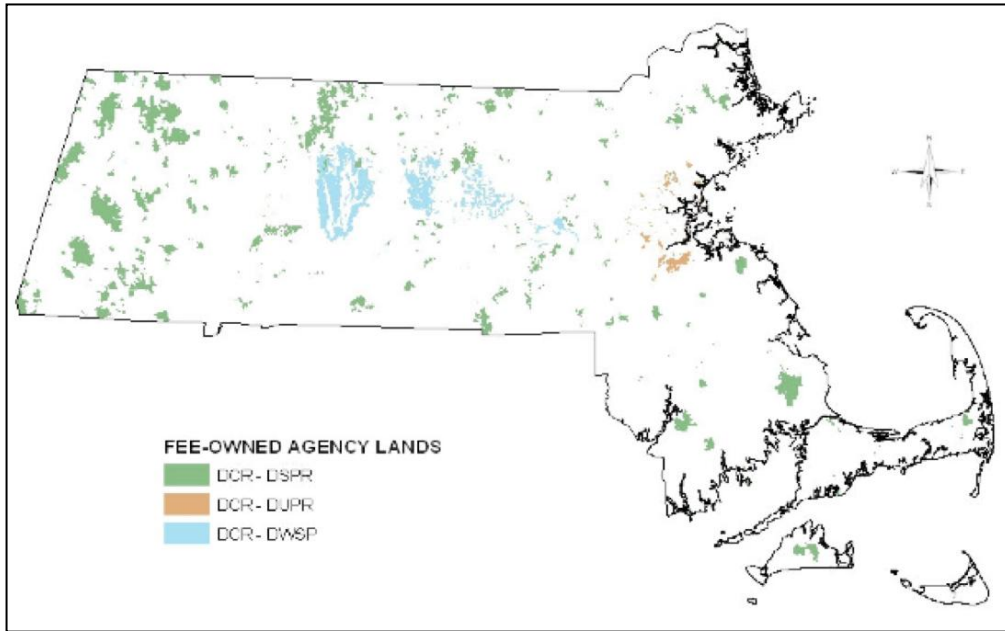
III. Overview of Massachusetts Forests and Parks

Forests cover approximately 63 percent of the landscape in Massachusetts and represent a critically important public resource that provides a wide array of environmental goods and services (referred to throughout this report as ‘ecosystem services’ and discussed in more detail in Recommendation 1).



The Massachusetts Department of Conservation and Recreation is steward for approximately 450,000 acres (including private lands where it oversees conservation restrictions) widely distributed across the Commonwealth. DCR’s direct ownership is approximately 415,000 acres. The agency’s Divisions of State and Urban Parks and Recreation oversee over 308,000 acres within this system. These lands are the primary focus of the Forest Futures Visioning Process, although the Committee’s recommendations recognize the broader role of DCR in promoting good forest stewardship on private and other state lands.

State Lands Managed by DCR



Management responsibilities for the DCR lands are distributed across three divisions within the Department, as outlined in the table below.

DCR Land Management Responsibilities¹	
DCR Division	Acres Managed
Division of State Parks and Recreation (DSPR) ²	290,072
Division of Urban Parks and Recreation (DUPR)	18,250
State & Urban Park Total	308,323
Division of Water Supply Protection	105,272

Note 1: The primary focus of the Forest Futures Visioning Process is management of the State and Urban Park lands, although the Committee's recommendations recognize the DCR's broader role in promoting good forest stewardship on private and other state lands.

Note 2: DSPR lands currently include approximately 38,000 acres designated as forest reserves.

Historically these DCR lands have provided extensive public recreational opportunities, protection for major drinking water supplies in the Commonwealth, habitat for rare and endangered species, and forests managed to supply locally grown sawlogs, pulpwood and firewood.

- DCR properties provide opportunities for swimming, camping, hiking, walking, canoeing, horseback riding, sailing, wind-surfing, rock climbing, skiing, golfing and other recreational activities. A recent statewide survey indicated that 54 percent of Massachusetts citizens had visited a public park, recreation facility, or state forest in the previous 12 months (The Insight Group and Dorr Research Corp., 2004). Even applying very conservative valuations (Loomis, 2005), these public recreational benefits have a value to the citizens of the Commonwealth in the tens of millions of dollars each year, and perhaps more.
- DCR watershed lands protect clean drinking water supplies for 2.2 million residents of the state.
- DCR lands are representative of 68 natural community types and provide habitat for 67 percent of the listed rare species in the Commonwealth (291 out of 435 listed species); 24 percent of DCR lands are designated as Priority Habitat of Rare Species (NHESP data summarized by Ricci, 2009).
- Sales of timber from DCR state parks and forests over the past decade have involved harvesting on approximately 1,250 acres per year – indicating cutting on approximately 0.5 percent of DCR’s 308,000 acres of state park and forest lands. These harvests on average have accounted for approximately 5 percent of all planned timber harvests in the state. On average, an additional 800 acres of DCR water supply lands are also harvested each year (DCR, 2009). In recent years, timber sales from the DCR forests and parks have generated annual revenues of approximately \$1 million for the Commonwealth.
- Growth of DCR forests, as well as other forests in the state, plays an important role in sequestering carbon and mitigating climate change. Studies at Harvard Forest suggest central Massachusetts forests can sequester between 0.4 and 1.3 tons of carbon per acre each year – in total DCR forests are offsetting hundreds of thousands of tons of greenhouse gas emissions each year (O’Donnell, 2007; Massachusetts Department of Environmental Protection, 2009; Munger, Barford, & Wofsy, 2004).

Included in the DCR properties are many of the Commonwealth’s largest blocks of forest that remain unfragmented by development. These forest blocks represent an enormously important resource for current and future generations, providing critical habitat for protection of biodiversity and important opportunities for mitigation of climate change through capture and storage of carbon in trees and soils.

IV. A Vision for Massachusetts Forests in 2110

To guide its deliberations, the TSC developed a long-term vision for the forests of Massachusetts -- both private and public. The purpose of the vision is to articulate the Committee's consensus view of long-term objectives for the Commonwealth's forest protection and management policies. The recommendations in this report are aimed primarily at developing a long-term management strategy for the 308,000 acres of DCR park and forest lands. In order to define the role of the DCR lands and make near-term recommendations, however, the Committee needed to consider the role these lands might play within the broader forested landscape of the state, and this is the reason for including a long-term vision for all Massachusetts forests. Of course, history suggests that new information will make any long-term vision obsolete over time in many fundamental ways, and there is no reason to believe ours will be different. But the TSC includes this vision to help make clear the context and assumptions about state-wide land use that frame our recommendations for DCR lands. Major changes in the extent or management of private forests in the future would likely necessitate revisiting the assumptions about the role of the DCR lands.

* * *

The TSC envisions a future where forests continue to comprise over half the land area of the Commonwealth, forming a permanent and connected system of undisturbed ecological reserves surrounded by parks and woodlands managed for a diverse set of ecosystem services. This system of public and private forests will provide numerous economic and social benefits to local communities, the state and nation -- clean air and water, biodiversity, recreation, tourism, climate change adaptation and mitigation, wood products, and a high quality of life for Massachusetts citizens.

To accomplish this, the current and anticipated suite of stresses on our forests must be reduced. These include (1) conversion of forests to other land use types (*i.e.*, development), (2) fragmentation, both ecological fragmentation of forest patches by roads and other infrastructure, and ownership fragmentation through the creation of smaller parcels, (3) invasive plants, insects and diseases, (4) the direct and indirect impacts of climate change, (5) atmospheric deposition that alters the chemistry of forest soils, and (6) poor silvicultural practices such as 'high grading.' Implementation of this vision and the TSC's recommendations that follow are intended to directly and indirectly address many of these threats by defining and protecting a resilient network of well-connected forests able to resist and recover from disturbance.

The TSC envisions a world one hundred years from now where privately owned forests will continue to account for the majority of forested land in the Commonwealth. These forests will have been permanently protected from development, predominately through conservation restrictions that encourage excellent land stewardship. Private forests will include the majority of the state's actively managed woodlands and serve as the engine for an invigorated local wood products industry and supply of local forest products. For these actively managed woodlands, a Director of Forest Stewardship will oversee the development and implementation of policies that promote innovative and sustainable forest management, empowering landowners and communities to make informed decisions about the future of their lands so as to protect the public values while respecting the needs and rights of a large diverse ownership base. The goal is a system of private forests that *continues* to deliver a wide array of essential ecosystem services, including wildlife habitat, carbon sequestration, water storage and purification, flood attenuation,

scenic values, and significant amounts of locally produced timber and wood products, to a public that is well-educated about the contributions of forests to their well-being. To compensate landowners for providing public benefits through good stewardship, the Commonwealth will reward private landowners with increased incentives for protecting and managing their forests to enhance these public values.

While private forests will provide a broad suite of valuable ecosystem services, the role of the Commonwealth's public forests will be to promote ecosystem services that private landowners are unable or less likely to provide well or in sufficient amounts – public recreation, large and small forest reserves, aesthetically pleasing landscapes, and demonstrations of innovative, state-of-the-art forest management -- ideally management designed to promote a landscape characterized by complex, resilient forests that support the full breadth of biodiversity and natural processes, and maximize the contribution of our forests to climate change mitigation and adaptation. State forests and parks will be better able to provide a full suite of ecosystem services if they are embedded in a well-managed continuous landscape of private and town owned forest lands.

Permanently protected large forest reserves – each one 15,000 acres or greater and located to represent the most intact examples of the state's major forest ecological landscapes -- are a particularly prominent and innovative feature of the Massachusetts forested landscape in 2110. The reserves will be owned and conserved primarily by public and non-profit entities to promote long-term ecological integrity and biodiversity values (Klyza, 2001). The reserves are intended to provide areas where evolving natural processes can be expressed, observed, recorded and appreciated -- including opportunities to observe and monitor the indirect human influences of climate change, acid rain and invasive plants, insects and diseases. An expansive network of smaller 'patch' reserves, designed to protect other ecologically sensitive or culturally significant sites, will complement the system of large forest reserves. Reserves will be distributed widely across the state and where possible link with abutting state parks, private reserves, conservation lands and actively managed woodlands so as to allow easy access to quiet refuges from the state's more developed urban and suburban landscapes. Active management for the purpose of timber production will be prohibited in the reserves. Statewide, the goal is to have between 90,000 and 120,000 acres of the land owned by DCR in 2010 designated as large forest reserves. Acquisitions and conversions of existing protected open space will push the total for DCR large reserves to at least 180,000 acres by 2035.

The remainder of the state system will be devoted to managed woodlands and parklands. The TSC is recommending that between 100,000 to 150,000 acres be designated as woodlands and 70,000 and 90,000 acres be as allocated to parklands. Managed woodlands will be a valuable source of ecological services, through the application of silvicultural approaches that emphasize carbon sequestration, wood production, clean water, creation of early successional habitat, and restoration of late successional habitat. The goal of the parklands is to deliver high quality and diverse public recreational opportunities that benefit from some active recreation and landscape management, but are insulated from more intensive silvicultural manipulations and harvesting operations that occur in the woodlands. When parklands are combined with the forest reserves, between 160,000 and 210,000 acres of DCR lands would be unavailable for timber harvesting, in addition to small 'patch' reserves that will be designated within the woodlands. Over the century between 2010 and 2110, however, we anticipate that the state will need to have added acreage to the parkland/woodlands system to meet the ecosystem service demands of a growing population.

This ambitious and integrated future for private and public lands is intended to make Massachusetts a national leader in forest conservation and stewardship, and will advance and complement the Commonwealth's future in terms of environment, energy, local resource production and quality of life in a world where these values will be in great demand, but also in increasingly short supply. In this broad context, DCR lands should set the standard for all landowners through demonstration of the very best possible land management approaches for delivering the full range of ecosystem services valued by the citizens of the Commonwealth. The citizens of Massachusetts should expect nothing less than the best possible management for the state's forest reserves, parklands, and woodlands to ensure a continuing flow of multiple ecosystem services into the distant future.

V. Recommendations of the Technical Steering Committee

Overview -- Shifting DCR's Forest Management Paradigm

The setting of forest policies is very much a product of their historic times. When 'sustainable forestry' was proposed in the early 20th century, the doctrine of Conservation advocated by Gifford Pinchot and President Theodore Roosevelt was a radical departure from the highly destructive practices that had been the norm since the first European settlement. Sustainable forestry came to mean primarily sustaining the production of wood for lumber, fuel, pulp and paper and even for industrial chemicals. Pinchot also argued for conserving forests for additional purposes such as water, wildlife and soils protection, but the production of timber often dominated forest management practices. The forest management practices that evolved to produce that outcome were appropriate for their time, but times change along with public values.

The extensive cutting of forests was justified by those who did it in the days of early settlement because forests were so vast, dwarfing human settlements and preventing the establishment of agriculture. Today, it is human settlements and agriculture that surround and fragment natural forests. While Massachusetts is fortunate to retain 63 percent of its lands in forests, the vast majority of these lands are in private hands and thousands of acres are lost to development every year (Mass Audubon, 2009). As forest land is converted and fragmented through development of (or expansion of) housing, commercial buildings and highways, we are experiencing the loss of many ecosystem services that were previously taken for granted. There is increasing public pressure to maintain these services on both public and private lands, and for the state to take the lead in demonstrating how to do this with its own lands while encouraging private landowners to do the same.

In this report, the TSC recommends new priorities and perspectives for conserving and managing forests in Massachusetts. The primary focus is the 308,000 acres managed by DCR's Division of State Parks and Recreation (DSPR) and the Division of Urban Parks and Recreation (DUPR). But the TSC recognizes that management of the State and Urban Park lands takes place in the context of a landscape of other public and private lands, and that decisions about state lands cannot be made in a vacuum. Consequently, the TSC provides several overview recommendations focused on conserving and managing the entire forested landscape of the state - the Committee intends that these broader recommendations articulate the need for policy measures that ensure DCR lands remain embedded in a broader system of protected and well-managed forests and therefore serve the purposes on which this report's recommendations are premised.

The TSC's recommendations are intended to encourage a paradigm shift at DCR, moving the Department's forest management towards a vision based on a more comprehensive suite of ecosystem services and implementation of a more balanced portfolio of management approaches - a process that actually began before the creation of the Forest Futures process with the development of more comprehensive district-level forest resource management plans. A key premise of the TSC's recommendations is that the science, both natural and social, underlying land management debates is constantly evolving in response to new information and knowledge - for example the Committee notes the wide range of views on optimal strategies for managing forests in the face of climate change (Luyssaert, et al., 2008; Perez-Garcia, Lippke, Connick, & Manriquez, 2005; Harmon, 2009).

Recognizing that the science informing our understanding of forest ecology and management currently allows a range of interpretations and applications and continues to evolve, the recommendations in this report reflect a public lands management philosophy that explicitly and intentionally relies on a variety of potential approaches for ensuring the continued provision of ecosystem services -- these range from active silvicultural management of some lands to a 'hands off' approach on others. The future is uncertain and the TSC therefore finds that it is critical to ensure a full assortment of tools remain in the land manager's toolbox. To this end, the Committee has tried to make recommendations that, while encouraging the adoption and ongoing evaluation of innovative approaches and current 'best' practices, leave open the use of a range of alternative approaches for managing DCR lands based on site specific needs, future refinements of our understanding of how ecosystems function, and changes in public values. For these reasons, the TSC recommends that DCR adopt a process of adaptive management that will rely upon insights gained from outcomes of practices implemented in this report.

Central to this new paradigm is the concept of ecosystem services -- where ecosystem services are defined as all the ecological, economic and cultural values provided by our forests. The TSC adopted the general ecosystem services model developed for the Millennium Ecosystem Assessment (2005), an international effort by scientists from around the world. Among the services identified are those that maintain important natural processes and others that are economic or cultural in nature. The former include carbon sequestration, soil, air and water quality, biological and ecosystem diversity, nutrient cycling, while the latter include culture, history, education and spiritual values, public recreation, and forest products. While many of these services are compatible, some are mutually exclusive. Our recommendations seek to include robust delivery of each.

The new paradigm more explicitly recognizes that state ownership of forests and parks is different from private ownership because of the assured very long-term stewardship of landscapes secured by one owner and because these lands are held in trust for the public. Hence state owned lands can reflect priorities that may require centuries to accomplish, such as development and protection of old growth forests. We propose a set of priorities for state forests that recognizes the unique potential of these lands to ensure the continued provision of the subset of ecosystem services that are not expected to be provided from private lands -- for example large unfragmented forest blocks managed as ecological reserves and parks managed for public recreation (Klyza, 2001).

Another element of the paradigm shift is the TSC's recommendation that DCR classify its lands into three zones -- forest reserves, parklands, and woodlands -- and develop integrated resource management guidelines for each zone that will be implemented in the form of management plans for all DCR properties. This allows a clear articulation of the ecosystem service goals for each zone and specification of appropriate site-specific strategies for realizing these goals. At the broadest level, our intent is that forest reserves provide for maintenance of ecological process and biodiversity services; parklands focus on recreational services; and woodlands are areas managed for services that benefit from active silvicultural manipulation of the forest, including demonstrations of sustainable forest management practices to produce forest products, restoration of late successional conditions that increase carbon sequestration, creation of early successional habitat for species that are currently in decline across the state, and promotion of effective watershed management.

The end result of the TSC's zoning deliberations is a recommendation for substantial increases in land set-aside from timber production, either as forest reserves or parklands. Our recommendation for forest reserves indicates the Committee's preference for a significantly expanded system of large reserves. The recommended management guidelines for reserves and parklands reflect the Committee's recognition of the need to provide clear direction while allowing a certain amount of flexibility, in the form of available management tools, to respond to future ecological restoration needs or recreation management challenges caused by events such as ice storms, hurricanes and disease infestations. *But the overall intent is that forest management activities in the reserves and parklands occur only as needed to support ecological and recreational objectives, respectively.*

Management of woodlands is also an area where the TSC is recommending changes to DCR policies. The Committee fully recognizes the potential contribution of active silvicultural management in the provision of valuable ecosystem services (Aber, et al., 2000), but also is aware that active silviculture is only one of several management approaches providing ecosystem services -- hence the Committee's recommendation is to significantly reduce the area of State and Urban Park lands open for active forestry and timber management. On the woodlands, the goal is to create examples of sustainable forest management that will both lead the way to improved management practices for supplying ecosystem services on private lands as well as highlight the importance of sustainably produced wood products to the public at large. To achieve this objective, the Committee is calling for a reduced emphasis on even-aged management and, where compatible with effective stand regeneration, a greater emphasis on uneven-aged selection methods that result in a more complex and potentially more resilient forest, one that is also likely to provide more continuous cover and high aesthetic values (Puettmann, Coates, & Messier, 2009). This will promote the development of a forested landscape that represents a more diverse set of age classes, including late successional stands that are seriously under-represented in the state's current forests (Keeton, 2006; D'Amato & Catanzaro, 2007).

