

RHODE ISLAND FOREST RESOURCES ASSESSMENT and STRATEGIES

"A PATH to TOMORROW'S FORESTS"



June 2010



Department of Environmental Management
Division of Forest Environment
1037 Hartford Pike
North Scituate, Rhode Island



The *Rhode Island Forest Resources Assessment and Strategies*, (RIFRAS), objectives and strategies were adapted from the *2005 Rhode Island Forest Resources Plan*, March 2005 in which the Division of Forest Environment and the State Planning Council comprised of state, local, and public representatives, and federal and other advisors, guided the work of the Plan.

The objectives of the Statewide Planning Program are:

- (1) to prepare strategic and systems plans for the state
- (2) to coordinate activities of the public and private sectors within this framework of policies and programs
- (3) to assist local governments in management, and
- (4) to advise the Governor and others concerned on physical, social, and economic topics.

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Electronic copies of the Rhode Island Forest Resource Management Plan, March 2005 are available at:

<http://www.planning.ri.gov/forestplan/frmp/forestplan.pdf>

Abstract

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"A Path to Tomorrow's Forests"

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ABSTRACT:

The R.I. Department of Environmental Management Division of Forest Environment developed this plan to meet the requirements of the 2008 Farm Bill, the earlier plan; *Rhode Island Forest Resources Management Plan* was completed in cooperation with the Rhode Island Statewide Planning Program. The *Rhode Island Forest Resources Management Plan* established a vision, goals, and policies and provides recommendations focused on the management of tree and forest resources within the State of Rhode Island. When construed and applied in conjunction with the *Rhode Island Urban and Community Forest Plan*, (State Guide Plan Element 156, 1999) this guidance is intended to advance the effectiveness of public and private stewardship of the state's tree and forest resources towards the twin goals of a healthy, sustainable economy and environment. As an element of the State Guide Plan, the *Rhode Island Forest Resources Management Plan* sets forth goals and policies that must, under state law, be reflected in future updates of local comprehensive plans.

The Rhode Island Forest Resources Assessment and Strategies was updated from these two documents, the *Rhode Island Forest Resources Management Plan* and *Rhode Island Urban and Community Forest Plan*, with input from the Forest Resources Assessment and Strategies Committee, (RI Stewardship Committee members and other invited environmental partners) to incorporate other statewide planning documents. Other documents used in the development of this plan were the: *Rhode Island's Comprehensive Wildlife Conservation Strategy*, *Rhode Island Greenhouse Gas Action Plan*; Forestry, Agriculture, and Land Use Change Strategies for Reducing Greenhouse Gas Emissions in Rhode Island, *Bays, Rivers, and Watersheds Systems-Level Plan: 2009-2013*.



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PREFACE

After over 100 years of service the Division of Forest Environment continues to conserve, protect and plan for the sustainability of Rhode Island's forests. Our forests still cover over 50% of the landscape and have returned and matured to a point not thought possible by the early settlers that cleared the landscape for farming. The 21st century brings challenges not thought about by earlier predecessors; budget and staff cuts take over as concerns where in the past it was over cutting of the forest and forest fires that were the challenges for the State Forester. Today it is the sustainability of not only the forest but of the programs needed to sustain this precious resource. With the concentration on stretching the budget and minding where each dollar goes the forestry community must focus attention to the importance of the forest resources and the multitude of services and benefits it provides but also must convey this critical need to protect the forest to the general public and politicians alike. This plan has been developed to create a path to tomorrow's forest.

This document is an update of the *Rhode Island Forest Resources Management Plan*, (FRMP), State Guide Plan Element 161, which were developed by the Department of Environmental Management, Division of Forest Environment and the Statewide Planning Program, in March 2005. This plan does not create a radical change of direction from past policy premises but is based on its predecessors. The plan carries forward many of the relevant policies and themes of the 1984 and 2005 plans, adding new policies or emphasis as the changing scale and dimension of issues surrounding forest management have evolved.

The *Rhode Island Forest Resources Management Plan* was adopted by the State Planning Council as an element of the State Guide Plan. The FRMP plan, along with other elements, including the *Rhode Island Urban and Community Forest Plan*, State Guide Plan Element 156, provide guidance to state government, to local governments (whose local comprehensive plans must be consistent with the goals and policies outlined herein), and to private sector entities and individuals whose actions affect the state's forests.

A meeting was convened of the Forest Resources Assessment and Strategies Advisory Committee on June 11, 2009 to identify relevant issues and set up a framework to guide the process of updating the *Rhode Island Forest Resources Management Plan*. Key issues were reconfirmed and the Committee recommended conducting another landowner survey utilizing the internet. The evaluation of the internet survey results in comparison to that of the previous landowner survey and a series of focus groups to clarify public opinion on these issues are presented in the Appendix.

This plan like *the Rhode Island Forest Resources Management Plan* seeks to protect and conserve Rhode Island's Forest Resources and the many attributes associated with this precious resource and in these trying times we can not wavier from the responsibility to conserve these resources as President Theodore Roosevelt stated at the Address to the Deep Waterway Convention, Memphis, TN, October 4, 1907:

“The conservation of natural resources is the fundamental problem. Unless we solve that problem, it will avail us little to solve all others.

And so with this updated Forest Resources Assessment and Strategies Rhode Island has developed its path to tomorrow's forests.



ACKNOWLEDGEMENTS

Funding for FRMP was provided by a grant from the U.S. Forest Service and by state appropriations to the Statewide Planning Program.

- The development of the base plan, the Forest Resources Management Plan, (FRMP), was accomplished through a cooperative agreement between the Department of Environmental Management's (DEM) Division of Forest Environment, and the Statewide Planning Program of the Department of Administration. Bruce Payton, Supervising Forester, and Gregg Cassidy, Senior Environmental Planner both with DEM, researched and drafted the FRMP in cooperation with Nancy Hess, Principal Environmental Planner, and George W. Johnson, Assistant Chief, of the Statewide Planning Program staff in assistance in editing the plan. Special thanks are given to Bryan McMillan and Kate Montieth, interns with DEM's Office of Strategic Planning, who assisted in research for the FRMP.

The *Rhode Island Forest Resources Assessment and Strategies* was produced through a grant from the Northeastern Area Association of State Foresters with guidance from the NAASF Forest Resource Planning Committee. Bruce Payton, Supervising Forester, researched and drafted the plan and Paul Jordan, DEM Planning and Development GIS Specialist provided GIS data and maps critical to the development and analysis.

Others who contributed ideas and insights, or otherwise aided development of the FRMP included:

- Members of the Forest Resources Assessment and Strategies Advisory Committee
- Sherri Wormstead, Sustainability and Planning Coordinator, USDA Forest Service DFO S&PF
- Chris Modisette, Rhode Island USDA-NRCS RC&D Coordinator

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Part 1: Introduction

The Rhode Island Division of Forest Environment, in cooperation with other agencies, prepares long-range forest resources management planning. The Rhode Island Forest Resources Assessment and Strategies was adapted from the Rhode Island Forest Resources Management Plan, State Guide Plan Element 161. RI Forest Resources Management Plan is part of a collection of plans and policy documents adopted by the State Planning Council that addresses the social, economic and physical development of the state. The last forest resources management plan was adopted in 2005. The 2008 Farm Bill and Federal regulations for receipt of Cooperative Forest Management consolidated payments require a State Forest Resources Assessment and Strategies document.

Organization for Forest Resources Management Planning

The State Planning Council, the Statewide Planning Program's policy body, serves to coordinate planning and development activities in the state. The Council adopts all statements of goals and policies and all elements of the State Guide Plan. The Council has a permanent advisory committee, the Technical Committee, and a Forest Resources Management Plan Advisory Committee was formed in 2003. The purpose of the Advisory Committee was to encourage public involvement in the forest resources management planning process and to develop, with the staff, the forest resources management planning documents that are adopted by the Council. The planning staff, as part of a state-planning agency, integrates forest resources management with other planning issues, such as land use and economic development. Additionally, advanced planning tools are housed within Statewide Planning, namely RI Geographic Information Systems (RIGIS). The staff works cooperatively with the Rhode Island Department of Environmental Management (DEM), other state agencies, officials in 39 cities and towns and one Indian tribe, neighboring states and federal agencies on forest resources management planning.

Scope of the Forest Resources Management Plan

The Forest Resources Management Plan establishes a vision for the management of the forest resources of the state. It provides goals and policies and strategies focused on the management of tree resources within the state. It is intended to advance local stewardship of the state's trees and forest resources towards the twin goals of a healthy, sustainable economy and environment in conjunction with the Rhode Island Urban and Community Forest Plan (State Guide Plan Element 156, 1999)

The following State Guide Plan Elements also address forest resources management topics:

- Element 121: Land Use 2025
- Element 131: Cultural Heritage and Land Management Plan
- Element 152: Ocean State Outdoors: RI's Comprehensive Outdoor Recreation Plan
- Element 155: Greenspace and Greenways Plan
- Element 211: Economic Development Policies & Plan
- Element 731: Nonpoint Source Pollution Management Plan
- Element 811: Transportation 2030

Forest Resources Management Plan Update to Rhode Island Forest Resources Assessment and Strategies Plan:

Bruce Payton, Supervising Forester of the DEM Division of Forest Environment (DFE) staff was appointed Chair of the Rhode Island Forest Resources Assessment and Strategies Committee by Catherine Sparks, Chief of DFE. Together with the Rhode Island Forest Resources Assessment and Strategies Advisory Committee the group prepared and recommended the plan to the USDA Forest Service. The Advisory Committee consisted of the members of the State Forest Stewardship Coordinating Committee, State Technical Team, (Committee), and selected members from various other environmental organizations throughout the state. Members were asked for their participation by the State Forester and represented approximately 30 various stakeholders related to the State's forest resources. After a series of facilitated meetings the Committee reviewed the forest resource issues of the Rhode Island Forest Resources Management Plan, March 2005, and discussed relevant issues outlined in the FRMP. The Forest Resources Assessment and Strategies Advisory Committee reaffirmed the following issues for the plan.

- Forest Resource Management
- Sustainability
- Information and Education
- Forest Health
- Commercial Forest Products
- Water Resources
- Recreation and Tourism
- Fragmentation

Additional issues for expansion in the *Rhode Island Forest Resources Assessment and Strategies*:

- Greenhouse gases
- Priority Forest Area

The Forest Resources Management Plan had several purposes.

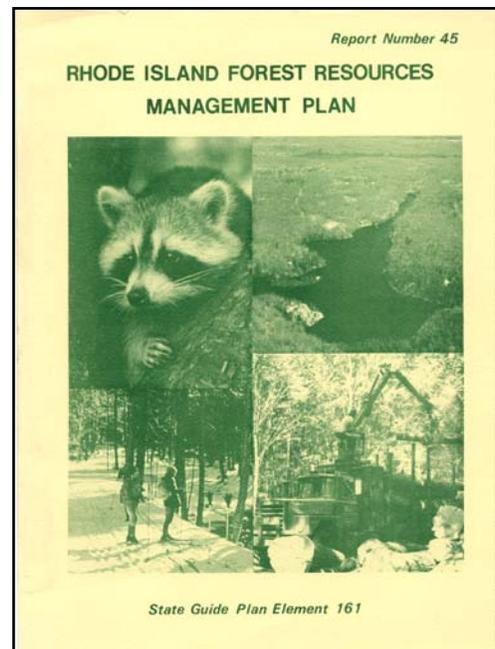
- It sets state policy, to guide public and private decisions involving the use of trees and forestlands.
- As a State Guide Plan element, it is a basis for determining consistency of local comprehensive plans and other plans, programs, and projects with state policies. As an element of the State Guide Plan, this plan requires the comprehensive plans prepared by the state's municipalities be consistent with its goals and policies. All (39) Rhode Island municipalities have locally-adopted comprehensive community plans, and, as of 2010, most (38) have received State Certification. State Certification is becoming increasingly important criteria for competitive state project approvals and grant funding in the era of dwindling fiscal resources.
- Publicly supported projects of several specified state agencies are also required to be consistent with the Guide Plan. Other elements of the State Guide Plan are integrated with and support this plan, in particular *A Greener Path... Greenspace and Greenways for Rhode Island's Future, State Guide Plan Element 155* and the *Rhode Island Urban and Community Forest Plan, State Guide Plan Element 156*. Inclusion of forest resources management goals and policies in the Guide Plan also helps insure that these concerns are properly coordinated with other functional areas covered by the Guide Plan; elements covering land use, transportation, economic development, water supply and other functions.



- It provides a long-range framework for advancing projects in annual work programs for the Division of Forest Environment of the DEM.
- Performance measures have also been established in Part 4. These measures will be used to monitor performance and may be used in the state budgetary process.

The FRMP update was based upon the following inputs:

- A Forest Resources Management Plan Advisory Committee comprised of representatives of state agencies, local governments, regional organizations, private forest organizations and user groups, and citizens having an interest or expertise in forest resource matters.
- Focus groups comprised of advisory committee members, invited agencies, private sector representatives, landowners and public members. These groups allowed for public discussion of the goals, policies, and recommendations of the current plan, as well as defining new issues. A total of 47 individuals participated in the five group meetings. The groups were:
 - Environmentalists
 - Private Forestland Owners
 - Resource Professionals
 - Commercial Forest Users
 - Recreational Forest Users
- Updated statistics on forest cover, species diversity and uses provided by the United States Department of Agriculture Forest Service.
- A 50-question survey¹ administered by the DEM's Division of Forest Environment and mailed to over 2,000 Rhode Island forestland owners. The survey included questions regarding current and future usage and management of private and state owned forestlands. Over 600 completed questionnaires were returned.
- An assessment of the conformity of the plan's recommendations with the *Rhode Island Urban and Community Forest Plan* (State Guide Plan Element 156, 1999)



Accomplishments Since the 1984 Plan

A number of recommendations made in the prior plan have been acted upon:

1984 Plan

1. Continued implementation of comprehensive statewide Forest Resources Management Plan, State Guide Plan Element 161, 1984 by the DFE.
2. Continued implementation of Forest Stewardship Plans for Arcadia and George Washington Management Areas, adopted in 1980 and 1992 respectively.

¹ See Appendix B

3. Established and continued coordination of State Management Areas through multi- disciplinary management councils.
4. Established of Statewide Forest Stewardship Committee, 1990.
5. Maintained statewide forest inventory statistics—surveys by USDA Forest Service in 1985 and 1998, changed to annual, continuous basis beginning in 2003.
6. Developed the Forest Legacy Program, 1993. This program is a partnership between participating states and the USDA Forest Service to identify and protect environmentally important forests from conversion to nonforest uses.
7. Provided funding and continued support to non-profit organizations for establishment of informational and educational organizations. Specific organizations assisted were:
 - RI Forest Fire Advisory Council 1985
 - Yankee Forest 1985
 - Southern New England Forest Consortium 1991
 - RI Forest Conservators Organization, 1990
 - RI Tree Council, 1992
 - Envirothon, 2004
8. Continued the Statewide Forest Health Program as established by the transfer of Plant Industry personnel to Division of Forest Environment in 1982, and conducted annual statewide Forest Health Inventory in cooperation with USDA Forest Service in 1990.
9. Updated Best Management Practices Handbook for reduction of soil erosion problems during timber harvesting, 1996 and 2003.
10. Developed and continue to implement comprehensive statewide Urban and Community Forest Plan, State Guide Plan Element 156, 1999.
11. March 2005, completed and had accepted the 2005 Forest Resources Management Plan as a State Guide plan Element 161

The Forest Resources Assessment and Strategies Committee reviewed the recommended NAASF Guide for Statewide Forest Resources Assessments and Strategies and the Rhode Island Forest Resources Management Plan, March 2005, (FRMP) and utilizing these two documents decided to update the data in the FRMP and investigate ways to incorporate the missing criteria from the NAASF Guide into the FRMP to develop the Rhode Island Forest Resources Assessment and Strategies.

The NAASF Forest Resource Planning Committee which set the following guidelines for the Statewide Forest Resource Assessment Strategies.

At a minimum, state resource strategies should:

- **Outline long-term strategies for addressing priority landscapes identified in the state forest resource assessment and the following national themes and associated management objectives.**
 1. **Conserve Working Forest Lands:** conserving and managing working forest landscapes for multiple values and uses.
 - a. Identify and conserve high priority forest ecosystems and landscapes.
 - b. Actively and sustainably manage forests.
 2. **Protect Forests From Harm:** protect forests from threats, including catastrophic storms, flooding, insect or disease outbreak, and invasive species.



- a. Restore fire-adapted lands and reduce risk of wildfire impacts.
- b. Identify, manage and reduce threats to forest and ecosystem health.
- 3. **Enhance Public Benefits from Trees and Forests:** including air and water quality, soil conservation, biological diversity, carbon storage, and forest products, forestry-related jobs, production of renewable energy, and wildlife.
 - a. Protect and enhance water quality and quantity.
 - b. Improve air quality and conserve energy.
 - c. Assist communities in planning for and reducing wildfire risks.
 - d. Maintain and enhance the economic benefits and values of trees and forests.
 - e. Protect, conserve, and enhance wildlife and fish habitat.
 - f. Connect people to trees and forests, and engage them in environmental stewardship activities.
 - g. Manage and restore trees and forests to mitigate and adapt to global climate change.
- **Describe how the state proposes to invest federal funding, along with other resources, to address state, regional, and national forest management priorities.**
 - 1. Include a long-term timeline for project and program implementation.
 - 2. Identify partner and stakeholder involvement.
 - 3. Identify strategies for monitoring outcomes within priority forest landscape areas and how action will be revised when needed.
 - 4. Describe how the state's proposed activities will accomplish national State and Private Forestry program objectives and respond to specified performance measures and indicators.
 - 5. Describe how State and Private Forestry programs will be used to address priority landscape and management objectives.
 - 6. Incorporate existing statewide plans including Wildlife Action Plans, community wildfire protection plans, and address existing S&PF program planning requirements.

These priorities, **Conserve Working Forest Lands**, **Protect Forests from Harm**, **Enhance Public Benefits from Trees and Forests** were in consort with the conceptual development of Rhode Island Forest Resources Management Plan and reinforced in the development of Rhode Island Forest Resources Assessment and Strategies Plan. The issues, goals, policies and objectives of this plan are interconnected with these national priorities to insure sustainable forests in Rhode Island.

Historical perspective

Rhode Island's first inhabitants interacted with the forest to provide for their basic needs. Native American groups like the Narragansett, Nipmuc, and Wampanaug periodically burned the forest to improve habitat for game animals. Small areas were cleared for agriculture and "hunting grounds" maintained by using frequent light fires to remove underbrush and stimulate the growth of grass. This resulted in a forest dominated by large trees with an open understory. William Cronin surmised the landscape was a patchwork of forests in many different stages of ecological succession, providing habitat for deer, grouse, and other game species.²

Rhode Island was probably 95 percent forested when Roger Williams founded a settlement in Providence in 1636.³ As the state became settled, more of the forest was cleared for agriculture; the earliest estimate of forest area was 31 percent in 1767.⁴ This trend continued as the population increased until, by the end of the nineteenth century, almost 80 percent of the land had been cleared. Forests were limited to untillable land or wetland. The remaining forest was harvested heavily to supply building material and fuel.

By the end of the nineteenth century, Rhode Island forests had reached their lowest point in both land area and forest condition. Forests were viewed as wasteland waiting to be cleared for agriculture or simply as a source of fuel. The introduction of portable steam-powered sawmills in the early 1870s coupled with Rhode Island's prominent role in the Industrial Revolution meant unprecedented harvesting of the remaining forest. In 1887, Bernard Fernow, Chief of the United States Department of Agriculture (USDA) Forestry Bureau, advised,

*"forests in the strict sense of the word can hardly be said to exist in [Rhode Island]. Although 24 percent is reported covered with wood, it is mostly coppice and white pine or pitch pine, which here and there may be said to rise to the dignity of forests, especially on the western borders."*⁵

Availability of more productive land in the western United States and improved transportation that brought western products to eastern markets led to the abandonment of many farms in Rhode Island. The industrial revolution also led to a shift in economic opportunities and many farmers moved into urban areas for work. This idle land quickly reverted to forest. The trend of increasing forest cover continued until after World War II. The land area covered by this "second growth" forest peaked in 1963, at 67 percent.⁶ Since then, forestland in Rhode Island has declined as land is cleared for development. The USDA, Forest Service reports a decrease in forestland area of 4.6 percent (16,500 acres) from 1985 to 1998.⁷ According to a Grow Smart Rhode Island report, this is not due to increasing population but a changing development pattern; "...while Rhode Island's total population increased by only 16 percent during [the 34 year period from 1961 to 1995] the state's land consumption for residential, commercial, and industrial uses increased by 147 percent, nine times faster than the population growth rate."⁸ The forest resources of Rhode Island have been periodically assessed since the 1950's but estimates of acreage are available from as far back as 1630. (See Figure 1.)

² Changes in the Land: Indians, Colonists, and the Ecology of New England, William Cronin, Hill and Wang Publishers. 1983.

³ *The Forests of Rhode Island*, USDA, United States Forest Service, Northeast Research Station, NE-INF-155-02, September 2002, preface.

⁴ Ibid.

⁵ Ibid.

⁶ *RI Land Use Trends and Analysis*, Technical Paper 149, Rhode Island Statewide Planning Program, July, 2000.

⁷ Forest Statistics for Rhode Island: 1985 and 1998, USDA Forest Service Research Bulletin NE-149, November 2000.

⁸ The Costs of Suburban Sprawl and Urban Decay in Rhode Island, Grow Smart Rhode Island, December 1999.



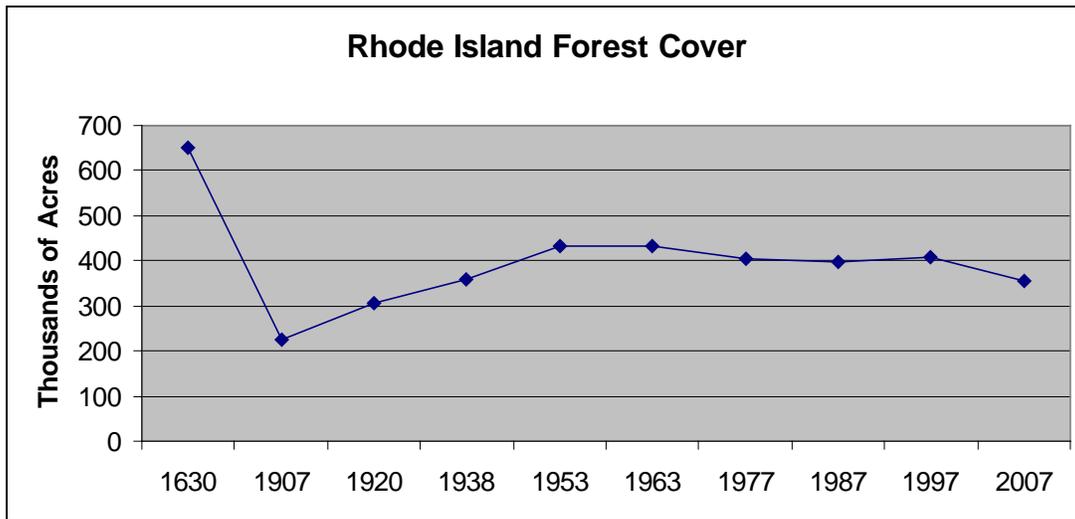


Figure 1
Changes in Rhode Island Forestland Area⁹

Although the overall amount of forestland in Rhode Island has decreased since the first assessment by the Forest Service in 1952, the ownership of forest by public agencies and non-profit organizations has increased. The acreage owned by state and local municipalities increased 13.7 percent, from 69,700 to 80,800 acres. Figure 2 shows trends in land acquisition by DEM. Private organizations, water suppliers, municipalities and land trusts have preserved an additional 77,400 acres.¹⁰ Funding for many of these purchases has come from bond issues approved by voters showing an increased public awareness about the importance of forestland and the danger of fragmentation. In addition, the Forest Legacy Program, which is funded by the USDA Forest Service, has acquired development rights to eighteen properties totaling 3,185 acres.¹¹

Rhode Island developed more residential, commercial, and industrial land in the last 34 years than in the previous 325 years according to Grow Smart Rhode Island.

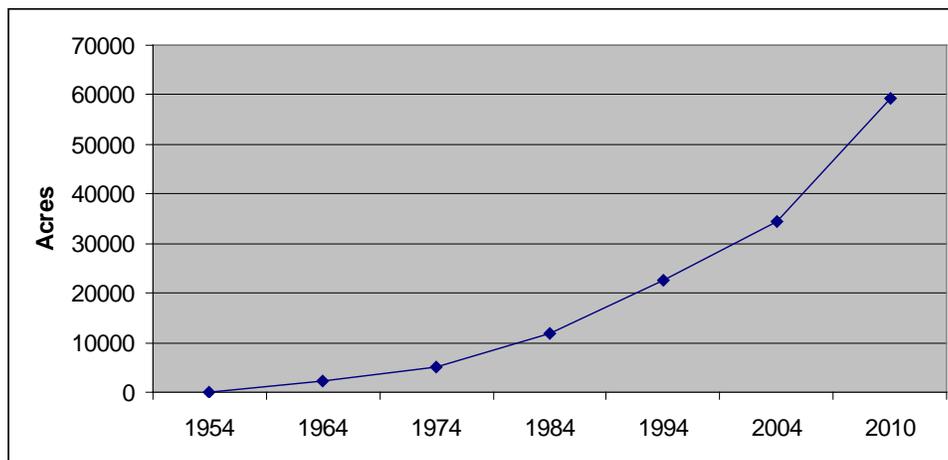


Figure 2
Land Acquired by DEM 1954-2010¹²

⁹ Smith, W. Brad, tech. coord.; Miles, Patrick D., data coord.; Perry, Charles H., map coord.; Pugh, Scott A., Data CD coord. 2009. Forest Resources of the United States, 2007. Gen. Tech. Rep. WO-78. Washington, DC: U.S. Department of Agriculture, Forest Service, Washington Office. Appendix C, Resource Tables: Table 3, page 157

¹⁰ Southern New England Forest Consortium, report by Yellow Wood Associates, Inc., 2002.

¹¹ Personal communication. Paul Ricard, DEM/Division of Forest Environment. 5/6/2010

There has also been a dramatic increase in enrollment in Rhode Island's Farm, Forest, and Open Space (FFOS) Program, which offers lower tax assessment (based on the land's use as forest) in return for a conservation restriction that insures the property cannot be developed for 15 years without paying a penalty. Interest in this Program has increased as higher tax assessments have made the cost of maintaining forestland prohibitive. Figure 3 shows the amount of forestland enrolled in this Program since 1985. A survey of forest landowners found 51 percent of eligible landowners in 13 rural communities participate in the Program.¹³ Of all properties enrolled in this program, 58 percent of the properties are enrolled under open space, 29 percent as forest, and 12 percent in the farm classification. This Program has been an effective means of slowing the change of forestland in both rural and suburban communities to other uses. The Rhode Island State Conservation Committee reports 3,600 properties enrolled in the Program statewide (28,614 acres in farmland and 29,345 acres as forest classification).¹⁴ 2010 records at the Division of Forest Environment show 439 certificates with 50,611.48 acres in the Forestland Classification.