Inherent in the TSC's land management recommendations is an inevitable tension between the need to clearly specify management methods without at the same time taking away from land managers the flexibility needed to achieve desired outcomes and adapt to changing ecological or social conditions. Such flexibility, however, requires an atmosphere of trust between the land managers and the public. Our management recommendations assume a basic level of trust, but it is clear to the TSC that DCR needs to rebuild and maintain this trust with the stakeholder community. The recommended land management approaches should therefore be viewed as part of a broader set of changes that must be implemented as a package to be successful.

For example, successful implementation of the ecosystem services approach will require major changes in the organizational culture at DCR. Strong and visionary leadership will be needed to reshape the agency's goals and planning processes and to insure new policies are implemented in the field. The new paradigm requires that all DCR staff understand and support the ecosystem services model and adopt a new way of thinking about the role of the public in forest stewardship. In the past the public has not always been adequately consulted on forest stewardship issues. This must change in the future if DCR is to successfully implement the TSC's vision for state lands. The state's current budget shortfall is certainly challenging but it also creates opportunities for DCR to partner effectively with 'friends' groups, non-governmental organizations (NGOs),

other agencies and entities to implement many of the planning, implementation, oversight and monitoring activities that are essential elements of the new vision.

The TSC is also recommending that forests -- and the full array of ecosystem services provided by them -- be elevated to a higher profile within state government. Without specifying details of such a bureaucratic reorganization, the TSC recommends elevating and broadening the responsibilities of DCR's Chief Forester, converting the position to a more prominent Director of Forest Stewardship.

Finally, although beyond the original charge of the Committee and therefore not included as one of our ten recommendations, the TSC urges the Secretary of Energy and Environmental Affairs to consider the potential benefits of adapting and applying the recommendations and insights from our work more broadly to all forest lands owned by the state. This would result in a more fully integrated vision and management approach for state lands, consistent with the TSC's long-term vision for the forests of the Commonwealth.

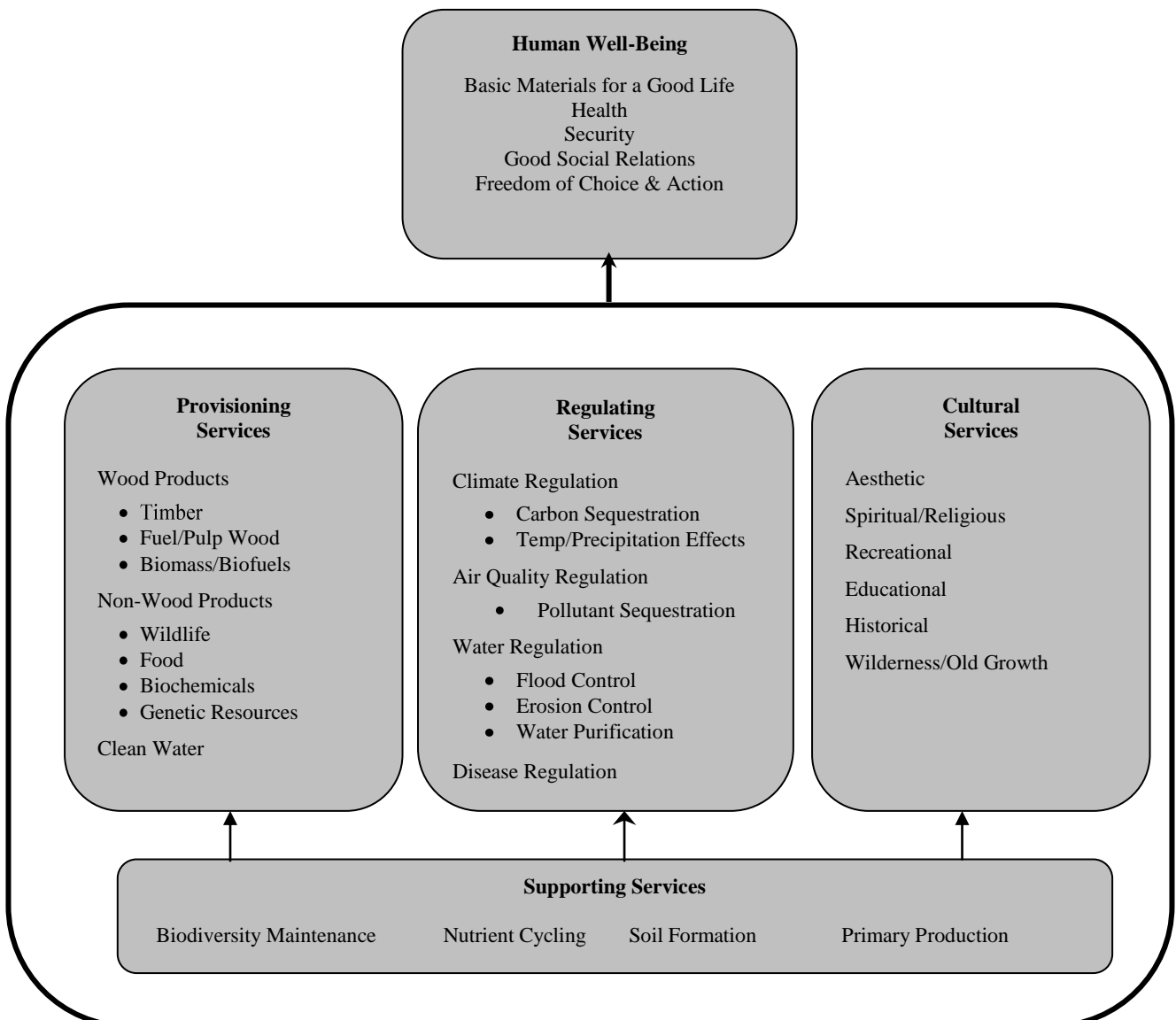
The remainder of this report outlines the details of our recommendations. Readers are urged to bear in mind that TSC intends its work as a roadmap designed to help DCR begin the journey of implementing the new paradigm. Full implementation of the vision embodied in these recommendations requires substantial DCR staff work, partnerships with other agencies and organizations, and public process. The three zones must be delineated on the ground, management guidelines and management plans rewritten, staff and financial resources found to support the new planning and monitoring requirements, and funds secured for acquiring additional lands needed to complete an ecologically functional system of forest reserves. In addition, the DCR Commissioner and the new Director of Forest Stewardship must dedicate themselves to providing strong leadership that shifts the forest management culture through clear articulation of the Forest Futures vision, training of department staff to implement the vision, and more effective communication with the public over planning and implementation details. Full realization of the vision will take time and DCR will require broad public support *and increased funding* to achieve these ends.

Although the TSC has not conducted extensive analysis of which laws and regulations governing DCR's forest land management will require modification to fulfill this vision, it is clear that numerous inconsistencies and ambiguities exist in these mandates. Interpretation and prioritization of these mandates and regulations has clearly been a factor in the diminished trust in DCR by segments of the public. Many of these mandates and regulations confer broad discretion or latitude for interpretation on the agency. In order for DCR to move forward, differences should be clarified and harmonized to align with the principles underlying these recommendations and to enable consistent implementation. Doing so will assist DCR staff in fulfilling the mission and reduce confusion and confrontation with the public. An example illustrating the need for this deeper legal analysis is Chapter 132A Section 2B provisions on acquired lands, which states "that they shall be in so far as possible collectively self-supporting; and that no commercial activities except those essential to the quiet enjoyment of the facilities by the people shall be permitted." This can be read to be in conflict with Chapter 132 Section 40, which states "and providing a continuing and increasing supply of forest products for public consumption, farm use, and for the woodusing industries of the commonwealth." To ensure the state's legal framework is fully supportive of the vision expressed in the TSC's recommendations, we suggest that the responsible agencies seek changes to existing laws and regulations as necessary to clarify the state's legal mandates for forest protection and stewardship.

Recommendation 1: Adoption of an Ecosystem Services Model to Guide Forest Protection and Management

Recommendation: *The fundamental guiding principle for all forest protection and management policies in the Commonwealth should be to ensure the sustainable provision of a comprehensive suite of forest ecosystem services. Moreover, DCR should adopt a planning framework for the state parks and forests that focuses on the provision of key ecosystem services not expected to be provided, or not provided in adequate amounts, from private lands in the Commonwealth.*

The forests of Massachusetts provide a wide array of goods and services to the citizens of the state. The TSC finds that the fundamental basis for forest policy in the state should be a planning and management model that recognizes the importance of the full range of these values and the need to ensure their sustainable provision for current and future citizens of the Commonwealth. To guide its recommendations, the TSC used the ecosystem services framework shown in the diagram below to systematically account for all of the potential ecological, economic and social benefits provided by forests in the Commonwealth. This diagram represents the TSC's adaptation of the ecosystem services framework originally proposed in the Millennium Ecosystems Assessment (2005).



Implementation Guidance: Many competing demands are being placed on all public lands, and recently there has been significant public controversy over current priorities and management practices for DCR forest lands. To address these issues, the TSC recommends that DCR, as it establishes its land management priorities, consider the following five organizing principles:

- Forests provide a host of valuable ecosystem services. Many of these services -- public recreation, carbon sequestration, soil and water quality, and habitat that promotes biological diversity -- have little or no market value, and are therefore unlikely to be supplied in sufficient quantities from private forests.
- Even though they account for only about 10 percent of the Commonwealth's forested land, DCR's state parks and forests include some of the state's largest continuously forested tracts, providing an opportunity for long-term ecosystem management that is not possible on more fragmented forest lands.
- To maintain ecosystem services for future generations requires that forest lands be managed with these goals in mind and on time scales of centuries or longer. The enduring ownership and responsibility for DCR lands by state government is a unique responsibility that no other institution or individual can fulfill.
- Over time climatic zones will shift, surrounding land use patterns will be altered, public values may change, and our understanding of forest and climate science will evolve. State ownership of forests provides an important, and perhaps unique, opportunity for managing and monitoring the adaptation of our forests to these changes and the uncertainties that surround them.
- The state should serve as the guardian of our collective future and forests represent a unique component of that future. DCR lands need management plans that can meet the goals inherent in a very long-term future and that will not necessarily be met by other forms of land ownership.

In the context of these five organizing principles, the TSC identified ecosystem services that it recommends take precedence in the management of DCR's state forests and parks, primarily because private forests are unlikely to provide adequate supplies of these services. These *essential ecosystem services* represent primary management goals for DCR lands. In the view of the TSC, these must include biodiversity protection (including both early and late successional species), clean water, carbon sequestration, soil formation and nutrient cycling, and public recreation including wilderness/old growth/spiritual experiences. In addition, demonstrations of how forests can be managed to provide sustainably grown wood products are an essential service on the subset of DCR properties classified as woodlands (see Recommendation 3).

The TSC further recommends that future DCR resource management plans for forest reserves, parklands, and woodlands explicitly propose priorities and goals for each of the essential ecosystem services and establish appropriate metrics for judging whether the goals are being met.

Discussion: In recent years, a number of planned and actual harvests on DCR lands have resulted in public controversies due to the scale of harvests, the large size of openings created by the

harvests, claims of poor oversight resulting in site degradation, and harvesting plans that conflicted with other public and ecosystem values of the site. These incidents were a major factor leading to the formation of the TSC by DCR Commissioner Sullivan.

The TSC recognizes that implementation of silvicultural prescriptions designed to produce quality timber and certain other valuable ecosystem services will sometimes conflict with other public values, particularly the recreational and aesthetic experiences provided by state parks and forests. Nonetheless, the TSC finds that production of timber and other related ecosystem services through sustainable forest management is desirable on a portion of DCR lands explicitly designated for these purposes. The reasons for this are not primarily economic. DCR lands represent a small portion of the state's public and private forests, and hence make a relatively minor contribution to overall forest sector economic activity in the state (although the contribution may be significant for some small towns and this 'community context' is a relevant consideration of the management planning process for specific properties). Moreover, revenues from timber sales are small and unavailable to DCR as the legislature currently requires these sale proceeds be returned to the general treasury – hence they make no substantial contribution to meeting the Department's budgetary needs.

In the TSC's view, the primary role of wood production on DCR lands should be an educational one. Silviculture on DCR forests provides an important opportunity for public education, outreach and training on sustainable forest and ecosystem management practices. The focus of forest management on DCR woodlands should be the creation of 'model forests' capable of demonstrating absolute 'best practices' to private landowners and the broader public. Through the collection of long-term ecological and economic data, this will allow state land managers to test both the efficacy and economic viability of sustainable forest management approaches that private landowners may currently believe to be too risky, unproven or uneconomic to adopt. Ultimately, demonstration efforts to identify and show the results of applying best practices should be judged based on how successful they are in improving the sustainable delivery of ecosystem services from private forests. Another important benefit of conducting silvicultural treatments on these lands is to create or restore ecological functions and processes that are in decline, for example valuable early successional or fire-dependent wildlife habitat. Finally, by allowing timber production on some of its lands, DCR can contribute to building a public sector program that encourages the use of locally produced wood and wood products, an initiative that would help promote economic development in the Commonwealth's rural areas. It is in light of these various considerations that the TSC has determined that wood production is one essential ecosystem service among several on DCR lands classified as woodlands.

Recommendation 2: Elevated Role for Massachusetts Forests in the Commonwealth Environmental Decision-making Processes

Recommendation: *In implementing its environmental priorities, the Commonwealth should focus increased attention on the protection and stewardship of the state's public and private forests through a reorganization that elevates the state's chief forest stewardship official to a more prominent decision-making role.*

Currently, forest stewardship decisions, affecting hundreds of thousands of acres across the Commonwealth, are spread across several state agencies and are often decided in a manner that does not adequately support and encourage forest protection and stewardship in the competition for the state's limited environmental resources and dollars. Relegating the responsibility for forests to agencies with other primary purposes has resulted in a lack of knowledgeable and effective leadership, often leading to poor accountability across the existing bureaucratic structure. Given the enormous importance of public and private forests in providing these critical environmental services to the public, the TSC recommends that DCR/EEA create a new organizational structure that results in more integrated and coordinated stewardship policies for Massachusetts forests. Specifically, the reorganization should support provision of a complete and non-declining suite of forest ecosystem services to current and future residents of the Commonwealth. This will require an organizational structure that:

- Results in a high degree of coordination for land protection and forest stewardship policies across the three million acres of public and private forests in the state.
- Creates a senior level leadership position in state government that serves as the focal point for innovative forest protection and stewardship of state lands.
- Improves integration of planning activities for both natural and cultural resource protection and recreation management through a strong focus on the development of integrated resource management plans for public lands and full implementation of an adaptive management framework to ensure their success.
- Fosters better communication and public participation in the development and implementation of state land management policies with the goal of ensuring broad-based public understanding of and trust in state land management policies.
- Elevates to key leadership positions staff with training, expertise and experience in forest ecology and other ecosystem services required to plan and implement land management policies.
- Allocates adequate funding to accomplish these goals.

Implementation Guidance: Specifying the details for a reorganization of the state land management system to achieve these objectives will be a complex and challenging task -- one that many believe is beyond the scope and expertise of the TSC. Nonetheless, the Committee is

clear that significant changes are needed in how the state organizes its forest stewardship and management functions. Changes could be implemented at a number of different levels within the EEA bureaucracy, and the TSC recommends that the Secretary consider how best to reorganize EEA to achieve the above objectives. Given the TSC's charge, we focus our specific comments on organizational changes needed to ensure improved management of DCR's 308,000 acres of DCR state parks and forests.

The principal organizational challenge at DCR is the coordination of resource stewardship and recreation management policies. Currently, responsibility for resource management is fragmented and isolated across the Department's organizational structure. This arrangement has contributed to less-than-ideal stewardship decisions and has certainly not provided adequate prominence to forest policy and decision-making. Consequently, the TSC is recommending reorganization of DCR to create a resource stewardship position on an equal footing with the Directors of the state (DSPR) and urban (DUPR) park systems. This however raises the question of who is ultimately responsible for the management of specific properties – a *Director of Forest Stewardship* or the parks and recreation director. The TSC's review suggests there is no simple answer to this question. Instead, some form of matrix management or joint responsibility is likely needed to ensure balanced and integrated consideration of natural resource and recreation policies.

In this context, the TSC recommends that the DCR Commissioner consider converting the existing Chief Forester position into a Director of Forest Stewardship, and elevate this position in the DCR organizational structure to be on a par with the DSPR and DUPR Directors. The Director of Forest Stewardship would have direct responsibility and oversight for Service Forestry on private lands, and for management of DCR woodlands and forest reserves; his/her department staff would also work collaboratively with the staff in State Parks and Recreation to carry out any necessary management of forests in state parks. It is critical for the person in this position to have an extensive background in forest ecology and conservation biology, a demonstrated understanding of the full breadth of ecosystem services that the state is advancing on its public and private forest lands, and a proven track record of working successfully with the diverse interest groups involved in forest policy. Creation of a new forest stewardship director would increase the prominence of forest policy within DCR's decision-making processes, thereby providing a stronger internal DCR voice for protection and stewardship of public and private forests in the Commonwealth. While not addressing the broader need for leadership and coordination of forest policies within EEA, a DCR Director of Forest Stewardship should provide greater assurance that the state's public and private forests are managed to provide a continuing and never declining stream of forest ecosystem services to current and future residents of the Commonwealth.

The TSC also notes the critical importance of selecting an individual with exceptionally strong leadership and public outreach skills for the Director of Forest Stewardship position. The person in this job will need to restore morale amongst the foresters at DCR, motivate foresters and planning staff to adopt and implement the new vision, and prove to skeptical segments of the public that DCR is committed to a new and ambitious course. This is a daunting set of challenges and will require leadership skills of the highest order.

Discussion: The TSC is fully aware that its recommendations leave open the details of reporting relationships within DCR for forest stewardship and parks and recreation. Our intent is to foster a

dialog about the best way to achieve the broad objectives outlined at the beginning of this recommendation. From the TSC's perspective, this dialog ideally would include discussion of how to ensure integrated policies based on a consistent vision across all DCR policies affecting forests – including management of Division of Water Supply Protection lands and the DCR Commissioner's role as State Forester overseeing policies promoting good stewardship of private forest lands. While not making any specific recommendations in this regard, the TSC suggests that organizational changes should include as a goal broader coordination of forest policies within DCR. In a similar context, the Committee recommends the EEA Secretary consider mechanisms for further ensuring implementation of a unified policy framework for all the forests owned by the state.

The recommendations discussed here focus on elevating the prominence of forest stewardship within DCR. Within the context of a reorganized DCR, a wide array of other planning and management issues will need to be addressed. The TSC discusses these in Recommendation 7.

Recommendation 3: New DCR Landscape Planning Model

Recommendation: *As an overarching template for organizing its land management activities, DCR should adopt a management structure that sub-divides its State and Urban Park lands into three categories: (1) Forest Reserves, (2) Parklands and (3) Woodlands.*

This categorization recognizes and supports the broad set of ecosystem service priorities that the TSC has identified, refining the Harvard Forest's 'wildlands and woodlands' concept (Foster, et al., 2005) for application to the State and Urban Park lands, and segregating incompatible activities into different land use zones. Creation of these zones should help to more clearly articulate dominant ecosystem services and set priorities across different lands in the DCR system:

- **Forest Reserves:** These lands are areas where the dominant ecosystem service objectives are biodiversity maintenance and the underlying supporting services of nutrient cycling and soil formation, watershed protection, and long-term carbon sequestration (Luysaert, et al., 2008); important secondary services include provision of wilderness/spiritual values and recreation. Management would generally consist of letting natural processes take their course (Foster & Orwig, 2006), although in some cases more active management might be permitted (Soule & Terborgh, 1999), for example fuels management may be necessary for forest reserves in the southeastern part of the state.
- **Parklands:** The dominant ecosystem service objectives for parklands are provision of public recreational opportunities that depend on natural areas, preservation of ecologically significant areas and 'special places,' and promotion of cultural values (aesthetic, historical, educational and tribal). These goals should also be compatible with the maintenance of a wide range of other important ecological values. Parkland management approaches are expected to range from areas where natural processes dominate to highly modified environments where use is intensively managed.
- **Woodlands:** Planning for these areas should emphasize the provision of ecosystem services that require management prescriptions with intensities that are less compatible with the activities in the parklands (or forest reserves). An over-riding emphasis for woodlands should be educating other landowners and the general public about sustainable forestry. This would be done through active forest management targeting sustainable production of timber for local markets, protection of water supplies through active watershed manipulation, management to promote early successional habitat (Massachusetts Division of Fisheries & Wildlife, 2006), and carbon sequestration through options that focus on late successional habitat restoration (Keeton, 2006; D'Amato & Catanzaro, 2007) and lifecycle carbon impacts (Perez-Garcia, Lippke, Connick, & Manriquez, 2005). In addition, active forest management may play a role in the ecological restoration of areas that have been significantly altered by previous management (*e.g.*, plantations of non-native species).

Implementation Guidance: The DCR Commissioner should immediately establish processes (both internal and public input) for mapping the 308,000 acres of DCR State and Urban Park lands into the three land use zones and then proceed with the development of integrated resource

management plans for these areas. As described below, DCR should continue its suspension of timber sales until the re-zoning process is complete. Similarly, until forest management plans are subsequently revised and/or completed for the woodlands, any timber sales should focus on uneven-aged management.

- **Overview** -- the TSC reviewed a number of preliminary analyses to evaluate the appropriate allocation of currently owned State and Urban Park lands to forest reserves, parklands, and woodlands. These analyses do not point to a single ‘correct’ allocation but the TSC agreed on general ranges for each zone based on the professional judgment of the Committee members and informed by various allocation scenarios presented in Annex 5.

Recommended Allocation of DCR Land to Zones		
Zone	Acres Range	
	Low	High
Forest Reserves	90,000	120,000
Parklands	70,000	90,000
Woodlands	100,000	150,000

Implementation still requires (1) a spatial analysis using objective criteria for large forest reserves, parklands, and woodlands to guide the layout of the zones across the full set of existing DCR properties; (2) comprehensive delineation of each zone including optimizing each zone, making difficult decisions for properties identified as important for two or more zones, and ground-truthing; and (3) implementation of a robust public process to vet and finalize the allocations, including discussions with towns where DCR forests account for a large portion of the town’s area. Overall, the zoning process should give adequate consideration to economic analyses of potential impacts in those communities that are most dependent on the local forest economy.

To guarantee the ecological integrity of the forest system and its capacity to deliver the described ecosystem services, the TSC finds that it is necessary to add to the protected forested land base, emphasizing the expansion of large forest reserves to 15,000 acres each. The TSC strongly recommends that the state also take action to add permanence to the reserve designation, which for example might include codification of forest reserves in legislation, via constitutional amendment, or through other appropriate means for maintaining reserve values in perpetuity.

The remainder of this section discusses the details underlying the TSC’s recommended zoning allocations. Management approaches for each of the zones are specified in Recommendations 4 through 6.

- **Large Forest Reserves** are intended to return significantly under-represented late successional forests to the Massachusetts landscape. Lorimer and White (2003) estimate that for eastern oak forests on the pre-settlement landscape, multi-cohort stands with a

component of mature and old trees would have been common, occupying roughly 25–40 percent of the landscape, and for northern hardwood forests, the estimated pre-settlement proportion of the landscape in old-growth forest (>150 years old) is 70–89 percent. D’Amato et al (2006) estimate that there are currently 1,119 acres of old growth in the Commonwealth, less than 0.04 percent of the state’s forests. Therefore, a key goal for DCR forest management should include restoration of missing late successional structure and function.

Forest reserves are a widely recommended approach to restoring and maintaining ecosystem functions associated with late successional forests, which provide unique ecosystem services and support resilience in the face of future uncertainties such as climate change. Norton (1999) stated that “On scientific grounds, reserves are important because they contribute to protecting the full range of biodiversity, including ecosystem processes that characterize the forest.” He mentions the extensive documentation of species benefiting from old-growth forest stands, highlighting “the value of having some areas free from all production management.” Norton concludes that “a primary reason for reserves is to ensure that representative examples of biodiversity indigenous to an area are protected. While many indigenous species can persist in forests managed for timber, changes in composition and age structure of forest stands resulting from forest management alter habitat availability for many species,” and that “if our overriding goal for managing a reserve is to protect the full range of biodiversity within it, then the changes that result from sustainable management, no matter how subtle, are not compatible with this goal.”

Examples of late successional forests supporting biodiversity include breeding bird densities that are significantly higher in old forests (Haney and Schaadt, 1996). Selva (1996) found that older forests yielded a greater diversity of lichens than younger forests and that some species were only found at sites that had supported mature trees for many centuries. Chandler (1987) found that many insect species were more abundant in old forest. These findings are especially important in the context of the fact that vascular plants and vertebrates make up only 20 percent of the species in our forests (Anderson, 2008). The remaining invertebrates, lichens, mosses, fungi, bacteria and other taxa represent ‘unknown biodiversity’ that place an imperative on protecting the full complement of forest structures and functions.

Unmanaged forests have recently been shown to play a crucial role in forest carbon sequestration and storage. Nunery and Keeton (2010) “showed that even with consideration of C sequestered in harvested wood products, unmanaged northern hardwood forests will sequester 39 to 118 percent more C than any of the active management options evaluated. This finding suggests that reserve-based approaches will have significant C storage value.” Reserves also provide important benchmarks against which to compare changes in managed ecosystems (e.g., for assessing the long term effects of sustained-yield harvesting on biodiversity (Norton 1999).

For the **large forest reserves**, DCR should build on the recent and successful analysis that identified and designated the nine existing large forest reserves by DSPR, DWSP and the Department of Fisheries and Wildlife (DFW), totaling approximately 50,000 acres (approximately 40,000 of which was on DSPR lands). This process emphasized large,

intact forest blocks and representation of Massachusetts forest biodiversity. Ideal large reserve design should be based on the principles of conservation biology that direct us to develop a connected network of large, well-buffered forest reserves with minimal internal fragmentation. Applying these concepts will require careful reserve selection and design analyses. To finalize the strategy for reserves, DCR should appoint a committee of forest ecologists and biodiversity experts to review and recommend the final layout of the forest reserve system. This should then be the subject of a broader public process.

To guarantee the ecological integrity of the forest reserve system, the TSC finds it is necessary to create large, intact forest reserves in each of the major ecological settings in the state (Anderson, 2008). Beier and Brost (2010) support this stating “a reserve or linkage designed to encompass the full diversity of dominant land facets at multiple spatial scales will encompass the full diversity of land-cover types and species, today and in the future, and will conserve ecological and evolutionary processes.” These principles would result in the following overarching large reserve selection criteria. Large reserves should be:

- located in the least fragmented forests with the highest amount of forest interior habitat.
- representative of the state’s diverse ecological settings (based on geology and elevation) which are the drivers of long term ecological and evolutionary processes, and as such are surrogates for forest biodiversity even under changing conditions such as those anticipated under climate change.
- large enough to capture the full range of ecological processes, such as infrequent but severe natural disturbances, and serve as source habitat for forest dependent species. The TSC has adopted The Nature Conservancy’s recommendation of 15,000 acres as a minimum size goal for large forest reserves. These large reserves will in some cases initially be smaller where there is currently not a protected area of 15,000 acres, but the goal should be to reach this size in a timely manner to capture the full benefits of having reserves.

In developing its allocation recommendations for large forest reserves, the TSC considered a number of alternative reserve scenarios. These included an analysis of the minimum acreage and reserve configuration required to represent forest settings in the Commonwealth, as well as review of configurations that provide greater redundancy across the major ecological settings and representation of smaller forests that no longer occur in 15,000 acre patches. Also reviewed were suggestions from a subgroup of the AGS that 80 percent of all DCR land be designated forest reserves and parklands. These various analyses are presented in greater detail in Annex 5.

Because the current arrangement of public lands does not represent an ideal reserve network, ultimately large reserves will need to be designated through a combination of existing protected lands and future acquisitions. Therefore, building on the approximately 40,000 acres currently designated as large reserves on DSPR land, DCR can achieve forest reserve goals through a combination of the following: (1) designation as reserves of additional currently owned DCR lands, plus (2) legal protection of adjacent

lands, through acquisitions of land or conservation restrictions, and incorporation into the reserves management plan of adjacent already protected lands held by other organizations. Even with addition of existing DCR protected lands, expanding each reserve to 15,000 protected acres will require the addition of at least 90,000 and perhaps as much as 130,000 more acres to the system (for a total of between 180,000 and 250,000 acres of large forest reserves). However, some of this land is already protected, for instance the Division of Fisheries and Wildlife and the Division of Water Supply Protection have already designated over 11,000 acres of large forest reserves that augment the DCR reserve system, and non-profit organization lands also can contribute to this reserve system through collaborative agreements.

Designation of a total of 90,000 to 120,000 acres of existing DCR lands to large forest reserves, which represents an acreage increase of between 125 and 200 percent over current acreage in reserves (40,000), would result in a reserve system on between 30 and 40 percent of DCR's existing State and Urban Park lands, or between 3 and 4 percent of total state forest lands. In addition, the TSC recommendations for future acquisitions and incorporation of other already protected lands into the reserve system – an essential action needed to ensure the ecological integrity of the system -- would eventually result in a state forest reserve system of between 180,000 and 250,000 acres, approximately 6 to 8 percent of all forested land in the state. This is necessary to provide protection for the full complement of the multiple, diverse forest ecosystems and their services within the Commonwealth, and provide the resiliency required as climate changes and development of land areas continues.

Within the system of forest reserves, the TSC also suggests that the Commissioner establish a wilderness designation -- perhaps through adaptation of the existing 'wildlands' and 'nature preserves' designations. The TSC envisions one or two such areas, embedded within other reserves and in total encompassing approximately 5,000 acres. In these areas, old growth forest would be a prominent feature, and human interventions would be subject to certain additional use restrictions designed to protect a sense of remoteness, as discussed below in Recommendation 4. In the view of the Committee, creating one or two wilderness areas of this type would provide important recreational and spiritual values that would not necessarily be present across other areas in the forest reserve system. The TSC anticipates that wilderness areas might be established as protected cores within individual forest reserves.

Because it takes centuries to develop many of the old growth structures, functions, and ecosystem services provided by forest reserves, some degree of permanence is needed to ensure these forest reserves are allowed to mature protected from political forces. Therefore, once the initial process of identifying and designating the reserves is complete, the TSC strongly recommends that the Secretary of Energy and Environmental Affairs evaluate how best to make reserve designation permanent, which may include a request that the legislature codify the forest reserves by law or advance a constitutional amendment, and then implement the most effective approach for maintaining reserve values in perpetuity, with provisions to add to the reserve network through land acquisition over time.

Finally, as part of the planning processes for the zones, DCR should designate additional **patch reserves** designed to provide greater protection to valuable natural or cultural assets. Typically, these would be areas where standard best management practices for the land-use zone are not adequate to fully protect these embedded areas (*e.g.*, highly sensitive ecological or cultural assets within any of the three zones where certain human uses or management might need to be discouraged to fully protect the resource). These areas will have altogether different selection criteria than large forest reserves (*e.g.*, old growth patches, forest dependent rare species habitat, important historical sites, etc.). The acre totals for large forest reserves discussed at the beginning of this recommendation do not include these areas. Management of these patch reserves is discussed in Recommendations 5 and 6.

- For **parklands**, the Commissioner should direct DCR’s planners to establish an approach and further public process for designating parklands throughout the DCR system. These should include all DCR lands in heavily populated areas and other forested areas with high recreational values while retaining other important ecosystem services. Potential criteria for identifying these other areas might include:
 - Density of officially designated trails (as opposed to bootleg or rogue trails), with denser or more extensive trail systems being most appropriate for parklands. DCR should consider whether motorized trail networks are more compatible with the woodlands zone than with the parklands for reasons of trail flow and experience.
 - Areas surrounding campsites and other control points such as water access and day use areas.
 - Nationally or regionally significant trail corridors.
 - Level of recreational visitation (how popular is an area?) with areas of high visitation -- both day and overnight use -- being most appropriate for parklands.
 - Availability of unique natural or cultural features, such as views, water features, chasms, unusual forest types, historical or cultural features.
 - Extent to which the setting is unique to the surrounding landscape – for example native forest habitat (or even just a forested setting) amid a suburban landscape – or where slopes, soils, etc. are not appropriate for timber harvesting.
 - Parklands should be situated on the land to provide adequate buffering from more actively managed woodlands, with particular attention given to aesthetically pleasing views and segregation of access roads for the woodlands. Parklands should explicitly incorporate and buffer the ‘special places’ with ecologically or culturally significant features.
 - DCR should consider partnering with local municipalities to manage recreational facilities that are not inherently dependent on the natural setting. These types of facilities do not enhance DCR’s important role in providing nature-based

recreation to the citizens of the Commonwealth, and indeed, these facilities likely diminish staffing resources and funding that should otherwise be allocated to nature-based recreation functions.

The TSC's recommended allocation of between 70,000 and 90,000 acres to parklands reflects the Committee's review of preliminary analyses from DCR and the AGS. At the TSC's request, DCR provided information on the acreage of existing State and Urban Parks that meets the parkland criteria discussed above. The most recent DCR analysis indicated that approximately 81,000 acres would fall into this category, but the TSC finds this still might be an underestimate and as a result increased the upper end of the range to 90,000 acres to ensure the possibility of full protection for lands where the primary ecosystem service is recreation. Details of DCR's analysis, as well as recommendations from the AGS working group, are included in Annex 5.

- **Woodlands** would be designated by DCR planners and vetted through the same public process as reserves and parklands. Criteria for woodlands include (1) areas suited for wood production, including wood to support DCR's home fuelwood program; (2) lands well situated for the creation of early successional wildlife habitat; (3) watersheds that will benefit from active manipulation of the forest; (4) areas where forest management has the potential to increase carbon storage through substitution of wood for more energy intensive materials such as steel and concrete, and (5) areas that will benefit from active silviculture to restore late succession characteristics. It is important to note that the goal of woodlands designation is to maintain sustainable delivery of multiple ecosystem services including wood products by utilizing management techniques. The selection criteria for woodlands might include location considerations such as proximity to wood processing facilities, as well as whether sites provide good access for model forest demonstration activities. Sites requiring ecological restoration and sites that have been subject to recent silvicultural treatments might also be good candidates for woodlands designation.

In light of the ecosystem service priorities highlighted in Recommendation 1 (*e.g.*, sustainable forest management demonstration and training, early and late successional habitat creation, manipulation of watersheds, and active carbon management strategies), the TSC is recommending that between 100,000 and 150,000 acres be allocated to woodlands. The TSC requested and reviewed an analysis from DCR that suggested the need for 155,000 acres of woodlands, which included 20,000 acres for watershed management, 30,000 acres for early successional habitat and the remainder for demonstration of sustainable forestry, including forestry aimed at restoration of late successional conditions and carbon sequestration (Annex 5 -- note that the DCR estimate in the Annex is 140,000 acres, reflecting a further focus on the most highly rated areas from the woodlands identification modeling). There was general agreement on the TSC that the approximately 20,000 acres of DCR lands that are actively managed for watershed values should be included in the woodlands. But the overall range in the TSC recommended woodland allocation reflects considerable uncertainty about how much land is really needed to meet the ecosystem service objectives described above.

While the published literature consistently demonstrates declines in early successional species, the TSC did not reach consensus about the total amount, location and patch size

of habitat necessary to support these species on DCR land. This was the result of uncertainty about how best to configure and maintain such early successional habitat on the ground, as well as recognition of the fact that the ‘right’ amount of such habitat depends on public values about the kinds of biodiversity worth protecting. The Committee reviewed management approaches suggesting the designation of (1) 4,500 acres that would be re-cleared every 15 years for early successional habitat versus (2) 30,000 acres managed as a shifting mosaic of clearings managed over a 100-year rotation. Based on comments received from a wide array of sources when the draft recommendations were made available for public comment, the TSC has decided that rather than designating a specific acreage target for early successional habitat, it is recommending that DCR establish a formal ongoing planning and adaptive management process for addressing these needs – the details of this recommendation are discussed further in the management recommendations for woodlands (Recommendation 6).

The other substantial uncertainty revolves around the amount of land needed to demonstrate sustainable forestry, including late successional restoration aimed at enhancing biodiversity and increasing carbon sequestration. In general the TSC finds that DCR should build up an estimate of these acreage requirements based on the identification of a set of stands that is representative of the range of forest types, age classes, and logging conditions in the state. An example of such an approach, which suggested the need for 90,000 acres of woodlands for demonstrating sustainable forest management, is included in Annex 5. But this analysis is only intended to be illustrative of the type of detailed, on-the-ground assessment that the TSC recommends be done to finalize the acreage necessary for a system of model forests. As part of this further analysis, TSC recommends that DCR coordinate closely with DFW to identify opportunities for integrating the early successional habitat creation into management of lands identified for forestry demonstrations.