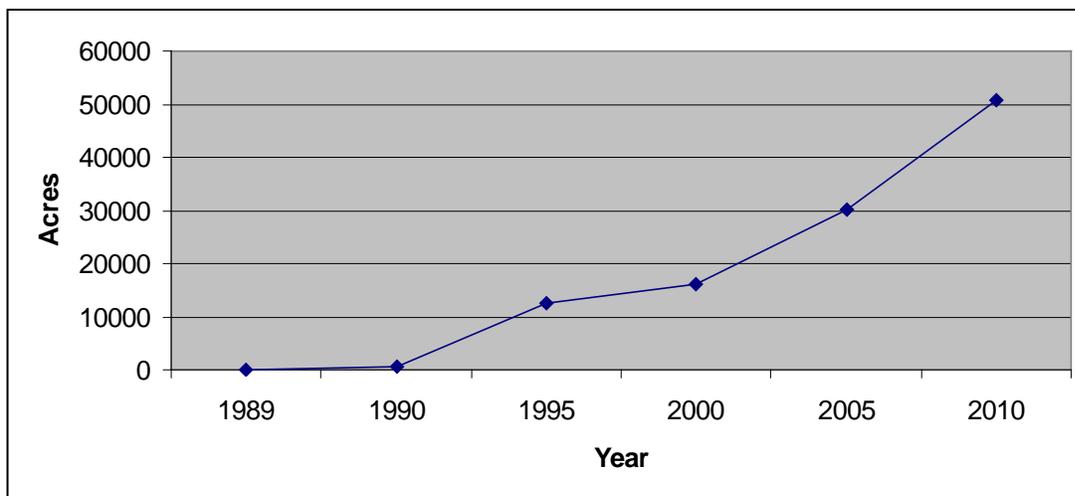


Figure 3
Acreage of Forest Classified Properties in FFOS Program¹⁵

Despite conversion of forestland for development, the most recent, (2008), USDA Forest Service Survey reports there are 348,400 acres of forestland in Rhode Island, and that approximately 52 percent of Rhode Island is covered with forest¹⁶ (See Figure 4). The Forest Service inventory reports the Oak/Hickory forest type, is the predominant forest type found in Rhode Island, comprising 414,952 acres. White Pine forest types cover 87,196 acres and Oak/Pine forests another 85,872 acres, includes Loblolly/shortleaf pine group forest types (Pitch Pine) which cover 27,415 acres. Oak/Gum forest types make up 47,200 acres. Maple/Beech/Birch cover 43,742 acres. The Elm/Ash/Red Maple forest types make up 24,595 acres. Other forest types with no one other groups comprising over 10,000 acres make up the remaining 8,746 acres.

¹² From DEM land acquisition data; 2010: Paul Jordan, GIS Specialist DEM/ Division of Planning & Development .

¹³ Rhode Island Forestland Owners Survey, Bruce Payton, DEM/DFE, Gregg Cassidy, DEM/P&D 2003.

¹⁴ *Rhode Island State Conservation Committee Annual Report*, fiscal year 2008-2009.

¹⁵ Personal Communication. Forestlands Cecil Drouin, Administrative Assistant, DEM/DFE, 5/6/2010

¹⁶ *Forest Statistics for Rhode Island: 1985 and 1998*, United States Department of Agriculture, Forest Service, Research Bulletin NE-149, November 2000. 2010 Update: USDA Forest Service, Forest Inventory and Analysis for Rhode Island: Table 1, 2008.



Rhode Island Forested Lands

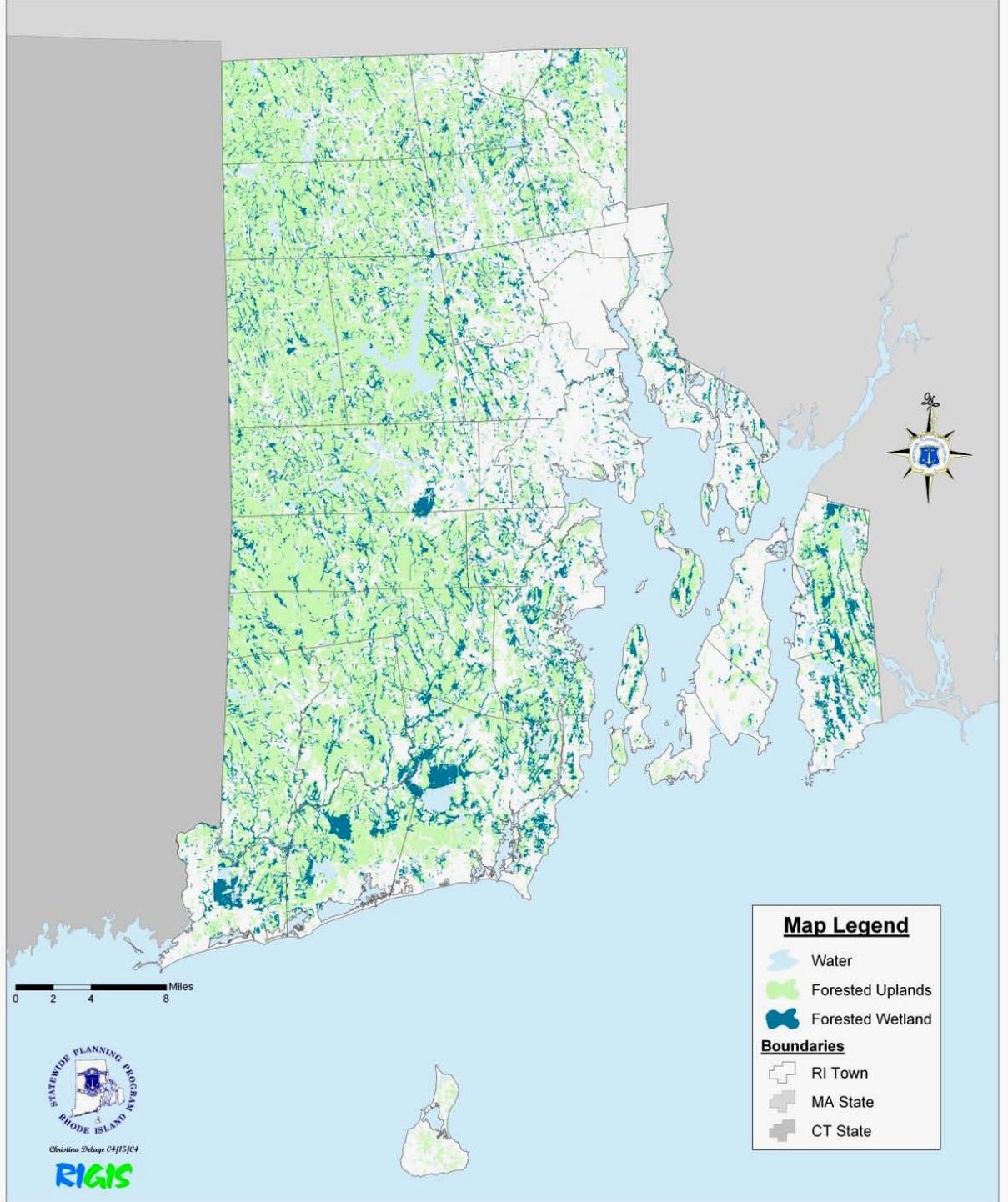


Figure 4

Rhode Island Forested Lands

Source: Rhode Island Statewide Planning Program, 1995 RIGIS Land Use Land Cover Data



Rhode Island Forest Types 1985 and 1998 (NE-149)

White/red pine: Forests in which eastern white pine, red pine, or eastern hemlock, singly or in combination, make up the plurality of the stocking; common associates include red maple, oak, sugar maple and aspen.

Oak/pine: Forests in which hardwoods (usually hickory or oaks) make up a plurality of the stocking and in which pines and or eastern red cedar contribute 25 to 50 percent of the stocking, (includes shortleaf pine associated with scrub oak and Pitch pine).

Oak/hickory: Forests in which upland oaks, hickory, yellow poplar, black locust, sweet gum, or red maple (when associated with central hardwoods), singly or in combination, make up a plurality of the stocking and in which pines or eastern red cedar make up less than 25 percent of the stocking; common associates include white ash, sugar maple, and hemlock.

Elm/ash/red maple (also called elm/ash/cottonwood): Forests in which elm, willow, cottonwood, or red maple (when growing on wet sites), singly or in combination, make up a plurality of the stocking; common associates include white ash, sugar maple, aspens, and oaks.

Oak/gum/Atlantic white cedar: Forests which include associates—gray birch, pitch pine, hemlock, and black gum.

Figure 5 shows the classification of forest, by forest type, based on the USDA Forest Service inventory.

The inventory identified 51 different tree species with eastern white pine the most common softwood tree species and red maple the most common hardwood species in Rhode Island forests.¹⁷

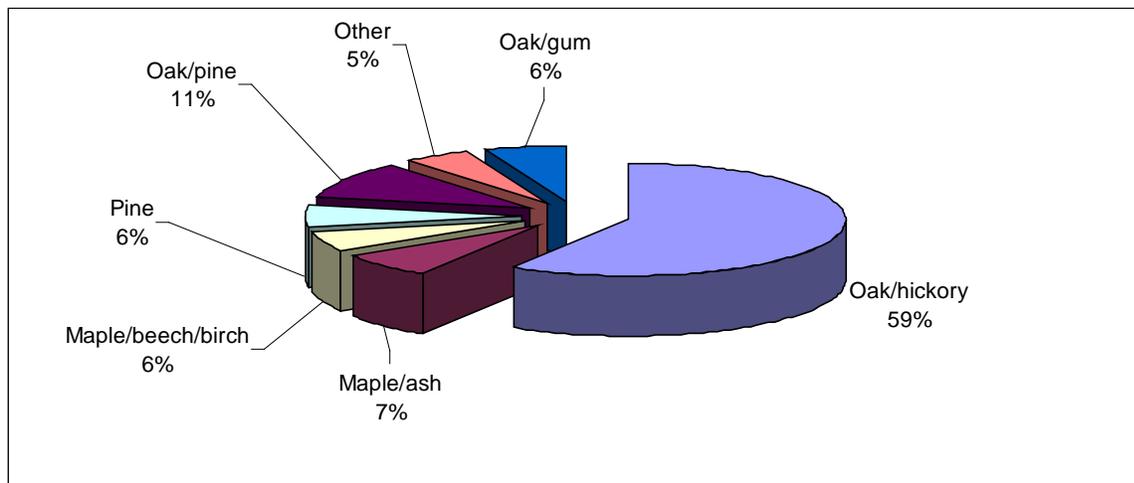


Figure 5
Forestlands by Forest-Type Group¹⁸

Although the forest in Rhode Island is growing on land that was cleared at one time for agriculture, more than half of the forest is over 60 years old with dynamic rolling cohorts of maturing trees. Figure 6 shows trends in the size of trees in the forest since the first USDA, Forest Service Inventory in the 1950's.

¹⁷ Ibid.

¹⁸2010 Update: USDA Forest Service, Forest Inventory and Analysis for Rhode Island: Table 1, 2008.

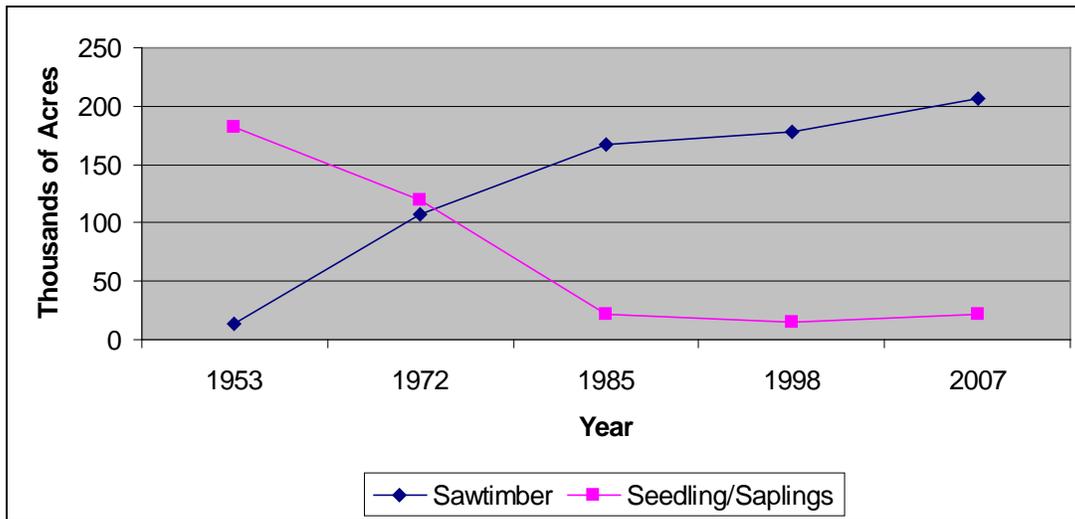


Figure 6
Changes in Area by Forest Size Class¹⁹

Although ownership of forest by public agencies and private and non-profits conservation groups has increased in recent times, private individuals still own most of Rhode Island's forestland. Figure 7 depicts ownership of forestland.²⁰ An increasing ownership group is non-profit organizations which are included in the "Other" category. In "Federal" ownership these "forest" areas are shrub and coastal areas included as "forest" by definition.

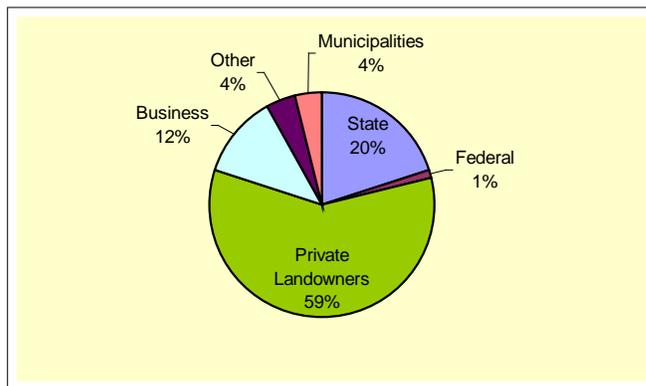


Figure 7
Distribution of Forest Ownership in Rhode Island²¹

As part of the update of the Forest Resources Management Plan, a mail survey of forest landowners who own more than ten acres of forestland in rural communities was conducted. As expected, parcel size was small, with 37 percent of respondents owning less than 20 acres and an additional 22 percent owning less than 30 acres. Most people who own forestland are of retirement age, with 30 percent more than 65 years old; less than 5 percent of the respondents were younger than 30 years old (See Figure 8). For the most part, respondents have maintained their property for a long time with 47 percent owning their land more than 20 years and only 19 percent less than 10 years (See Figure 9).

¹⁹ *Trends in Rhode Island Forests: A Half-Century of Change*, United States Department of Agriculture, Forest Service, Northeastern Research Station, NE-INF-144-02, 2002. 2010 Update: USDA Forest Service, Forest Inventory and Analysis for Rhode Island: Table 3, 2008

²⁰ *The Forests of Rhode Island*, United States Department of Agriculture, Forest Service, Northeastern Research Station, NE-INF-155-02, September 2002.

²¹ Ibid

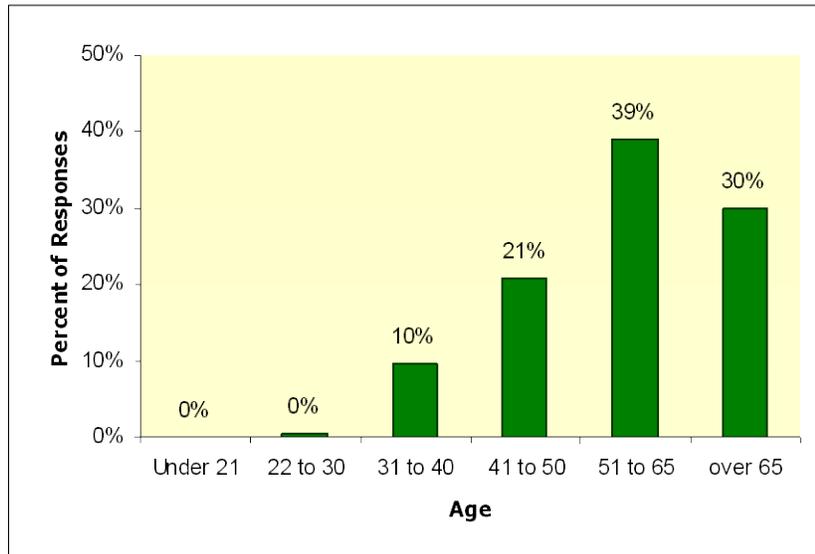


Figure 8
Age Distribution of Forest Landowners 2003²²

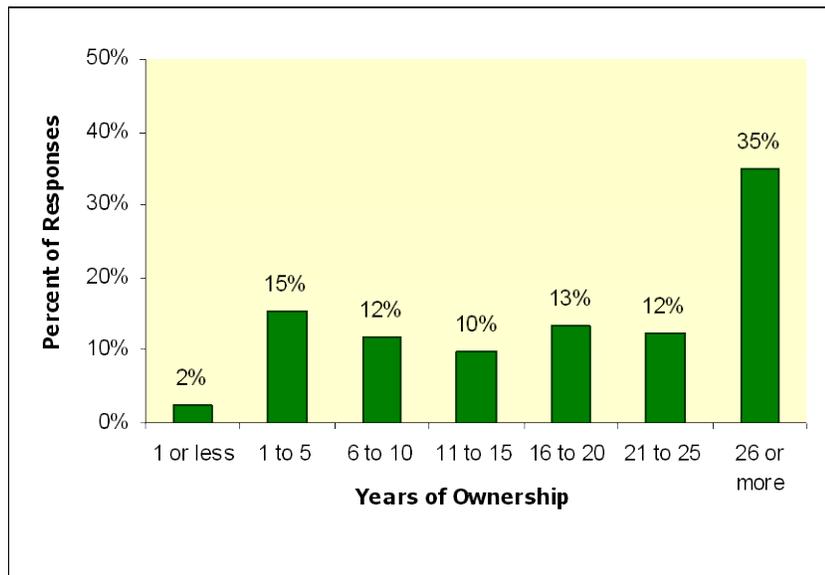


Figure 9
Length of Ownership of Forestland 2003²³

Most forest owners in Rhode Island live on their land, with 22 percent of survey respondents giving a place of residence as the most important reason for owning forestland. The survey revealed investment (13 percent) and forest products (12 percent) were the other important reason for owning forest. Recreational use (10 percent) and for hunting and fishing (6 percent) are other common reasons respondents gave for owning forestland.

²² Rhode Island Forestland Owners Survey, Bruce Payton, DEM/DFE, Gregg Cassidy, DEM/P&D 2003.

²³ Ibid

Forest Resource Values

The forests of Rhode Island are valuable for numerous environmental, economic, aesthetic, and quality of life reasons. Some of the more important resources values are discussed in this section.

Water Resources

Issues affecting water quality are at the forefront of public concern; 84 percent of respondents to a survey done as part of the update of the State Comprehensive Outdoor Recreation Plan (SCORP) said watershed protection was a very important function for DEM.²⁴ Specifically, protecting sources of drinking water was identified as the highest concern of respondents to a survey conducted in the year 2000 concerning growth and land use issues by the RI Statewide Planning Program²⁵. Drinking water needs in Rhode Island are supplied by a combination of groundwater, 25 percent and surface water 75 percent.²⁶

A watershed, the surface basin that drains into a surface water body, surrounds and feeds every surface drinking water supply source. Within a watershed, the quality and quantity of groundwater and surface water is directly related to land use activities. As development increases, threats to water quality also increase due to the loss of the filtering capacity of forests (and other undeveloped land), the potential for failed septic systems and other pollution sources, and degradation of riparian buffers. Impacts can also include loss of storage capacity, and increased runoff volumes leading to downstream flooding and reductions in available water during dry seasons. Development that increases impervious surfaces and out-of-basin transfers of water can affect the quantity of water available within a watershed.

It has long been recognized that maintaining forests is the key to insuring high quality water. Forests affect the flow and quality of water in the streams in the surface basin that contribute to reservoirs and which interact with groundwater. Maintaining healthy forests in watersheds is the most effective means to insure high water quality; it is also cheaper than water treatment.

Since a major threat to the Rhode Island water supply sources can be improperly sited development, a key strategy over the years has been to protect, through public or water supplier control, as much of the land immediately adjacent to water supply reservoirs as feasible. The RI Public Drinking Water-Watershed Protection Program, established by the Public Drinking Water Supply System Protection Act of 1997, funds the purchase of land to protect water supplies. This program, which is administered by the Rhode Island Water Resources Board, has funded the acquisition or purchase of development rights of 8,600 acres since its inception in 1964.²⁷ Figure 10 shows watersheds for public surface water supplies and protected forestlands within those areas.

Loss and degradation of aquatic habitat are of major concern for aquatic species and the issues goals and strategies expressed throughout the Water Resources section of this document reinforce those in the Rhode Island's Comprehensive Wildlife Conservation Strategy.

²⁴ *Ocean State Outdoors: Rhode Island's Comprehensive Outdoor Recreation Plan*. Report Number 105, State Guide Plan Element 152. Statewide Planning Program, March 2003.

²⁵ Rhode Island Growth Priorities for 2000 and Beyond, Survey Report, Rhode Island Statewide Planning Program, February 2000.

²⁶ *Public Water Supplies in Massachusetts and Rhode Island: Investigations of Processes Affecting Source-Water Quality*, United States Department of the Interior, United States Geological Survey, April 1997.

²⁷ Personnel Communication Elaine McGuire. Water Resources Board.

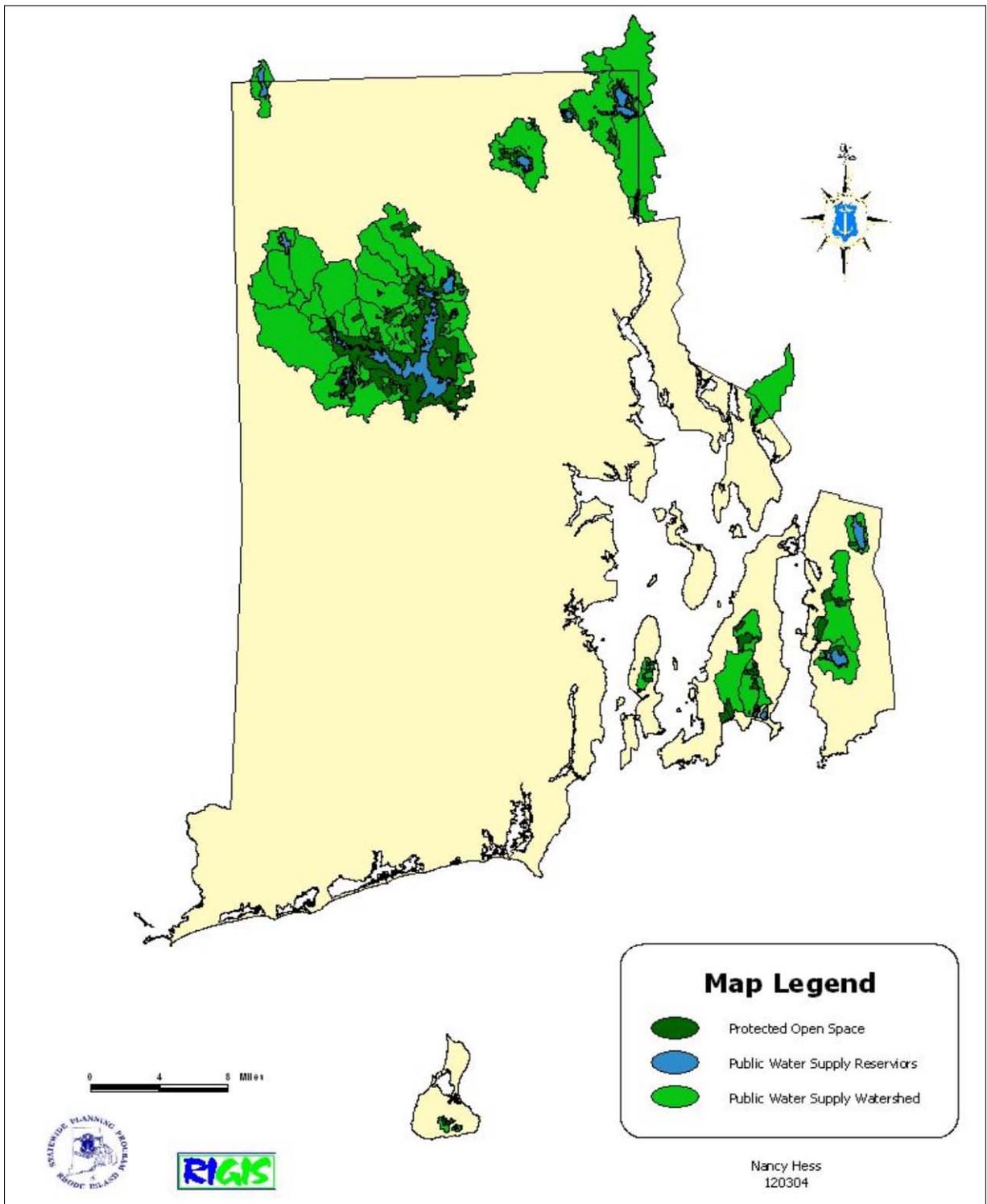


Figure 10
Protected Lands in Public Surface Water Supply Watersheds

Since it is impractical to purchase the entire watershed, most of the forestland surrounding key surface (and groundwater) resources will remain privately owned. Since this land is subject to development and therefore, some threat of contamination, it is essential that water quality protection concerns be a prime consideration in the control of land use activities by cities and towns through their zoning and development regulations. A key strategy outlined in Scituate Reservoir Management Plan, (State Guide Plan 125), is for watershed communities to accommodate future development by using innovative land management techniques to minimize the threat of water quality impacts. Examples of strategies outlined in the Plan include: overlay zoning which distinguishes an area of town that is considered of particular significance for conservation, and revised zoning and subdivision regulations to incorporate flexible land use regulations to minimize the impact of development.²⁸

Recreation

Leisure activities that take place (entirely or partially) in forests can be described as forest-based recreation. Forests offer a preferred setting for solitude or passive activities such as walking or nature watching, as well as more strenuous exercise. A recent survey of Rhode Islanders done for the *Ocean State Outdoors, Rhode Island's Comprehensive Outdoor Recreation Plan* (SCORP), State Guide Plan 152, reported that many had participated in outdoor recreational activities that use forest-based resources: nature watching (31 %), hiking (14 %), overnight camping (17 %), hunting (3 %), off-road vehicle driving (4 %) and equestrian trails (5 %).²⁹ For detailed goals, policies and a 5-year action agenda for all the uses listed above and other outdoor recreation uses see Part 152-4 of the SCORP entitled Rhode Island's Plan for Recreation, Conservation and Open Space.

Numerous recreational opportunities are available at State management areas, which provide passive recreation in a more natural outdoor setting than the (more developed) State parks. The State owns and manages twenty-three management areas that encompass 45,000 acres that are predominantly forest.³⁰ These areas are managed for multiple uses including hunting and fishing, nature study, and passive recreation.

The 2003 DEM/DFE survey of forest landowners found recreation was a very important reason for owning forestland. Six (6) percent reported hunting/fishing as an important reason for owning forestland, two (2) percent cited motorized recreation, and eleven (11) percent of respondents noted other recreation use as a reason for forestland ownership. Of respondents, 59 percent owning forestland allowed recreational use by others on their property; hunting (44 percent), hiking and nature study (both 19 percent), and horseback riding (17 percent) were the most common uses. Trespassing for recreational use was also cited as a common occurrence -- with hunting, motor biking and /or off road vehicle use occurring on roughly 30 percent of parcels.³¹

Wood Resources

As Rhode Island's forest matures, the number of trees large enough to be valuable for forest products is also increasing. Saw timber volume averaged 3,875 board feet per acre, an increase of 29 percent since 1985.³² White pine is the top species making up 28 percent of the saw timber volume. Oaks comprise 18 percent and red maple 15 percent of the saw timber volume.

The USDA Forest Service reports 1.3 billion board feet of saw timber in Rhode Island, an increase of almost 23 percent since the previous forest inventory.³³ Since the last forest inventory the annual growth of timber in trees exceeds that harvested (or lost to mortality) by 2.4 to 1. Average net annual growth of saw timber is 26 million board feet statewide (76 board feet per acre per year) while removals are 10.6

²⁸ Scituate Reservoir Zoning Project, DEM, April 1998.

²⁹ Outdoor Recreation Demand Survey. DEM, Leisure Vision, Inc. 2002.

³⁰ *Ocean State Outdoors: Rhode Island's Comprehensive Outdoor Recreation Plan*, State Guide Plan Element 152. Statewide Planning Program, March 2003.

³¹ Rhode Island Forestland Owners Survey, Bruce Payton, DEM/DFE, Gregg Cassidy, DEM/P&D 2003.

³² Forest Statistics for Rhode Island: 1985 and 1998, NE-149, August 2000.

³³ Ibid, table 37.

million board feet per year (31.2 board feet per acre per year average). The ratio varies by species with white pine growth exceeding removal by 16.6 to 1, red maple 5.8 to 1, while red oaks 1.4 to 1.9.

Oaks (including red, black, and white) are the most valuable (for timber) tree species in Rhode Island forests. White pine is the most valuable softwood species. The Southern New England Stumpage Price Survey showed demand for the most valuable tree species remained strong providing an economic incentive for forest landowners to manage their land (See Figure 11). The ancillary benefits of harvesting include improved forest health, enhanced wildlife habitat, and improved access for recreation. Based on the USDA Forest Service Inventory data and the Southern New England Stumpage Price Survey, the value of stumpage (trees in the woods) at the time of the last USDA Forest Service Inventory (1998) was 120 million dollars. This most certainly has increased due to improved market conditions and growth of the forest since the inventory.

The 2003 DEM/DFE survey of forest landowners found 31 percent have had commercial harvesting activity on their land, with 6 percent of these harvesting within the last five years. Saw timber and firewood are the most common products, each comprising about 32 percent of the harvest activities. Alternative products such as floral greens, mushrooms, maple syrup, and witch hazel involve one to five percent of the commercial harvests.

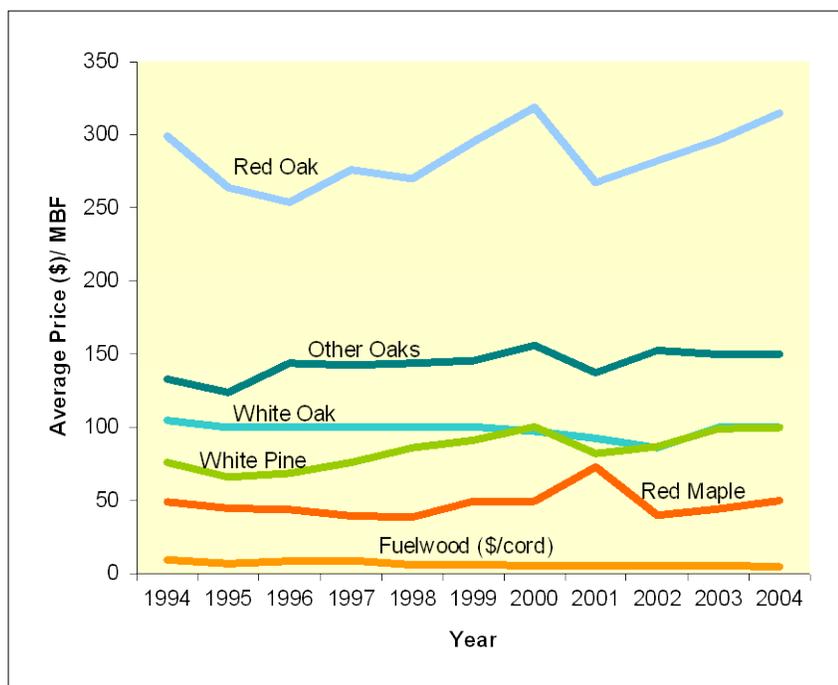


Figure 11
Tree Species Price Trends 2004³⁴
 (MBF = thousands of board feet)

Wood-Using Industries

The forest products industry in Rhode Island is small in relation to other business sectors but is an important component of the economy, representing approximately 3.3 percent of all manufacturing jobs in the state. The annual payroll income of the lumber and wood products industry totals over 22 million dollars.³⁵ Employment in the forest related sector includes three categories: harvesting trees, processing lumber and wood products, and secondary processing.

³⁴ Southern New England Stumpage, University of Connecticut, Cooperative Extension, Quarterly Price Survey, March 2004.

³⁵ Rhode Island Forest and Paper Industry at a Glance, American Forest and Paper Association, 2001.

Since 1932, commercial woodcutters have been required to register and report on their harvesting activities with the DFE. There are currently 88 individuals registered with the DFE. In the period from 1993 through 2003, these individuals were involved in harvesting 20,495 acres of forestland.

Lumber production in Rhode Island peaked in the early 1900's with 33 sawmills operating.³⁶ In 1956 this had decreased to 30, some of these being portable sawmills. By 1984, there were 33 sawmills employing approximately 200 people with an additional 200 persons employed in related jobs like transporting wood products or equipment repair.³⁷ Rhode Island's forest provides raw materials for the State's 6 sawmills that process an average of 5.5 million cubic feet of lumber per year.³⁸ Figure 12 shows the lumber production in Rhode Island. Although the number of local sawmills has decreased in recent times, sawmills in neighboring states and shipment to northern New England and Canada provide additional markets for Rhode Island forest products. There were 15 sawmills throughout the State in 1990³⁹ Wood production exceeded 1,200 MBF per year by 2008⁴⁰ there were only five sawmills producing approximately 3,600 MBF.

In 2009, Rhode Island's first public facilities utilizing woody biomass heating plants came into operation in the Foster/Glocester Regional School District. These two facilities, one 670 M Btu/hr, at the Ponagansett High School and the other, 340 M Btu/hr, at the Ponagansett Middle School utilize approximately 2300 tons of hardwood chips per year.

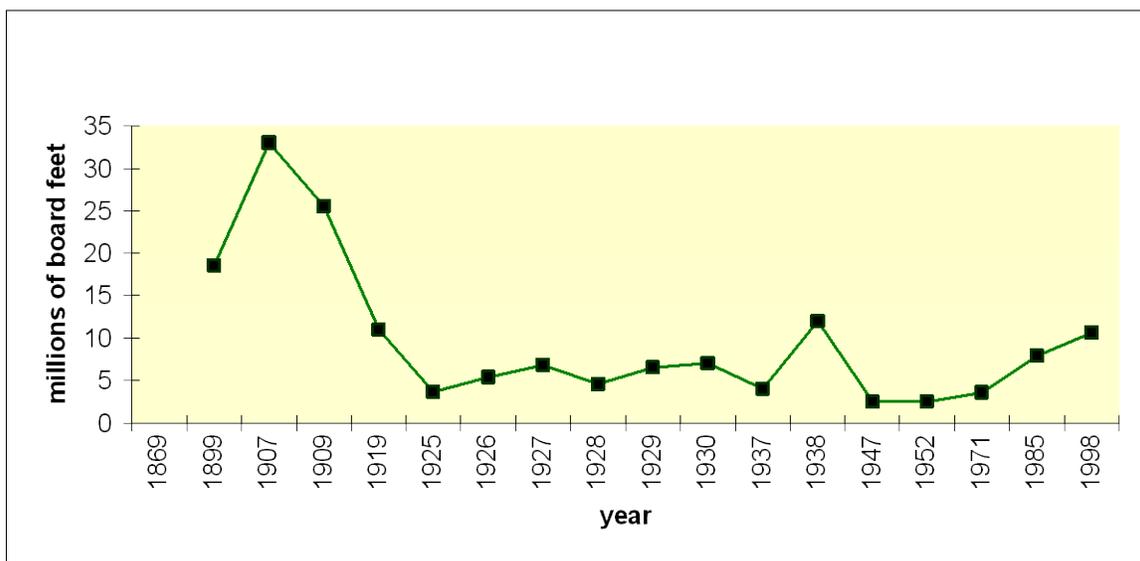


Figure 12
Tree Harvest Volumes 1869 – 1998

Note: Data is not continuous

³⁶ *The Forests of Rhode Island*, United States Department of Agriculture, Forest Service, Northeastern Research Station, NE-INF-155-02. September 2002.

³⁷ *Rhode Island Forest Resources Management Plan*. State Guide Plan Element 161. Statewide Planning Program, 1984.

³⁸ *Understanding your Forest Economy: Rhode Island*, See The Forest- Module Two, Yellow Wood Associates, 2001.

³⁹ *Rhode Island Primary Wood Producers Directory*, Bruce Payton, Senior Forester, Division of Forest Environment, May 1990

⁴⁰ *Rhode Island Primary Wood Producers Directory*, Bruce Payton, Supervising Forester, Division of Forest Environment, March 2008



Secondary Wood Processing Industries

Secondary processing involves creating finished products from raw materials. The Southern New England Forest Consortium reports that 156 companies in Rhode Island are involved in the manufacture of wood furniture, millwork, cabinets, ornamental woodwork, and other products from wood.⁴¹

In addition to wood products, Rhode Island's forests produce many commercially valuable products including edible and medicinal plants, floral greens, fee-based recreation, and specialty wood products. These specialty crops, which can be produced on the small acreage parcels typical for Rhode Island and sold to nearby markets, provide viable business opportunities for forest landowners. According to the 2003 DEM/DFE survey of forest landowners, one to five percent of landowners have commercially harvested an alternative forest product.

Suburbanization and the small size of most parcels of forestland make management for traditional wood products difficult for the typical Rhode Island landowner. DEM and the Rural Lands Coalition have cooperated to investigate and promote alternative forest products, such as edible and medicinal plants, specialty wood products, floral greens, or forest based recreation as an option for landowners who wish to actively manage their property and generate income to offset ownership expenses. It is the hope that such natural resource based economic development in rural areas will help prevent forest fragmentation. As part of this effort, using a grant from the USDA Forest Service, a website has been created:

<http://www.dem.ri.gov/programs/bpoladm/stratpp/forprod/forstprd.htm>

Brochures have also been developed and workshops co-sponsored with other organizations to educate landowners about the alternative forest products concept. Challenge grants were awarded to facilitate the startup of 28 alternative forest based businesses.

Fish and Wildlife Resources

Forests are the most common land cover type in the state and provide habitat for hundreds of species of wildlife. This includes 91 species of mammals, 427 species of birds, 300 species of freshwater and saltwater species of fish, 46 species of amphibians and reptiles⁴². Some species, such as warblers, are dependant on large tracts of unbroken forest while others use a mixture of land uses or depend on forests for only part of their life cycle. Many species of fish and amphibians depend on forest cover adjacent to their primary habitat to maintain optimal conditions in their habitat. Changes in Rhode Island's forest cover impact wildlife species that rely on it as habitat. The loss of forest through land conversion or subdivision of land into smaller parcels fragments habitat, limiting dispersal and threatens biodiversity.⁴³

Other than conversion to other land uses and fragmentation into smaller parcels, the age and tree composition of the forest has the greatest impact on wildlife. In Rhode Island, forests are maturing with sawtimber size stands, (those comprised predominately of trees greater than 10 inches in diameter (measured at breast height (DBH) -- a standard measure), now making up more than 51 percent of the state's forests. Generally, mature forests are beneficial for the most species of wildlife by virtue of their large, mast- producing trees, shrubs for food and cover, dead trees for feeding and nesting sites, and coarse woody debris on the forest floor.

Mast (acorns and nuts) comprises an important food source for many species of wildlife. Oaks are the most abundant trees found in Rhode Island forests, with mature oaks comprising 44 % of all trees. Other mast-producing trees, including beech and hickories, make up about 2 % of Rhode Island forests. Fruit

⁴¹ *Promoting Wood Industries*-,Secondary Directory, Southern New England Forest Consortium, 2000.

⁴² Rhode Island's Comprehensive Wildlife Conservation Strategy, September 2005

⁴³ Written communication from Richard Enser, RI Natural Heritage Program Coordinator, March 2005.

bearing trees, like cherry, black gum, and sassafras, comprises over 7 % of the trees in Rhode Island's forest⁴⁴. The size and species of a tree influence its value for mast production. As the forest matures, more mast is produced since larger trees are capable of producing more mast. White oak is the preferred food source for most species of wildlife. Due to naturally occurring events, the amount of white oaks in Rhode Island's forest is decreasing. This is balanced by the increase in other mast-producing trees like red oak, beech, and hickories. Figure 13 shows the trend in mast producing species in Rhode Island's forest.

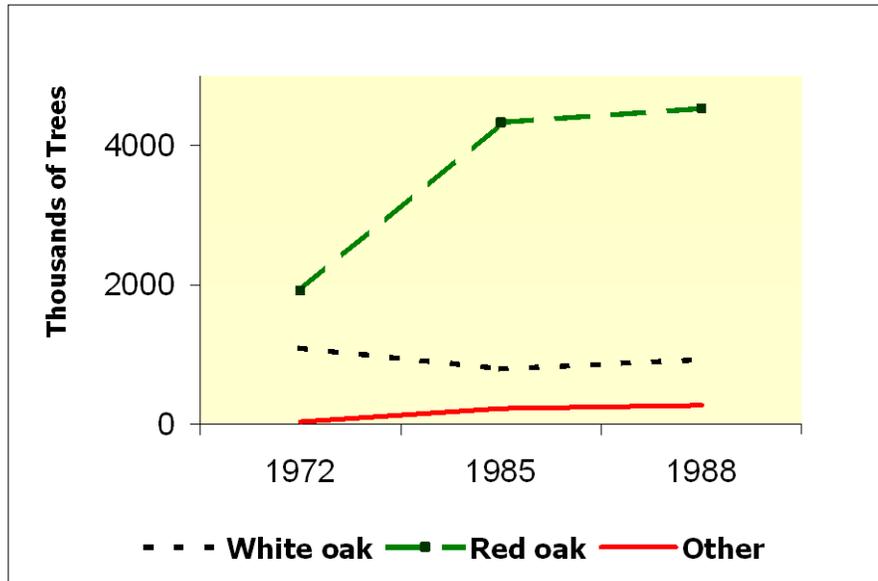


Figure 13
Number of Mast Producing Trees in RI Forests

Over 85 species of birds in Rhode Island use snags (standing dead trees) for nesting, shelter and feeding sites. This includes common birds such as chickadee, nuthatch, creepers or woodpeckers. Snags also provide essential habitat requirements for cavity-using amphibians, reptiles and mammals. Mature forests, especially those not intensively managed, usually have snags of various sizes and stages of decay to provide habitat. The number of snags in Rhode Island's forest is decreasing but, as shown in a USDA Forest Service Survey, there are still abundant snags to provide habitat for wildlife.⁴⁵

As previously stated, forest cover in Rhode Island increased starting in the early 1800's as abandoned farms reverted to forest. Continued farm abandonment, repeated clearing of forests for fuel, as well as forest fires kept a variety of age classes dispersed through Rhode Island's landscape through the 1950's. Since then, Rhode Island's forest has matured, with 51 percent now in saw timber size class according to the most recent forest survey. The lack of young forest impacts species that need the unique nesting and feeding habitat that these early successional areas provide, such as those shown in Table 1-1.⁴⁶ Table 1-1 shows species of nesting birds in Rhode Island of conservation concern in New England that are dependent on forest and early successional habitats as based upon analysis by *Partners in Flight* (a regional bird conservation collective).

⁴⁴ United States Department of Agriculture, Forest Service Resource Bulletins NE-149 and NE-INF-155-03, *Rhode Island Forest Facts: 1959 – 60, Forest Statistics for Rhode Island: 1985 and 1998*, November 2000.s

⁴⁵ Ibid.

⁴⁶ Written Communication from Richard Enser, RI Natural Heritage Program Coordinator, March 2005.

**Table 1-1
Species Associated with
Early Successional Habitat⁴⁷**

Common Name	Scientific Name
Cerulean Warbler	<i>Dendroica cerulean</i>
Wood Thrush	<i>Hylocichla mustelina</i>
Worm-eating warbler	<i>Helmitheros vermivorus</i>
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>
Louisiana Waterthrush	<i>Seiurus motacilla</i>
Baltimore Oriole	<i>Icterus galbula</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>
Scarlet Tanager	<i>Piranga olivacea</i>
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>
Blackburnian Warbler	<i>Dendroica fusca</i>
Canada Warbler	<i>Wilsonia canadensis</i>
Eastern Wood-Pewee	<i>Contopus virens</i>
Black-and-white Warbler	<i>Mniotilta varia</i>
Northern Parula	<i>Parula americana</i>
Hairy Woodpecker	<i>Picoides villosus</i>
Purple Finch	<i>Carpodacus purpureus</i>
Northern Goshawk	<i>Accipiter gentilis</i>
Red-shouldered Hawk	<i>Buteo lineatus</i>
Long-eared Owl	<i>Asio otus</i>
Sharp-shinned Hawk	<i>Accipiter striatus</i>
Cooper's Hawk	<i>Accipiter cooperii</i>
Barred Owl	<i>Strix varia</i>
Early Successional Shrub/Pitch Pine Barrens	
Blue-winged Warbler	<i>Vermivora pinus</i>
American Woodcock	<i>Scolopax minor</i>
Eastern Towhee	<i>Pipilo erythrophthalmus</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>
Yellow-breasted Chat	<i>Icteria virens</i>
Prairie Warbler	<i>Dendroica discolor</i>

(Bolded species = highest priority)

Maintaining healthy and diverse wildlife populations requires that a range of forest types and age classes be well distributed across the landscape to insure habitat needs of a variety of species are met. Priority upland wildlife habitats that are of conservation concern include early successional forest, shrub-scrub dominated habitats, old fields and grass-herbaceous dominated areas.

Interest in hunting and fishing has remained strong as shown through license purchases (See Figure 14). The focus of wildlife habitat management on State owned property has been directed toward game species, such as ring necked pheasant, ruffed grouse, and white tailed deer. Interest in hunting on private property has increased -- with 18 percent of landowners responding to the 2003 DEM/DFE Survey allowing hunting, but a large number also reporting hunting as an unauthorized use.

⁴⁷ Ibid

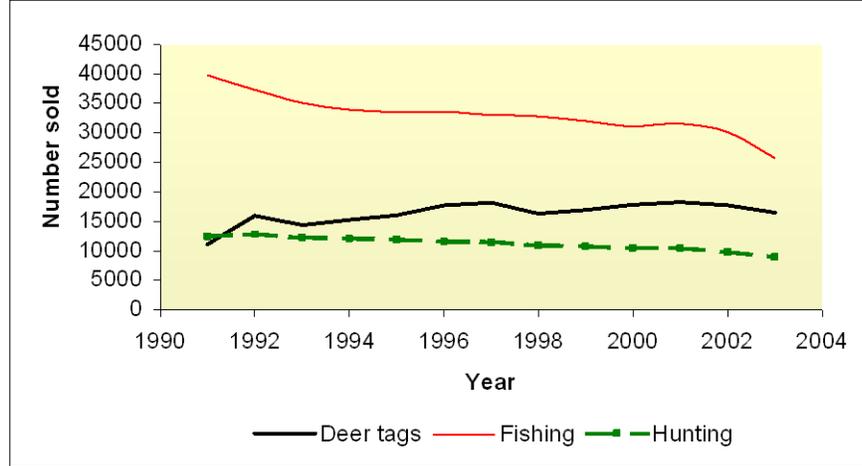


Figure 14
RI Hunting and Fishing License Sales

Nearly 20 percent of respondents to the forest landowner survey used their land for recreational purposes including wildlife observation. Non-game species play an integral role in the ecological integrity and diversity of an area, in addition to providing immeasurable values to those who study and enjoy observing wildlife.

In Rhode Island, the DEM designates species in danger of extinction throughout all or a significant portion of their ranges as “endangered”, while those likely to become endangered in the foreseeable future are considered “threatened”. In Rhode Island there are six endangered and eight threatened species identified by the State. Of these, six depend exclusively on the forest for survival.

Forest management for wildlife on a statewide level consists of acquisition of habitat and management of parcels controlled by DEM for game species. A comprehensive state wildlife conservation plan has been developed by DEM to focus and coordinate conservation planning efforts. The goals of the plan are to assess the status and needs of wildlife, including identification of species of greatest concern and habitat of greatest need, and to develop and prioritize conservation actions. The *RHODE ISLAND'S COMPREHENSIVE WILDLIFE CONSERVATION STRATEGY* can be found in electronic format at:

<http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/swgplan.pdf>

Calls were made to the National Fish and Wildlife Office at the Ninigret National Wildlife Refuge in Charlestown, RI without any return calls. Forest land is very minimal and not considered critical enough to require involvement.

Forest Carbon Dynamics

Forests store carbon, atmospheric carbon dioxide (CO₂), by converting it to woody biomass. Therefore one potential mechanism to reduce carbon emissions is by increasing carbon sequestration in forests. The forest is a complex and ever changing ecosystem and is being studied to evaluate its role in reducing greenhouse gases. In the forest, carbon is stored as biomass in vegetation; in trees this is the woody biomass. This biomass is stored in several carbon sinks, standing woody vegetation, and in the soil; in the root mass, debris and in very small amounts the mineral soil itself. Managing Rhode Island’s forests to produce higher quality trees, which will be utilized as high value commercial wood products, could increase carbon sequestration.

In a managed forest where timber is extracted and another sink is added, wood products, although this carbon initially removed from the forest, long-term, high value carbon storage can be obtained in commercial products, i.e.; dimensional lumber stock, furniture stock and timber framing materials. This is an important sink and management strategy.

The DEM and the State Energy Office have convened stakeholders from business, industry, citizen groups, environmental organizations, and other government agencies to address what the state and citizens can do to address the challenge of global climate change in a report entitled "*The Forestry, Agriculture and Land Use Change Strategies for Reducing Greenhouse Gas Emissions in Rhode Island, Report to the Working Group of the Rhode Island Greenhouse Gas Process*". The report is in Appendix D.

Priority Forest

Value layers used in initial assessment of priority forest areas:

- Conservation Lands – includes all federal, state, local and NGO lands permanently protected from development.
- Core Habitat – those areas of land lying at least 1000 meters from a road, critical habitat areas as outlined in State Wildlife Action Plan, Comprehensive Wildlife Conservation Strategy (CWCS).
- Water Supply – any lands encompassed within a State designated surface or groundwater drinking water supply protection area, aquifer or aquifer recharge area.
- Pitch pine habitat identified by the State Natural Heritage Biologist.
- Areas able to produce clean water as identified by the USFS.
- Blocks of contiguous forest > 500 acres and having a compact form and non-convoluted perimeter (calculation comparing area & perimeter of polygon to that of a circle of the same area).
- Areas of greater than average density of State Natural Heritage Data element occurrences.
- State Conservation Priority Areas including areas targeted by DEM, TNC, Audubon and others for permanent protection through fee title or conservation easement interest.
- State Forest Legacy Areas.

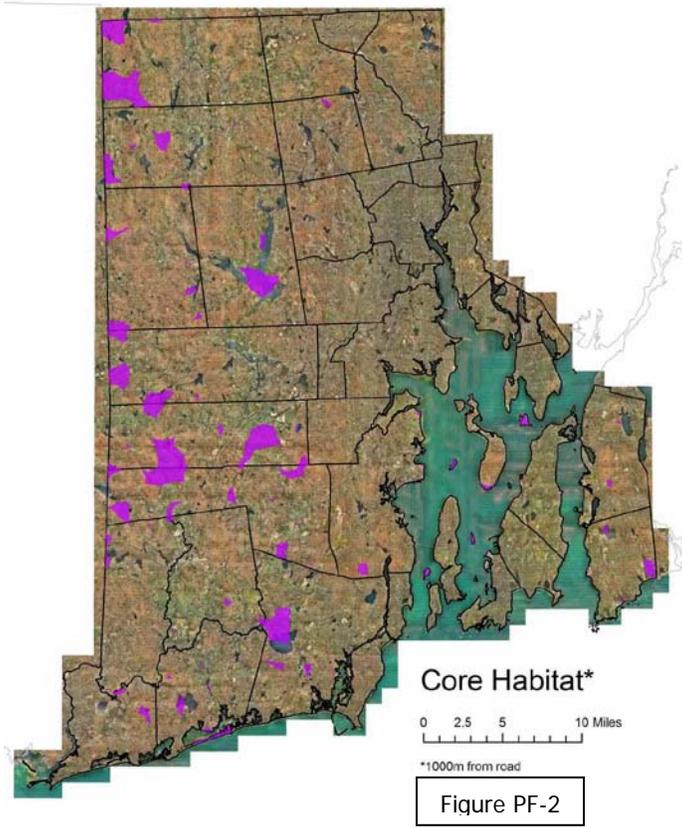
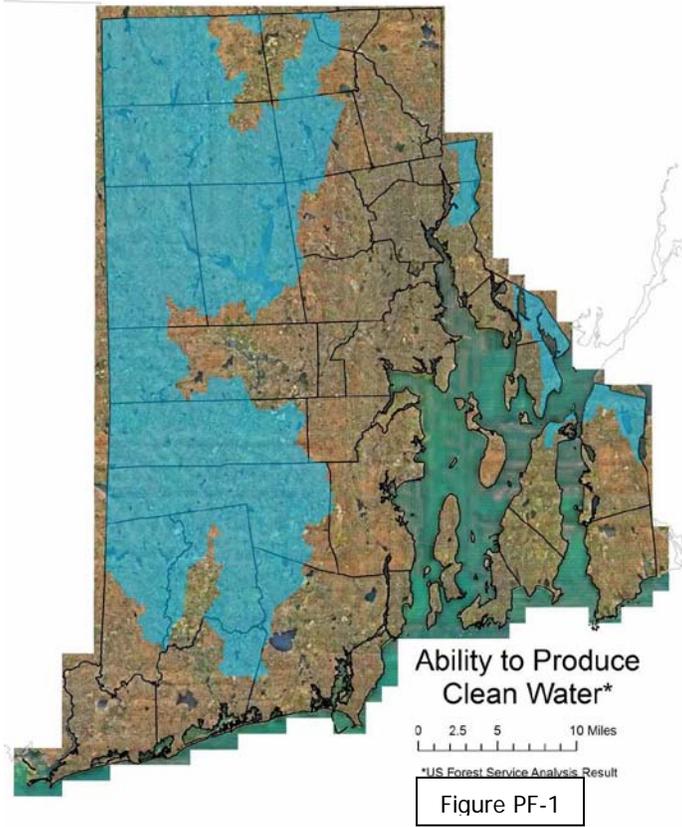
The initial analysis was a simple raster addition in which each input layer was coded 0 or 1 for presence/absence of the value represented. From this, a number of layers were developed for presentation to the stakeholder group, figures PF-1 through PF-9.

During the stakeholder presentation each input layer was presented and discussed for its relevance. There were no suggestions for additions or exclusions. Next the results of the raster addition were presented with only areas having three or more coincident values (i.e.: a raster value of 3) Initial Priority Forest, figure PF - 10.

During the second Priority Forest stakeholder discussion the group expressed a desire and concluded to have a more inclusive definition of the priority forest since data seemed to be lacking from those areas of large private forest landowners. It was discovered that Density of Natural Heritage Occurrence, Figure PF -3 was sparse due to the more intensive survey data within state lands.

Given the stakeholder preference for a more inclusive view of the Priority Forest, figure PF- 11 shows the result of including all areas containing at least one of the value layers. This area very closely approximated the Urban Service Boundary. This image gives the best geospatial image however it should be noted that the priority forest areas also included city and community parks but due to size did not show up well in the final image.

During the Land and Water Conservation Summit, March 27, 2010 with attendance of over 300, some 60 people chose the entire state as their Priority Forest. This opinion was also expressed by many at the April 29, 2010 Advisory meeting but in the end a final version of the Priority Forest, Figure PF 11 was unanimously approved.