Transitioning to the New System

- To complete the zone mapping, DCR planners will need to make final decisions about allocations to the three zones in collaboration with partners and informed by careful public review. The TSC notes the desirability of a large forest reserve system built on greater redundancy; based on very preliminary analyses there would appear to be adequate land in the DCR system to support a certain amount of redundancy across ecological settings (see Annex 5). For example, if 80,000 acres are designated as parklands and another 120,000 as woodlands, it should be possible to devote approximately 110,000 acres to an extensive proposed reserve system, given the current acreage of the State and Urban Park system. Greater redundancy could be achieved as additional lands outside of current state holdings are added to meet the stated goals (see the discussion below on the role of easements and purchases). It is critical to note, however, that the TSC has not had the data, analytic capabilities or time to fully verify that this more extensive system of reserves can be configured on the ground in a way that meets the goals for each zone. Moreover, the allocation process must address the complexity of certain properties, for example Mount Greylock, where decisions will have to be made about how existing infrastructure will be handled in the context of a property that is largely allocated to a forest reserve. *In light of this, the allocation scenarios, and*

supporting analyses in Annex 5, should be viewed as broad goals and are not intended to define the future status of specific properties. This can only be done through a much more detailed planning exercise that considers the ecosystem service objectives of each zone and applies specific criteria for configuring the system on the ground. This final allocation process should include careful consideration of both forest ecosystem science and public values, while reconciling any on-the-ground conflicts.

- The transition to the new zoning and management system raises a number of questions about DCR land management policies in the period before the management planning is finalized. The TSC recommends that the current suspension of new timber sales be continued until the zoning process, including public review, is complete. This will be followed by a period when DCR develops revised Forest Resource Management plans including guidelines for each of the zones. During this period, timber sales could be reinstated, but until such time as the guidance and management plans are complete, all timber sales should focus on less controversial silvicultural prescriptions (*e.g.*, uneven-aged management for late successional characteristics as discussed in Keeton (2006) and D'Amato & Catanzaro (2007)).
- As noted in the Forest Reserve section, future land protection (acquisition and easements) will play an important role in developing a sufficiently protected land base to provide the full suite of ecosystem services. The TSC recommends an aggressive land acquisition program, in collaboration with EEA and other Massachusetts land protection agencies and organizations. Because the large forest reserve network requires additional acreage to realize reserve design goals and become fully functional, the TSC recommends prioritizing forest reserve acquisition within intact forest blocks, and including buffers and connections. In addition, further acquisitions of parklands and woodlands will likely be needed to ensure that future public ecosystem service demands are met.

Discussion: DCR currently has a three-zone system for mapping its lands. This system, however, has resulted generally in a commingling of parklands and woodlands, and a resulting lack of clarity about differences in management approaches. The TSC has identified two major benefits of adopting the proposed zoning system.

First, the zones align better with ecosystem service priorities and make explicit where different management approaches are appropriate, generally organizing the DCR lands along a continuum that reflects the intensity of human intervention and management. Forest reserves would clearly have the least intervention, although this does not necessarily imply zero management -- approaches for managing human access (trails), invasive species/pests, herbivore damage, or woody fuel loadings are all things that might warrant intervention. The main emphasis on the parklands would be enhancing the recreational experience of visitors -- although generally this will require a greater degree of intervention than in the forest reserves, management would be performed only with the goal of supporting the recreational experience and enhancing the types of ecosystem services also provided by forest reserves. The woodlands would be the locus for the more intensive (primarily vegetation) management practices that, for example, support provision of local wood products, early successional habitat creation, clean water needs requiring active watershed manipulation, and active management to promote the development of late successional characteristics and lifecycle carbon storage.

Second, the recommended zone system could be implemented more quickly than property-specific resource management plans, since it is essentially a refinement of the district planning process currently used by DCR forest planners. Recently, DCR, with guidance from the Stewardship Council, established a priority scheme for the development of property-specific resource management plans. In the future, as funds become available and as is required by M.G.L Ch. 21, Sec. 2F, this prioritization can serve as a starting point for resource management planning focused on areas most likely to benefit from more detailed on-the-ground planning.

The TSC notes that over the longer term, flexibility will be needed in the delineation of zones in order to adapt to changing future ecological conditions and societal preferences. Both factors are subject to change, with the possibility that climate change could result in dramatic alterations. The TSC therefore recommends that DCR periodically reassess the appropriateness of the areas delineated as parklands and woodlands. As noted above, the TSC has recommended that the forest reserve designations become permanent. Finally, it is important to note that the goal of woodlands designation is to maintain sustainable delivery of multiple ecosystem services including wood product production by utilizing management techniques.

Recommendation 4: Management Approaches for Large Forest Reserves

Recommendation: *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.*

This will accomplish the primary goal of large forest reserves, which is to support the biodiversity that results from natural forest processes, structure and function over long time frames.

- Annex 6 contains the general approach developed for managing forest reserves by EEA and the ‘Management Guidelines’ developed by DCR that should be followed but augmented as discussed below.
- In addition to these specific recommendations and guidelines, for the reserves to maintain their ecological function over long time frames:
 - There is a need for large forest reserves (>15,000 acres each), minimally fragmented, and representative of varied ecological settings that define Massachusetts forest biodiversity.
 - Because it takes centuries to develop many of the old growth structures, functions and ecosystem services provided by forest reserves, some degree of permanence is needed to ensure these forest reserves are allowed to mature protected from political forces. Forest reserves should therefore be codified in law or made permanent through other vehicles.
 - Reserves should be embedded in, and connected to, a larger forest ‘matrix’ or woodland. Efforts to protect this forest matrix should proceed in parallel with forest reserve designation.

Implementation Guidance: The TSC provides implementation guidance in two specific areas for the forest reserves: (1) ecosystem management and (2) recreation and infrastructure management.

Ecosystem Management

Despite regional variation and site-specific differences, in general the TSC recommends forest reserve management with the least amount of human intervention. When in doubt, or where there is disagreement among qualified ecologists and foresters, the default management prescription should be to do nothing (*i.e.*, a ‘humble and hands off approach’ as prescribed by Foster et al. (2005)). Natural processes, such as disturbance, should be allowed to play out unimpeded by human activities or intervention.

Supporting natural processes and the resulting biodiversity are the primary ecosystem service goals for large forest reserves. Wood production is not a utilized ecosystem service in forest reserves, and therefore the majority of the reserves will not be actively managed. However, in the context of this approach, as discussed and detailed below, some situations may call for ecological restoration and vegetation management in reserves. This flexibility, with the safeguards discussed below, is crucial to maintain forest reserve functions in the context of diverse forest types characterized by a tremendous range of land use histories and disturbance regimes across the state. For example, fire adapted forest reserves in southeastern Massachusetts will require active restoration and management to maintain open habitat for rare species and reduce the risk of catastrophic wildfire that can threaten human health and safety.

As a safeguard, no sales of wood should occur on forest reserves beyond the revenue collected **incidentally** from restoration and management activities directly within a restored or managed area. Related to this idea, existing state guidance on reserves management requires that “(e)ach large reserve will have an operational plan established with opportunities for public input to clearly define what activities will and will not occur, and to determine in advance how managers will coordinate with local officials in response to events like wildfires, pest and pathogen outbreaks, extensive blow downs, and other natural disturbance events.” The TSC also recommends that a ‘Science Advisory Board,’ consisting of conservation biologists, be established to inform, review and approve major restoration and management activities within forest reserves.

In developing the existing system of large forest reserves, EEA, DCR and DFW have given significant thought to the question of how forest reserves should be managed. A key point from the most recent EEA guidelines is that “the primary difference in activities between reserves and other state owned forest lands will be the exclusion of commercial timber harvesting” (Annex 6).

The TSC specifically recommends:

- No salvage logging or preemptive logging associated with disturbance, for example after wind or ice storms (Foster & Orwig, 2006).
- The Guidelines listed in DCR’s ‘Forest Reserve Management Plans’ should be followed (Annex 6). Summarized and paraphrased, these guidelines require that:
 - Habitat manipulations and traditional silvicultural treatments and operations are not permitted, with exceptions for rare species habitat management and invasive species control.
 - Management may be permitted to control erosion or stabilize soils.
 - Spread of major significant forests pathogens [and insects] may be controlled if there is a major threat to the identified ecosystem service objectives for a reserve.
 - Prescribed fire and related mechanical management activities may be used when it is compatible with forest reserve values, restoration of native communities and ecological processes, and public safety. Fire-breaks may be maintained.

- As discussed in Recommendation 3, the TSC also suggests that one or two wilderness areas, comprising approximately 5,000 acres in total, be established within the proposed system of forest reserves. In general, the ecosystem management guidelines for these areas would be the same as for the rest of the area dedicated to forest reserves – the primary differences for the wilderness areas are related to human uses (see below).
- Forest reserves should be monitored over long time frames to assess the development and maintenance of key ecological functions, structure, and composition; and to provide baseline data to inform forest management on areas managed for other values.

Recreation and Infrastructure Management

State land in forest reserves should be accessible and useable by humans in keeping with both the original intent of state lands and certain important ecosystem service values associated with them (*i.e.*, aesthetic, recreational, historic and spiritual). Human activities, however, should have minimal impact on the other intended values of forest reserves (*i.e.*, biodiversity, wildlife, acoustic and visual aesthetics, etc.). Therefore, the amount and nature of human activities within the reserve areas is important to define. Again, Massachusetts state agencies have thought through many of the issues related to reserve management.

The TSC specifically recommends that the guidelines listed in DCR’s ‘Forest Reserve Management Plans’ should be followed (Annex 6). The Guidelines specify:

- Activities that are prohibited include creation of new roads, construction of new wind towers and communications sites, use of off-road vehicles (ORVs), and all forms of intensive, development-dependent recreation. The TSC recognizes, however, that in some cases existing infrastructure supporting human uses will need to be maintained.
- Activities that may be allowed are hiking, hunting, fishing, bird watching, mountain biking, snowmobiling (only on designated trails with snow >4” packed), and horseback riding.
- Other allowable activities are (i) limited trail construction to relocate existing trails to avoid adverse impacts to rare species or late seral habitat, water quality, or archaeological sites; (ii) minimal cutting to maintain public vistas and trails, and to remove hazardous trees directly adjacent to trails that pose an imminent risk to public safety; and (iii) existing roads will be managed and maintained according to DSPR road standards. Roads not needed may be closed and restored.
- The TSC envisions further restrictions on human uses in the wilderness areas, which would be established within the forest reserve areas. To the maximum extent, existing roads would be closed and restored as functioning ecosystems, and new roads would be prohibited. Due to their potential negative impacts on the wilderness experience and wildlife in the areas, snowmobiles, mountain biking, dogs and horses also would be prohibited. Similarly, only bow hunting and catch-and-release fishing would be permitted. Further, no mechanized or power equipment would be allowed for management activities, except in the event of an emergency (*e.g.*, evacuation of an injured person).

Discussion: There are two significant challenges in defining recommended guidelines for large forest reserves. The first is the ongoing debate, even among forest ecologists and conservation biologists, as to the level of intervention, restoration, and management necessary within forest reserves (Soule and Terborgh, 1999). Based on the high levels of anthropogenic alteration to forest composition, structure and function (*i.e.*, past land use and logging history, atmospheric deposition, non-native insects, diseases, and plants, fires suppression, elimination of large predators and subsequent over-abundance of browsing herbivores such as white tailed deer and moose), some ecologists or forest managers may consider the current condition of the forest to be in need of ecological restoration and management. What actions to take to remedy these situations are arguable, and run the gamut from ‘do nothing’ to ‘actively manage’ to restore structure, composition, and function.

Secondly, forest reserve management is confounded by the fact that conditions and desired outcomes vary across ecological settings. For instance, in northern hardwood forests, where creation of relatively limited gaps within stands (gap dynamics) is the predominant disturbance regime with occasional large scale, stand-replacing weather events, allowing natural processes to proceed will most likely result in forest composition, structure and processes within their natural range of variation. On the other hand, in the pitch pine-scrub oak systems of southeastern Massachusetts, millennia of anthropogenic burning as well as periodic severe weather-related disturbances have fostered a unique mosaic of important habitats dependent on continued management to retain their full suite of biodiversity. As a result, what works for one forest reserve may not be appropriate for another.

To address these issues, the recommendations and guidelines presented above allow forest reserves to function as ecological ‘stages’ on which natural processes play out. The ‘actors’ may change in response to disturbance and other processes (especially in the context of climate change), but the goal is for forest functions to remain resilient. For this to occur:

- Large reserves management should allow natural processes to determine the long-term structure, composition, function and dynamics of the forest to the maximum extent possible. The resulting forest will develop and retain biological legacies (*e.g.*, soil structure, coarse woody debris, seed banks, etc.), ecological function (*e.g.*, water storage and cycling, nitrogen cycling, etc.), complex structure and composition, and old growth or late successional forest characteristics that will support a broad suite of biodiversity and resilience in the face of climate change. While this may not always result in a forest that is as aesthetically pleasing as a managed park -- for example large natural disturbances will not be cleaned up -- the TSC finds there is substantial ecological value in preserving large, unfragmented blocks of forest and letting these evolve largely via natural processes, particularly given the existence of other DCR lands managed more actively for parkland and woodland values. The Massachusetts state agencies support this approach (Annex 6) with certain caveats -- for example “(f)or each natural disturbance that occurs within a given reserve, a decision must be made as to whether or not the disturbance can be allowed to proceed to any degree without threatening human life and property outside the reserve.” The agencies state that “(e)ach large reserve will have an operational plan established with opportunities for public input to clearly define what activities will and will not occur, and to determine in advance how managers will coordinate with local officials in response to events like wildfires, pest and pathogen

outbreaks, extensive blow downs, and other natural disturbance events.” The TSC supports these exceptions.

- Under certain situations related to forest conditions, desired outcome (e.g., rare species habitat viability), specific threats (e.g., fire suppression) and other factors, ecological restoration and management may be necessary to support functionality of large forest reserves. Reserve management must be based on ecological principles, fully vetted with an interdisciplinary team of experts and scientists (in this case the Science Advisory Board mentioned above). In this context, decisions are based on transparency, collaboration and trust rather than on rigid policies that restrict ecological management principles due to mistrust, ineffective communication or inadequate public process.
- The primary purpose of the new wilderness designation is to create opportunities for recreational experiences that exclude certain other human uses that would generally be permitted across the system of forest reserves. Prohibition of all mechanized vehicles and power equipment, as well as mountain bikes, horseback riding, and certain forms of hunting and fishing will provide a qualitatively different and unique experience for visitors to the areas covered by the wilderness designation.
- The long-term function of state forest reserves will depend not only on the management within the reserve boundaries, but also on the size and configuration of defined forest reserves and on the protection and management in the surrounding forest as well. For these reasons, it is important to designate large forest reserves -- greater than 15,000 acres each where possible -- and to locate these reserves in the least fragmented and most intact areas of the state, with examples in each of varied ecological settings that define Massachusetts forest biodiversity. In addition, a focused effort on keeping the lands surrounding the reserves in forest, and defining and protecting key wildlife corridors among forest reserves, are all crucial aspects of a successful reserve system.

Recommendation 5: Management Approaches for Parklands

Recommendation: *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.*

In parklands, the primary ecosystem service is recreation, although these lands will also be managed to provide a wide array of other services. Although some parklands may be managed intensively to accommodate recreational use or address recreational impacts, 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.

Implementation Guidance: Parklands should be designated according to the process outlined in Recommendation 3. The parkland zones should be managed in a manner that is similar to what currently occurs at DCR's forested Urban Park properties, with any tree work being conducted to support the recreational, aesthetic and cultural uses and values of the property. Designation of a property as parkland is not intended to change current recreational uses or recreational use decisions in the area. All recreational use decisions, including decisions regarding OHV use, should continue to be made on a property-by-property basis, with public input, as they are now.

Since the focus for parklands is recreation, wood production should not be a management objective in this zone. Instead, any tree or forest management activities should be directed primarily at maintaining or improving the recreational experiences of visitors. Tree cutting generally will only be for purposes of hazard tree removal, pest or disease management, trail construction and maintenance, and view maintenance. In some cases, management will also be needed to advance ecological or other values within the park zone, e.g., the maintenance of a cultural landscape. Park managers may find it occasionally necessary to remove downed trees from intensive recreational use areas after major natural disturbances. View maintenance should be approved by the park managers, but only after consultation with or at the request of local trail stewards, 'friends groups,' to ensure that aesthetic values are being managed by those responsible for overseeing the recreational uses of the property. And as a safeguard, no sales of wood should occur on parklands beyond revenue collected **incidentally** from restoration and management activities directly related to maintaining or improving the recreational experience as described above, and as long as this can be done without additional impacts to the site. For example, if a major natural disturbance causes a drive-in campground to be inundated with downed high-value trees, the park manager may be able to generate some revenue from necessary work. To conduct more routine tree work, DCR may wish to consider bringing in an arborist crew to serve its properties because this type of work generally does not yield enough revenue from the timber that is cut. Revenue generation should not be a driving factor for any cutting decision in the parkland zone, but revenue from harvests in DCR's woodland zones should be available for parklands management.

The TSC would like to note, however, that on occasion there may be extenuating circumstances where more intensive cutting than recommended above may make sense. For instance, if a stand of fire-dependent species is degrading as a result of fire suppression, the forest stewardship team, together with park and planning staff, may decide that silvicultural treatment for ecological restoration is desirable to protect habitat as well as future aesthetic values. If a park manager or

forest steward identifies such a need, DCR should be required to pro-actively engage and consult with local citizen stewards and users in both evaluating options and, if silvicultural treatment is determined to be appropriate, the cutting plan. Cutting plans that fall into this ‘extenuating circumstance’ category in the parklands zone should require the approvals of the Director of State Parks and the Director of Forest Stewardship.

Parklands may also contain areas of ‘patch reserves’ designed to protect ecologically sensitive or culturally important resources that require management standards more restrictive than would generally be the case for parklands (e.g., archaeological sites). From an ecological perspective, management guidelines for these patch reserves should allow for ecological restoration as needed to support continued provision of a patch reserve’s ecosystem services, including control of invasive plants, insects and herbivores as necessary. Hazardous trees along trails and roads could be removed and cutting would be allowed where necessary to promote rare and endangered species. A parallel set of guidelines would need to be developed to protect culturally significant resources.

Finally, DCR should focus substantial educational efforts in the parklands zone. The state parks and forests can play an important role in reconnecting society with the Commonwealth’s natural and cultural heritage, while also serving a potentially significant role in encouraging more people to participate in the care of these areas.