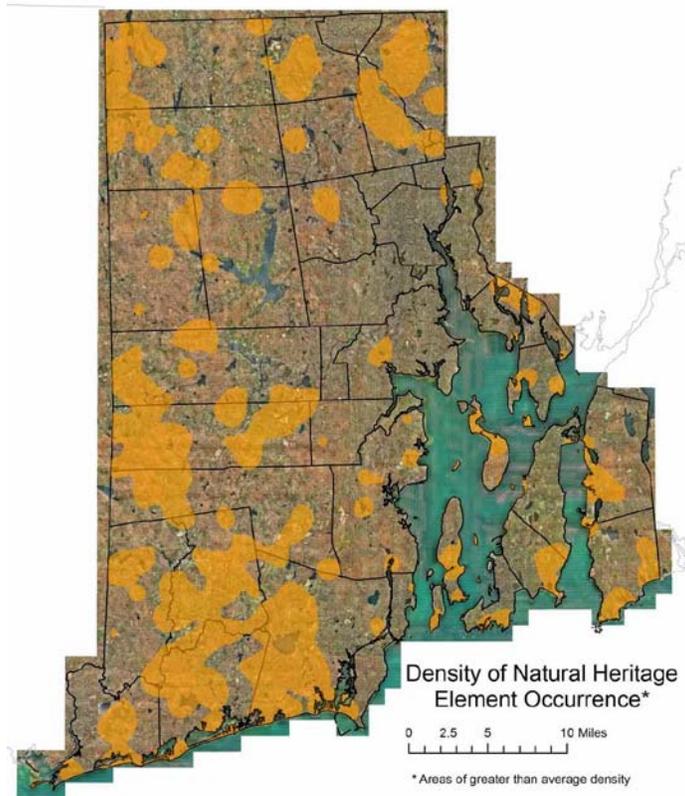


Figure PF-3

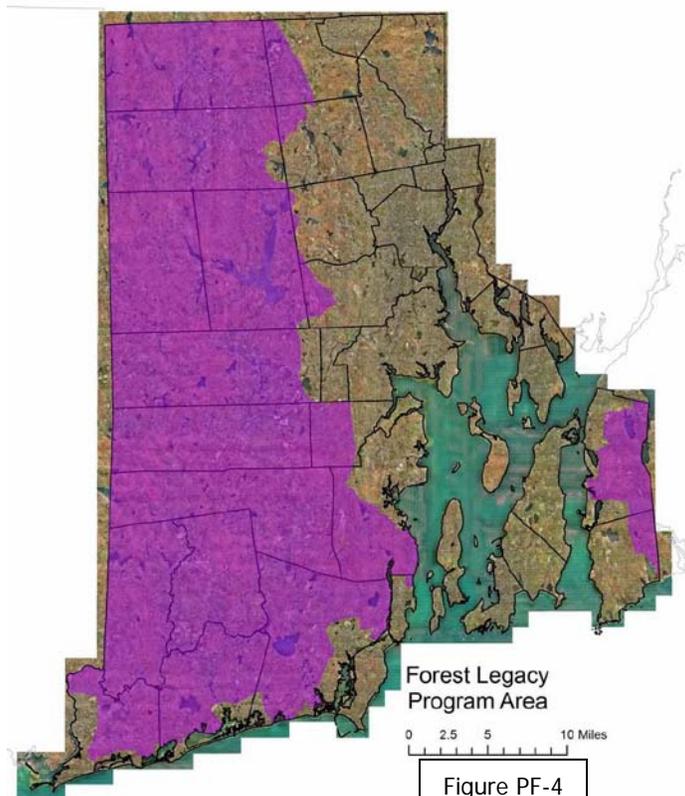


Figure PF-4

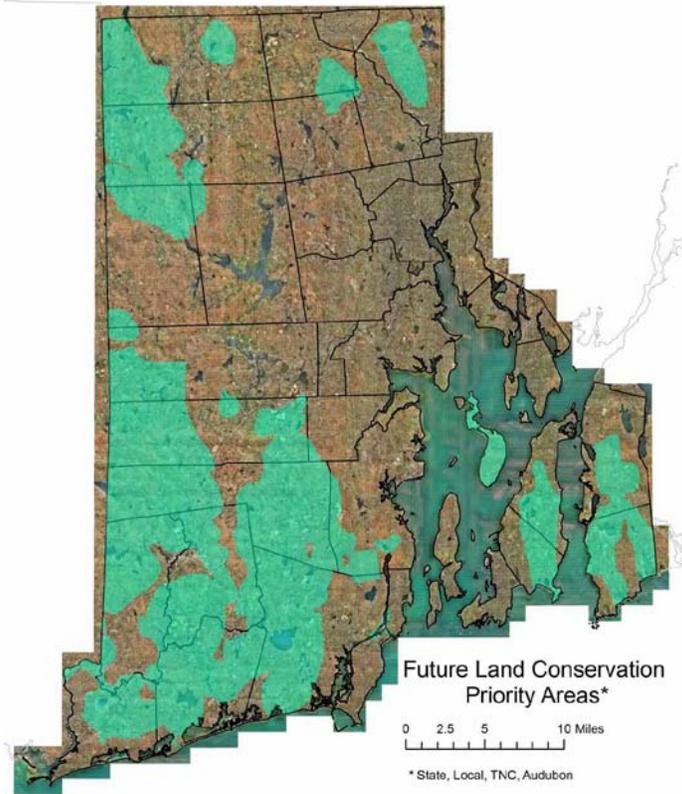


Figure PF-5

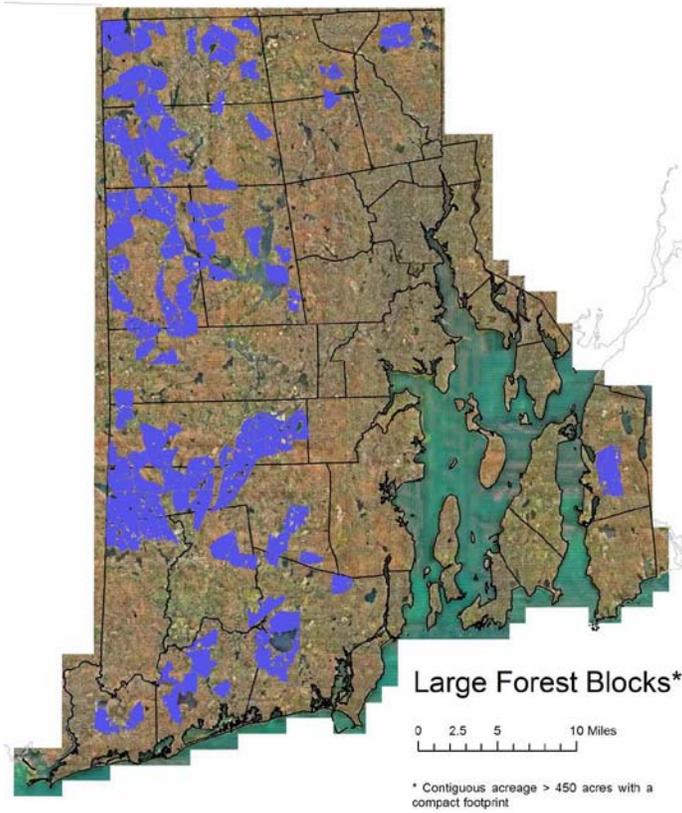


Figure PF-6

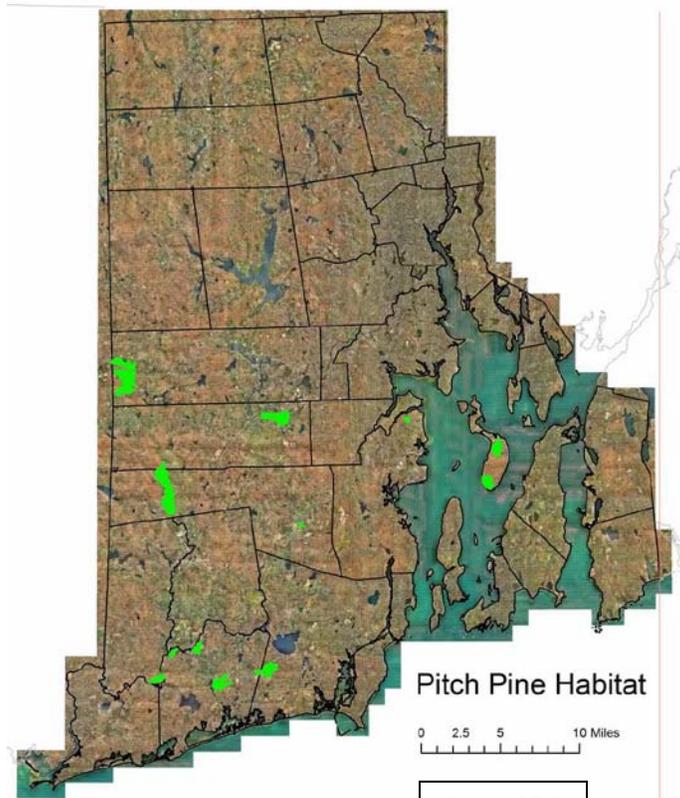


Figure PF-7

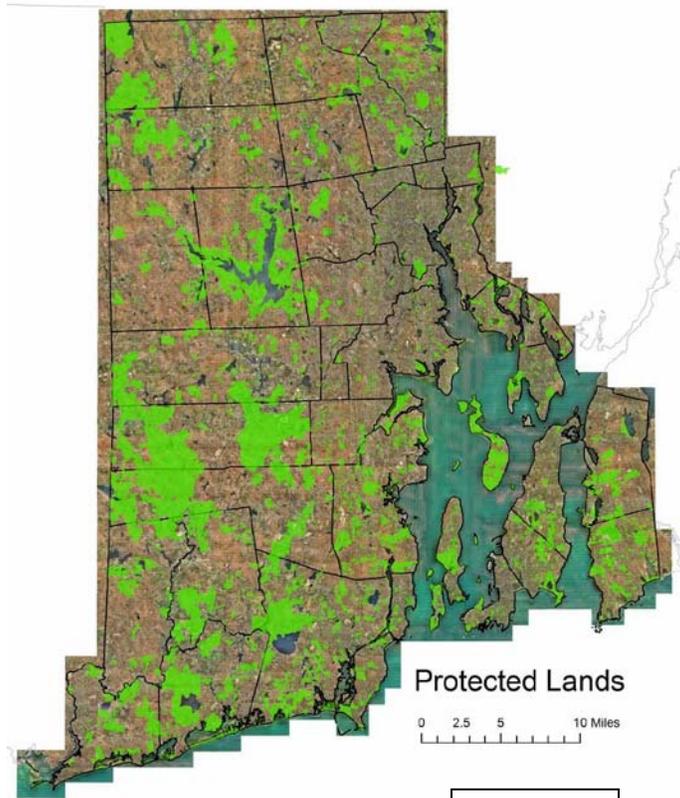


Figure PF-8

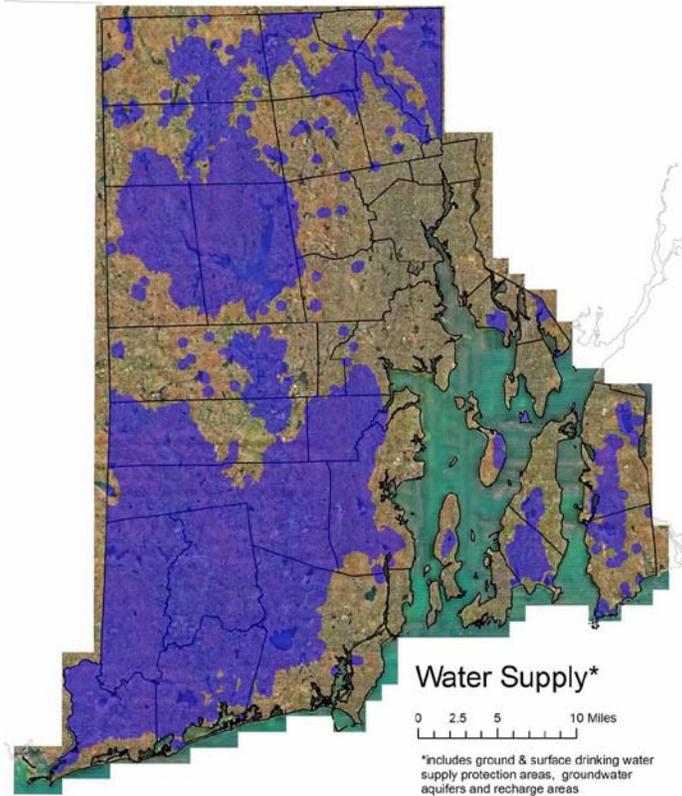


Figure PF-9

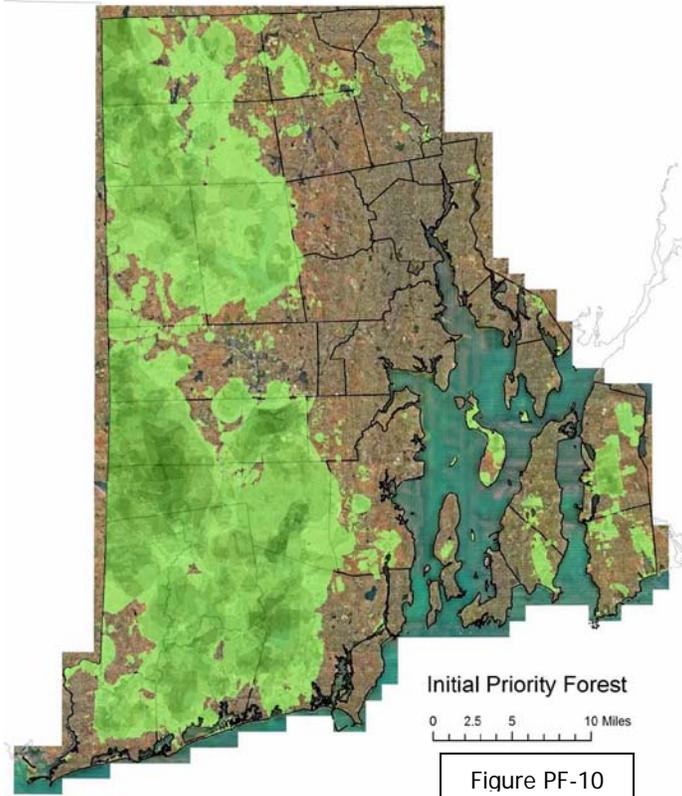


Figure PF-10

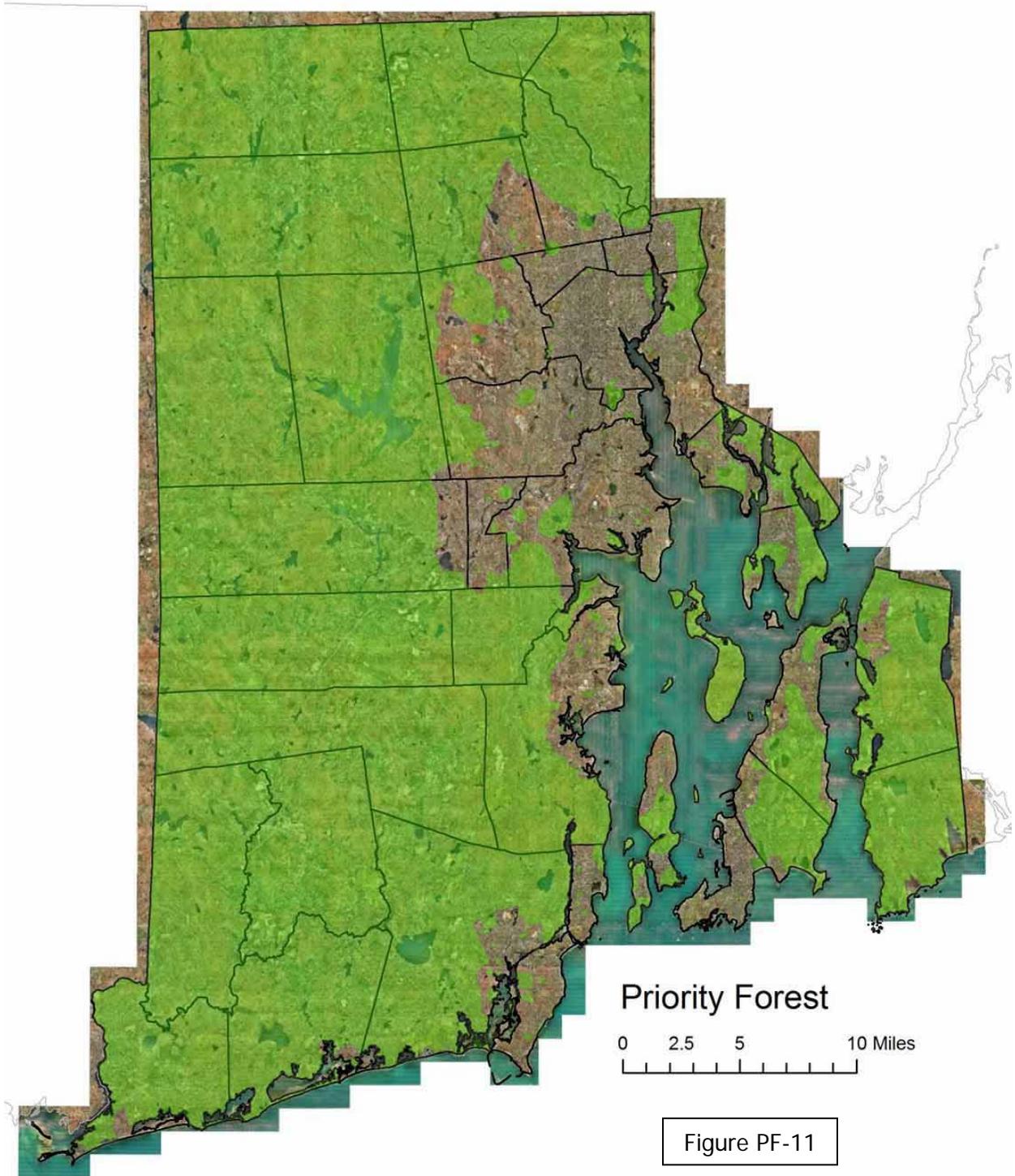


Figure PF-11

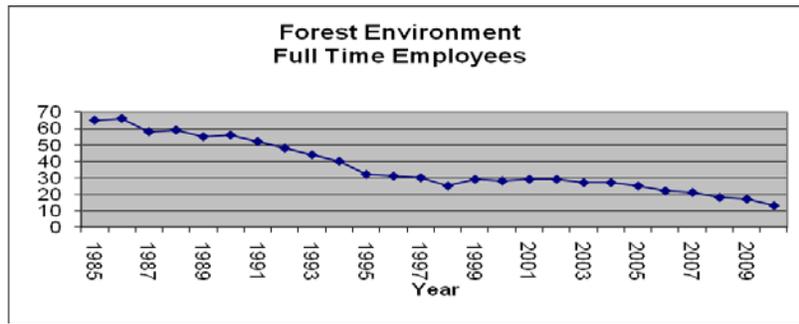


Figure 15
Division of Forest Environment Full Time Employees

Capacity to Deliver Programs Needs

The ability for the Rhode Island Division of Forest Environment to carry out program needs is at an all time low with only thirteen full-time employees, (FTE's), and five professional foresters. An increase in forestry programs and the State Administration's freeze on hiring FTE's have forced the Division into innovative partnerships and alternative contractual methodologies. This trend is not new and should not be blamed on the current economical environment as the Figure 15 shows a steady decrease in FTE's started in the late 1980's. Programs are systematically changed from FTE's to contractors as staff transfers to other state employment or retires. The success of the contractual arrangements has only maintained a contractor for in one program for less than one year before losing that first contractor to an outside job opportunity. The loss of FTE's creates several losses to the forestry programs; the transfer of institutional knowledge is lost and untold information on past conditions of the state's forest and previous methods attempted to resolve past problems and threats. The need to retrain new contractors as they are hired costs valuable time needed for training. The cost of time is lost to other programs needs further limiting the ability of the Division to carry out much needed programs much less the attempt to develop new programs required to maintain the forest ecology due to ever changing environmental and health threats to the forest. Additional staff must be added to continue forestry program delivery, this especially applies to in line supervisory positions.

Other Values

Since forests cover a large part of Rhode Island their extent and condition obviously have a major influence on the character of the state. Forests, and the trees comprising them, provide a wide range of amenities described both in this plan and in the *Rhode Island Urban and Community Forest Plan*, State Guide Plan Element 156 (1999). The Urban Forest Plan provides information, assesses issues and presents strategies for improving and expanding the state's tree resources. Adopted by the State Planning Council, the Plan must now be used by cities and towns in developing and implementing their own local comprehensive plans. It is both the *Rhode Island Urban & Community Forestry Plan* and this Forest Resources Management Plan that when applied in conjunction with one another are "intended to advance the effectiveness of local stewardship of the state's resources towards the twin goals of a healthy, sustainable economy and environment."

Some attributes such as the aesthetic, social or cultural value of forests are difficult to measure but obviously have a positive impact on Rhode Island's quality of life. DEM/DFE's 2003 survey of forest landowners found the most important reason people own forest of Rhode Island is that they want to live in a forest setting. Home sites in a forested setting may be more attractive to potential buyers. A study on Aquidneck Island found property values 3 to 12 percent higher associated with properties closer to open space. The impact differed with the type of open space, size of the open space parcel, and distance between the home and open space parcel.⁴⁸

⁴⁸ *Aquidneck Island and Open Space: An Economic Perspective*, Aquidneck Island Partnership. Coastal Resources Center, University of Rhode Island. Rhode Island Sea Grant Publication P1461.

Part 3: Forest Resource Management Entities in Rhode Island

Although Rhode Island's forests are often times overshadowed by Narragansett Bay, our forested ecosystem is a valuable natural resource offering a wide variety of opportunities and benefits to the state, its residents and visitors. Our forests help clean the air and water, provide a renewable natural resource for building materials and other products, fuel for heating and electric power, and provide recreational and educational opportunities. With all these benefits and resources, and given the complexities of governmental interests and forest ownership patterns; it is not surprising that a partnership of federal, state, and local agencies, as well as private for-profit and non-profit organizations are needed in order to maintain the diverse forest resource. It is through the coordinated efforts of this multitude of jurisdictions, agencies, organizations and personnel involved in aspects of forest management and conservation that future generations will be able to continue to enjoy the benefits that our forested lands provide.

Federal Agencies and Programs

Federal involvement in forest resource management occurs principally through several agencies and programs of the U.S. Department of Agriculture:

United States Department of Agriculture (USDA)
Forest Service
<http://www.fs.fed.us/spf/>



The State and Private Forestry (S&PF) organization of the USDA Forest Service reaches across the boundaries of National Forests to states, tribes, communities and non-industrial private landowners. S&PF is the federal leader in providing technical and financial assistance to the State, landowners and resource managers to help sustain the nation's forests and to protect communities and the environment from wildland fires. S&PF programs bring forest management assistance and expertise to a diversity of landowners, including, tribal, state, and federal, through cost-effective, non-regulatory partnerships.

The 2008 Farm Bill granted expanded authority and provided resources for the U.S. Forest Service to work with states on urban and community forestry. A 15-member Urban and Community Forestry Advisory Council was established and \$25 million in annual funding authorized for community programs. The Urban and Community Forestry Assistance Program offers technical assistance, education, and partnerships to communities and organizations. The America the Beautiful Act, passed in 1990, seeks to stimulate planting and improving trees in every rural area, town, and city across the country. Funding is provided for each state to create an urban forestry coordinator and to establish state urban forestry councils. Grants for tree planting programs are authorized.

In addition to providing state and local grants, the U.S. Forest Service has also taken a leadership role in region-wide planning for urban forestry resources. The Northeastern Area office of the Forest Service has developed and is implementing an Urban Forestry Five Year Plan 1995-1999, including objectives for awareness, outreach and environmental equity, partnerships, and comprehensive natural resource management.

The Forest Legacy Program helps private forest landowners, state and local governments preserve environmentally important forest lands by providing funds to state governments for the acquisition of land or conservation easements over the forested lands offered by willing sellers. Eligible lands must provide aesthetic, recreational, water quality protection, and habitat benefits and must be within identified Forest Legacy areas established as priorities by the State. Funding for the program by the Congress has been on an annual basis since the Program's creation in 1990.



The Natural Resources Conservation Service, (NRCS), formerly known as the Soil Conservation Service, works hand-in-hand with the people of Rhode Island to improve and protect their soil, water and other natural resources. For decades, private landowners have voluntarily worked with NRCS specialists. NRCS employs soil conservationists, soil scientists, agronomists, biologists, engineers, geologists and resource planners. These experts help landowners develop conservation plans, create and restore wetlands, restore and manage other natural ecosystems as well as advise on storm water remediation, nutrient and animal waste management and watershed planning.

State Agencies and Programs

Several Rhode Island state agencies have designated responsibilities for management of forest resources or programs that support forest resources management. These include:



Department of Environmental Management (DEM)

<http://www.dem.ri.gov/>

This is the web page address for locating information on the DEM. Each division that is described below has a web URL or link that can be located on this home page. The individual URL for the Division of Forest Environment is included specifically due to its main responsibility of implementation of this Plan.

DEM Overall Mission:

- Enhance the quality of life for current and future generations by protecting, restoring and managing the natural resources of the state; enhancing outdoor recreational opportunities; protecting public health; and preventing environmental degradation.
- Achieve a sustainable balance between economic activity and natural resource protection.
- Motivate citizens of the state to take responsibility for environmental protection and management, based on an understanding of their environment, their dependence on it, and the ways their actions affect it.

Within DEM, the principal entity for forest resource is the Division of Forest Environment (DFE), but several of the Department's Divisions and Offices have direct or indirect roles or administer programs affecting the state's forests:

Division of Forest Environment (DFE)

<http://www.dem.ri.gov/programs/bnatres/forest/index.htm>

DFE Mission

- Working to ensure healthy sustainable forests for Rhode Island's future.

The Forest Environment Program manages approximately 40,000 acres of state-owned rural forestland. It coordinates a statewide forest fire protection plan, provides forest fire protection on state lands, assists rural volunteer fire departments, and develops forest and wildlife management plans for private landowners who choose to manage their property in ways that will protect these resources on their land. The Program promotes public understanding of environmental conservation, enforces Department rules

and regulations on DEM lands, and assists the federal government in providing landowner assistance programs.

Additional Program mandates are: to monitor and recommend controls for insects and disease, to work with communities promoting urban tree health, to license arborists, and to certify forest land under the state's Farm, Forest and Open Space Act. Major functions carried out by the Program include: Operation and maintenance of 40,000 acres of state land under DEM/DFE jurisdiction, Forest Fire Control, Law Enforcement, Forest Management, Insect & Disease Management, Forest Health Monitoring, Landowner Assistance Programs, Urban and Community Forestry Program, Conservation Education Program, Forest Legacy Acquisition Program, Timber Sales, Arborist Licensing - Tree Warden, and Recreation Management.

The Program manages George Washington Campground, as well as three intensively used beaches, a horseman's campground and a cross-country skiing area. Additional staff is required (as part of the federal grant programs) to assist in programs including stewardship, forestry cost share incentives, urban and community forestry, insect and disease control, forest health monitoring, forest legacy, and arborist licensing programs.

Office of Strategic Planning & Policy

The Office of Strategic Planning and Policy is responsible for developing policies and plans to meet the goals of the Department; working with constituents and stakeholders to develop and implement strategies to meet the goals; conducting research on environmental and natural resource stewardship issues as well as departmental functions; developing environmental indicators and performance measures; developing and maintaining systems to track progress; analyzing and reporting on progress and results; and making recommendations for continuous improvement. **Expired 2009**

Sustainable Watersheds Office

The Office assists communities to plan for sustainable development that minimizes negative impacts to the environment and preserves community character and meaningful open space. The Office also helps communities identify and protect their important natural, cultural and recreational resources. The Office coordinates activities in watersheds, assisting to prepare and implement watershed action plans.

A current project in this office is the Alternative Forest Products Business Challenge Grant. Alternative forest uses may be an option for landowners who wish to actively manage their property and may provide an additional incentive for large landowners to retain their land. Managing for alternative forest uses may provide new ways for landowners to generate income (at least enough to pay property taxes) and may have the potential to develop into a small business. **Expired 2009**

Division of Law Enforcement

The Division enforces Rhode Island's laws and regulations governing the recreational take of fish and wildlife. Over 12,000 hunting licenses, 39,000 fishing licenses, and 15,000 deer hunting permits are sold each year. These recreational activities support a healthy sporting goods industry in Rhode Island. The fish and wildlife laws are designed to ensure the long-term viability of these resources and thereby provide for the long-term viability of the sporting goods industry. Game regulations enforced by the Division also facilitate hunter safety. Enforcement of game regulations takes on additional importance as suburban development encroaches on woodlands and increases the possibility of interactions between hunters and homeowners.

Division of Fish and Wildlife

The Division of Fish and Wildlife protects, restores, and manages the fish and wildlife resources of the state. The Division is responsible for operating and managing approximately 21,180 acres of state-owned land. The Division is responsible for setting seasons, size limits, methods of taking, and daily limits for the harvest of all wildlife as well as all recreational and commercial fisheries in the state. It is divided into three separate sections: Marine Fisheries, Freshwater Fisheries, and Wildlife Management. Each section is responsible for specific program activities. These activities include fisheries and wildlife research and management, freshwater fish hatcheries and fish stocking programs, habitat restoration, public access, land acquisition, education and information, public angling and hunting programs, and commercial fisheries management.

Division of Planning and Development

The Division of Planning and Development is responsible for several related and wide ranging Departmental functions. The functions of this division related to the management of forest resources include:

- Land Acquisition and Real Estate: the Division administers four programs designed to accommodate land acquisitions. The programs are the Agricultural Land Preservation Program, State Land Acquisition, Forest Legacy, and the North American Wetland Conservation Act.
- Local Open Space and Recreation Development Grants: awards and administers grants from state and federal funds to communities, land trusts and non-profit environmental groups for development of recreation facilities and acquisition of open space.
- Natural Heritage Preservation Program: conducts an inventory of the state's rare and endangered species and maintains a database of rare species and habitats that is used for land conservation planning and environmental review.
- Capital Development Projects: plans, designs and supervises construction of new state park and beach facilities, commercial fishing pier improvements, boat ramps, fish hatcheries and other DEM-managed facilities.
- Geographic Information System (GIS): to coordinate the mapping and analysis of spatial environmental data, provide technical support to GIS users in the Department, and to maintain the GIS database.
- Bikeway and Trail Development: to administer and coordinate with the Department of Transportation, bikeway and multi use trail programs through grants to state agencies, communities and non-profits.



Department of Administration (DOA)

Rhode Island Statewide Planning Program (RISPP)

<http://www.planning.ri.gov>



RISPP Mission

To prepare and maintain plans for the physical, economic, and social development of the State; to encourage their implementation; and to coordinate the actions of state, local, and federal agencies and private individuals within the framework of the state's development goals and policies.

It is the responsibility of the RISPP staff to relate this Forest Resources Management Plan to other relevant Guide Plan Elements and to work cooperatively with the DEM/DFE and others for its implementation.

Water Resources Board

<http://www.wrb.ri.gov/>



Big River Management Area

The primary role of the Water Resources Board (WRB) is to oversee the proper development, protection, conservation and use of the state's water supply resources. The WRB is included in this Section as it has authority over the second largest forested parcel owned by the state. This area is the Big River Management Area. It consists of approximately 8600 acres of open space. Its borders extend through portions of the towns of West Greenwich, East Greenwich, Coventry, and Exeter. Largely undeveloped, the land was originally acquired for water supply purposes. The forest resources of the property are managed by the DEM DFE for the WRB under contract, and in accordance with the 1996 Big River Management Area Land Use Study. This study established guidelines for uses that would not impact future water supply including wildlife management, sustainable forestry, historic preservation, environmental education, and passive recreation. See page 24 for the DEM/DFE responsibilities related to the Big River Area. The management policies can be viewed at:

http://www.wrb.ri.gov/program_pm.htm

Municipal Entities

Several municipal government entities have important functions relating to the management of Rhode Island's forest resources. Comprehensive plans and municipal land management regulations adopted to implement their provisions can support the principles of forest resource management and conservation. Municipal tax administration can support the retention of land in forests via promotion and support of enrollment of appropriate properties in the Farm, Forest, and Open Space Act. State law authorizes the appointment of municipal conservation commissions and municipal tree wardens; both of these entities can assist in resource inventories and in developing and promoting conservation and effective management of forestland. Several communities have municipal land trusts, which actively pursue the acquisition of land as public open space, others have town forests and a few have their own tree boards to work on local tree issues.



Non-Profit Organizations

R.I. Forest Conservators' Organization (RIFCO)

<http://www.rifco.org>



The Rhode Island Forest Conservators' Organization is a non-profit organization dedicated to the protection and wise use of Rhode Island's woodland resources. RIFCO works to promote the stewardship of Rhode Island's wooded lands and watersheds and better awareness of the role of a healthy forest in improving environmental conditions. It works with its members, many of whom own and manage significant forestlands, to provide information and educate the public on issues affecting Rhode Island's forests. In addition to forest landowners, RIFCO members include natural resource professionals, land trust and forest product industry representatives, and citizens concerned with forest conservation issues.

Southern New England Forest Consortium (SNEFCI)

<http://www.snefci.org>



The Southern New England Forest Consortium, Inc. is a nonprofit forest conservation organization that promotes forest conservation ethics and the productive use of the region's forests and natural resources. SNEFCI's mission is to promote programs, policies, and partnerships within southern New England that work to ensure the future of the region's forest resources and improve the quality of life for its citizens. The diverse membership includes natural resource professionals, private enterprise and citizens from Massachusetts, Connecticut and Rhode Island. Established in 1985, SNEFCI works to conserve the forests of southern New England through a variety of programs aimed at reducing fragmentation of forest land and open space, promoting the stewardship of forest resources, and enhancing urban and community forests. **Expired 2009**

Rhode Island Tree Farm

<http://www.treefarmssystem.org>

The American Tree Farm System[®] (ATFS), a program of the American Forest Foundation, is committed to sustaining forests, watershed and healthy habitats through the power of private stewardship. Since 1941, ATFS has educated and recognized the commitment of private forest owners in the United States. Currently, ATFS has 33 million acres of privately owned forestland and 51,000 family forest owners who are committed to excellence in forest stewardship, in 46 states. Tree Farmers share a unique commitment to protect wildlife habitat and watersheds, to conserve soil and to provide recreation for their communities while producing wood for America. These individuals hold the key to the kinds of forests, forest activities and forest resources future generations of Americans will enjoy. For local information contact the DEM DFE.

Society of American Foresters (Rhode Island Chapter)

<http://www.safnet.org>



The Society of American Foresters (SAF) is the nonprofit national scientific and educational organization representing the forestry profession in the United States. Founded in 1900 by Gifford Pinchot, it is the largest professional society for foresters in the world. The mission of the Society of American Foresters is to advance the science, education, technology, and practice of forestry; to enhance the competency of its members; to establish professional excellence; and, to use the knowledge, skills, and conservation ethic of the profession to ensure the continued health and use of forest ecosystems and the present and future availability of forest resources to benefit society. SAF members include natural resource professionals in public and private settings, researchers, CEOs, administrators, educators, and students. For local information contact the DEM DFE.

The Nature Conservancy (Rhode Island Chapter)
<http://nature.org/wherewework/northamerica/states/rhodeisland>



Mission: To preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

The Nature Conservancy works closely with government organizations, communities, businesses and people in a non-confrontational approach to achieve their mission using a science-based plan that achieves tangible results. The Nature Conservancy preserves the white pine forests, rivers, wetlands and habitats that make Rhode Island unique. Thanks to the support of The Nature Conservancy members and volunteers, TNC has protected 24,000 acres of critical land and waters throughout the state.

Audubon Society of Rhode Island, (ASRI)
<http://www.asri.org/>



The mission of the Audubon Society of Rhode Island is:

- To carry out a broad program of public environmental education,
- To foster conservation of wild birds and other animal and plant life,
- To conserve wildlife habitat and unique areas through acquisition or other means,
- To focus public attention on natural resource problems,
- To provide leadership when action on natural resource problems is necessary, and
- To do all other things necessary to foster better management of the natural environment for the benefit of people and all other life.

ASRI continues to devote its energies to improving the use, management and protection of all natural resources and the environment for the benefit of humans and all other forms of life. The ASRI manages over 9,500 acres of land protected for wildlife habitat and public recreation. It also advocates, monitors and speaks out for a clean and healthy environment.

Rhode Island Tree Council
<http://www.ritree.org/>



The Rhode Island Tree Council was established in 1991 as a non-profit citizens' group dedicated to sustaining, improving, and expanding tree resources. The Council's vision is "A Flourishing Forest Ecosystem" accomplished through increased public awareness, good planning, knowledgeable volunteers, and proper tree planting. In March 1997, to assist the public in identifying our organization, the Rhode Island Urban and Community Forest Council simplified its name to the Rhode Island Tree Council. A Board of Directors representing a diverse range of interests and organizations guides the Council.

The Council conducts educational and professional workshops, disseminates technical information, sponsors awareness campaigns, and in conjunction with the state Division of Forest Environment and the United States Forest Service, distributes competitive grants to communities and non-profit groups for tree planting and care. The Council also strives to encourage elected officials, business leaders, and private citizens to form partnerships leading to the development and implementation of planting and stewardship programs at the local level. The assistance from the Council has led communities to create outreach efforts to broaden public involvement in the many dimensions of urban forestry.

The Rhode Island Land Trust Council
<http://www.rilandtrusts.org/>



The Rhode Island Land Trust Council is a coalition of land trusts - community organizations with a mission of protecting land to preserve open spaces, natural areas, scenic character, farmlands, forests, historic sites, watersheds, and drinking water areas that uniquely define Rhode Island and its communities. Established in 1999 by the leadership of the state's land trusts, it seeks to foster a sustainable land conservation movement in the State of Rhode Island by supporting the missions and operations of land trusts and providing a forum for their effective cooperation. The Council strives to increase land trusts' capacity to protect land, coordinate efforts, exchange ideas and information, share technical expertise, and to affect state policy and initiatives. Collectively, we are preserving the heritage of our communities so that it remains a legacy for future generations.

One-third of the 45+ land trusts in Rhode Island are "municipal land trusts" formed by municipal charter, municipal ordinance or state enabling legislation. The remaining two-thirds are 501(c) 3 non-profit organizations. Only 3 of Rhode Island's land trusts have staff; the other 43 are volunteer organizations. Through their involvement with local land trusts, dozens of people across the state are directly involved in protecting and managing their community's special places, natural areas, farmland, scenic areas, watersheds, and drinking water supplies.



Part 4: The Vision, Issues, Goals, Policies, Objectives and Strategies

In July 2003, the Division of Forest Environment held its first meeting in the process of updating the Forest Resources Management Plan, (FRMP), State Guide Plan Element 161. At that meeting 30 people representing various stakeholder groups were invited to discuss the FRMP and its direction. It has been twenty years since the original plan was completed. The group developed issues to be explored in the updated plan. The issues decided upon were (not in any priority order):

1. Forest Resource Management Statewide
2. Sustainability
3. Information & Education
4. Forest Health
5. Forest Products Marketing
6. Water Resources
7. Recreation and Tourism
8. Fragmentation
9. Wildfire Control
10. State Land Forest Management

In September 2003, the State Planning Council appointed a State Forest Resources Management Plan Advisory Committee (FRMPAC) to advise the Council in the preparation of this plan update. In December of 2003, a 50-question survey, (see Appendix B), was mailed to 2,819 forest landowners owning 10 or more acres of land in 13 communities identified as rural by the RI Statewide Planning Program⁴⁹. 645 questionnaires were returned and tabulated by March 2004 – a 24% response rate. The major objective of the survey was to solicit the opinions and concerns of forestland owners on major forestry issues and to compare those to the opinions of similar surveys conducted in 1979 and 1981. Detailed results of the 2003 survey are included as Appendix B.

Mission and Vision

The earlier (1984) edition of the Rhode Island Forest Resources Management Plan created a single, all-encompassing goal. This goal has continuing validity, and is adopted in this update as an overall Mission Statement for stewardship of the state's forest resources:

Mission: Protect and manage the forest resources of Rhode Island to meet the demands for recreation, water supply, wildlife habitat, forest products, and a high-quality environment.

The FRMPAC developed a Vision for Rhode Island's forests to supplement the 1984 Goal:

Rhode Island's Forest -- a Green Hope for All

⁴⁹ Rural: less than 500 persons per square mile or a developed land area of less than 25%. 14 communities are identified but the Town of Tiverton did not supply the requested information for the survey.

Goals, Policies, Objectives and Strategies

A new format for the Plan was developed around each policy issue described above as follows:

Goal(s)

Policy(ies)

1. Objective(s)

A. Strategy (ies) for each objective

a. Performance Measure(s) for each strategy where applicable

From this framework a matrix was developed for this plan, which shows the objectives, strategies, and performance measures. It was developed for future reference in the comprehensive community planning review process and use in Plan implementation. (See Table 4-1, Implementation Matrix) The Advisory Committee reviewed and considered issues of the 1984 Forest Resources Management Plan during the plan updating. Previous issues were reviewed and updated, consolidated, or removed – depending upon the Committee’s judgment as to whether they were a continuing concern, or had been acted upon. Several new issues, considered critical at this point in time, were added. Specific goals, policies, objectives and strategies proposed to obtain the desired future conditions were developed from current issue concerns and solutions suggested by Rhode Island’s forest landowners, environmental groups, forest resource professionals, commercial forest users and forest recreational users (e.g., ideas from the survey and focus groups). These concepts were then refined by staff and through meetings of the Advisory Committee. The resulting list of Forest Resource Management Issues addressed in the updated plan follows, together with a listing of issues considered in the 1984 version of the plan, for comparison:

1984 Policy Area Issues	2005 Policy Area Issues
Forest Resource Planning	Forest Resource Management
Forest Resources Management	Sustainability
Forest Resources Education	Information & Education
Wildfire Control	Forest Health
Insect and Disease Protection	Forest Health
Legislation	(issue not identified by FRMPAC for 2005)
Forest Products Marketing	Commercial Forest Products
Soil Management	Water Resources
	Recreation and Tourism
	Fragmentation

The photographs in this section were provided from the DEM/DFE collection of archival photos except where otherwise noted.

FOREST RESOURCE MANAGEMENT ISSUES, GOALS, POLICIES, AND OBJECTIVES

Forest Resource Management (FRM)

Over the past forty years, forestlands have been decreasing in Rhode Island⁵⁰. In 1984, this was identified as a critical issue. Nothing has changed concerning this issue, in the sense that we continue to lose forests every day. "Forests are being lost to urban, suburban, and commercial land uses at an average rate of 6 acres per day"⁵¹. Forest resource management on a statewide basis of the total resource and resource management on state owned properties were both rated as very important/critical concerns in the landowner survey and in the focus groups (69%) sixth, and (67%) seventh, respectively. (Detailed responses for individual focus groups and the complete landowner survey results are provided in



Appendix B.) Effective management of Rhode Island's forest resources affects many factors considered critical to a high quality environment and is, therefore, central to the continued well-being of all Rhode Islanders. A consistent course of comprehensive planning, identifying and implementing management priorities, is crucial to the sustainability of the forests and their continued ability to meet the many demands placed upon them, and to provide the benefits we derive from them.

State-owned Management Areas constitute over 40,000 acres and include sizable areas of forest. The management of State-owned forests should provide a leadership example of effective stewardship. However, declining State resources relative to needs is a particular concern in terms of effective forest management on State lands. Over the last twenty years, DEM figures indicate a reduction of 65% of the manpower and 60% reduction of budget⁵² within the DFE. In the same period the Division's land management responsibilities have increased by 4,755 acres, and several new (programmatic) forestry initiatives have been added. The Division, caught in the bind of more responsibilities and fewer resources to carry out programs and projects, has necessarily become less proactive in management and planning for the care of the resource base and infrastructure – and more reactive to issues and problems – addressing some only on an as-needed basis.

FRM Goal: **To manage State-owned forestlands in order to provide a safe environment and reduce conflicts between users while maintaining the health, vigor and sustainability of the forest resources.**

FRM Policies:

- FRMP 1. State owned forestlands will be managed to provide sustainable forest resources for a variety of uses while working to insure the health of the forest and promote the safety of its users.
- FRMP 2. Develop and maintain a comprehensive planning process to evaluate and manage the forest resources of the state.

[FRM Objectives & Strategies:](#) See Table 4-1

⁵⁰ Trends in Rhode Island Forests: A Half-Century of Change, USDA Forest Service, NE-INF-144-02

⁵¹ The Forests of Rhode Island, USDA Forest Service, NE-INF-155-02

⁵² Budget calculation based on 1984 budget figures to 2003 budget using S. Morgan Friedman, Inflation Calculations.

Forest Sustainability (S)

The World Commission on Environment and Development defines sustainability as meeting "the needs of the present without compromising the ability of future generations to meet their own needs" (1987). This definition of sustainability recognizes human actions and inputs; it includes wood fiber supply, recreation, water yield and quality, abundance and diversity of flora and fauna, and other forest resources. What does the future hold for our forests? Will they remain? Will they be green, healthy, and continue to protect the water, clean the air and supply other valuable benefits and resources for future generations? Will we lose more forestland to development? Are we managing forests sustainably, that is, are forestlands currently used in ways that meet today's needs without sacrificing the needs of future generations? The effectiveness of the implementation of this plan, the implementation of the *Rhode Island Urban and Community Forest Plan*, State Guide Plan 156, and future forest resource management plans of this State and other states will determine if we are good stewards of the land.

The responses from the Rhode Island forestland owners survey and the focus groups conducted for this plan update demonstrated an amazing concern for sustainability of our forest resources, with 85% in the survey rating it as "very important/critical", and second in the hierarchy of issues considered in the focus groups.



S Goals: **To create, conserve, and maintain sustainable forest resources.**

S Policy: S 1. Promote sustainable management of forests that provides a wide range of benefits to fulfill current needs without compromising the ability of these forests to provide for future generations.

S Objectives & Strategies: See Table 4-1.

Information and Education (IE)

The 1984 Plan identified Information and Education, as an important issue: "An increase of forestry information and education programs could be extremely beneficial in assisting to resolve many issues addressed in this plan". This has not changed in the intervening 20 years: 72% of the forestland owners surveyed considered education to be critical or very important. The focus groups respondents reflected this by placing seven out of ten of top key issues as educational programs. One major change relative to this issue is that University of Rhode Island's (URI) Cooperative Extension has



almost completely disappeared from the educational role it formerly played in forestry issues. That a need for forest-related information and education continues to exist, perhaps more now than ever, is shown in both the survey and focus groups results, and is reinforced by responses to another question in the landowner survey, that indicated that 22 cents of every additional dollar made available for forest resource management would be placed by respondents into educational programs.

To fill in the gap left by the declining role of URI's Cooperative Extension Service in forest information and education, the Division of Forest Environment has helped to establish several organizations having education as one of their primary responsibilities. The R.I. Forest Conservators Organization (RIFCO) has taken on the role of educating private forestland owners through fact sheets, brochures and workshops. Other organizations that also address public education and the DFE works with are:



Smokey Bear, <http://www.smokeybear.com/>
FireWise, <http://www.firewise.org/>
Envirothon, <http://rienvirothon.org/index.htm>
Project Learning Tree, <http://www.plt.org/>
RI Forest Conservators Organization, <http://www.rifco.org/>
RI Tree Council, "Tree Stewards", <http://www.ritree.org>

Smokey Bear

IE Goal: To educate public officials and the general public to gain an understanding and appreciation of the state's forest resources, so they might better utilize, conserve and protect these resources for future generations.

IE Policy: Promote increased awareness and appreciation of Rhode Island's forest resources through education and information.

IE Objectives and Strategies: See Table 4-1.

Forest Health (FH)

This section combines the Insect & Disease and Wildland Fire issues from the previous (1984) version of the Forest Resources Management Plan. Though both of these issues concern the health of the forest, the threat vectors involved as well as control mechanisms, are very different. Relative to insects and disease control, many treatment methods and chemicals used in the past have been replaced with newer, safer and more effective methods. Despite progress made in this realm with newer control



methods, 79% of the forestland owners surveyed continue to believe that forest health is very important or critical as a forest resource issue. A major concern today comes from introduced or exotic pests from imported goods exchanged in the modern global economy. The use of chemicals has become the last in a line of defense against insects and disease. Preferred methods include education, Integrated Pest Management, silvicultural and biological controls. Present day threats to our forests include⁵³:

- **Ramorum Blight**: is a recently recognized disease that is killing oaks and other plant species in the western United States. First noticed in 1995, the disease has been confirmed in the coastal areas north and south of San Francisco, and in a relatively remote location in southwestern Oregon. The pathogen responsible for the disease, a fungus-like organism called *Phytophthora ramorum*, is also found in Germany and Denmark, where it is causing a recently identified disease on Rhododendron and Viburnum. Although in the U.S. the disease has been found only in California and Oregon, it is of great concern to land managers in the Eastern U.S. as well, because at least two eastern oak species, northern pin oak (*Quercus palustris*) and northern red oak (*Quercus rubra*), are highly susceptible to the disease when inoculated with the pathogen.
- **Asian Longhorned Beetle** *Anoplophora glabripennis* (Motschulsky), (ALB): Although not presently found in Rhode Island, ALB is a major forest pest in China. In New York and Illinois ALB has demonstrated formidable potential for harming many important commercial tree species in the forests of North America. ALB has potential to alter North American ecosystems, due to its tree killing and polyphagous habits and potential for widespread distribution on the continent.
- **Emerald Ash Borer**, *Agrilus planipennis* Fairmaire (EAB): Emerald ash borers are not presently found in Rhode Island, but have killed trees of various size and condition in Michigan. Larvae have developed in trees and branches ranging from 1 inch to 55 inches in diameter. Stress likely contributes to the vulnerability and rapid decline of infested ash trees. However, emerald ash borer has killed apparently vigorous trees in woodlots and urban trees under regular irrigation and fertilization regimes, making this pest capable of infesting ash trees in any environment.
- **The gypsy moth** (GM), *Lymantria dispar*, is one of North America's most devastating forest pests. The species originally evolved in Europe and Asia and has existed there for thousands of years. In either 1868 or 1869, the gypsy moth was accidentally introduced near Boston. About 10 years after this introduction, the first outbreaks occurred and in 1890 the first state and federal attempts to eradicate the pest began. These attempts ultimately failed, and since that time, the range of gypsy moth has continued to spread. Presently, gypsy moth is at a low population stage in Rhode Island, but the Division of Forest Environment continues to survey for the pest on an annual basis.

⁵³ Adapted from: <http://www.fs.fed.us/foresthealth/programs/invasive-species-mgmt.shtml>

- The hemlock woolly adelgid, *Adelges tsugae*, (HWA), has been in the United States since 1924. This introduced insect, believed to be a native of Asia, is a serious pest of eastern hemlock and Carolina hemlock. In the eastern United States, it is present from northeastern Georgia to southeastern Maine and west to eastern Tennessee. HWA continues to kill hemlock trees in the forest and urban and suburban landscapes throughout RI. A pilot project to determine the extent and impact of the HWA has been underway by the Division of Forest Environment since 2003. Timber harvests on state properties are carried out to remove dying trees before the timber value of the trees is lost. This reduces hazards and liability in recreational areas while providing revenue. The Connecticut Agricultural Experiment Station provided this photo.



The above-described insect pests are all introduced to the United States -- imported from other countries, either for attempts of commercial ventures or from packing material used in the shipping of imported products. As Rhode Island's role as both a consumer and producer in the global economy increases, it is important to retain vigorous surveillance and response capabilities to control incipient outbreaks of these, or other, currently unknown, threats to the health of the state's forests.

Many of the recommendations outlined in the Wildland Fire issue in the prior (1984) edition of this Plan have been implemented through the lead of the Division of Forest Environment. Perhaps as a result of the actions taken on this issue, forestland owners surveyed ranked wildfire as a lesser concern compared to other forest management issues: 38% of those landowners responding identified wildfire as a very important or critical concern. Some of this change in attitude since the 1984 Plan may also be due to the change in infrastructure and development within the State and changes within the forest itself. Roads and developments have fragmented the forested area, lessening the extent of large, unbroken forested tracts. The forests themselves have aged -- changing fuel load behavior within the forest. Greater numbers of people living in and traversing forested areas and communication advances, such as the cellular telephone, have made reporting of fires more common through this media than the previous surveillance system of manned fire towers. Many fire stations have upgraded facilities and several new fire stations have appeared in rural, forested areas to handle increases in residential homes. The increase in residences permeating the forest, however, has also brought new concerns. One such concern is the wildland/urban interface; any area where wildland fires threaten to ignite combustible homes or structures. Due to this increase in wildland/urban interface, human and personal property fire loss risk has increased the need for Community Wildfire Protection Plans, without sufficient Division staffing this is one of the most deficient issues within this plan.

FH Goal: **To protect and improve the health of Rhode Island's forests.**

FH Policies:

FH 1. Monitor and respond to forest health threats to avoid unacceptable losses to the state's forest resources.

FH 2. Maintain a forest fire defense plan to protect against the possible loss of lives, homes and forest resources.

FH Objectives and Strategies: See Table 4-1.

Commercial Forest Products (CFP)

Although the Farm, Forest and Open Space Act Program offers a vehicle for reducing their impact, local property taxes remain a significant cost of forestland ownership. Other costs include forest management activities to conserve and improve forest productivity. The sale of commercial forest products can help forestland owners offset the costs of retaining their land in forest and provide revenue to support effective management.



Timber harvesting contributes to the forest products industry in Rhode Island. The value of the annual timber payroll and the value of timber and allied

products in the state increased from \$69.9 million in 1985 to \$118.8 million in 2000. The industry represents 2.7 percent of the state's manufacturing workforce and employs 2,100 workers, with a payroll of \$60 million.⁵⁴ While the number of primary wood product processors—sawmills—has dropped; secondary wood processors continue to be a strong source of generated income for Rhode Island forest landowners. The recent survey of forest landowners found 31 percent have had commercial harvesting activity on their land; 6 percent of these within the last five years. Sawtimber and firewood were cited as the most common products, each comprising about 32 percent of the harvest activities. Future Strategies to manage the forests of Rhode Island to produce larger and higher quality trees, to promote higher-value, commercial wood products instead of harvesting smaller diameter good quality trees for firewood, could also increase carbon sequestration.

The small size of most parcels of forestland makes management for traditional wood products difficult for the typical Rhode Island landowner. DEM and the R.I. Rural Lands Coalition have cooperated to investigate and promote *alternative* forest products. These include products such as edible and medicinal plants, specialty wood products, floral greens, or forest-based recreation, and offer an option for landowners who wish to actively manage their property to generate income to offset ownership expenses. It is hoped that encouragement of such natural resource-based economic development in rural areas will encourage retention of land in forests and limit the impetus for further forest fragmentation.

CFP Goal: **To maintain a viable forest products industry in Rhode Island.**

CFP Policy: **To optimize the economic values of forest products from Rhode Island forestlands.**

CFP Objectives and Strategies: [See Table 4-1.](#)

⁵⁴ (a) S.B. Remington, P.E. Sendak, D.R. Schuman, "Rhode Island's Timber Economy: A Review of Statistics", USDA Forest Service, NE Forest Experiment Station 1985. (b) American Forest and Paper Association, "Why the Forest and Paper Industry is Important to Rhode Island", 1997.

Water Resources (WR)

Good water quality is one of the many benefits derived from forestland. Eighty-four percent of the surveyed forestland owners believe forest resources are very important or critical for water. While timber harvesting can contribute to water quality degradation, the utilization of best management practices and wetland protection, and generally small scale of activities limit such impacts in Rhode Island to negligible levels.



The protection, conservation, and restoration of forested riparian areas along rivers and streams offers a wide range of environmental and social benefits including improved water quality, greater wildlife diversity, educational opportunities, enhanced aesthetics, reduced flooding, and a higher quality of life for residents, and increased civic pride. Presently the DEM is conducting several projects for watershed conservation action plans.

WR Goal: **To protect and manage the state's forestlands in support of water resource goals and objectives and the needs of Rhode Islanders for plentiful and healthy water supplies.**

WR Policy: Promote the development, protection and maintenance of forested landscapes to protect water quality.

[WR Objectives and Strategies: See Table 4-1.](#)

Forestland Recreation and Tourism (FRT)

Recreation and tourism are important industries in Rhode Island. Tourism is the second largest and fastest growing industry in Rhode Island⁵⁵. Rhode Island's forests provide numerous recreational opportunities, including hiking, hunting, fishing, camping, bird watching, picnicking. 60% of respondents to the 2003 Landowners' Survey strongly agreed or agreed that DEM should focus resource management on state-owned forestland to enhance recreation and tourism.



DEM, through the DFE and Fish and Wildlife Division, manages extensive forested tracts that provide recreational opportunities and support the state's tourism sector. These include the DFE-managed George Washington and Arcadia Management Areas, consisting of approximately 27,800 acres, and an additional 21,200 acres managed by the DFW.