Discussion: As the forests of Massachusetts continue to be permanently lost with the spread of development, many State and Urban Park properties have become increasingly important as an outlet for people to connect with nature and the state’s cultural history. Properties in the vicinity of relatively dense population and development are true assets for the state, serving as refuges where people can experience a quiet setting and natural elements without having to travel long distances. Massachusetts also boasts some areas that are truly remarkable for their scenic and relatively remote backcountry qualities.

Across this spectrum of properties that have high recreational and aesthetic qualities, which the TSC recommends be designated as parklands, visitors value and expect to find a relatively natural or natural-seeming setting free from timber harvesting activities. Nevertheless, these areas would still need to be actively managed, although the range of management intensities would vary both within and between properties. The limited areas with campgrounds and other areas of recreational infrastructure would be managed very intensively, while other areas would be managed using approaches more akin to those for the forest reserves.

The benefits of the management approaches recommended above for parklands include the following:

- By prioritizing the management goals for the parklands clearly on recreation, while still supporting the sustained provision of many other ecosystem services, and making DCR park staff and planners the primary decision-makers for land management activities in this zone, DCR will add clarity to the planning and decision-making processes for these lands. This should improve communication with key stakeholders and generally provide a higher quality recreational experience for parkland users. While advice from DCR foresters can certainly help inform necessary forest management decisions, timber

harvesting should not be an objective on the parklands, thereby allowing DCR to avoid any confusion resulting from potentially conflicting recreation and timber values.

- More specifically, implementation of the suggested management guidance will clarify expectations for tree work, which will be focused principally on management objectives that improve the recreational experience, such as maintaining scenic vistas and removing hazard trees.
- Under the TSC's proposed management approaches, DCR will still have the option of conducting more intensive forest management on parklands should a situation truly call for it, but only in conjunction with a more integrated planning and public participation process.
- An intentional education effort that seeks to engage more people in conservation should produce a cadre of volunteers to help with stewardship efforts as well as a broad-based and diverse segment of the public that understands and supports the conservation of the Commonwealth's natural and cultural heritage.

Recommendation 6: Management Approaches for Woodlands

Recommendation: *DCR should develop and implement management guidelines for Woodlands that demonstrate excellent forest management practices for sustainable production of wood, restoration of late successional habitat, active management of drinking water quantity and quality, creation of early successional habitat, and promotion of carbon sequestration and any other ecosystem services that benefit from relatively active manipulation of the forest. Over time, these guidelines should promote a greater emphasis on uneven-aged forests across the DCR system. At the same time, woodlands management should include guidelines to protect rare species habitat and other natural resources, as well as the integrity and scenic quality of trails and scenic roads in the woodlands zone.*

The TSC is recommending that DCR put in place a set of silvicultural guidelines for woodlands that result in the creation of ‘model forests’ established for the purpose of demonstrating to private landowners and the public at large how excellent silvicultural management can be implemented across the variety of forest types and stands that exist in the Commonwealth. To be useful to private landowners, these demonstrations should consider both the biological and economic benefits and costs of sustainable management across a range of management scales. Although the model forests will be managed primarily for the subset of forest ecosystem services that require relatively active human intervention, these areas should at the same time continue to accommodate high quality recreational experiences for the public.

Management of woodlands poses a wide array of social and scientific challenges, among the most important of which is the difficulty of specifying a ‘one size fits all’ set of silvicultural prescriptions. Silviculture -- the art and science of tending a forest -- provides the core set of tools for controlling forest establishment, composition, structure and growth. But selection of the appropriate tools is a function of societal values and ecosystem service objectives mediated through our scientific understanding of ecosystem dynamics and site-specific conditions. Furthermore, all these factors change over time – public attitudes shift, ecologists develop new insights, and the ecosystems themselves evolve in response to exogenous factors like climate change and introduction of invasive species, and as a result of specific silvicultural techniques that are applied over time (McDonald, Motzkin, & Foster, 2008). The challenge is to specify guidelines for applying silvicultural techniques that reflect our current ‘best’ interpretation of public values and ecosystem science, while allowing land managers flexibility over time to adapt to change through experimentation with and implementation of alternative silvicultural practices.

Within that broad context, the TSC’s recommendations for DCR woodlands management are designed to increase the emphasis on uneven-aged silviculture. Our current understanding of forest ecology suggests that, for many types of stands, uneven-aged management will deliver the broad set of woodland ecosystem services more effectively than even-aged approaches, although it will be important to carefully monitor ecosystem impacts over time to ensure this is the case (see Recommendation 7). Under the guidelines, even-aged management would be reserved for two primary purposes. First, it would be applied to create larger openings (up to 5 acres) in areas being managed jointly with DFW to create early successional habitat (primarily tertiary stands -- see below). Second, even-aged silviculture may be appropriate in cases where ecological restoration is needed to ensure continued provision of suite of woodlands ecosystem services --

for example to promote regeneration in timber stands extensively damaged by natural disturbance.

The TSC would like to emphasize, however, that the recommendations anticipate that management practices will need to evolve over time in response to changing values, science and ecosystems. Such change should be informed by the adaptive management system described in Recommendation 7 and the public processes outlined in Recommendation 8. Paraphrasing Dr. Mark Ashton in his presentation to the TSC, the intent is not to remove tools from the forest manager's toolbox. Instead, the TSC is proposing a shift in the current emphasis of silviculture, while recognizing that effective provision of woodlands ecosystem services in the future will likely require experimentation with a wide range of silvicultural techniques in DCR's model forests.

Implementation Guidance: To implement this recommendation, DCR needs to create management guidelines specific to the woodlands zone. These guidelines need to address five major elements of woodlands management -- silvicultural practices, creation of early successional habitat, issues related to harvests of wood for biomass energy generation, educational aspects of woodlands management, and recreational use of woodlands.

Silvicultural Practices in Woodland Zones

The goal of the proposed silvicultural practices for woodlands is to put in place guidelines that allow DCR to demonstrate ecologically and economically sustainable forest practices to private landowners and the public. These recommendations represent a shift towards a greater focus on ecosystem-based management.

1. Forest Assessment - Stand and Type Classification

As a first step in defining appropriate silvicultural practices for model forests, DCR will need to assemble additional information on the origin, age and condition of the forest stands. The three classifications proposed are **primary, secondary and tertiary** forest. *The classification will be a major factor in determining the appropriate silvicultural prescriptions for a stand.*

- **Primary** forests are those areas that have always been in forest growth and never pastured or cleared for tillable crops. Consequently the original biotic community is present.
- **Secondary** forests are those areas that were in agricultural use at one time but have since grown back to forest, been harvested once, and now have re-grown a second post-agriculture stand.
- **Tertiary** forests are the first stands to grow after agricultural abandonment. Their condition and composition is usually characterized by early successional species (pines, birches, maples) that will be replaced over time by other species; plantations of native and non-native conifer species, which may or may not represent the long term species composition of the site; or stands degraded by partial harvests. These stands developed or were planted on agricultural lands that had been previously tilled or used for pasture.

In the past DCR avoided treating hardwood tertiary stands in favor of other more highly productive stands found in secondary and tertiary (conifer plantations) forest. This recommendation proposes that all stands, both high and low productivity in all classes, be selected for treatment on an equal basis across the forest.

Forest type maps, already prepared by DCR for Green Certification, should be helpful for classifying DCR lands. In addition, Harvard Forest researchers have assembled a collection of 1830 forest history maps showing forested areas at around that time; these also would likely be helpful for further classification of DCR woodlands.

2. Levels of Silvicultural Management

Much of the controversy on DCR lands has centered on the issue of the appropriate size of openings created by harvests, with certain stakeholders arguing that large openings, whether they be clearcuts or shelterwood harvests, are inappropriate. However, as pointed out in a public comment on the TSC draft report, submitted jointly by five prominent New England silviculture professors (Ashton et al., 2010), natural disturbances in Massachusetts forests cause a fairly wide range of opening sizes and the structure and composition of the state's forests result from these processes. In northern hardwood forests, where typical openings may be between one-eighth and one-fourth of an acre, events like micro-bursts result in less frequent but larger openings typically in the 1 to 10 acre range. Other research has linked the development of oak-pine forests to more episodic and larger disturbance regimes related to hurricanes and Native American cultivation and use of fire. In these stands, the recommendation from the silviculturalists is to allow patches of up to 10 acres to be harvested in order to approximate the natural disturbance regime.

Based on our current understanding for forest ecosystems, the TSC finds that over the long-term a silvicultural approach that approximates the pattern of natural disturbance is appropriate for ensuring the regeneration of an age and species diverse forested landscape in Massachusetts. Under such an approach, DCR foresters would implement harvests across the landscape in patterns that are representative of the size and frequency of canopy openings occurring as a result of (non-catastrophic) natural disturbance. But the TSC also recognizes the potential for controversy and public distrust when larger opening are created. To reconcile these issues, the TSC is recommending that DCR adopt silvicultural guidelines, based on three alternative levels of woodlands management, that require a high degree of public consultation and acceptance for harvests that would create larger openings.

- **Level 1** management is designed for protecting ecologically sensitive or culturally significant patch reserves in the woodland zones. Level 1 would allow for ecological restoration as needed to support continued provision of a patch reserve's ecosystem services, including control of invasive plants, insects and herbivores as necessary. Hazardous trees along trails and roads could be removed and cutting would be allowed where necessary to promote rare and endangered species. Timber production would not be a management objective for these areas. A parallel set of guidelines would need to be developed to protect culturally significant resources.
- **Level 2** management is designed for use in high productivity primary and secondary forests where uneven-aged silvicultural prescriptions -- including single tree and group-patch selection methods -- would be applied to promote the development of multi-aged

and late successional stands (up to 150 to 200 years of age) with quality timber and high biodiversity, watershed protection and carbon storage values (D'Amato & Catanzaro, 2007; Keeton, 2006; Hagan & Whitman, 2004; Aber, et al., 2000). Harvested patches should not exceed one-third of an acre. This approach is intended to encompass both classic uneven-aged management as well as irregular uneven-aged methods where stands are entered and re-entered at intervals that, while resulting in a diverse forest, may not achieve the perfectly balanced distribution of size and age classes that defines textbook uneven-aged silviculture. Uneven-aged management will allow for the regeneration of both shade tolerant and intermediate tolerant species. The tops and branches of harvested trees (< 4 inches in diameter) would be left in the forest to maintain nutrient and organic matter levels, and to provide wildlife habitat. Level 2 management would permit ecological restoration as needed to promote woodland ecosystem services -- including actions to address stands extensively damaged by natural disturbance, and control of invasive plants, insects, diseases and herbivores.

- **Level 3** management is designed for use in lower productivity and damaged primary, secondary and tertiary stands where a variety of uneven- and even-aged silvicultural prescriptions might be employed, both for intermediate and regeneration cuts. Uneven-aged methods, both those designed to produce balanced distribution of age and size classes and those that result in a more irregular configuration, would be used to harvest single trees, groups of trees and patches up to one-third of an acre in both primary and secondary stands. Irregular shelterwood systems would also be available to restore the structure, composition and function of these lower productivity primary, secondary and tertiary stands (Raymond, Bedard, Roy, Larouch, & Tremblay, 2009). The use of even-aged shelterwood methods (with reserve trees) would be limited to low productivity and damaged tertiary stands with opening sizes not to exceed five acres, unless after consultation with the interested public (see Recommendation 8), DCR concludes that there is a need to expand this limit for ecological reasons at a specific site. All Level 3 harvests would leave tops and branches (< 4 inches in diameter) in the forest in order to maintain nutrient and organic matter levels, and to provide wildlife habitat. Level 3 management allows for ecological restoration – including actions to address stands extensively damaged by natural disturbance, and control of invasive plants, insects, diseases and herbivores -- with the goal of maintaining a site's function, composition and structure.

The silvicultural approach outlined above must be linked to an effective adaptive management system, as described in Recommendation 7. This will allow land managers to evaluate in a rigorous manner whether the ecosystem service objectives for the woodlands are being met, and if not should result in changes to the management approach or objectives.

3. Other Silvicultural Considerations

Silvicultural treatments, both even- and uneven-aged, should be applied to retain forest conditions especially in terms of the aesthetics. This requires a non-uniform approach with mixtures of both the treated and untreated areas. DCR has proposed harvesting only 25 percent of woodland growth, which is not only modest but conducive to the development of structural components such as snags, cavity trees, and down woody debris.

Overall it is essential that DCR's management guidelines for woodlands promote the highest standards for harvests. An important consideration for both Level 2 and 3 management is the siting of permanent harvesting roads. Foresters should lay out a permanent network of harvesting roads before a site is treated, and these roads should comprise no more than 10 percent of the treated area. This is important for maintaining the maximum amount of land in forest growth and to facilitate the use of hand-felling methods that are required in more complex stands. Many DCR logging operations have allowed the logger to determine both the road layout and density of roads, which resulted in more than 10 percent of the treated area in roads, thereby creating problems for future management. Going forward, silvicultural treatments far into the future should be directed and limited by the permanent road layout. Such a permanent system of logging roads, located on land that supports the size and operation of the anticipated harvesting equipment, can be used multiple times without soil and erosion problems. These roads should be used each time the area is treated, even when they grow back to young trees between cutting cycles. In addition, when old town or cart roads pass through the treated area, they need to be maintained in a condition to allow permitted public uses.

DCR silvicultural guidelines should require that every tree designated for removal be marked with paint at breast height and at the root collar. In all managed woodlands, exceptional trees, groups of trees and stands of trees should be identified, mapped, and not treated. These exceptions would include legacy trees, as well as single trees, groups of trees, and stands capable of growing to great size, age, and quality due to exceptional site conditions or genetics. In addition, all wetlands including vernal pools need to be identified on the ground and mapped for all treated areas, including all access roads used in the sale. As a starting point for this identification process, DCR land managers should consider the full range of available vernal pool data sources. This allows for the additional mapping of buffers and special treatment zones associated with these wetland features. Clusters of vernal pools would eliminate woodland management in their vicinity. More generally, DCR's silvicultural guidelines should ensure full compliance with all requirements of the Massachusetts Endangered Species Act (see MGL Ch. 131A, Regulations at 321 CMR 10 for special section on Responsibilities of State Agencies), particularly with regard to promoting habitat for rare and endangered species.

It is also essential that the guidelines for woodlands management ensure that the harvesting equipment is well matched to the silvicultural treatment and that harvests leave enough woody material in the harvested stand to maintain nutrients and habitat. Traditional logging practices employ hand-felling methods in conjunction with forwarders and/or cable skidders to remove the tree from the forest; these methods are appropriate for both even- and uneven-aged stands due to their ability to minimize damage to the residual stand. Advanced cut to length logging machinery that replaces hand-felling is generally more appropriate for use in less complex even-aged stands. Both logging methods leave branches and tree tops that are important to nutrient cycling, wildlife habitat, carbon sequestration, plus shade and physical protection to soils and emerging regeneration.

Conversely, TSC members expressed concern about 'whole tree' logging equipment (feller buncher/grapple skidder combinations). Generally, the Committee finds that the prohibition on removal of tops and branches is likely to make such methods uneconomical on DCR lands. However, if this is not always the case, the TSC urges DCR foresters to carefully consider the potential damage (e.g., compaction and mixing of soils) caused by this type of equipment at a particular site -- in most cases use of such equipment is inconsistent with the types of silviculture

recommended in this report. The one possible exception is whole tree removal for purposes of restoring pitch pine savannah conditions in the Myles Standish State Forest, where whole tree removal reduces the fire hazard and impoverishes the site to help maintain it in pitch pine.

Large landowners, such as DCR, can leverage their requirements for the use of specific logging equipment by requiring widths and weights in the sale contract. In time, if loggers are interested in working on DCR lands they will acquire the appropriate equipment. In addition, DCR should begin requiring that contractors on state lands have a Master Logger certification.

The woodlands management guidelines also need to recognize that the regeneration of trees is an integral component of plant succession. This happens slowly in forests that develop on their own or more quickly where silvicultural treatments have been applied. In either case, regeneration needs to be a continuous process. Herbivores can disrupt this process and where this is a problem it needs to be addressed. For Level 2 and 3 silvicultural treatments, regeneration is expected to be diverse and suited to site conditions. Such diverse advance regeneration appropriate to site conditions needs to be in place before treatments to release this regeneration can go forward. Silvicultural methods that are designed to promote and/or release advance regeneration must include a monitoring system to validate this regeneration and its protection and the data should be made available to the public. Monitoring data should include information on the presence and impact of herbivores.

Managers of DCR's model forests also will need to continuously look for ways to improve and enhance best management practices (BMPs). Forestry on DCR woodlands should be representative of the absolute best practices available. This can be accomplished through rigorous application of the adaptive management process described in Recommendation 8 and through adoption of the recommendations included in the recent Spencer report on harvesting practices on DCR lands (Annex 1).

Third-party certification of public lands management by the Forest Stewardship Council (FSC) has been a major area of concern for some members of the AGS. There is a perception that FSC certification has been used by DCR to justify heavy cutting practices, that the program has not effectively identified problems with the state's management approaches, and that certification is an unnecessary expense for a state agency facing serious budget shortfalls.

While acknowledging these comments from the AGS and the more general concern about certification of public lands (Yale Forest Forum, 2002; Mass Audubon, 2009), the TSC finds that FSC certification is a potentially valuable tool for advancing the ecosystem service goals outlined for DCR woodlands in these recommendations. Third-party verification provides additional impetus for public input, has an overlay of additional standards to be met which aid in protection of ecosystem services, provides impetus for planning, helps educate staff on the broader array of approaches, and makes wood products more marketable/valuable.

But it is also important to recognize that the FSC process takes as a starting point the land management plan and objectives articulated by DCR. Consequently, it is critical that these management objectives reflect the results of a robust and legitimate public process as well as the full suite of ecosystem services essential to these lands. Once the FSC certification team is comfortable that the management objectives reflect such a process, the third-party auditors will be able to provide valuable independent assessments of whether on-going management of the DCR forests is achieving the plan's ecosystem service objectives. For example, the auditors can

determine whether on-the-ground implementation of silvicultural prescriptions is consistent with DCR's integrated resource management plans, and whether such practices are achieving the anticipated ecosystem service results (*e.g.*, carbon sequestration increases in areas managed for late successional forest characteristics). The TSC understands that the FSC process will consider the forest reserves as a requirement for certification, but suggests that DCR request that the parklands be removed from the certification process, thereby focusing FSC's review of land management practices primarily on the woodlands.