The importance of forests to Rhode Island's quality of life is increasing as development continues. In just seven years -- between 1988 and 1995, Rhode Island developed farm and forestland acreage that almost equaled the total land area of the City of Providence (12,029 acres). This loss of resource land has been taking place in spite of relatively slow population growth. As a result of sprawl, an additional 24,000 acres of forestland could be converted to developed land by 2020⁵⁶.

Forests within management areas and other protected open space properties will, by and large, remain in their forested state, and by virtue of their ownership and management, they are generally accessible to the public. As such, these forests will become increasingly important in providing recreational opportunities as other forested areas are converted to other uses, or restrict access. The National Recreation and Park Association has documented a number of benefits provided by parks and other outdoor recreation facilities:

- * Visits to national, regional and local parks exceed 1 billion annually.
- * \$59 billion is spent every year on wildlife tourism.
- * Americans spend over 500 million days per year fishing.
- * 66,000 deaths annually could be prevented through regular physical exercise.

Adding to these quantifiable benefits, are studies of less tangible benefits of parks and the recreational and exercise opportunities they afford. These range from the favorable impact that investments in waterfront open spaces have on attracting new business to reports that families that share recreation together report greater stability and satisfaction.

FRT Goal: **To provide statewide recreational activities and promote tourism in forested recreation areas.**

FRT Policy: To include diverse recreational opportunities in the state's forestlands consistent with objectives for sustainable and healthy forest resources and the promotion of recreational user safety.

FRT Objectives and Strategies: See Table 4-1.

⁵⁵ Rhode Island Travel and Tourism Report, Volume 18, Number 1 May, 2001 by Timothy J. Tyrell, URI

⁵⁶ The costs of Suburban Sprawl and Urban Decay in Rhode Island, Executive Summary, H.C. Planning Consultants, Inc. and Planimetrics, LLP, December, 1999.

Fragmentation (F)

Rhode Islanders greatly value their forests and the amenities they provide. A partnership of environmental organizations involved in the updating of the Rhode Island Forest Resources Management Plan identified subdivision of forestland into small parcels (fragmentation) and/or conversion of forestland to other uses as a major issue affecting Rhode Island's forests. This was consistent with the findings of the forestland owners survey in which 83% of respondents rated development as a critical issue and 11% felt it was a very important issue. Participants in focus groups also identified preventing and offsetting the effects of fragmentation and development as the number one issue.

It was the consensus of all parties involved in the planning process that to insure healthy forests that provide a variety of benefits we need to take immediate and decisive action to protect forestland from loss and degradation due to development pressure. When asked in the survey if the state should allocate funds to acquire important forestlands and/or development rights 49% strongly agreed and an additional 33% agreed. On the question of allocation of forest resource funding for each additional dollar made available, 26 cents would go to acquisition of the forestland and 19 cents more to the purchase of development rights.

Development in Rhode Island tends to reduce the number of large contiguous forests with the remaining forests composed of smaller forests owned by many landowners and often times are comprised of backyard woodlots. Many of the landowners' objectives for their forests differ with the change of ownership and parcel size. Owners of forestlands larger than 100 acres actively manage their forestland; those owning forested tracts less than 30 acres in size report their primary reason for owning forestland is that it is part of their residence⁵⁷. The aerial photographs below demonstrate how development can change the forest over time.



1954



1972



1992

Forest Fragmentation in Coventry, RI (1954 – 1992)

⁵⁷ Private Forestland Owners of the Northern United States, Birch, Thomas W. 1996. USDA, Forest Service, Northeastern Forest Experiment Station. NE-136.

Fragmentation has many negative impacts. As large, contiguous tracts of forest are broken into fragments, its value as wildlife habitat is reduced. A major concern and repeated theme in Rhode Island's Comprehensive Wildlife Conservation Strategy as shown in the table below:

Table 3.1 General Statewide Threats to Rhode Island's Fish and Wildlife

- Habitat loss and fragmentation from lack of conservation planning and coordination (resulting in land conversion, etc.)
- Habitat loss from inadequate-sized reserves (including poor landscape context, loss of connectivity, etc.)
- Habitat fragmentation from lack of focal area approach to conservation.

Development brings with it the creation of roads, commercial support development, and other infrastructure. Residential development brings the introduction of plant cultivars species that often escape into the forest replacing native plant species, negatively impacting habitats and food supplies for native insects and animals. New residents in rural areas bring expectations regarding noise and aesthetics that may lead them to challenge forestry and agricultural practices that were generally accepted by long-time rural residents who have an understanding of the role and necessity of such practices. Such changes brought about through fragmentation and development impact upon both economic and ecological viability of our forests.

The Forest Legacy is an important tool in the conservation of forests helping to reduce further fragmentation of forests through the purchase of both conservation easements and upright fee simple purchases. As identified in the Forest Legacy Needs Assessment 1994, when fragmentation or parcelization of woodlands occurs; "These small parcels are usually uneconomical to manage and may lead to forced sales to the highest bidder, a developer or speculator with little intent to keep the property in its natural state. Though the tract may not be developed or parceled immediately, its speculative ownership removes it from the roster of lands managed for future productivity and open space. With shrinking acreage of contiguous ownership, management and productivity of forest lands will be increasingly difficult and less cost effective. The future of the region's already weak forest products industry is at stake, while clean air/water, recreation, wildlife and aesthetic values are threatened.

The Forest Legacy Program will be implemented according the Rhode Island Forest Legacy Program (FLP) Assessment of Need (AON), which was approved by the Secretary of Agriculture on December 30, 1993. The AON includes the approved Eligibility Criteria for the Forest Legacy Areas (FLA), the Approved FLAs, specific goals and objectives to be accomplished by the Rhode Island FLP and the process by which the State Lead Agency will evaluate and prioritize projects to be considered for inclusion in the FLP. A copy of the State Lead Agency designation letter, and the AON approval letter can be found in Appendix E. A copy of the AON may be obtained from the Department of Environmental Management/Division of Planning and Development.

F Goal: **To conserve and restore Rhode Island's forests so as to minimize forest fragmentation.**

F Policy: To maintain forestland area and minimize further fragmentation of forest resources through innovative land conservation and management techniques.

F Objectives and Strategies: See Table 4-1.

MULTI-STATE PROJECTS

The State of Rhode Island Division of Forest Environment through the direction of Paul Dolan, the Deputy Chief of the Division of Forest Environment, and support from the Governor, RIDEM/DFE has embraced the following initiative especially section, "**Southern New England Heritage Forest**". This Initiative enforces all of the concepts developed with in this plan and is inclusive in the RI Priority Forest Area.

NEW ENGLAND/NEW YORK FOREST INITIATIVE

I. Introduction

Once reduced to just 20-30% of the landscape in large portions of the NE/NY region, forests now occupy some 80% of the land base. This astonishing recovery, and the fact that the region is a leader in sustainable management, offer a compelling opportunity to secure the economic benefits and forest values that the region's people cherish and steward for future generations.

In 2008, the North East *State* Foresters Association¹ (NEFA) launched an effort to identify methods to maintain the region's forested landscape, increase the quality of stewardship of these lands, and strengthen the rural economy of the region. The project became known as the Northern Forest Keeping Forests as Forests initiative (NF KFAF) and included New York, Vermont, New Hampshire and Maine. NEFA invited representatives of the Natural Resources Conservation Service and the US Forest Service to participate in this effort. At the same time, the New England Governors' Conference (NEGC) independently established a Blue Ribbon Commission on Land Conservation (CLC).

As a result of these combined efforts, in September 2009 the New England Governors' Conference called upon the region's State Foresters to develop, "...a New England Forest Initiative to Keep Forests as Forests that will constitute a new blueprint to protect the region's forest land-base and ensure the sustainability of these lands, as a public policy appropriate to all New England; and identify barriers to and opportunities for sustaining forestlands that are in private ownership and expanding forest products production and consumption."

With this charge, the NF KFAF initiative expanded to include the southern New England States. The seven State Foresters have defined the *mission* of the New England/New York Forest Initiative: **to establish a regional model/demonstration program to strengthen markets for forest products, improve forest stewardship, and conserve the region's forest landscape for future generations.**

The mission will be pursued within the following *guiding principles*:

- **Spur job creation and maintenance by improving the forest based economy;**
- **Build a landscape-scale effort that emphasizes connectivity to Keep Forests as Forests;**
- **Foster collaboration and partnerships across borders and sectors;**
- **Encourage significant contributions from the private and philanthropic sectors; and**
- **Generate significant contributions to expanding renewable energy resources.**

II. Background

A Treasured Resource:

New England and New York's forests define the character of the region, are integral to its economy, and sustain many of its communities - from the expansive timber ownerships of the Northern Forest to the back-forty woodlots of the south. These forests have proven resilient through time, having recovered from land clearing and harvesting of centuries past, undertaken without regard for future crops of timber. Today, these forests cover some 52 million acres in seven states that:

- Represent the largest intact temperate broadleaf forest in the nation, and one of the largest in the world, including almost 19 million acres in large contiguous blocks;
- Form the backbone of many if not most of our rural economies, providing a sustainable source of forest products including building supplies, firewood, furniture, toys and paper; creating jobs in the woods and mills and serving as an economic engine of the region's economies; and contributing over \$20 billion annually and sustaining over 100,000 jobs;
- Host a wondrous diversity of plant and animal life and the source of clean water for our rivers, lakes, aquifers and reservoirs;

- Safeguard public and private drinking water sources, both surface and groundwater, for millions of residents often acting as the primary barrier against pollutants and pathogens;
- Provide an important source of renewable energy that will reduce dependence on fossil fuels and enhance national security;
- Provide, through trees in towns and villages, ecosystem services including: storm water filtration, air cleansing, and energy efficiency through moderation of temperature, as well as scenic beauty;
- Offer outdoor adventures unsurpassed elsewhere in the eastern United States and supporting an emerging forest-based recreation and tourism economy that is already valued at more than \$5 billion and is poised to grow as more visitors seek out unique eco-tourism experiences; and
- Store great quantities of carbon and sequester approximately 10% of the region's annual greenhouse gas emissions each year.

Unpredictable Future Joined with Unusual Opportunity:

These extraordinary values in a region so densely populated represent a tremendous opportunity to have the best of both worlds: a vital built environment that includes large metropolitan areas as well as quaint historic villages, while securing for present and future generations the economic benefits and natural values the region's forests and their stewardship provide.

At the same time, the future of the region's forests has become uncertain and subject to a host of new pressures. Proposals to subdivide, develop, and convert forest tracts are greatest in the south, but present throughout the region. With some 80% of the region's forests privately owned, decisions by forest landowners will largely determine whether New England and New York's forest landscape, the jobs that depend on it, and the multitude of public values it provides will remain for future generations. Recent trends in the region's demography, land use and ownership, and climate change create strong doubt that these values will persist:

- Over the past two decades, fully two-thirds of the Northern Forest area has been sold at least once. From 1997-2003 nearly 400,000 acres of forest land have been converted to development uses in New England and New York. In Connecticut, from 1985-2006 over 5,500 acres of forest *per year* has been converted to developed use – nearly a 6% loss. In Massachusetts, from 1999-2005, nearly 10,000 acres of forest per year was converted for development.
 - Since 1993, the average size of forest ownerships dropped across the region, as forested tracts have been subdivided and sold. A 2006 US Forest Service survey of forest landowners showed that 86,000 landowners in New England/New York owning 2.77 million acres plan to sell some or all of their lands within five years. Some 35,000 landowners owning 869,000 acres of forest land indicated they plan to subdivide their forest lands over the same period.
 - Intergenerational transfers of forest land will occur at an unprecedented rate as over one-third of forest owners, who own 44% of forestland in the US, are 65 years old or older;
 - In many parts of the region, there is a wide and growing gap between the timber value of forest land and its value for development. Increasingly, timber management returns cannot justify current prices for forested acreage even in parts of areas where timber has, and continues to be, the primary use.
 - Forest products-based infrastructure and communities are facing an unprecedented challenge from volatile markets for home-grown timber, high energy costs, foreign competition, high domestic production costs, and mill closings with associated job losses.
 - Uncertainty regarding the stability of property tax policy for forest land, which greatly discourages private forest owners from maintaining their forests as forests.
 - Expanding responsibilities to monitor and manage conservation easements in the public and private sectors without adequate resources.
 - Finally, climate change itself creates great uncertainty about future forest conditions.

Coupled with these uncertainties, tremendous opportunity exists to maintain the exceptional economic and environmental values and traditional uses of the region's forests. The forest land base is largely intact in many parts of the region, with more forested acreage today than a century ago. Despite a difficult business climate, traditional forest products industries including paper mills and sawmills remain integral to our local economies and provide thousands of high-paying jobs. Newer uses of the forest as a



renewable energy resource can create economic opportunities and new jobs. The boom in ecotourism combined with the proximity of the region's forests to major cities offers attractive prospects for businesses providing forest-based recreation.

Today, these opportunities coincide with the federal Administration's powerful and timely interest in an "All Lands" policy for management of the nation's forest resources (US Dept. of Agriculture), for strengthening the nation's "Treasured Landscapes," (US Dept. of Interior) and for developing the nation's renewable energy resources (US Dept. of Energy).

III. Goals and Demonstration Projects

The State Foresters see three important and related goals for this initiative:

Goal #1 - Strengthen Markets for Forest Products – Retain and strengthen the forest products industry in the region so that it employs people and produces at pre-recession levels;

Goal #2 - Improve Forest Stewardship – Implementing sustainable forestry on half the family forest ownerships in the region; and

Goal #3 - Minimize Forest Fragmentation, Parcelization, and Conversion – Permanently conserve an additional 15 million acres of forest land in the region (reaching the goal of conserving half the forest land in the region);

...and have devised a variety of strategies and an initial set of pilot or demonstration projects to address them:

- **Quabbin to Cardigan** – a three-pronged strategy of core-area land conservation, forest stewardship practices and forest industry assistance on a 2 million acre landscape of working forests, water supplies and unfragmented forests spanning western New Hampshire and northern Massachusetts.

- **The Berkshire/Taconic's** – A 230,000 acre area containing an inordinate number of rare species threatened by development and climate change. Efforts here to focus on restoring ecosystem functions through on-the-ground stewardship and preservation of large unfragmented forest blocks.

- **Southern New England Heritage Forest** – A 1.4 million acre area that will receive focused land-use planning assistance with a variety of land conservation tools preserving the working heritage of the last remaining rural landscape in Southern New England.

- **Green Mountain/Berkshire** – a programmatic working forest stewardship approach over the unfragmented forest of southern Vermont and Western Massachusetts.

- **Keeping Maine's Forests** – four priority landscapes now under consideration, ranging in size from 500,000 to 2 million acres that will be targeted for a collaborative effort involving federal and states agencies as well as private interests to keep these forests as forests.

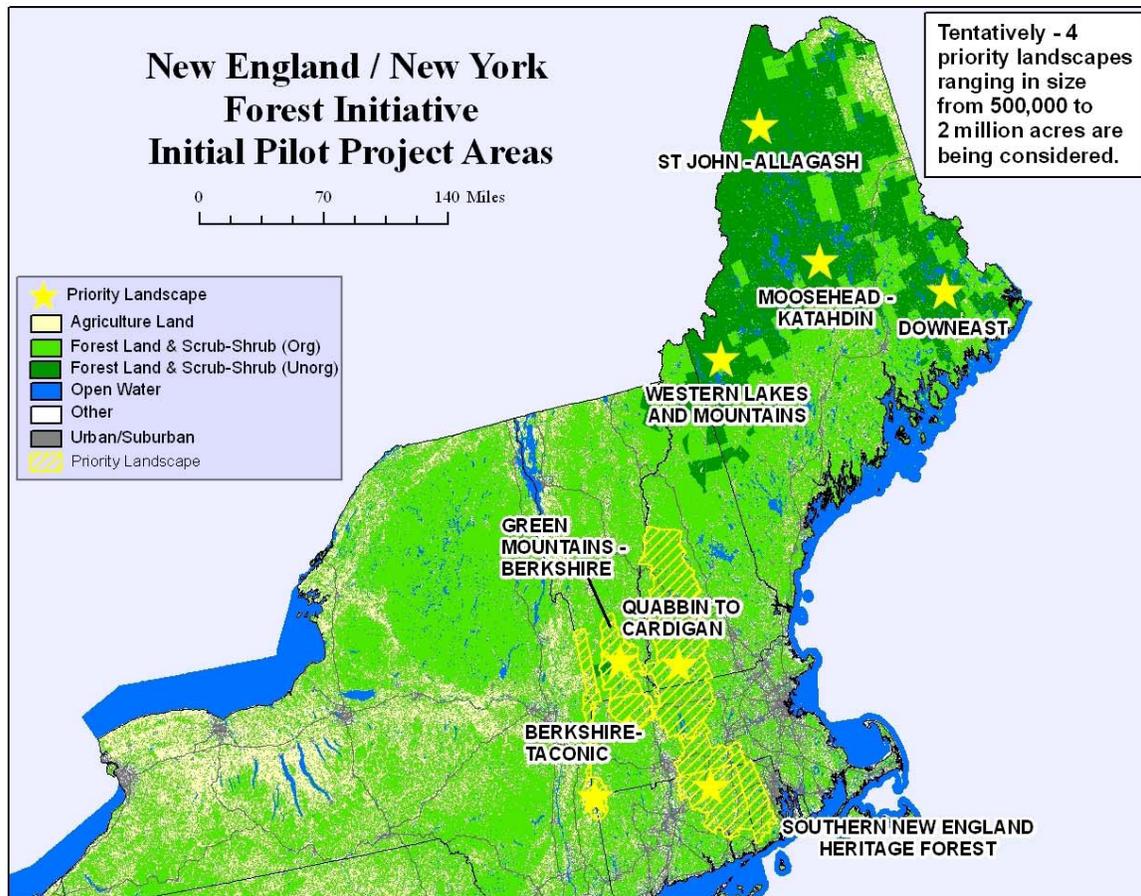
- **Vermont Conservation Easement Stewardship Project** – development of a model conservation easement stewardship program for the working forests of Vermont and the region.

- **Several region-wide programmatic efforts** will aim to strengthen the forest products industry, monitor and increase stewardship on private forest lands, and ensure a strong, continuing, and university-based research and evaluation element to measure progress toward the goals and assure that we learn "what works."

IV. Implementation and Funding

The State Foresters from New England and New York will lead implementation of this effort, in collaboration with the NEGC/CLC; and funding will generally flow to and through the states and specific projects. As the 10-year demonstration program outlined above goes from pilot to fully operational, the State Foresters estimate that \$200 million of *annual* funding will be required to achieve the stated goals, from a combination of federal support and state and private sources. Public funding will be made available primarily through enhancing and pooling current funding mechanisms with broader authorities to shift funds to priority areas and programs that will promote:

- Improved markets for forest products;
- Greater stewardship of forest land;
- The capacity to effectively monitor conservation easement and manage fee lands;
- Acquisition of conservation easements, with selective fee purchases;
- Broader outreach to and education of all stakeholders;
- Continued and improved public access to lands; and
- Continuing, independent evaluation of the effort.



The Keeping Forests as Forests group includes the following members:

- Alec Giffen, Maine State Forester (Chair)
- Anne Archie, US Forest Service, State & Private Forestry
- Astor Boozer, New York State Conservationist, Natural Resource Conservation Service (NRCS)
- George Cleek, New Hampshire State Conservationist, NRCS
- Juan Hernandez, Maine State Conservationist, NRCS
- Karen Woodrich, Acting Vermont State Conservationist, NRCS
- Jer Marr, Supervisor, Green Mountain and Finger Lakes National Forest
- Rob Davies, New York State Forester
- Brad Simpkins, New Hampshire State Forester
- Steve Sinclair, Vermont State Forester
- Tom Wagner, Supervisor, White Mountain National Forest
- Christopher Martin, Connecticut State Forester
- Paul Dolan, Deputy Chief, RIDEM/DFE, Representative for Rhode Island State Forester, Catherine Sparks
- Mike Fleming, Massachusetts Dept. of Conservation and Recreation
- Robert O'Connor, Massachusetts Executive Office of Energy and Environmental Affairs
- Douglas Zehner, Connecticut State Conservationist, NRCS
- Christine Clarke, MA State Conservationist, NRCS
- Chris Modisette, Representative for Pooh Vongkhamdy, RI State Conservationist, NRCS
- Bruce Wight, NRCS National Forester.
- Consultant staff: Charles Levesque

TABLE 4-1, IMPLEMENTATION MATRIX

Table 4-1, Implementation Matrix, contains the objectives, strategies and performance measures, where applicable for the eight policy areas outlined above. The table is laid out according to the eight policy area narratives as presented in this Section. All policies are referenced by the policy abbreviations cited in the text and page numbers are provided to enable cross-referencing with the narratives, goals and policies. The objective and strategies are followed by performance measures, where applicable, along with the primary responsible implementing party or partners for each. A listing of acronyms used within the Table precedes the Table. The following time frames are used in Table 4-1:

- OG = On Going projects or programs
- ST = Short projects or programs to be acted on in 1-5 years, and
- LT = Long projects or programs to be acted on in 5 + years

See also the relevant policies of the following State Guide Plan Elements concerning forestlands in the State Guide Plan Overview document at: <http://www.planning.state.ri.us/sgp/sgp.htm>.

- Element 121: Land Use 2025
- Element 131: Cultural Heritage and Land Management Plan
- Element 152: Ocean State Outdoors: RI's Comprehensive Outdoor Recreation Plan
- Element 155: Greenspace and Greenways Plan
- Element 211: Economic Development Policies & Plan
- Element 731: Nonpoint Source Pollution Management Plan
- Element 811: Transportation 2030



Acronyms for Table 4-1	
ACP	Agricultural Conservation Program
APHIS	Animal and Plant Health Inspection Service
ASRI	Audubon Society of Rhode Island
ATV	all terrain vehicle
BMP	Best Management Practices
DEM	Department of Environmental Management
DFE	Division of Forest Environment
DOT	Department of Transportation
ENF	Division of Enforcement
EPA	Environmental Protection Agency
EQUIP	Environmental Quality Improvement Program
F&W	Division of Fish and Wildlife
FFAC	Forest Fire Advisory Committee
FFOS	Farm, Forest and Open Space Program
FRMP	Forest Resources Management Plan
FRMPAC	Forest Resources Management Plan Advisory Committee
FSC	Forest Stewardship Committee
GIS	geographic information system
IPM	Integrated Pest Management
Legal	Division of Legal Services
MS	Division of Management Services
NRCS	Natural Resource Conservation Service
OWR	Office of Water Resources
OIC	Office of Inspection and Compliance
P&D	Division of Planning and Development
P&R	Division of Parks and Recreation
PLT	Project Learning Tree
RC&D	Resource Conservation & Development
RI	Rhode Island
RIFCO	Rhode Island Forest Conservators Organization
RILTC	Rhode Island Land Trust Council
RIRC	Rhode Island Rivers Council
RIRDC	Rhode Island Rural Development Council
RISPP	Rhode Island Statewide Planning Program
RITC	Rhode Island Tree Council
RITF	Rhode Island Tree Farm
S&PF	State and Private Forestry
SAF	Society of American Foresters
SCORP	State Comprehensive Outdoor Recreation Plan
SIP	Stewardship Incentive Program
SNEFCI	Southern New England Forest Consortium Incorporation
STT	State Technical Team, (Committee)
TAC	Trail Advisory Committee
TNC	The Nature Conservancy
URI	University of Rhode Island
USDA	United States Department of Agriculture
USFS	USDA Forest Service
WHIP	Wildlife Habitat Improvement Program
WRB	Water Resources Board



Table 4-1 Implementation Matrix

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame		
Forest Resources Management (FRM)	FRMP1	40	1. Seek increased and sustainable funding for management and improvements to access in State management areas.				
			A. Continue to implement Capital Improvement Program.	DEM/DFE, DEM/P&D, and DEM/MS	OG		
			B. Use income from timber sales to increase resources for state lands management.	DEM/DFE and DEM/MS	OG		
			Performance Measures				
			A. N.A.				
			B. Timber income to State Forestry Fund				
			<hr/>				
			2. Map, inventory, analyze, and classify state owned forestlands to insure sustainable uses on state forestlands.				
			A. Inventory and document existing conditions, growth, harvest and reforestation levels.	DEM/DFE	OG		
			B. Continue to Use DFE personnel to maintain property bounds.	DEM/DFE	OG		
			C. Strengthen process to document and report boundary trespass and property damage for litigation.	DEM/ENF. and DEM/Legal	OG		
			D. Use DEM enforcement and Legal Services to resolve boundary trespass and property damages.	DEM/ENF. and DEM/Legal	OG		
			E. Document existing recreational impacts on forest resources for management planning.	DEM/DFE and DEM/P&R	OG		
			Performance Measures				
			A. # of acres inventoried				
			B. Location and # of feet of bounds maintained				
			C. Development of policy for actions on encroachment issues				
			D. N.A.				
			E. See Performance Measures FRM OBJ 2 A				
			<hr/>				
			3. Continue to demonstrate sustainable, best forest management practices on state forestlands. (aesthetics, integrated pest management, inventory & map Heritage Program indicators including threatened and endangered species, crucial and diverse wildlife habitat).				
			A. Inventory and document existing conditions, growth, harvest and reforestation levels to insure sustainable harvest practices on state forestlands.	DEM/DFE	ST		
			B. Evaluate Sustainable Forest Initiative Program certification.	DEM/DFE	ST		
			C. Identify and sign forest management practices for educational purposes.	DEM/DFE, RISAF and RIFCO	ST		
Performance Measures							
A. # of acres inventoried.							
B. Complete evaluation of DFE forestland properties and Division to Sustainable Certification Programs.							
C. # of educational forestry plots							
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4. Promote and strengthen partnerships and continue to work with a variety of stakeholders through a coordinated effort to maintain diversity of user groups and activities on state owned forestlands.							
A. Continue to use Management Councils for planning implementation on state management areas.	DEM/DFE	OG					
B. Use State Trail Advisory Committee as an advisor for recreational issues and policies affecting State forestlands.	DEM/DFE and DEM/P&D	OG					
Performance Measures							
A. # of Management Council meetings							
B. # of State Trail Advisory Committee meetings attended							

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame		
Forest Resources Management (FRM) (continued)	FRMP1		5. Evaluate roads and trails to improve management and emergency access.				
			A. Seek increased funding for improvements to roads and trails within state management areas	DEM/DFE	OG		
			B. Improve state management areas through a program of trail maintenance, road repair and infrastructure improvements.	DEM/DFE	ST		
			C. Replace permanent structures blocking access points: boulders, logs and fences with gates.	DEM/DFE	ST		
			D. Continue to use Trail Grants to improve roads and create access in publicly owned forestlands	DEM, LAND TRUSTS, and municipalities.	OG		
			Performance Measures				
			A. & D. # of grants and value obtained				
			B. # of feet of trails improved				
			C. # of gates installed at blocked access points				
			6. Protect the forest resources while providing a variety of services within state management areas.				
Performance Measures							
A. Use DEM personnel to enforce Rules and Regulations within Management Areas. (See also objectives under Forest Health Section.)			DEM/DFE and DEM/ENF	OG			
7. Obtain new properties to expand existing management areas.							
A. Use DEM's Land Acquisitions Committee process to purchase land, development rights, or conservation easements to expand natural areas within the State and buffer the existing State-owned management areas from development.			DEM/DFE and DEM/P&D	OG			
Performance Measures							
A. # of acres obtained							

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame
Forest Resources Management (FRM) continued	FRMP2		8. Develop and maintain comprehensive statewide forest planning.		
			A. Maintain and periodically update the RI Forest Resource Management Plan. (SGP 161)	DEM/DFE, STT, FSC, and RISPP	LT
			B. Develop comprehensive, diverse and sustainable management strategies for state management areas.	DEM/DFE	LT
			C. Continue to use Management Councils for planning implementation on state management areas.	DEM/DFE	OG
			D. Use the forest resource plan to establish priorities for forest resource management and coordinate planning efforts with all entities that have an impact on forest resources.	DEM/DFE FSC, and STT	OG
			E. Determine priority areas where forest management could be undertaken on a regional or watershed level rather than the parcel level basis.	DEM/DFE, DEM/P&D,TNC, FSC STT and ASRI	OG
			F. DFE shall maintain legislative authority to use revenue generated from the State Forestry Fund to implement the Rhode Island Forest Resources Management Plan.	DEM/DFE	OG
			Performance Measures		
			B. & C. # of Management Council meetings attended		
			E. # of meetings and projects with non-profit organizations		
			9. Protect sufficient forestland to meet present and future resource needs.		
			A. Use of cooperative approach between state and local government and private organizations to identify, plan for and protect valuable and ecologically sensitive forestland from development in critical areas.	DEM, STT, TNC, ASRI, FSC , PWS, RIWRB, Champlin Foundation RI Foundation and municipalities	OG
			B. Continue to promote the current tax provisions of the FFOS Act as a tool to conserve forestland and work with municipal tax assessors to reach eligible land owners.	DEM,RIFCO, STT and municipalities	OG
			C. Seek legislation to modify the FFOS program so municipalities have a right of first refusal when land is to be converted out of program classification.	DEM / RILTC and municipalities	ST
			D. Use the State Guide Plan process to insure communities address forest resources objectives and strategies within local comprehensive plans.	DEM/DFE, RISPP, STT and FSC	OG
			E. Continue the statewide program to purchase conservation easements on forestland based on the framework established by the Forest Legacy Program.	DEM/DFE, DEM/P&D,TNC and ASRI	OG
			Performance Measures		
			B. # of acres in FFOS program		
			C. # of acres obtained		
			D. # of community comprehensive plans approved		
			10. Coordinate planning and management of Rhode Island's forest resources.		
			A. Broaden the role of the Stewardship Committee to oversee (coordinate) the implementation of the Forest Resources Management Plan.	DEM/DFE, FSC, STT AND RISPP	ST
			11. Evaluate the status of Rhode Island's forest resources on a statewide level.		
Performance Measures					
A. # of acres and classification of forestlands	DEM/DFE and USDA Forest Service	OG			
12. Continue to partner with federal agencies to maintain a statewide forest inventory process to track forest conditions and trends.	DEM/DFE and USDA Forest Service	OG			
Performance Measures					
A. # of acres and conditions of forestlands					

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame
Forest Sustainability (S)	S	41	1. Maintain diverse forests.		
			A. Maintain and enforce the requirement of active management for forestland classified under the FFOS Act.	DEM/DFE, FSC,STT and municipalities	OG
			B. Actively manage state forestland to provide a wide range of benefits.	DEM/DFE, F&W and P&R	OG
			C. Publicly owned forest should provide demonstration areas to promote sustainable forest management.	Municipalities, Landtrusts, and PWS	OG
			Performance Measures		
			A. # of properties in FFOS, Forestland classification		
			B. See FRM3		
			C. # of publicly owned, (non-state) forestry demonstration areas		
			2. Encourage good forest practices on private owned forest.		
			A. DEM should provide "on the ground" technical assistance offering advice on forestry, wetlands, fish and wildlife advice to assist land owners to refine their objectives and provide guidance toward sustainable forest resource management.	DEM/DFE, FSC, STT and F&W	OG
			B. Encourage landowners to seek assistance from qualified natural resource professionals.	DEM/DFE and F&W	OG
			C. Inform landowners about the value of their forest resources and encourage sustainable forestry practices and certification on private lands.	DEM/DFE, RIFCO and RI Tree Farm	OG
			D. Continue to identify, protect, and maintain natural areas of concern that support rare and endangered plant and animal habitats, geological features and other special natural resources in forested areas.	DEM/P&D, DFE, F&W, STT and P&R	OG
			Performance Measures		
			A. # of assists to private landowners		
			B. # of referrals to consultants		
			C. # of workshops		
			3. Conserve sufficient forestland in Rhode Island to meet the present and future needs of citizens.		
			A. Use all available means to conserve Rhode Island's remaining forestland (including purchase of development rights, promotion of the FFOS program, innovative zoning techniques and outright purchase.	DEM/P&D, DFE, TNC, ASRI, RIFCO, STT, municipalities and landtrusts	OG
			B. Use innovative land use techniques, incentives and partnerships to conserve large forested areas and associated wetlands.	DEM, TNC, ASRI, NRCS,STT, Corporations municipalities and landtrusts	OG
C. Research and develop maintenance levels and types of forestlands to be used as carbon sinks for carbon sequestration.	Forestry Working Group of the RI Greenhouse Gas Process	ST			
Performance Measures					
A. # of acres permanently conserved as forest					
B. See above					
C. N.A.					
4. Encourage forest management actions to promote and conserve wildlife habitats that will meet the needs f the state's wildlife in order to encourage a diversity of species.					
A. Recognize the need to manage and conserve priority forest habitats for conservation.	DEM/F&W, DFE, P&D, TNC, ASRI, RIFCO RIFCO, municipalities and landtrusts	ST			
B. Promote forest management actions and activities that consider landscape level needs and/or deficiencies for specific habitat types.	DEM/F&W, DFE, P&D, STT, TNC, ASRI, RIFCO,FSC, municipalities and Landtrusts	OG			

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame
Forest Sustainability (S) (continued)	S		C. Promote forest management activities on state and private lands that will diversify forest age class to meet the needs for priority wildlife species and habitats.	DEM/F&W, DFE, P&D, TNC, ASRI, RIFCO, municipalities and landtrusts	OG
			D. Develop statewide landscape level prescriptions for the forested habitats of RI as a goal for management (using UFS inventory as a baseline) to achieve renewable forests and habitats.	DEM/F&W	ST
			Performance Measures A. N.A. B. N.A. C. N.A. D. Developed statewide landscape level prescriptions		

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame		
Information & Education (I&E)	IE	42	1. Expand educational opportunities and use electronic media to provide more information about forest resources.				
			A. Maintain and expand the Division of Forest Environment website to include links to information on educational opportunities available.	DEM/DFE	ST		
			B. Expand the Division of Forest Environment website to include web sites for teachers.	DEM/DFE and PLT	ST		
			C. Provide resources and partner with other organizations to educate the general public on the value of forest resources and forest management.	DEM, TNC, ASRI, RIFCO, RISAF, RITF, RITC, USFS and NRCS	OG		
			D. Use web site links to existing programs to educate persons of all ages about forest resources.	DEM, TNC, ASRI, RIFCO, RISAF, RITF, RITC, USFS and NRCS	ST OG		
			E. Promote partnerships with traditional and non-traditional organizations.	DEM, TNC, ASRI, RIFCO, RISAF, RITF, RITC, USFS and NRCS	OG		
			Performance Measures				
			A. N.A.				
			B. N.A.				
			C. & D. # of workshops held and statistics on diversity of partners reported.				
			2. Continue to provide pamphlets to the general public with information on current techniques of forest management.				
			A. Develop, update and distribute information pamphlets on Forestry.			DEM/DFE, RIFCO, and RITF	ST
			B. Use the DEM Offices and municipal buildings throughout the State to make publications available to the public.			DEM/DFE, RIFCO, and RITF	OG
			Performance Measures				
			A. # of informational pamphlets developed and distributed				
			B. # of locations pamphlets made available				
			3. Use public lands, state forestland, town forests, and private lands to educate forest landowners.			DEM, RIFCO, and RITF	ST
			Performance Measures				
			# of workshops held, location and # of attendees				
			4. Educate the general public and Legislators regarding the role of forest resources in maintaining water quality of public water supplies.				
			A. Provide resources (assistance) and work with a large diversity of partners to educate legislators on the function of the forest.			SAF, RIFCO, and RITF	OG
B. Inform and educate state and local government officials, as well as the general public of the need to provide sound policies for the protection enhancement of community forest resources.			SAF, RIFCO, and RITF	OG			
C. Build and strengthen partnerships with municipalities, local land trusts and conservation organizations.			DEM, TNC, ASRI, RIFCO, RISAF, RITF, RITC, USFS and NRCS	OG			
Performance Measures							
A. # and type of partners utilized, number of projects							
B. # of programs presented							
C. # and type of partners utilized, number of programs							

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame
Forest Health (FH)	FH1 & FH2	44	1. Continue to evaluate aspects of forest health conditions in Rhode Island's forests.	USFS, APHIS and DEM	OG
			A. Monitor and report on the aspects of forest health conditions- insects pathogens, invasive plants, air pollution, weather, manmade, fire, etc.		
			Performance Measures		
			A. # of acres surveyed (aerial & ground) & # of forest health plots surveyed		
			2. Increase partnerships with traditional and non-traditional organizations to obtain the best management techniques and proper technical practices to protect and improve the health of Rhode Island's forests.	USFS, APHIS, DEM and URI	OG
			A. Attend and invite cooperators/ partners to training sessions and meetings.		
			Performance Measures		
			A. # of training sessions, meetings and attendees		
			3. Cooperate locally and nationally on forest health issues.	USFS, APHIS and DEM	OG
			A. Attend and invite cooperators/ partners to training sessions and meetings.		
			Performance Measures		
			A. # of training sessions, meetings and partners attending		
			4. Develop, revise and implement policies to limit the spread of forest health threats (insects & pathogens) without endangering non-target species.	USFS, APHIS and DEM	ST
			A. Evaluate current policies and develop, revise and/or implement as needed.		
			B. Communicate revisions and changes to partners.	USFS, APHIS and DEM and URI	ST
			C. Use Integrated Pest Management (IMP) and biological controls where applicable.	USFS, APHIS and DEM	OG
			Performance Measures		
			A. # of policies evaluated and action taken		
			B. N.A.		
			C. # of alternative controls used in place of chemicals		
			5. Strengthen communication mechanisms with partners in forest health to maintain clear responsibilities for forest health control and evaluation.	USFS, APHIS and DEM and URI	ST
			A. Evaluate current policies and develop, revise and/or implement as needed.		
			B. Develop, obtain and distribute information to stakeholders on forest health threats.	USFS, APHIS and DEM and URI	OG
Performance Measures					
A. # of policies evaluated and action taken					
B. # of pamphlets developed and distributed					
6. Update DEM DFE website to include links to current forest health threats.	DEM/DFE	ST			
Performance Measures					
Updated website					
7. Reduce impacts of wildlife and manmade influences to minimize threats to forest health.	DEM/DFE and F&W	OG			
A. Promote and continue whitetail deer hunting as a valuable and necessary management tool to prevent deer overpopulation from impacting forest generation of desirable hardwood species.					

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame
Forest Health (FH) (continued)	FH1 & FH2		B. Strengthen and continue to enforce all-terrain (ATV) regulations on private and public property to prevent damage to valuable tree species regeneration and prevent soil and water quality degradation.	DEM/DFE, ENF., F&W, State Police and municipalities	ST/OG
			Performance Measures		
			A. # of meetings attended & pamphlets developed and distributed		
			B. # of ATV violations issued		
			8. Continue to aggressively fight forest fires through coordinated efforts with local fire departments.		
			A. Strengthen and encourage interagency cooperative agreements.	USFS, DEM/DFE, Fire Districts, and municipalities	ST/OG
			Performance Measures		
			A. # of cooperative agreements evaluated and utilized		
			9. Contain the average forest fire to minimal acreage.		
			A. Maintain records to track individual fire statistics.	DEM/DFE	OG
			B. Use fuel reduction measures on state lands in high-hazard areas.	DEM/DFE, P&R and F&W	LT/OG
			Performance Measures		
			A. # of fires, acres burned, number and type of buildings burned		
			B. # of acres surveyed, # of acres of prescribed burns or other control		
			10. Strengthen communication mechanisms with local fire departments to maintain clear responsibilities for forest fire control and management		
			A. Hold regular meetings with Forest Fire Advisory Committee.	DEM/DFE	OG
			B. Use the FFAC to promote the use of prescribed burns for wildlife habitat enhancement through demonstration and training burns	DEM/DFE, Fire Districts, FFAC and municipalities	ST
			Performance Measures		
			A. # of meetings attended		
			B. # of training exercises and # of people trained		
			11. Continue a process of hazard analysis for the state that will identify critical areas and times of extreme fire conditions		
			A. Evaluate forest fuel conditions and weather conditions on an ongoing basis.	DEM/DFE	OG
			B. Supply local planning departments with hazard fuel analysis information for community development planning.	DEM/DFE	OG
Performance Measures					
A. # of fire days evaluated					
B. # of reports distributed					
12. Encourage rural fire departments to install dry hydrants.					
A. Work to install dry hydrants in local fire districts.	USFS, DEM/DFE, RC&D and NRCS	ST/OG			
Performance Measures					
A. # of dry hydrants sites evaluated & # of dry hydrants installed					

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame		
Forest Health & (FH) (continued)	FH1 & FH2 cont'd		13. Continue efforts with various federal, state, and local partners to train and provide funds, personnel and equipment, especially during fire emergencies.				
			A. Maintain Forestry hose records on inventory supplied, serviced and loaned to municipal departments.	DEM/DFE, Fire Departments, and FFAC	ST/OG		
			B. Hold fire-training exercises with local fire departments and communicate training sessions to local fire departments.	DEM/DFE, Fire Departments, and FFAC	ST/OG		
			C. Use Incident Command System (ICS) for all incidents; train other agencies in its use.	DEM/DFE, Fire Districts, FFAC, FEMA RIEMA and Municipalities	ST/OG		
			Performance Measures				
			A. # of feet of forestry hose loaned and/or serviced				
			B. # of training exercises and number of people trained				
			C. # of incidents using ICS, number of agencies trained				
			14. Develop interdepartmental and statewide database of emergency equipment and use the Federal Excess Personal Property (FEPP) program and Firefighters Property Program,(FPP).				
			A. Maintain records of the federal equipment loans to fire departments.	DEM/DFE	OG		
			B. Work with Emergency Management Agencies to maintain an inventory of fire apparatus and public heavy equipment statewide.	DEM/DFE, Fire Districts, FFAC, FEMA RIEMA and municipalities	ST/OG		
			Performance Measures				
			A. # of departments with FFP and FEPP & # of departments inventoried				
			B. Check on yearly update of records.				
			15. Use DEM /DFE personnel in non-fire seasons to take a more active role in fire prevention activities and general public educational programs.				
			A. Use Smokey Bear Educational program to educate school children about fire safety.	DEM/DFE	OG		
			B. Develop and distribute Firewise packets in local fire district tax bills & insurance bills in suburban and rural communities.	DEM/DFE, Fire Districts, FFAC and municipalities	ST		
			C. Work with communities to promote awareness of forest fire/fuel reduction measures reduction measures applicable to their respective communities.	DEM/DFE, Fire Districts, FFAC and municipalities	OG		
			Performance Measures				
			A. # and length of programs and # of students attending				
			B. # of packets developed and distributed.				
			C. # of communities promotion programs presented				
			16. Use prescribed burns for forest health and wildlife habitat enhancement.				
A. Use prescribed burns to reduce hazardous levels of fuel build up in forests.	DEM/DFE, P&R and F&W	OG					
B. Use prescribed burns for wildlife habitat enhancement.	DEM/DFE and F&W	OG					
Performance Measures							
A. & B. # of prescribed burns and acres burned							
17. Petition for additional staff to fill gaps in fire protection program to develop CWPP program							
Performance Measures							
A. Additional staff added to Fire Program.	DEM/DFE	ST					
B. Number of CWPPs developed.	DEM/DFE and Fire Districts	OG					

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame
Commercial Forest Products (CFP)	CFP	45	1. Promote the wood and paper industry as a significant economic resource to the state, using forest products that focus on renewable resources and promote carbon sequestration.		
			Performance Measures		
			# of promotional articles and projects	DEM/DFE, RIRDC, RIRC&D And RIFCO	OG
			2. Obtain accurate information on the economic viability of the state's forest products industry.		
			Performance Measures		
			Check on 5 year updates on value of RI forest products industry	DEM/DFE and RIRDC	OG
			3. Use data sources such as intent to cut forms and forest land classification to track the economic status of forest resources on a statewide level.		
			Performance Measures		
			# of intent to cut forms filed and reviewed	DEM/DFE and RIRDC	OG
			4. Use the State review process to insure that local comprehensive plans support opportunities for sustainable harvest of forest products in an appropriate manner.		
			Performance Measures		
			# of municipal comprehensive plans reviewed	RISPP and DEM/DFE	OG
			5. Continue participation in the southern New England stumpage price survey as a means of assessing market conditions.		
			Performance Measures		
			N.A.	DEM/DFE and RIRDC	OG
			6. Promote timber harvesting as enhancing forest diversity and creating beneficial wildlife habitat.		
			Performance Measures		
			# of Stewardship Program acres	USFS, DEM/DFE and F&W	OG
			7. Work with the RIRDC to promote forest products markets by encouraging value-added industries and activities.		
			Performance Measures		
			# of promotional articles and projects	RIRDC and DEM/DFE	OG
			8. Insure that forest management plans and BMPs are used during commercial harvesting of forest products.		
Performance Measures					
# of Stewardship Program acres	DEM/DFE	OG			
9. Develop and implement forest management plans using BMPs for state owned forestland.					
Performance Measures					
# of acres with forest management plans	DEM/DFE, F&W and P&R	LT			
10. Provide technical assistance to facilitate management of forestlands.					
Performance Measures					
# of assists with forest landowners	DEM/DFE	OG			
11. Promote alternative wood products as viable forest products to sustain uses of RI forestlands.					
Performance Measures					
# of grants and dollar value of alternative wood product grants # of pamphlets developed and distributed	DEM/DFE, RIFCO and RITF	ST/OG			

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame		
Commercial Forest Products (CFP) (continued)	CFP	37	12. Promote alternative wood products through distribution of success stories from DEM challenge grants.				
			Performance Measures				
			# of pamphlets developed and distributed			DEM/DFE, RIFCO and RITF	
			# of workshops held				
			13. Promote secondary wood product production to increase forest resources uses in RI.				
			Performance Measures				
# of pamphlets developed and distributed			DEM/DFE, RIFCO and RIRDC				
# of workshops held			ST				
14. Promote the use of locally grown wood products to help insure viable outlets for forest resources within the state.							
Performance Measures							
# of pamphlets developed and distributed			DEM/DFE, RIFCO and RIRDC				
# of workshops held			ST				

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame
Water Resources (WR)	(WR)	46	1. Increase public awareness about the role forests play in protecting water quantity & quality.		
			A. Provide information to communities about the condition and value of their watershed resources (Inventory & GIS maps)	DEM, RIRC WRB	OG
			Performance Measures		
			A. # of meetings and workshops		
			2. Integrate forestland protection into community planning to provide water quality benefits.		
			A. Manage forestlands within watersheds, especially adjacent to public water supplies and aquifers, to protect water quality as well as wildlife habitat, and maintaining aesthetics.	DEM WRB	OG
			B. Plan watershed wide greenway systems to identify and protect key riparian resources.	DEM, and RIRC Land Trusts and municipalities	ST
			C. Promote the adoption of land development standards that require consideration of and the protection of key forest-related water resources.	RISPP and Municipalities	ST/OG
			Performance Measures		
			A. # of acres within forested riparian areas with stewardship plans		
			B. # of watersheds with action plans		
			C. # of communities with innovative land development protection standards		
			3. Guard against loss or unnecessary degradation of forested riparian areas.		
			A. Encourage retention of forested riparian buffers and use of standards that provide for the retention and/or restoration of forested buffers in all development projects.	municipalities	OG
			B. Use innovative land use ordinances that direct development to less sensitive land to conserve/protect existing forested areas.	municipalities	ST/OG
			C. Promote greater use of the FFOS Act to protect forested lands designed as open space in local comprehensive plans to protect riparian buffers.	DEM/DFE and municipalities	OG
			Performance Measures		
			A. # of communities with innovative land development protection standards		
			B. # of communities with innovative ordinances for riparian protection		
			C. # of communities that have received information on methods to protect riparian areas		
			4. Encourage stewardship of forested riparian resources.		
			A. Educate private forest landowners to protect and manage forested riparian buffers by providing information and technical assistance.	DEM, RIRC, RITF and RIFCO	OG
			B. Develop and distribute guidelines for buffer restoration to encourage establishment of forested riparian buffers.	DEM and RIRC	ST
C. Support municipal funding for projects to restore and/or create forested riparian buffers where appropriate on public lands.	municipalities	ST			
Performance Measures					
A. # of assists					
B. # of pamphlets developed and distributed					
C. # of communities with publicly-owned riparian buffer restoration as capital expense					
5. Protect water quality during forest harvesting operations.					
A. Continue to require the use of BMPs for all timber-harvesting operations.	DEM/DFE, WRB and OIC	OG			

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame
Water Resources (WR) (continued)	(WR)	38			
			B. Continue to provide training to foresters and loggers on the use of BMP's.	DEM/DFE, and RIFCO	OG
			C. Continue to provide a coordinated review of timber-harvesting operations involving wetlands.	DEM/DFE, WRB and OIC	OG
			D. Continue to work with other groups to educate landowners on land management practices.	DEM/DFE, RITF and RIFCO	OG
			E. Strengthen and continue to enforce ATV regulations on private and public property to prevent damage and soil and water degradation.	DEM/DFE, WRB and OIC and ENF	ST
			F. Strengthen compliance with the DEM <i>Intent to Cut</i> Rules and Regulations and increase fines for violations to insure protection of forested riparian buffers during logging operations.	DEM, WRB	ST
			Performance Measures A. # of <i>Intent to Cut</i> filed in wetland areas B. # of workshops and attendees C. # of <i>Intent to Cut</i> filed in wetland areas D. # of workshops and attendees E. # of violations written F. # of violations acted upon		

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame		
Forestland Recreation and Tourism (FRT)	(FRT)	47	1. Inventory, map, and classify forested recreation areas.				
			A. Inventory and document existing conditions, allowed recreational activities and insure sustainable practices on the state forestlands.	DEM/DFE, F&W, and P&R	LT		
			B. Use the inventory data to develop brochures promoting forested recreation areas for recreation and tourism.	DEM/DFE, F&W, and P&R	ST		
			C. Protect, and maintain natural areas of concern that support rare and endangered plant and animal habitats, geological features, and other special natural resources in the forested recreation areas	DEM/DFE, F&W, P&R,TNC,ASRI, Land Trusts, and Municipalities	OG		
			D. Use the Rhode Island's Natural Heritage Program in planning recreational and tourist projects and uses in forested areas.	DEM/DFE, F&W, P&R,P&D, TNC, ASRI, Land Trusts, and Municipalities	OG		
			Performance Measures				
			A. # of acres inventoried and documented				
			B. # of brochures developed and distributed				
			C. # of natural areas of concern protected				
			D. # of assists				
			2. Provide adequate funding for forestland recreational projects.				
			A. Create and maintain a fee system to adequately support capital and operating expenses.	DEM	ST		
			B. Use generated funds to help support recreational areas.	DEM	OG		
			C. Improve state forest recreation areas through a program of trail maintenance, road repair and infrastructure improvements.	DEM/DFE, F&W, and P&R DEM/DFE, F&W, P&R,P&D, TNC, TAC,	OG		
			D. Continue to use the Trail Advisory Committee to allocate National Recreational Trails Program funds to improve facilities and create access.	ASRI, Land Trusts, and Municipalities	OG		
			Performance Measures				
			A. Amount of reduction in requested dollars for capital and operating expenses				
			B. # of dollars reinvested				
			C. # of feet of roads and trails improved				
D. # of grants and dollar value awarded to successful projects							
3. Protect the forest resources and users while providing a variety of services within forestland recreation areas.							
A. Use DEM personnel to enforce State Rules and Regulations.	DEM	OG					
Performance Measures							
A. # of immediate compliance reports, warnings & # of violations filed							
4. Coordinate the policies affecting the recreational use of State management areas with recreational groups through the Trail Advisory Committee in support of the objectives of the SGP 155, the State Comprehensive Outdoor Recreation Plan "the SCORP".			DEM/DFE, F&W, P&R,P&D, TNC, TAC, Land Trusts, Municipalities and RISPP	OG			
Performance Measures							
N.A.							

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame
Fragmentation (F)	(F)	49	1. Track the status of forest resources on a statewide level.		
			A. Develop information management systems to track and analyze forest conversion data.	USFS, DEM/DFE, and TNC	ST
			B. Identify critical areas of rapid forest conversion and fragmentation.	DFE/DFE, and TNC	ST
			C. Develop cooperative agreements with the USFS to inventory and assess forest conversion data and trends.	USFS, and DEM/DFE	
			D. Develop cooperative agreements with URI to coordinate research regarding the impact of forest conversion and fragmentation on resource values.	URI, USFS, and DEM/DFE	ST
			Performance Measures		
			A. information management systems developed		
			B. # of critical areas identified		
			C. & D. # of cooperative agreements developed		
			2. Identify forest resources as a significant natural resource.		
			A. Update State standards for local comprehensive plans for community forest resources, including inventorying, mapping and policies.	DEM/DFE and RISPP	ST
			Performance Measures		
			A. # of standards developed and in comprehensive community plans		
			3. Promote forest conservation and management in priority areas where significant development pressure exists and land conversion is occurring.		
			A. Work with partners to promote and implement land use ordinances that minimize forest cover and fragmentation.	DEM/DFE, TNC, RISPP and municipalities	OG
			B. Promote the use of property tax incentive programs that minimize the loss of forestland.	DEM/DFE, TNC, RISPP and municipalities	OG
			Performance Measures		
			A. # of working ordinances developed & # of acres protected		
			B. Provide information on property tax reduction incentive programs, alternative development design standards and other techniques that minimize the loss of forestland.	DEM/DFE, TNC, RISPP and municipalities	OG
			4. Promote land use and "smart growth" policies on the local and watershed levels.	DEM/DFE, RISPP and municipalities	ST
			Performance Measures		
			# of working partnerships		
			5. Use innovative land development techniques to conserve forests.		
			A. Encourage the adoption of innovative land use ordinances and incentives to protect forests during site planning.	DEM/DFE, TNC, RISPP and municipalities	ST /OG
			B. Encourage programs such as "growth centers" to guide development towards established areas where infrastructure exists to reduce fragmentation	municipalities and RISPP	OG
			Performance Measures		
			A. # of communities with innovative land development ordinances.		
			B. # of developments on reclaimed land		

Issue	Policy	Page #	Objectives & Strategies	Primary Responsibility / Partners	Time Frame
Fragmentation (F) (continued)	(F)	40	6. Encourage voluntary preservation and stewardship of open space by landowners.		
			A. Continue to recognize and promote the FFOS Act as a tool to conserve forestland.	DEM/DFE and municipalities	OG
			B. Maintain a clearinghouse of information about land conservation.	TNC and RILTC	ST
			Performance Measures		
			A. increased acres or conservation easements in FFOS Program		
			B. information program established		
			7. Support sustainable forest product industry as a means to retain forestland and to prevent fragmentation.		
			A. Educate private forest landowners how to manage their forest sustainably and prevent fragmentation.	DEM/DFE, RC&D and RIRDC	OG
			Performance Measures		
			# of forest product industries		

Appendices

Appendix A, Related Forestry Laws in Rhode Island

Appendix B, Focus Group Report & Forestland Owners Survey

Appendix C, Comparison of 2005 Survey and 2010 Survey

Appendix D, Forestry, Agriculture and Land Use Change Strategies for Greenhouse Gases Emissions in Rhode Island

Appendix E, Forest Legacy Documentation

Appendix A

Related Forestry Laws in Rhode Island

RELATED FORESTRY LAWS IN RHODE ISLAND

Rhode Island Constitution

Article 1, §17 of the Rhode Island Constitution secures the right of the public to “the use and enjoyment of the natural resources of the state,” and directs the General Assembly to “provide for the conservation of the air, land, water, plant, animal, mineral and other natural resources of the state...and to adopt all means necessary and proper by law to protect the natural environment....” Tree and forest resources clearly fall within the Constitutionally directed protection of the natural resources of the state.

State Statutes

The Rhode Island General Assembly has enacted a number of statutes directly and indirectly governing the management of the state’s trees and forest resources. Elements establishing the legal framework for forestry in Rhode Island include:

Department of Environmental Management R.I. General Laws § 42-17.1 et seq. establishes a state Department of Environmental Management and authorizes it to “supervise and control the protection, development, planning, and utilization of the natural resources of the state....including.... plants, trees.....”