4. Early Successional Habitat Creation and Management

As noted in the discussion of land use zoning (Recommendation 3), while the published literature consistently demonstrates declines in early successional species, the TSC did not reach consensus about the total amount, location and patch size of early successional habitat necessary to support these species on DCR land. Determination of these implementation parameters for early successional habitat creation on DCR lands raises complex ecological, economic and social issues. Rather than setting a specific target for acreage devoted to early successional habitat, the TSC recommends instead that DCR work closely with DFW and the academic community to establish a planning process with the following elements.

- Develop integrated resource management plans that include detailed inventories of the location, acreage and size distribution of openings that currently provide early successional habitat across all three land management zones -- this needs to be done at a scale appropriate for identifying the relevant patches of habitat.
- Estimate, to the extent feasible, the likely impacts of future natural disturbances across the three zones and add this to forest harvest plans developed independent of early successional habitat needs in order to estimate total available early successional habitat across the entire DCR forest system (including DWSP lands).
- Work closely with DFW to modify or expand cutting plans to reconcile differences between DFW goals for state lands and the actual occurrence of early successional habitat expected in light of ongoing natural disturbance and harvesting on DCR woodlands.
- Solicit public input on these plans to and make appropriate modifications in order to finalize the area, size distributions and locations of additional vegetation management activities needed to meet early successional habitat goals.

Given AGS concerns about early successional habitat creation, the DCR/DFW plans should configure habitat creation projects to minimize clearing of intact and mature forests while addressing DFW goals for state lands, to the maximum extent compatible with other ecosystem service objectives for DCR woodlands. Cutting in unfragmented forest should be avoided and to the extent possible priority given to management of overgrown fields and expansion of existing open areas. Finally, the plans should address funding issues -- while a shifting mosaic approach results in more land under management, it does have the advantage of paying for itself through the value of the harvested trees, whereas an approach based on frequent re-cutting of immature stands would require that DCR pay contractors to do the cutting.

Essentially, under the TSC's proposal DCR's integrated resource management planning process would be the locus for periodically reviewed decisions about the amount of cutting needed to support early successional species; but this would be informed by better data on current and likely future natural disturbance on DCR lands and should be divorced from decisions relating to timber production in the woodlands zone.

5. Biomass Removals for Energy Production

During the spring of 2009, Secretary of Energy and Environmental Affairs Ian Bowles indicated that he would look to the TSC's opinion on the issue of using state forest lands to produce wood fuel (biomass) to support large-scale biomass plants that have been proposed across the state.

Based on a recent analysis (Kelty, D'Amato, & Barten, 2008) and input from the AGS, the TSC recognizes that the expansion of biomass energy facilities in the state poses a potentially significant risk to many ecosystem services that are critical to maintain on DCR forests. Our woodland zone recommendations reflect a conservative approach for avoiding adverse impacts of biomass removals through a general prohibition on removal of tops and branches, a technique that could diminish nutrient levels and organic matter or degrade wildlife habitat. As discussed above, the TSC wishes to be clear that in light of the many uncertainties about the potential ecosystem impacts of biomass harvesting, a cautious approach -- requiring that 'forestry residues' be left in place to build soil carbon and protect nutrient stocks and habitat -- is called for to ensure the sustainable delivery of ecosystem services from DCR's woodlands. As part of DCR's adaptive management policies, these restrictions should be re-evaluated periodically in the light of new science that may more clearly identify risks. However, DCR would need to be assured through sound scientific evaluation and after public input that permitting or promoting biomass harvesting on state woodlands could be done in a sustainable manner that would not degrade other ecosystem services.

The TSC is also aware of the 'Manomet study' that proposes to look closely the impacts of biomass removals on forest health. We strongly urge that the Manomet team recognize that the ecosystem services prescribed in the TSC's report must not be compromised for biomass production or any other purpose. Indeed, the TSC's ecosystem service priorities provide a framework in which to evaluate the possible costs and benefits of all decisions that are relevant to forest stewardship -- not just decisions about biomass production -- and can make the evaluation and decisions transparent to all stakeholders -- something which we feel is critical going forward.

6. *Model Forest Educational Objectives*

A key role for DCR woodlands is the creation of model forests that provide public demonstrations of sustainable forestry practices, with the goal of promoting the use of such practices on the state's extensive privately owned forests. To accomplish this, DCR will need to develop a program for engaging landowners in outreach and education programs. To this end, DCR should establish a silvicultural demonstration program based on woodland sites that are widely distributed across the state and representative of the major forest types, site conditions, and sustainable silvicultural and harvesting techniques. Private forest landowners and the forest industry, as well as the general public, will benefit greatly by seeing on-the-ground examples of

the best forest management practices, implementation of the Best Management Practices, and demonstration of sustainable silvicultural practices and harvesting techniques through time. To be effective, this education and outreach program should also include development of careful economic accounting practices to demonstrate the economics of sustainable forest management on private lands. Effective and robust outreach to the public will be necessary to raise awareness of demonstration forests, and to provide effective interpretation and education around demonstration forests.

7. *Management of Recreation in Woodland Zones*

The TSC anticipates that recreation will continue to be an important public value in DCR forests that are managed as woodlands. Consequently, it is important that management guidelines for the woodland zones be appropriately tailored to protect the recreational experience. The aesthetic qualities of recreational resources can often be substantially preserved simply by identifying which trees are critical to retain -- decisions that occur best through a collaborative discussion and joint site visit of foresters, recreational experts, and local trail stewards. Possible standards or guidelines include:

- For nationally and regionally significant trails, any forest management within 100 feet of the trail should be only for the benefit of the trail or the trail experience itself -- the Appalachian Trail already has a 'primary' zone, where this requirement is in place. Additionally, local trail managers and DCR park staff should be consulted on any harvesting plans.
- For all other trails, any forest management activities within 50 feet of the trail should only be for the benefit of the trail and trail experience itself, unless foresters come to an alternative agreement with local trail stewards and park managers on harvesting plans within the vicinity of abutting trails. Forest managers should consider a joint site visit to collaboratively develop the cutting plan around trails, including a determination of where trees should be retained or where harvesting methods should be relatively light to preserve the quality of the trails as an alternative to a 50' buffer to develop a more flexible and collaborative approach with stakeholders.
- Skidder paths should avoid crossing nationally and regionally significant trails. Where any trail must be crossed, a skidder path should be located at an angle perpendicular to the trail.
- Based on the recommendations of park staff and the public, forest management plans should identify areas of high scenic quality that fall outside the parkland zone, including, for example, views from above, views from below, and views across water. Silvicultural plans should maintain and protect the scenic quality of those areas.
- Slash resulting from forest management adjacent to and within 25 feet of a trail or other recreational use area should take the form of a light and natural appearing forest ground cover (this is similar to language in the existing forest management plans).

Discussion: State forest lands committed to active woodlands management need to be run as 'model forests,' illustrating to private landowners, the forest industry and the public at large how

excellent silvicultural management is undertaken on the full range of forest types and stands that exist within the Commonwealth. To achieve this goal, the TSC suggests that all harvesting on state woodlands should be conducted to showcase sustainable forest practices, with tours provided to the public prior to the start of harvesting but after the stand is marked so private landowners can be provided the opportunity to learn why individual trees are marked, why roads and stream crossings are located where they are, and how and why vernal pools and other features are protected. Post harvest tours should be conducted as well. These tours and activities should offer continuing education credits for forester licensing and be widely advertised. Sponsorship of these tours can be developed with local 'friends groups,' local and regional non-profits, and town government agencies. It is also possible that management of these lands could be contracted out to private consultants under the supervision of DCR staff who have developed the silvicultural prescriptions based on the guidelines and goals established by an approved forest management plan. This potentially might free up personnel to provide greater assistance to private landowners (see Recommendation 9).

Recommendation 7: DCR Organizational Structure, Decision-making, and Planning

Recommendation: *The DCR Commissioner should establish a fully integrated planning and management structure focused on long-term stewardship and adaptive management for the complex and inter-related set of ecosystem service priorities established for DCR parks and forests.*

The goals of this recommendation are three-fold. First is to make clear that long-term stewardship of the forest resource is the fundamental purpose of DCR's land management, since public values rely on a well-functioning forest ecosystem. Second, based on the observation that DCR forest planning is not adequately integrated across the Department's various bureaus, the TSC recommends creation of a single, unified planning and adaptive management system that addresses the full suite of ecosystem service priorities across the forest reserves, parklands and woodlands. Third, DCR needs to expand current efforts and formalize methods for incorporating into its planning and land management activities: (1) information collected from forest resource data; (2) advances in scientific knowledge; (3) alternatives analysis; and (4) a means to gauge the success of its activities and make changes based on results of a formal feedback mechanism.

Implementation Guidance: Our specific guidance under this recommendation falls into three primary areas.

Clarifying the Mission of DCR

The TSC recommends that the DCR Commissioner provide leadership in clarifying and clearly articulating the relative importance and inter-relationships of DCR's multiple missions, with an emphasis on making clear that:

- Resource protection that leads to the sustainable provision of ecosystem services is DCR's fundamental obligation; a high quality visitor experience is derived from successful resource protection; this relationship enables DCR to fulfill an important role in strengthening society's connection to, appreciation for, and support of Massachusetts forests.
- Protection of DCR's forest resources requires integrated planning and monitoring to ensure provision of the broad suite of priority ecosystem services across the state park and forest system.
- Silviculture provides a valuable set of tools that can help DCR to achieve some, but not all, of its ecosystem service objectives.

While the TSC has not conducted extensive analysis of the laws governing management of forest lands, it is clear that many inconsistencies and ambiguities exist in these mandates (see Annex 7 for a more detailed analysis of DCR mandates, prepared by TSC member Kathleen Connolly). To ensure the Commonwealth's legal framework is fully supportive of the vision expressed in the TSC's recommendations, we also suggest that the Commissioner of DCR consider the need for

changes to existing laws in order to clarify the state's legal mandates affecting forest protection and stewardship.

Integration of DCR's Planning Functions

To efficiently accomplish the newly articulated mission, the Commissioner should combine the Department's currently dispersed planning functions into a single unit tasked with the timely development of integrated plans for providing ecosystem services from forest reserves, parklands and woodlands. Over time, the planning unit should be staffed to include individuals with substantive expertise in forest ecology, silviculture, public recreation, watershed management, biodiversity maintenance, and carbon sequestration. At a minimum, this planning unit should include the staff involved in delineating the three new general zones for DCR lands according to Recommendation 3. Once this zoning exercise is complete, the planning unit can begin working to coordinate the development and implementation of the new management guidance described in Recommendations 4 through 6.

Adaptive Management, Science and Data

The TSC recommends that the Commissioner clearly delineate organizational responsibilities and resources for implementation of adaptive planning and management techniques. In this regard, it makes sense to take advantage of the best ideas from any of the divisions/departments and apply them to the management of land in all three zones. It also makes sense to look for opportunities to leverage staff capabilities and to harmonize data collection and analysis. To accomplish these objectives, the TSC has the following suggestions.

- **Forest Resources Inventory and Monitoring:** There is an opportunity to build on a substantial body of existing work and initiatives. The Continuous Forest Inventory (CFI) system is a well-established dataset that has huge value in documenting changes and trends in the forest. The University of Massachusetts proposals and work on Long-Term Ecological Monitoring (LTEM), both within and outside forest reserves, offer the basis for building a minimum common dataset that can be expanded and used on all state lands. DCR planners should also be aware of the NSF's National Ecological Observatory Network (NEON). Some version of the concepts and techniques described in the UMass proposals and existing contracts, and in NEON, need to be incorporated into the normal operations of the Department, rather than operating externally and completely subject to grant and funding vagaries. Opportunities for research cooperation with outside organizations and researchers can be exploited on a case-by-case basis and as funding is available, but cost-effective administration of a 'minimum common dataset' should be a key responsibility of DCR's planning and management staff.

While CFI, LTEM and NEON data are vital for a number of purposes, they are not sufficient. Land management operates on a number of scales, and a corresponding hierarchy of data collection methods is essential. Current management plans and operations use some of these. It would be worthwhile for DCR, optimally in cooperation with DFW and DWSP and external technical participation as needed, to conduct a formal assessment of the adequacy of existing datasets and sources of inventory information used by DCR in its planning and management (*e.g.*, Ecoregional, CFI, FIA, GIS, District, Stratum, Compartment, Stand, pre- and post-harvest sampling, etc.). Identifying

opportunities to achieve efficiencies across divisions/departments should be part of this evaluation.

Finally, DCR should develop a system for tracking the deed status of its parcels to ensure that all deed restrictions are recognized in the development of management plans.

- **Keeping up with Science:** Evaluating the applicability of new scientific information to short and long-term land management decisions is a daunting task. The chances for successfully analyzing and incorporating advances in scientific knowledge will be greatest if there is a formal mechanism for gathering, synthesizing and analyzing scientific data, concepts and thinking.

There is an existing model, presently dormant, within the DWSP that could be well-applied across the full Secretariat. The Quabbin Science and Technical Advisory Committee (QSTAC) operated for several years in the late 1990s and early part of this decade. QSTAC had no 'public input' purpose, but brought together highly qualified professionals to deliberate and advise on scientific and technical questions. There is every reason to revive this model and use it in DCR, preferably across divisions/departments.

- **Keeping Up with Social Science to Understand Visitor Uses and Attitudes.** While recreation is an essential service that DCR provides, the Department has little objective information about who its visitors are, what they are doing, and what their attitudes are. Working with academia, DCR should undertake periodic surveys to understand and monitor the changing human dimension of its forests and this information should inform, together with input from stakeholders, management of DCR lands.
- **Alternatives Analysis:** No amount of inventory data or scientific revelation will tell DCR what to do. There are always many 'correct' or 'feasible' alternatives. DCR should develop the internal capacity to evaluate the information it has to compare alternative management paths. This capacity is an essential aspect of using data, making good decisions and fulfilling the public trust. It makes most sense to build this capacity at the Secretariat level and share it across all landholding agencies. GIS is just a starting point; there are a variety of modern analytical tools available. Building the required capacity, however, will involve software purchase and hiring or retraining existing planning staff.
- **Adaptive Management/Feedback Mechanism:** The concept of 'adaptive management' has broad appeal, but cannot be adopted and implemented casually or in every instance. As a full-blown process, adaptive management can be both demanding of staff time and expensive. Adaptive management requires substantial and long-term commitment from the Department. Adaptive management is a good idea only if the results of monitoring/assessment can reduce management uncertainties and actually lead to change in management actions. Adaptive management requires a model or models (sophistication and complexity can vary) for predicting what will happen. Assessment and monitoring should lead to a corroboration of the model or indicate how the model need to be changed. In the case of DCR forests, some of what is called adaptive management may really be more accurately described as increased pre- and post-activity measurement.

Regardless of whether adaptive management is technically desirable or achievable for DCR, some sort of feedback mechanism is essential. As an applied and integrated activity, forest management has always depended on feedback, usually incorporated informally or even unconsciously into field decisions. At this point, it is critical for DCR to design a more formal version of collecting and using feedback – for several audiences and purposes:

- field personnel need to know whether a silvicultural prescription ‘worked’ and is repeatable elsewhere;
- supervisors, program managers, and department administrators need to be able to tell the public whether the prescription achieved the desired outcome;
- field personnel and program managers need to understand the implications of inventory and monitoring data, as well as current scientific findings; and
- planners need to incorporate results into the ongoing process of alternatives analysis

Tangible steps to institutionalize a feedback process would include: a) fully developing the procedures and protocols listed in the Inventory, Monitoring, and Evaluation section of the District management plans; b) assigning the responsibilities within annual work plans for specific monitoring and evaluation tasks; c) specifying how monitoring and evaluation will proceed to conclusions, and how two-way communications and involvement of all staff levels will be assured; d) specifying how input from any outside technical/advisory committees will be collected, analyzed, and communicated throughout the organization.

Discussion: The TSC conducted extensive interviews with DCR staff, including all the management foresters as well as senior managers in the Department. These interviews provided valuable insights that have guided our recommendations on how to fine-tune the structure and organization of DCR. Through this process, we observed:

- DCR managers and staff do not operate with a common understanding of department’s mission and values -- some believe the primary mission is to satisfy public recreational needs while others think natural resource protection and management should be the main focus for the Department.
- Decision-making and planning at DCR are fragmented and slow, often reflecting bureaucratic structures that are a holdover from the time when the current functions of DCR were carried out by separate agencies.
- There is a perception, and likely a reality, that the main planning activities at DCR have been driven by silvicultural considerations. Human dimensions of resource management have not been systematically integrated into the forest planning processes.

- Lack of funding and staffing have been major barriers to successfully organizing and implementing the mission of DCR. Specifically, the Department needs more ecologists and planners if it is to carry out a mission based on providing a broad suite of ecosystem services.
- In recent years, management in the Bureau of Forestry has not provided adequate oversight of silvicultural operations, either at the planning or implementation stages, although there is a perception that, as a result of recent hires, this may no longer be the case.
- DCR's management foresters do not feel their concerns are adequately appreciated by senior management, particularly regarding how the Department responds to public criticisms. Lack of public confidence has resulted in low staff morale.
- Given the large forested area of the state – over 60 percent of the land in Massachusetts -- the Commonwealth needs to elevate the importance of forest protection and sustainable forest management, both on state and private lands.

These observations were critical to our earlier recommendation to elevate the role of forests in the Commonwealth's environmental decision-making processes (Recommendation 2). But the interviews also suggest a variety of other necessary changes at DCR, including the need to clearly define the Department's mission, harmonize its planning functions and focus them on a broader set of ecosystem services, elevate the resource stewardship role in the organization, and greatly increase the emphasis on adaptive management and related data collection and analysis tasks.

Recommendation 8: Improving Public Process

Recommendation: *Create a robust process that gives members of the public an opportunity for their concerns and values to be addressed and incorporated throughout the planning and implementation of management of the publicly owned land under DCR's care.*

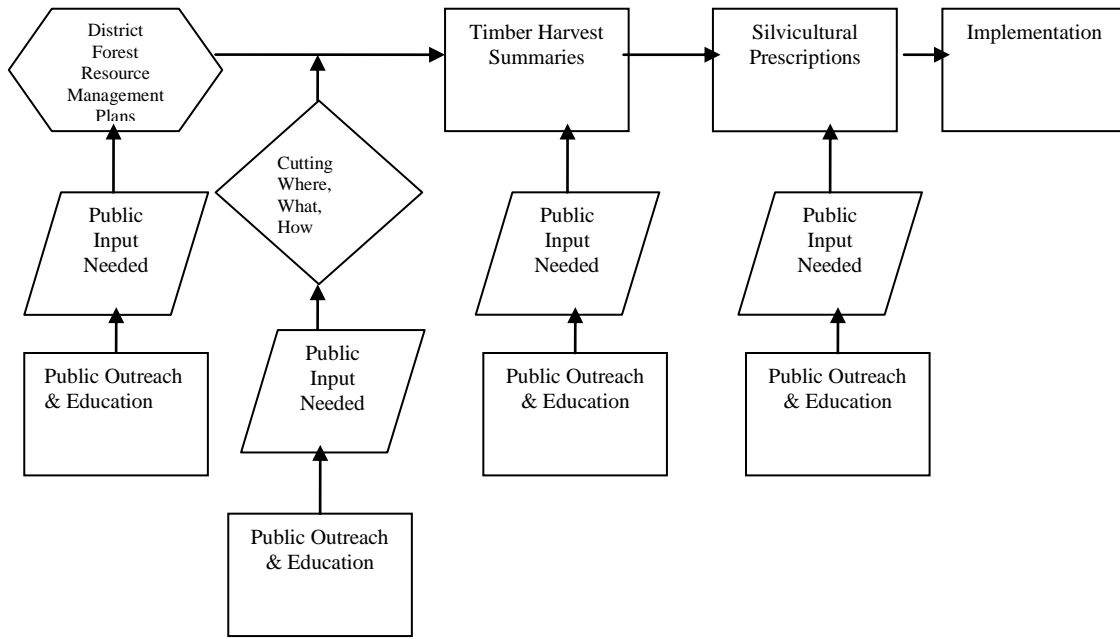
DCR manages a diversity of state forest land on behalf of the general public of Massachusetts. No management decision will be universally accepted by the public, and conflicts of opinion will always be an element of DCR's forest stewardship. Broad public acceptance of DCR's management will therefore need to acknowledge and address the full range of public views, and DCR must enlist a broader cross-section of society in its work to ensure that the full range of views is represented in the decision making process. There is a need for authentic and broad-based public participation in decision making for allocation of land within the three zone landscape zoning mode (Recommendation 3) and at the full range of planning scales for forest management and implementation -- from the broadest, state-wide and district-level forest resource management planning, down to the much finer-scale, stand-level forest cutting plans. There is also a need to address internal processes to improve public participation and better address the concerns of those engaged in the decision making process, as well as ensuring that DCR staff is equipped to effectively respond to the issues raised by the public. Annex 8 includes an outline of more detailed recommendations for a DCR public engagement strategy.

Implementation Guidance:

Allocation of Land in the Landscape Zoning Process: The Forest Futures Visioning Process has developed an approach to the long-term management of DCR forest lands based on ecosystem services (Recommendation 1). The approach relies on classification of land into categories that prescribe management approaches, ranging from extremely limited management in forest reserves, management to maintain recreational and cultural values in parklands, to active silvicultural management in woodlands. The public must be involved in the process for DCR land allocation within the three zone model. The general public is highly invested in the management regimes of its land, and expects to have the opportunity to provide input in decisions about how a valued state property is classified. Opportunities to help identify 'Special Places' and patch reserves will also be highly valued. Also, a well-designed and implemented process for identification of the ecosystem service objectives is a necessary precursor to determining allocations that will be the basis for FSC certification audits.

Management Planning: Each management zone has a different regiment of management prescribed in order to ensure that DCR forests continue to meet ecosystem service objectives. The public expects to be given opportunities to provide input throughout the full range of management planning, and to have the chance to review management decisions prior to implementation. The success of DCR's future forest stewardship activities lies in creating and executing an effective public input process that demonstrably incorporates public concerns and comments, even (and especially) when members of the public are not supportive of intended management actions. DCR needs to increase transparency of management decisions by clearly articulating decisions, including the information that is relied upon in making decisions, and communicating with the public when input is not reflected in final management plans.

As an example, the chart below provides a visual representation of key points within DCR’s forest management planning processes that require public participation. Similar models could be developed to identify key points for public input in the development of other management objectives.



Internal Processes: DCR needs to institutionalize ‘best practices’ for public participation and engagement. Effective public engagement is critical to the development of trust in DCR’s management of public resources. The TSC has clearly heard the concerns of some that a more ‘robust’ public process might have the unintended consequence of causing unnecessary project delays or somehow inhibit DCR staff from carrying out their duties in an efficient manner. The TSC believes that a more proactive approach to engaging the public will improve the substance of policy, reduce conflict while raising trust, take advantage of public knowledge and expertise, cultivate civic capacity and engagement, and lead to successful implementation of management decisions. Some recommendations for improving public process are as follows:

1. *Dedicate management-level staff resources to improving department development and oversight of public participation processes.* Specifically, it is recommended that DCR have at least one senior-level staff person responsible for overseeing ‘public involvement’ and ‘public participation.’
2. *Create clear timelines for projects or policy development/implementation that provide adequate time, opportunity and funding for meaningful public involvement.* In planning a project or policy initiative, it is critical for DCR to consider the time and funding necessary to engage the public on a variety of levels and to ensure that time is available. Too often agencies rush through a public process in favor of meeting a project or policy deadline leaving the public feeling angry, frustrated and unable to support the outcome --

and in the end taking much longer to resolve an issue. Further, when possible, projects should be designed to allow for public input at all stages of the project, rather than involving the public at the very end. In order for citizens to have confidence in public agencies and their commitment to involve them in policy decisions, efforts to engage them must be genuine and not perceived as an ‘afterthought.’

3. *Improve tools used to engage the public.* Establish an opt-in list-serve that facilitates e-mail notification of all public hearings, meetings, site visits, review and comment periods, with links to documents, schedules, and other resources posted on DCR web pages. A list-serve that is open to the public but allows moderator-only posting would allow any interested individual to join and receive notifications without DCR taking on the burden of managing a list of individual e-mail contact information. Notifications should be widely distributed to ‘friends groups,’ e-mail list-serves, conservation commissions, etc. in a timely fashion. Schedules, supporting documents, and hearing notifications should be posted on a prominent area of DCR’s website homepage (for instance, in a ‘Managing Your Land’ section). DCR should continue to explore other methods of reaching out to the public.
4. *Invest in internal capacity building for public engagement.* DCR managers need to equip themselves and their staff with tools and proven approaches to engaging the public through public processes. The very best predictor of innovation within departments and agencies is the level of experience held by managers and more senior staff. The more experience agencies have with effective approaches to public engagement, the better-prepared managers will be to match the appropriate engagement methods to policy and program development.
5. *Engage the public in discussions about effective participation in public processes.* Just as DCR needs to equip themselves with tools for public engagement, members of the public also need guidance about how to be effectively heard at DCR. In seeking public input, DCR should provide clear and consistent guidance on its decision-making processes and categories of input that will be constructive in informing forest and park management decisions. DCR may find an investment in periodic workshops for managers and stakeholders (including ‘friends groups’) in public process, effective feedback, and conflict resolution to be a worthwhile means of fostering more trusting and collaborative exchanges. DCR could partner with private/public organizations that specialize in direct democracy and/or civic engagement and draw upon existing resources. Overall greater engagement and support for ‘friends groups’ is also recommended.
6. *Measure benefits beyond cost.* DCR leadership should evaluate successful public engagement processes beyond the layout of public involvement expenditures. While successful public involvement can reduce costly litigation and project delays, other benefits, such as increased trust in the Department and its personnel, public education, and increased civic capacity should be accounted for as well.
7. *Incorporate public engagement practices into project and performance management review for all three land management zones.* Performance management reviews for programs and specific projects should incorporate standards for successful public engagement practice. Furthermore, once public participation standards are in place, it

may be appropriate in some instances to develop, along with them, participatory performance appraisal techniques that engage the public in the performance feedback cycle.

These changes in public process will allow DCR to engage the general public on a wide array of topics that must be addressed if the Department is to move beyond the current environment of mistrust, miscommunication and conflict. These topics include gaining broad public understanding and acceptance for the forest ecosystem services model and for the ecosystem management approaches in the three land use zones. The following recommendations should drive the development of DCR's outreach and education programs:

- *Engage a diverse cross section of the public in a dialog on forest ecology and ecosystem processes, as well as the many ecosystem services and values that DCR forest management is designed to promote.* Education around these functions and values is needed to help the public understand the ways in which management can support and promote the ecosystem functions and values that are seen as important.
- *Promote public discussion around the challenges of balancing the wide variety of uses typical of DCR forest land.* DCR is charged with maintaining land for a wide variety of purposes and uses, which are often in conflict with one another. Outreach focused on promoting an understanding of the balancing act that active management strives to achieve will help the public understand and more fairly debate the underlying goals of forest management.
- *Increase public understanding of sustainable forestry practices and silviculture as implemented on DCR woodlands.* The demonstration program for private landowners discussed under Recommendation 6 should be adapted to help develop a broad-based public understanding of DCR's woodlands management objectives, silvicultural practices, and their ecosystem impacts, including on-the-ground examples of the best forest management practices, physical implementation of the Best Management Practices, and demonstration of the results of silvicultural through time. Effective and robust outreach to the public will be necessary to raise awareness of DCR's sustainable forestry demonstration program, and provide effective interpretation and education around demonstration projects.
- *Engage the public in discussion of their role in forest stewardship and in the public process that directs management of the land held in the public trust.*

Discussion: A very wide range of views exists on the appropriate management of state forests and on the relative importance of the myriad ecosystem functions and values provided by our forests. Management decisions, therefore, will always engender some level of conflict between points of view representing competing, and essentially incompatible values.

A robust public process that strives to reach common ground and gives members of the public an opportunity for their concerns and values to be heard and addressed, will result in a significant improvement in forest management on state lands managed by DCR. Without a robust public process that invites and incorporates the values and concerns expressed by members of the public, the Department will continue to encounter significant resistance to its management decisions and public trust in the DCR's management of public lands will not improve.

Public engagement in the DCR decision-making process needs to be open, transparent, and must occur throughout the lands management program of the Department, from allocation of land to the three zones to on-the-ground practices. Further, and possibly most importantly, the public needs to be confident that its concerns are not only heard, but are given serious consideration and weight in management decisions. Public input cannot be a *pro forma* exercise; this leads to the lack of trust that has been evident in recent years, and engenders conflict that undermines DCR's forest and parks management.

Recommendation 9: Policies for Privately Owned Forests in the Commonwealth

Recommendation: *A prominent part of DCR's mandates include oversight of all forests in Massachusetts. Due to the importance of private forests to public forest function and integrity, and the high level of public benefits provided by private forests in Massachusetts, the Commonwealth should adopt measures to prevent further forest fragmentation and conversion to other land uses, and promote better stewardship of private forests, including the implementation of a requirement that all forest harvesting plans be prepared by a licensed forester.*

Conservation and protection of the public values provided by private forests in Massachusetts requires increased leadership, education, public investment and alignment of incentives to ensure that these forests will continue to exist in the future and that private landowners make informed decisions about the stewardship of their forest lands. As reflected in the majority of the TSC's recommendations for private lands, wherever possible promotion of good forest stewardship should rely heavily on incentive-based rather than regulatory approaches for improving forest land management.

Implementation Guidance: Currently, markets do not exist for many of the important public ecosystem services provided by private forest landowners, and as a result landowners receive no compensation for these services. In general, the TSC finds that added assistance to landowners is desirable to promote the continued provision of these services. The TSC suggests there are three major areas where the Commonwealth can take action to improve the prospects and opportunities for ensuring a continuing supply of public ecosystem services from Massachusetts forests. These are discussed below, with reference to specific examples of actions that merit further study and consideration by the state.

- ***Preventing Forest Conversion and Fragmentation:*** Under the implementation of the Global Warming Solutions Act, the TSC recommends the state study the benefits and costs of legislation to ensure 'no net loss' of forest canopy, acreage or delivery of forest ecosystem services in Massachusetts. Developers would be required to replace forest canopy converted to development with forest canopy and acreage of comparable ecological value – this might include a combination of permanent protection of private forests via conservation restrictions and the planting of new forest canopy on private land previously not forested (principally in cities and suburbs).

The TSC also recommends the state conduct further analyses to support the development and funding of cost share programs to facilitate private forest conservation. The public comments on the draft TSC report make clear the broad public support for these types of programs. Such programs, focused on partnerships with land conservation trusts and landowners, will provide valuable public benefits by facilitating completion of upfront activities that currently may act as barriers to the forest land conservation process (*e.g.*, group appraisals, estate planning education and technical assistance, group baseline documentation for conservation restrictions, surveys for conservation restriction exclusions, and small forest business planning and implementation grants). These types of cost incentives serve an important function by reducing initial barriers faced by

landowners who, rather than make no decision and see the forest developed as a result of estate taxes or fragmentation across multiple beneficiaries, prefer to conserve their forest lands.

In addition, the TSC suggests that DCR and EEA closely monitor the progress of the ongoing legislative commission on forest conservation finance. Implementation of the recommendations from this commission will likely need to be integrated with the recommendations of the TSC.

- ***Promoting Improved Forest Stewardship on Private Lands.*** DCR should initiate programs to improve stewardship of public values supplied by private forest lands. Approximately 76 percent of Massachusetts 3.1 million acres of forest are privately owned (including 69,000 acres owned by land trusts). Securing a sustainable flow of public values from these forests can only be assured if the Commonwealth makes a serious commitment of financial and human resources focused on promoting good stewardship of these lands. ***To meet these objectives, the TSC recommends further study and consideration of the merits of the following set of initiatives:***
 - *Promulgation of revised Chapter 132 Forest Cutting Practices Act regulations.* EEA has been working for a number of years to issue revisions to state regulations governing timber harvests on private lands. Revised regulations are essential for ensuring a high level of stewardship on private lands. The Secretary of Energy and Environmental Affairs should move quickly to ensure that revised Chapter 132 regulations are issued for public comment and then finalized.
 - *Tabulation and analysis (including GIS overlay analysis) on an annual basis of information obtained from the Chapter 132 cutting plans.* This information on harvesting in the state is critical for examining areas that undergo various degrees of harvesting, changes in species composition, age class distribution, and short and long term harvesting trends. This information should be shared with private forest landowners and public decision-makers to help them make better informed choices about how to manage their lands within the context of surrounding regional forest management.
 - *Access to GIS mapping and training for private forest landowners, licensed foresters, and land conservation trusts* to assist in the identification of significant forest values on their lands and on adjacent or surrounding lands. These values might include vernal pools, rare and endangered habitat, water supply areas, forest types, nearby protected lands, prime forest soils, and historic sites that can be extremely helpful with short and long term planning, and with identifying abutting and nearby landowners who might have shared interests.
 - *Continuance of cost share programs for new forest management plans that include inventories of carbon stocks* with the goal of facilitating establishment of carbon credits, aggregation of carbon credits for third party verification, and sale to qualified carbon markets. This will provide a new source of income for forest landowners, providing real compensation for the public benefits derived from storage of carbon in privately owned forests.

- *Develop public/private partnerships to provide funding for:*
 1. Annual support for part-time coordinators of woodland councils across the state to bring together forest landowners, public officials, business leaders, educators, foresters, loggers, sawmill owners, hunters and fishermen to discuss land use issues and learn from their peers about land conservation efforts, stewardship opportunities and provide local education opportunities. The coordinator is the person who arranges the speakers and programs, arranges for a location and sends out the invitations to ensure the community knows of the meetings.
 2. Annual support for the Keystone program (formerly Coverts), run by the University of Massachusetts extension, which trains 25 volunteers annually as local ambassadors for private land stewardship and conservation. Recent analysis of the program indicates an \$18,000 annual investment returns the equivalent of 12 full-time people in volunteer hours.

- *Initiate legislation to:*
 1. Create a state tax credit for 100 percent of landowners' costs for forest management plans and possible carbon inventories, as well as for forest small business planning and implementation costs that would expand outreach to landowners and provide a stable, long-term increase in managed forest land.
 2. Under the implementation of the Global Warming Solutions Act, pass legislation to provide a state tax credit to landowners, harvesters, mill owners and other secondary processors for the sale of forest products that are verified by DCR to have been harvested from long-term sustainably managed forest lands that will return to forest following the harvest and that are sold to a processor or end user less than 100 miles from where the wood was harvested (and within the boundaries of Massachusetts). These products would also be exempt for state sales tax.
 3. Under the Global Warming Solutions Act, amend state building codes and implement an Executive Order to increase the use of local wood in construction and transportation infrastructure.
 4. Under Chapter 61, provide a state tax credit equal to the cost of property taxes for those landowners in good standing in Chapter 61, as verified by DCR.
 5. Chapter 61 should expand the state tax credit for approved private land management practices that promote a set of prescribed ecosystem services (e.g., biodiversity, carbon sequestration, water management, soils protection, etc.) in addition to the supply of local wood products.

6. Develop a state tax credit for Massachusetts Licensed Timber Harvesters to cover the costs of training to obtain ‘Master Logger’ certification or the equivalent.
- **Require Licensed Foresters prepare all Forest Harvesting Plans:** The importance of the Commonwealth’s private forests in producing ecosystem services highly valued by the public requires that all harvesting plans and amendments be prepared by a licensed forester. This would eliminate the current exclusion that allows a landowner to prepare a forest harvest plan without the participation of a licensed forester. According to DCR, 80 percent of cutting plans are currently prepared by licensed foresters. Closing the loophole on the remaining 20 percent can reduce the number of so called short term harvests and encourage private landowners to give greater consideration to long term forest management decisions. The TSC heard from many members of the natural resource community that private rights come with responsibilities as well. A major potential benefit of such a requirement is to lessen, but certainly not eliminate, the need for oversight of Chapter 132 compliance by DCR service foresters through the shifting of this responsibility to licensed foresters. The existing exclusion has provided numerous opportunities for sub-standard harvesting that are unlikely to have occurred had a licensed forester developed the plan. The risk of license loss by foresters violating the requirements of state law provides added incentives for higher silvicultural standards in the forest. This recommendation is also intended to confirm that all harvesting plans for public lands be prepared by a licensed forester responsible for their implementation. While the TSC heard considerable opposition to the licensed forester recommendation, the Committee finds that allowing unlicensed landowners to prepare forest harvest plans in place of a licensed forester violates the intent of the forester licensing law and is contrary to the TSC’s goal of promoting good stewardship on all the forests of the state.

Discussion: The TSC’s vision for Massachusetts forests relies heavily on providing long-term protection for all the state’s forest resources and on promoting good stewardship on these lands. Because the vast majority of forests in the Commonwealth are privately owned, protection of the public values provided by these forests requires the state to work actively with private landowners. In the view of the TSC, far too little attention has been paid to this group over the years, and it is now time to reverse this state of affairs. Clearly this will require new resources and a new focus. It is important to note, however, that some of the ideas described above are designed to create better incentives for forest protection and stewardship, and may not therefore require new forestry staff at the state level (*e.g.*, cost share programs). On the other hand, the TSC has also suggested changes that could free up the time of certain existing state personnel who might then be available to assist private landowners. For example, the requirement that a licensed forester prepare all harvesting plans, while promoting better management, might also have the effect of freeing up time for DCR service foresters to spend assisting landowners.

Recommendation 10: Resources Needed to Implement the TSC Recommendations

Recommendation: *The DCR Commissioner should develop and implement strategies for funding the specific recommendations from the Forest Futures Process.*

Implementing the Forest Futures recommendations will require both reprogramming of existing resources and development of new revenue streams. While it would be convenient to assume that all the proposed changes could be put in place through reallocation and re-assignment of existing DCR staff, this is simply not the case. Increases in DCR staff are needed to support creation of the three zone system, development of new management guidelines and plans, implementation of expanded public participation process, and for both short and long-term management and monitoring of forest reserves, parklands and woodlands. The recommendations in this report form an integrated package of changes that are needed to assure effective management of DCR lands. Many of the recommendations address areas that have been severely under-funded or not funded at all in the past (e.g., preparation of integrated resource management plans, collection and analysis of data to support adaptive management). Consequently, it is critical that EEA/DCR seek additional funding from the legislature to support implementation of the recommendations in this report. Absent new funding, major portions of the recommendation package cannot be implemented. This includes not only funding for DCR staff but also funds for acquisition of the additional lands needed to (1) ensure the future build-out ecologically functional system of forest reserves and (2) provide adequate parkland and woodlands to meet the public's future ecosystem service demands.

Implementation Guidance: In making the recommendations in this report, the TSC is keenly aware of the state's current budget crisis and the difficulty this poses for DCR. With that in mind, we have attempted to identify the highest priority funding needs associated with this report's recommendations.

Priorities

- *Zoning* is a key first step towards implementing the TSC's recommendations. This will primarily require DCR staff time, both to develop plans and to run a robust public process to finalize allocations of land to forest reserves, parklands and woodlands.
- *Management Guidelines and Plans* are needed for lands in each of the three zones once the zoning process is complete. Again, this primarily involves DCR staff time for planning and public process activities but also requires additional resources to complete inventories.
- *Management Plan Implementation and Monitoring* will require extensive staff resources if all three zones are to be given adequate attention. Both parklands and forest reserves must be staffed to ensure compliance with limitations on their use, to ensure the quality of recreational experiences and *to monitor long-term ecological*

conditions. In particular, while not generally requiring silvicultural interventions, forest reserves absolutely need staffing to meet these monitoring needs. On woodlands, the TSC also envisions a much more extensive set of monitoring protocols including collection and analysis of economic data to illustrate the financial costs and benefits of the different model forest practices that are implemented.

- *Public Outreach and Education* is a critical element of the TSC's vision. DCR will need to devote greater resources to these activities in the future, both in the planning phases and through implementation of its resource management plans.
- *New Land Acquisitions* to complete the build-out of the forest reserves will require substantial funds over the coming decades. The Commissioner should develop cost estimates for these plans and work with the legislature to put a strategy in place that will ensure annual funding is available to bring additional lands into the reserve, parkland, and woodlands system as they become available.
- *Compensation for Towns* should be considered by the Commissioner to reduce the impact on communities where lands leave the tax rolls as a result of their purchase and incorporation into the DCR public lands system.

Potential Funding Sources

- *Temporary Reallocations of Staff* within DCR offer an opportunity to make quick progress on the zoning and management planning recommendations. In the interests of moving to the new system as quickly as possible, the TSC recommends that the Commissioner consider the utility of reassigning field forestry and recreation staff to planning activities.
- *Carbon Credits* are a potential source of revenues that the state should evaluate. These could potentially provide a one-time infusion of millions of dollars to the state and are potentially consistent with the management objectives for both parklands and reserves.
- *Timber Sale Revenues* provide one source of additional funding. Currently the legislature requires the return of these revenues to the general treasury. The TSC strongly recommends that the legislature revise its current practice so as to allow DCR to retain timber sale revenues for planning, management and monitoring purposes. These funds should be available for use in the forest reserves and parklands, as well as for infrastructure and management needs in the woodlands.
- *Increases In and Greater Retention of User Fees* are another potential source of revenues to support implementation of DCR's management plans. To the maximum extent possible, it is desirable that ongoing management in the three zones be self-supporting while still being affordable for users. A careful analysis of ongoing management and monitoring costs is needed to determine the potential future role of user fees in supporting the forest reserves and woodlands.

In this regard, the Commissioner will need to work with the legislature to increase the percentage of user fee revenues retained in the future by DCR.

- The ongoing activities of the *Legislative Commission on Forest Conservation Finance* should be carefully monitored by DCR to take advantage of opportunities to develop funding to support the build-out of the forest reserves.
- *DCR Partnering with Non-Profits* is also a potential source of resources, particularly in the areas related to public participation and monitoring. Volunteers from ‘friends’ and other groups could potentially be of great assistance to DCR in devising and organizing the public input to both the planning processes, the implementation of the plans, and the monitoring of ecosystem conditions. DCR should develop a plan to take advantage of these valuable citizen resources.
- *Additional Allocations of State Budget Resources to Forest Stewardship.* The Commissioner, stakeholders, and general public must make a strong case that too little of the state budget is allocated to the care and protection of public forests in Massachusetts. Given the breadth of ecosystem services that they provide -- all of which are critical to a healthy and vibrant society -- the Governor and the Legislature must allocate additional public funds to the care of these lands.

Discussion: Locating funds for change is always difficult and this is especially the case now in Massachusetts. But new funding (or reallocation of existing monies and resources) is critical if the recommendations in this report are to be implemented. Moreover, the TSC has noted that partial implementation also poses risks -- for example creation of forest reserves without the necessary long-term ecological monitoring and use management is from the TSC’s perspective highly undesirable, and could result in reserves being degraded by unauthorized uses.

The DCR Commissioner will need to play a key leadership role in developing an integrated funding plan for supporting the recommendations in this report. The Commissioner can make decisions about reprogramming existing DCR funds and staff, and also will have a lead role in working with the Secretary of Energy and Environmental Affairs on needed changes to legislation and budgets. Development of funding must go hand in hand with the management recommendations outlined in this report and should itself be one of the highest priorities of the Commissioner.

IV. Alternative Viewpoints on Recommendations

Bruce Spencer

My position on codification of forest reserves:

I am opposed to the codification of reserves primarily because it establishes a strong barrier against forestry actions that may be needed to address non-extractive anthropogenic degradation of these forested reserves. During the previous century the Massachusetts forest lost key tree species (American chestnut and American elm), and other key species were seriously weakened (American beech) or threatened (Eastern hemlock and White ash). In addition, invasive plants, insects, and disease have been introduced. This century has seen the continued expansion of invasive plants, insects and diseases plus the enhancement of native insects due to climate change. Trees have started to die on a landscape level. A state law that discontinued moose hunting a century ago is now a difficult barrier to overcome to reduce the severe impact of these herbivores on hardwood regeneration. The interest groups that will fight strongly to prevent a moose hunt are no less ardent than those opposed to any tree cutting that would address anthropogenic degradation of forested reserves.

Charles Thompson

Basis for Comments. Recognizing that all members of the TSC have a variety of disagreements with the final document, I believe that it is important for members to limit written dissent to only those issues believed to compromise the value of the document in particularly serious ways.

Issue 1 -- Overall Value of 'Woodlands'

I am concerned that the general approach we have taken with 'woodlands' effectively understates their total contribution to the social fabric. A primary emphasis on the concept of demonstration and model forests relegates many of the benefits of land stewardship to second-class status. It is precisely the integrated character of thoughtful stewardship at a landscape scale that can be a powerful social good. In an integrated approach, sustainable production of local wood products is part and parcel of the production and protection of water, the protection of biodiversity, and the provision of diverse recreational and educational opportunities. I am concerned that a primary emphasis on "demonstration" amounts to a ghetto-ization of activities, confining them to limited areas.

I also don't believe that any government agency can be cavalier about rejecting perpetual and sustainable sources of revenue that accomplish core objectives, have economic multiplier effects, and result in employment, even if direct revenues may only amount to a few million dollars a year.

Issue 2 – Silviculture and Silvicultural Approaches

I think that the recommendation to increase the emphasis on uneven-aged management is unnecessary, and has the potential to create a good deal of confusion. The inevitable danger is

that readers of the document will equate “uneven-aged management” and “uneven-aged forest”; they are different.

Throughout this process, we have spoken about the “toolbox”; the idea of keeping all tools in the toolbox is a good one, as is the idea of adding new tools as they become available. Going forward, DCR will have to navigate its way through the minefields associated with public perceptions and aesthetic impacts of forest operations. Starting with an emptier toolbox is not the way to start down that road.

Similarly, specification of opening size limit is neither desirable, nor necessary, from a forestry standpoint. Finally, the “levels of silvicultural management” are unnecessarily prescriptive in their specificity and do not allow the degree of flexibility needed in land stewardship.

Issue 3 – Biomass Removals

A categorical or ‘general’ prohibition against whole tree harvesting or removal of tops is neither necessary, nor desirable. This recommendation, while obviously intended to achieve a political objective, is undesirable from a land stewardship standpoint. Concerns about nutrient depletion can be handled by the adoption of a conservative approach in which maintenance of site capability is the overriding principle. There are certain stand situations on certain soils where the ability to remove tops may be part of a completely reasonable silvicultural prescription. A blanket prohibition is unnecessary.

Issue 4 – Private Lands

I acknowledge the importance of the private forests of the Commonwealth, but believe that Recommendation 9 should not be included in the main report. By exceeding our very clear charge, I believe that the TSC is undermining its own credibility.

Many of the ideas detailed in Recommendation 9 are worthy of serious study, as is the overall question of how best to maintain the economic viability of private land ownership in Massachusetts. This effort is worthy of a separate process, by a group fully representative of the interests appropriate for tackling private forest issues. That is not the TSC.

Finally, I do not support the proposed requirement that a licensed forester prepare all cutting plans, except on Ch. 61 and 61A lands. I believe that there are public interests in private lands (water quality, erosion control, endangered species, wetlands protection), and that these are well-covered in current law and regulation. I believe that almost all landowners would be well-advised to use a forester to represent their interest, but I don’t believe that this should be required. The public interest in private lands does not extend to the fine points of silviculture or decisions on when to sell or what to cut.

Respectfully submitted,

Charles Thompson

Joseph Zorzin

According to the FSC web site, "Being FSC certified shows that you comply with the highest social and environmental standards on the market."

The management of the Massachusetts state forests at best could be described as mediocre and therefore does not deserve to be FSC certified. But the fact that it was certified by FSC and will probably regain its certification shows that the public has not gotten what it has paid for, an honest appraisal.

Instead of FSC certification, the public's interest in their state forests would be improved by new laws and regulations with higher standards and by hiring the best possible leadership of the agencies.

That same web site also says, "This gives you credibility with customers and business partners as well as financial institutions and watchdog organizations. FSC certification helps to protect your brand and reputation and it allows you to access highly environmentally sensitive markets."

Such considerations of "brand and reputation" are inappropriate for government agencies. Only the public should be judging the brand and reputation of their government agencies.

Annex 9

References

- Aber, J., Christensen, N., Fernandez, I., Franklin, J., Hidinger, L., Hunter, M., et al. (2000). Applying Ecological Principles to the Management of U.S. National Forests. *Issues in Ecology*, 6.
- Anderson, M. (2008). Conserving Forest Ecosystems: Guidelines for Size, Condition and Landscape Requirements. In R. Askins, *Saving Biological Diversity*. Springer.
- Ashton, M, Keeton, W., Ducey, M., Kelty, M., Seymour, R. 2010. Comments on Forest Futures Draft Report. Submitted to MA Dept. of Conservation and Recreation via email.
- Beier P, and B Brost. 2010. Use of Land Facets to Plan for Climate Change: Conserving the Arenas, Not the Actors. *Cons. Bio.*
- Chandler, D.S. (1987). Species richness and abundance of Pselaphidae (Coleoptera) in old-growth and 40-year-old forests in New Hampshire. *Canadian Journal of Zoology*, 65, 608–615.
- D'Amato, A.W., D.A. Orwig, and D.R. Foster. 2006. New Estimates of Massachusetts Old-growth Forests: Useful Data for Regional Conservation and Forest Reserve Planning. Northeast Naturalist.
- D'Amato, D., & Catanzaro, P. (2007). *Restoring Old-Growth Characteristics*. UMass Extension. DCR. (2009). Chapter 132 Cutting Plan Database. Boston, MA: Department of Conservation and Recreation.
- DeGraaf, R. M., & Yamasaki, M. (2003). Options for managing early-successional forest and shrubland bird habitats in the northeastern United States. *Forest Ecology and Management*, 185, 179-191.
- Foster, D., & Orwig, D. (2006). Preemptive and Salvage Harvesting of New England Forests; When Doing Nothing is a Viable Alternative. *Conservation Biology*, 20 (4), 959-970.
- Foster, D., Kittredge, D., Donahue, B., Motzkin, G., Orwig, D., Ellison, A., et al. (2005). *Wildlands and Woodlands: A Vision for the Forests of Massachusetts*. Harvard Forest, Harvard University, Petersham, Massachusetts.
- Hagan, J., & Whitman, A. (2004). *Late-successional forest: a disappearing age class and implications for biodiversity*. Manomet Center for Conservation Sciences, Brunswick, Maine.
- Haney, C.J. and C.P. Schaadt. 1996. Functional Roles of Eastern Old Growth in Promoting Forest Bird Diversity. Pp. 76-88 in M.B. Davis (Ed.). *Eastern Old-growth Forests*. Island Press. Washington, D.C. 383pp.
- Harmon, M. (2009). The Role of Federal Lands in Combating Climate Change. *Testimony before the U.S. House of Representatives Subcommittee on National Parks, Forests, and Public Lands of the Committee of Natural Resources*.

- Keeton, W. (2006). Managing for late-successional/old-growth characteristics in northern hardwood-conifer forests. *Forest Ecology and Management* , 235, 129-142.
- Kelty, M., D'Amato, A., & Barten, P. (2008). *Silvicultural and Ecological Considerations of Forest Biomass Harvesting in Massachusetts*. Department of Natural Resources Conservation, University of Massachusetts. Massachusetts Division of Energy Resources and MA Department of Conservation and Recreation.
- Klyza, C. (2001). *Wilderness Comes Home - Rewilding the Northeast*. Hanover, NH: Middlebury College Press.
- Loomis, J. (2005). *Updated Outdoor Recreation Use Values on National Forests and Other Public Lands*. U.S. Department of Agriculture, Washington.
- Lorimer C.G. and A.S. White. 2003. Scale and frequency of natural disturbances in the northeastern US: implications for early successional forest habitats and regional age distributions. *Forest Ecology and Management*.
- Luyssaert, S., E.D., S., Borner, A., Knohl, A., Hessenmoller, D., Law, B., et al. (2008). Old-growth forests as global carbon sinks. *Nature* , 455.
- Mass Audubon. (2009). Comments on FSC Recertification.
- Mass Audubon. (2009). *Losing Ground: Beyond the Footprint*.
- Massachusetts Department of Environmental Protection. (2009). *Statewide Greenhouse Gas Emissions Level: 1990 Baseline and 2020 Business as Usual Projections*.
- Massachusetts Division of Fisheries & Wildlife. (2006). *Comprehensive Wildlife Conservation Strategy*. Boston.
- McDonald, R., Motzkin, G., & Foster, D. (2008). The effect of logging on vegetation composition in Western Massachusetts. *Forest Ecology and Management* , 255, 4021-4031.
- Millenium Ecosystems Assessment. (2005). *Ecosystems and Human Well-Being: Policy Responses*. Island Press.
- Munger, J., Barford, C., & Wofsy, S. (2004). Exchanges between the Forest and the Atmosphere. In D. Foster, & J. Aber, *Forests in Time*. New Haven, CT: Yale University Press.
- National Coalition for Dialogue & Deliberation (2009). *Core Principles for Public Engagement*
- Norton, D. 1999. Pp. 525-555 in M.L. Hunter (editor). *Maintaining biodiversity in forest ecosystems*. Cambridge University Press. New York.
- Nunery, J.S., Keeton, W.S. (2010), Forest carbon storage in the northeastern United States: Net effects of harvesting frequency, post-harvest retention, and wood products. *Forest Ecol. Manage.*

O'Donnell, F. C. (2007). Carbon Dynamics of a New England Temperate Forest Five Years After Selective Logging. *Senior Thesis in Organismic and Evolutionary Biology*. Cambridge, MA.

Ohio Library Council (2009). *Community Connection Toolkit*.

Perez-Garcia, J., Lippke, B., Connick, J., & Manriquez, C. (2005). An Assessment of Carbon Pools, Storage, and Wood Products Market Substitution Using Life-Cycle Analysis Results. *Wood and Fiber Science* , 37, 140-148.

Puettmann, K., Coates, K., & Messier, C. (2009). *A Critique of Silviculture: Managing for Complexity*. Washington, DC: Island Press.

Raymond, P., Bedard, S., Roy, V., Larouch, C., & Tremblay, S. (2009). The Irregular Shelterwood System: Review, Classification, and Potential Application to Forests Affected by Partial Disturbances. *Journal of Forestry* .

Ricci, H. (2009). Facts about DCR Lands; Notes for presentation to June 23, 2009 Forest Futures Vision Meeting.

Scientific Certification Systems. (2009). *Forest Management and Stump-to-Forest Gate Chain of Custody Certification Evaluation Report*. Massachusetts Executive Office of Environmental Affairs.

Selva, S. 1996. Using lichens to assess ecological continuity in northeastern forests. Pp. 35-48 in M.B. Davis (Ed.). *Eastern Old-growth Forests*. Island Press, Washington, D.C. 383 pp.

Slay, C., & Smith, K. (2008). Nest Success Rates of Four Shrubland Specialists in Conservation-Managed Fields with Comparisons to Other Managed and Unmanaged Shrublands. *Proceedings of the Fourth International Partners in Flight Conference: Tundra to Tropics*, (pp. 705-712).

Soule, M., & Terborgh, J. (1999). *Continental Conservation: Scientific Foundations of Regional Reserve Networks*. Washington, D.C.: Island Press.

The Insight Group and Dorr Research Corp. (2004). *The Public's Use of Outdoor Resources in Massachusetts*. Massachusetts Department of Conservation and Recreation.

Yale Forest Forum (Hodgton, B. (2002). Public Lands Certification. *Yale Forest Forum* , 5 (4).