Within the R.I.DEM, the Division of Forest Environment is assigned responsibility for forest management, including “assisting other agencies and local governments in urban programs relating to trees, forests, green belts, and environment.”

Pursuant to this responsibility, the Division operates the state’s Forestry Program, provides cooperative forest management, wildfire prevention and suppression, insect and disease control, and management of state owned forests. The Division works closely with the U.S. Department of Agriculture’s Forest Service, other units of DEM, municipalities, and private groups in pursuit of its forest management responsibilities.

Forested Wetlands

R.I. General Laws § 2-14-1 et seq., the Rhode Island Freshwater Wetlands Act, offers regulatory protection to approximately 75,000 acres of forest land that meet the statutory definition of a freshwater wetland. Alterations to wetland areas require permission from Rhode Island’s DEM’s Director. In general, the Freshwater Wetlands Program seeks to avoid or minimize permanent changes that negatively impact wetland values.

Activities may be permitted, permitted with stipulations, or denied, depending on their impacts upon the wildlife habitat, recreational, water supply, and other values of the wetland affected. Permit restrictions on cutting and clearing of vegetation, draining, watercourse alterations, and requirements for maintenance of vegetated buffers surrounding wetlands all help to protect the state’s forest resources.

Municipal Tree Wardens

R.I. General Laws § 2-14-1 et seq., requires municipalities to appoint a tree warden and charges the appointed official with responsibility for the “care and control” of trees and shrubs within public land and rights-of-way controlled by the municipality, and of portions of private trees that extend into or over public roads or grounds. Tree wardens must be licensed arborists, are authorized to prune or remove hazardous trees at public expense, cooperate with the R.I.DEM in the suppression of pests and diseases, and propose regulations governing the care and preservation of suitable trees. Several municipalities have adopted tree ordinances that further detail the responsibilities of the local tree warden.

Criminal and Civil Penalties for Unlawful Cutting or Vandalism to Trees

R.I. General Laws § 11-44-2 et seq., prohibits persons from uprooting, cutting down, or otherwise injuring or damaging trees or underwood on land of another, without permission of the owner, and establishes a penalty of up to one year's imprisonment or a fine of (the lesser of) triple the monetary damage or \$1,000 plus compensation of triple damages to the wronged property owner. R.I. General Laws § 34-20-1 creates liability for civil damages for the unauthorized cutting of trees or wood on the land of other persons.

Licensing of Arborists

R.I. General Laws § 2-19-1 et seq., establishes definitions, standards, examination, and licensing requirements for individuals and business entities engaging in the practices of "pruning, trimming, spraying or repairing fruit, shade and ornamental trees." The R.I.DEM is authorized to establish rules and regulations governing the practice of arborists.

Protection of Trees and Plants Generally; Replacement of Trees Removed on Public Land

R.I. General Laws § 2-15-8 et seq., requires that permits be obtained from the local tree warden, park commission, or state department having jurisdiction prior to the cutting or removal of any tree or shrub, or the burning of rubbish or debris on public lands. Any person, firm, or governmental entity that removes or substantially damages any tree on public land must replace the tree with substantially equivalent tree or trees, having the sum of the diameters equal to twice that of the tree removed or damaged. Public utility work in accordance with a properly approved trimming and replacement program is exempt from the requirement.

Right-of-Way Tree Planting

R.I. General Laws § 45-2-43 authorizes cities and towns to appropriate resources under the direction of the tree warden for planting shade trees upon (private) land adjoining a public right-of-way at a distance of up to 20 feet. This section allows municipalities the discretion to spend public funds to plant street trees on private land provided that the tree will function as a public tree by improving, protecting, shading, or beautifying the public way. This option allows municipalities to involve private landowners in the stewardship of what remain essentially street trees and gives flexibility to site new trees away from utility corridors, avoiding the need for severe pruning and improving their vitality and beauty. The City of Newport has utilized this authority in its tree planting and replacement programs and anticipates significant maintenance cost savings over the long term.

Right To Farm

R.I. General Laws § 2-23-1 et seq., finds that agricultural operations are valuable to the state's economy and general welfare and that they are being adversely affected by the random encroachment of urban land uses throughout rural areas of the state. The Act declares it to be policy of the state to promote an environment in which agricultural operations may be safeguarded against nuisance actions arising from conflicts between agricultural operations and urban land uses. The statute defines agricultural operations to include "forestry", and provides (generally) that no agricultural operation shall be found to be a public or private nuisance due to alleged objectionable odors, noise, dust, or use of agri-chemicals associated with generally-accepted agricultural practices. The Act further provides that no city or town may enforce any ordinance pertaining to the construction, location or maintenance of places for the keeping of animals, against any agricultural operation as defined in the Act.

Registration of Wood Cutting Operations

R.I. General Laws § 2-15-1 et seq., requires that any persons, firms, and corporations cutting standing or growing trees for commercial forest products must be registered as a woods operator with the R.I. Department of Environmental Management, and, further, such persons must file with the R.I.DEM a notice of intent to cut or saw at least five days prior to the cutting or sawing, and must utilize best management practices while harvesting trees.

State Guide Plan

R.I. General Laws Chapter 42-11 establishes a Statewide Planning Program, and requires the preparation and maintenance of a State Guide Plan for the physical, economic, and social development of the state. In addition to this Urban and Community Forestry Element, the State Guide Plan includes related elements that establish a policy framework for management of the state's forest resources: Forest Resources Management Plan (1984), Greenspace and Greenways Plan (1994), Outdoor Recreation Plan (2004), and State Land Use Policies and Plan (1989). Local comprehensive plans must be consistent with the State Guide Plan's policies.

Local Comprehensive Planning

R.I. General Laws Chapter 45-22.2 requires all municipalities to prepare, adopt, and periodically update local comprehensive plans providing a rational basis for decisions regarding the long-term physical development of the municipality. A Natural Resources Element, which inventories and sets policies "for the protection and management of significant natural resources, including natural vegetation systems" is a required part of the comprehensive plan. Comprehensive plans must be based upon citizen input, must be internally consistent in their goals and policies, and must be consistent with the State Guide Plan. Local zoning decisions must be consistent with the approved local comprehensive plan's land use element.

Municipal Zoning Authority

R.I. General Laws § 45-24-27 et seq. requires, and establishes minimum standards for, all municipal governments to enact zoning ordinances. Ordinances are intended to regulate "the nature and the extent of the use of land for residential, commercial, industrial, recreational, agricultural, open space or other use....as the need for land for those purposes is determined by the city or town comprehensive plan." A complete update of the state's zoning enabling act was adopted in 1991. In addition to establishing permitted future uses of land that accord with adopted plans, the act authorizes communities to have "...requirements for: the density and intensity of use, ...landscaping, ...open space, ... and buffers, ...and, permitting, prohibiting, limiting, and restricting development in ...designated significant natural areas." Municipalities may also adopt special provisions including incentive zoning, transfer of development rights, and regulation of "development adjacent to ...public greenspaces...or valuable natural resources." As the principal governmental control over future usage of land, local zoning ordinances have great impact on Rhode Island's forests.

Subdivision and Land Development Project Review

R.I. General Laws § 45-23-25 et seq., completely updated in 1992, requires all municipalities to develop and adopt regulations controlling the process of land subdivision and land development within their boundaries. Among the purposes of municipal subdivision/land development project review is "promoting the protection of the existing natural and built environment and the mitigation of all significant negative impacts of any proposed development" Municipalities are authorized to enact a master planning review process for approval of new development and subdivision projects and to adopt requirements for physical design, including: "...open space, landscaping,... and the relationship of proposed developments to natural and man-made features of the surrounding neighborhood." Ordinances may also include public

design and improvement standards for "landscaping, and ...soil and erosion control." Standards for dedication of private land, or payment of a fee in lieu thereof, in connection with new development are also authorized. Communities may utilize the powers and authorities conferred by the Land Development and Subdivision Review Act to require protection of existing tree resources and to specify requirements for replacement or new tree resources in connection with new development.

Watershed / Forestland Acquisition

R.I. General Laws § 46-15-3 et seq., entitled the Public Drinking Water Supply System Protection Act of 1997, is primarily a drinking water protection statute that also benefits the forest resources of the state. It requires that each public drinking water supplier add a charge to be known as a "water quality protection charge" to every water bill issued. The Act requires that not less than 55% of the funds shall be spent for acquisition of land or rights in land or physical improvements to acquired land to protect the quality of raw water of the water supply system. The acquisition of land often involves the acquisition of forestlands that become protected lands as described in Part 2, through the Watershed Land Acquisition Program, administered by the Rhode Island Water Resources Board.

Appendix B

Report On Five Focus Groups of Rhode Island Forest Stakeholder Groups

in preparation for the development of the
Rhode Island Forest Resources Management Plan 2004

Prepared by
Greenwich Marketing, Ltd.
Spring 2004

**Rhode Island Department of Environmental Management
Division of Forest Environment**

Landowner Survey 2003

Overview

In November and December 2003 the Division of Forest Environment issued a 50-question mail survey to over 2,000 Rhode Island forestland owners regarding current and future usage and management of private and State owned forestlands. Over 600 completed questionnaires were returned. The questionnaire was similar to the one developed and issued by DFE and the Audubon Society in 1984 in preparation of that year's long range Rhode Island Forest Resources Management Plan. In preparation for the focus groups, Greenwich Marketing, Ltd. analyzed the first 249 responses.

In April and May 2004, Greenwich Marketing, Ltd. conducted focus groups with five forestland stakeholder groups, in preparation for the writing of the 2004 edition of the long range, Rhode Island Forest Resources Management Plan. The groups were Environmentalists, Resource Professionals, Commercial Forest Users, Private Forestland Owners (RIFCO), and Recreational Forestland Users (RI Trailways Advisory Council). A total of 47 individuals participated in the 90-minute discussion groups. The following represents the key findings of the focus groups:

Key Observations:

1. DFE is under-funded to accomplish its missions. Although respondents have great respect for the Division of Forest Environment for its expertise, professionalism, hard-work, objectivity, integrity, and as the trusted arbiter between user groups, most believe that the division is under-funded and does not have sufficient manpower, money, and resources to carry out the many missions that fall within its areas of responsibility, in an optimal way. Legislator education and public education are seen as the cures for this situation.

2. Stakeholder groups have differing priorities. As expected, each of the stakeholder groups had different mission priority rankings according to their special interests.

- A. **Environmentalists** were most concerned with preserving existing forests in their natural States and acquiring more forestland to prevent its development.
- B. **Forest resource professionals** were most concerned about protecting forestlands to protect both the freshwater and ultimately the saltwater resources of the State and to protect forestlands against fire and disease catastrophes.
- C. **Private landowners** were most interested in getting the State to provide them with on-the-ground forest management assistance, tax-relief for their forestlands, and guidance on the best ways to transfer the ownership, development rights, or conservation rights of their properties.
- D. **Commercial forest users** were most interested in having the State open up more State forestlands to commercial timbering, which they thought would provide employment and fund more State forest management through shared sale revenues, lease fees, and sales taxes. The commercial group seemed to be one of the most scientifically informed groups about forest management and sincerely committed to maintaining, long-term, healthy forests as an environmental and economic resource.
- E. **Recreational users** wanted the State to maintain its forestland recreational facilities, open up and manage more recreational areas, and manage user conflict, most notably between, off-road motorized vehicle users, hunters, and other forest recreational users.
- F. **All agreed** that children, citizen-taxpayers, town officials, business leaders, State legislators, the media, and the governor, all needed to be educated about Rhode Island's forests, and their environmental, recreational, and economic importance to the State in order to obtain the public and financial support necessary to preserve and optimize forest resources. Education should take

place through literature distribution, forest demonstration areas, forest education tours, school programs, adult speakers programs, extension services, lobbying, PR, and mass media.

3. Key issues are forestland acquisition, broader management of State lands, and public education.

The mail survey showed the following hierarchy of funds allocation to DFE missions, if additional funds were to be made available, as a good indicator of forestland owner priorities:

Allocation Of Additional Funds To DFE Missions

Acquire key parcels *	26%
Broaden management on State lands	11%
Purchase development rights *	19%
Provide on ground technical assistance	9%
Increase public education	7%
Publish to educate landowners	6%
Promote forest recreation & tourism	5%
Survey forest health **	5%
Strengthen fire control ***	5%
Enhance recreational opportunities	5%
Promote forest product industry	2%

* There was a general consensus that funds to acquire key parcels of forestlands or development/conservation rights should be separate and above funds for DFE operations.

** There seemed to be a general consensus that, with "globalization", preventing forest infestation and disease may be impossible and in many cases only nature will be able to heal itself. Limited resources are focused on real problems occurring today rather than only possible future problems, no matter how potentially disastrous.

*** There seemed to be a general consensus that a major forest fire in Rhode Island was improbable because of fragmentation, people traveling with cell phones, the nature of dominant hardwood forests, and adequate mutual aid resources. Once again, limited resources are focused on real problems occurring today rather than possible future problems, no matter how potentially disastrous.

4. The State should acquire key forestland if it is going toward residential/commercial development. There was a general consensus that the State should only acquire the amount of forestlands that it could effectively manage. But, if the choice had to be made to purchase land or have it go to residential development, the choice would be to have the State acquire the land or development/conservation rights. The thought was that the State could always re-sell the land later with development restrictions.

5. The key issues of acquisition, current resource management and education reflect the broader mail survey. Respondents within the various focus groups generally reflected the levels of concern about issues that were expressed in the private forestland owner mail survey. Within the focus groups, when asked what should be done about the concerns on a priority basis with limited resources the general consensus was: Accrue funds to buy key land or rights. Resource manage State forestlands. Educate all citizens about the benefits and needs of Rhode Island's forests.

RI Landowner Concerns

<u>Issue</u>	<u>% Very Important or Critical</u>
Protecting forestland from development	94%
Forest sustainability	85%
Water resources	84%
Forest health (disease & infestation)	79%
Education	72%
Forest resource management	69%
State forestland management	67%
Forest products marketing	66%
Recreation and tourism	52%
Forest fire prevention / control	38%

6. Respondents within the various focus groups generally reflected the levels of agreement about issues that were expressed in the private forestland owner mail survey.

RI Landowner Agreement On Issues

<u>Issue</u>	<u>% Agree or Strongly Agree</u>
DFE should distribute more forest management literature	89%
DFE and others should provide more landowner workshops	85%
DFE should acquire key forestland or development rights	82%
DFE should manage State forestlands as demonstration areas	79%
DFE should promote incentives for active forest management	77%
DFE should use media to promote sound forest laws and regs.	76%
DFE and Extension Service should coordinate forest PR efforts	76%
DFE and towns should use more conservation easements	75%
DFE should provide on ground technical assistance	75%
DFE should limit tech assistance and seek forestry consultants	74%
Towns should promote innovative development	73%
Towns should promote mutual aid agreements	71%
DFE and towns should recruit more volunteer firefighters	70%
DFE should use media to communicate forest benefits & threats	66%
DFE should provide local fire control training and support	63%
DFE should use mass media to prevent forest fires	60%
DFE should focus on State lands to enhance recreation/tourism	60%
There should be a single Statewide FF&OS assessment	53%
DFE should provide more forest marketing information	50%
DFE should focus on State lands to promote economic benefits	39%
DFE should focus on State lands not private	23%

7. RIDEM/DFE is seen as the primary educational source on forest issues. Seven of the top ten key issues involve communication or education. A general consensus was the RIDEM/DFE is a primary source and a funnel for federal information regarding forest issues and provides on ground technical assistance and demonstration areas. Private consultants in the focus groups stated that they provide a great deal of education to private and commercial landowners. RIFCO was seen as an excellent owner-to-owner forum for the exchange of forest management information and the operation of its workshops and demonstration areas. (DFE is a member of RIFCO and financial supporter.) There is a great deal of self-education through books, Internet and television. A general consensus was that the URI Extension Service could play a much greater role in forestry education and service. This correlates with the findings of the mail survey.

Where do you get information about forest management?

RIDEM Forester	204
Private Consultant	91
Books	90
Neighbor, landowner, friend	72
Brochures, fact sheets	55
Workshops	32
Internet	28
Other government agencies	27
Television, video	27
Procurement Forester	26
Other	18
Non-profit group	9

Informational Programs DFE Should Develop....

Farm, Forest & Open Space Program	16%
Wildlife	12%
Water quality	11%
Forest health	11%
Invasive Species	9%
Estate Planning	8%
Forest fire control	6%
Wood products	6%
Alternative forest products	6%
Forest Legacy	6%
Aesthetic benefits	6%
Recreation	3%

8. All activities should be allowed on State forestlands that can be managed. There was a general consensus that the State should allow all of the activities on its public forestlands that appeared on the list provided, to the extent that the State could manage and police the activities.

9. Private landowners are restrictive in the activities they allow, but there is much unauthorized use. Private landowners, as reflected in the mail survey, were much more discriminating in terms of allowing any activities at all, or in the activities that were allowed by individual and special permission. Most private landowners experienced frequent trespassing and unauthorized activity on their properties, but most did not post their properties.

Allowed Public Use Activities On Private Forestlands

No activities allowed	39%
Hunting	18%
Horseback riding	7%
Natural history education	7%
Hiking	7%
Fishing	4%
Cross-country skiing	4%
Firewood cutting	3%
Cross-country running	2%
Picnicking	2%
Camping	2%
Snowmobiling	2%
Motorbiking	2%
Trapping	1%



10. Off-road motor vehicles and hunting are the primary user conflicts. The greatest user conflicts were between off-road motorized vehicle users and hunters versus all other users. The Rhody Rovers motorized vehicle organization cited the number (1,900) of new off-road vehicles that are sold in the state each year, multiplied that number by a factor of two, for used vehicles and vehicles purchased out of state, and argued that the sales tax revenue and tourist revenue that the State could collect justifies the State providing large forestland areas for off-road use. Proponents pointed to other larger states that have designated motorized vehicle areas. Some suggested that off-road vehicles could be permitted and licensed so that they could be identified, policed, and revenues could support designated areas. Other recreational users argued that motorized vehicles are dangerous to riders; dangerous to other forestland users; they are noise polluting; air polluting and, destructive of trails and forest habitat. Many thought that Rhode Island just has too few acres of forestland to designate the large acreage that an off-roading area would take. They also felt that such an area would still not stop the hundreds of kids and irresponsible adults with motor vehicles who live abutting forestlands and trespass daily. Although some private landowners and the State allow hunting in designated areas at designated times, the major concern is for the number of hunters who hunt unsafely, against the rules, beyond designated areas, and beyond designated times.

11. Timbering on State forestlands was a key issue in the focus groups. Commercial forestland operators made a compelling case stating that for every dollar Connecticut invests in a State Forester to supervise commercial timbering on State forestlands, the State earns back three dollars in revenues. They also suggested that supervised, selective, timbering increases state employment, enhances long term forest health, clears out combustible buildups, improves species distribution, and opens up interior forest access trails. Commercial users displayed excellent, scientific forest management knowledge and a sincere interest in maintaining the long-term ecological health of forests. Commercial foresters said they would be willing to work under DEM supervision and meet with environmental groups to discuss mutual interests.

12. The Farm, Forest and Open Space Program is good and necessary, but not used by all. All agree that more information about this program must be communicated to forestland owners and to local town officials. Many private landowners said they don't participate because of "inertia", the fact that they need to have an active forest management plan, a feeling that they would lose money because expenses to manage their land would be too high, or they "just want to leave the land in its natural State". Some respondents were concerned about lost property tax revenues to towns if single FF&OS tax ceilings were mandated statewide. (This is also a concern if the State acquires forestlands and takes them off the tax rolls.) Proponents pointed out that residential property is much more expensive to support by a town than forestland. The general consensus was that the FF&OS program is a good and necessary program for preserving forestlands in Rhode Island.

THE FOLLOWING ARE OBSERVATIONS REGARDING SPECIFIC QUESTIONS

13. Does RI have sufficient manpower, money, and resources to prevent or cope with a major forest fire?

The general consensus is that RI does not have the manpower, money, or resources to prevent or cope with a major forest fire.

Some observed problems are:

- A. There is not enough manpower and it is perhaps not young enough for forest fire fighting within the rural volunteer fire companies.
- B. There is insufficient training.
- C. There are not enough vehicles and equipment.
- D. Access roads into forests have been gated and allowed to become overgrown and inaccessible.
- E. Due to insufficient manpower and funds, fire towers are no longer maintained and manned, except the very few remaining, during the most extreme fire danger periods.



- F. There are more homes in or near forestlands and that increases the danger of fire and presents a higher risk of residential property damage, human injury, and loss of life.
- G. There is a buildup of fuels on the ground and not all deep woods areas have water holes to supplement tanker trucks.

Some recommended solutions are:

- A. More financial, technical, and material support, recruiting, training and equipping of rural volunteer fire companies from town, State, and federal governments.
- B. Development and distribution of a Comprehensive Mutual Aid Plan between volunteer and full-time fire departments, between towns, the State, including the RI National Guard, other states, and federal agencies. Chief David Shaw, of the Pascoag Fire Department, believes that the State Fire Chiefs Association is developing such a statewide plan that, in addition to fire, covers Emergency Medical Services and Hazardous Materials Response.
- C. Providing manpower and resources for adequate resource management of private and State forestlands, and perhaps supervised, selective, timbering that could provide funds for forest management, clear fuel buildups, maintain water holes, and clear fire access roads into forests.
- D. Creative ideas to keep fire towers open are to lease space on them to cell phone companies to hang their antennas and maintain them, or to rent the towers as overnight camp sights to hikers/campers.
- E. Promote the passage of strict forest fire prevention laws, post them throughout forests, and enforce them.
- F. Provide major forest fire prevention education, as in the “Smokey Bear” program in schools, through literature distribution, as part of general forestry education seminars, and through the media.
- G. Encourage all persons, when traveling near or through forestlands, to carry cell phones and report any evidence of forest fires immediately.

14. Does RI have sufficient manpower, money, and resources to prevent or cope with a major forest infestation or disease?

The general consensus is that RI does not have the manpower, money, or resources to prevent or cope with a major forest infestation or disease. However, there is also a general consensus that there is not much that humans can do to prevent or cope with forest infestations and disease.

Some observed problems are:

- A. In a globalized world, plant diseases and infestations are being spread all over the planet.
- B. The State’s land grant college, URI, does not have a certified forester education program and does not maintain an active Forest Extension Service.
- C. The State alone does not have the manpower and resources it had in the past to detect or cope with a major problem, such as the capability to “cut out” infested areas, or spray areas, if those actions were deemed necessary and practicable – less damaging than the infestation.

Some recommended solutions are:

- A. Reliance on mutual aid from other states and federal government agencies
- B. Promotion of a more active Forester Education and Extension Service at URI

15. What are the major issues facing Rhode Island's forestlands?

The general consensus throughout all of the groups was that forestland acquisition, forest resource management by the State, on both State and private forestlands, and education were the key issues. To most respondents, this very broadly meant that the State should have sufficient manpower, money, and resources to positively affect all the other major issues by its operations and acquisitions of land or development rights, its supervision of forestland commercial operations and its cooperative education programs.

Effective Forest Resource Management by the State on State and private lands means...

- A. Preventing and offsetting the effects of fragmentation and development (acquisition)
- B. Protecting the State's freshwater supplies and the Bay
- C. Promoting the sustainability of forests
- D. Preventing and coping with forest fires
- E. Preventing and coping with forest disease
- F. Promoting forest commercial use in an environmentally positive manner
- G. Managing recreational use and user conflict
- H. Educating the public and legislators about forest benefits and needs

After all the above Forest Resource Management activities, the respondents generally assigned to the Division of Forest Environment and other government and non-government agencies, the responsibility to educate a wide range of audiences about forest issues to promote forest stewardship and political and financial support to acquire forestlands and/or conservation rights and to conduct forest management operations.

- 1. Children
- 2. Citizens
- 3. Taxpayers
- 4. Landowners
- 5. Commercial users
- 6. Recreational users
- 7. Towns
- 8. State Legislators
- 9. Governor
- 10. Congressional delegation
- 11. Federal agencies
- 12. Business community
- 13. Media

16. What activities should be allowed on State forestlands?

The general consensus of all groups was that all activities listed should be allowed on State forestlands, to the extent that they can be managed, supervised, and policed by the State.
Some observed problems:

The activity of most concern to all groups was unauthorized, uncontrolled, off-road motorcycling. Respondents objected on several bases:

- A. Dangerous to riders, especially juvenile riders
- B. Dangerous to other forest users
- C. Environmentally destructive of forestlands
- D. Environmentally destructive of air quality
- E. Promotes general trespassing
- F. Difficult to police because of offenders' high-speed mobility.

The activity of second most concern, especially to environmentalists, was commercial timbering of State lands. Respondents objected on the following bases:

- A. Fear of clear-cutting and non-replenishment
- B. Fear of collateral damage from skidders and equipment
- C. Fear of selective species distribution
- D. Conflict with other forest users

The activity of third most concern was unauthorized hunting and/or trapping.

Some recommended solutions

Off-Road Vehicles

- A. Several respondents, especially members of the Rhody Rovers, an off-road riding organization, suggested designating large areas of forestland for off-roading, and charging admission. They cited the fact that over 1,900 new, major-manufacturer, off-road vehicles are sold in the state each year. They suggested that that number could be multiplied by two or three due to the number of used vehicles bought and sold, and out-of-state purchases. The income from charging fees to use State forestland could be used to manage the program and yield additional income to the State. Private clubs would also contribute to the maintenance and management of the course. Two problems foreseen are that it would take miles of forestland from a small state and this would do little to prevent people, especially youth who live near forestlands, from daily using both private and State forestlands.
- B. The Rhody Rovers recommended more stringent training for off-roaders as recommended by motorcycle manufacturers, prior to delivery of a vehicle.
- C. Others recommended that all off-road vehicles would have to be permitted and carry large-letter registration tags, so that they could be identified.

Timbering on State Forestlands

- A. Commercial forestland users made a strong economic and environmental case for commercial timbering by State employees or by contractors, under the supervision of State foresters, on State forestland. They noted that Connecticut funds the salaries of several State foresters with the money it earns from commercial timbering on State forestlands. It also provides funds for other forest management activities, and provides contract revenue and sales-tax revenue for the general treasury. It also produces several dozen jobs. Commercial users generally said that they would be happy to work under the direct supervision of State foresters or contract foresters; would not clear-cut; would use best management practices, would prevent and reduce forest damage; and, would replace all varieties and species in a sensible distribution.
- B. Most agreed that mutual understanding and agreement could be achieved if there were more meetings and direct communications, especially on-site, in forestland locations and demonstration areas. Most also agreed, that RIDEM/DFE is the expert and mutually trusted arbiter between groups.

Unauthorized Hunting and Trapping

- A. Most private and commercial landowners said that they had at least occasional unauthorized hunting on their properties, ever year.

- B. Some private landowners said that they allowed hunting and trapping on their lands but only to a select few and by verbal or written approval each time.
- C. Most agreed that posting their lands against hunting and trapping is a good idea, at least from a legal liability perspective, but most do not post their lands out of “inertia” or belief that it will do little good.

17. Does the State own too much, too little, or just the right amount of forestland?

There was just about even distribution on the three responses to this question. Most respondents agree that the best option is that forestlands ought to stay in the hands of private landowners, if they are going to remain forestlands, and hopefully be managed with the help of the State. This allows for more “invested” management and keeps properties on town tax rolls. However, if there is a near possibility of forestlands being sold for residential or commercial development, especially in an area that would fragment a large forest parcel, then most feel that the State and/or towns and NGOs should first attempt to buy development or conservation rights. If that fails, most feel the State and/or towns and NGOs should move to buy the property outright.

The general feeling was that “once property is sold for residential development it’s gone forever”. “If the State buys the property, it can at least re-sell it later, with restrictions on its development.” The final answer is ambiguous. There was a general consensus that the State currently owns more land that it can adequately manage with current resources, but most respondents would rather see the State acquire more forestland rather than lose it permanently to development.

18. Does the State adequately manage its forestlands from a stand perspective and from a recreational facilities perspective?

The general consensus, on a no-fault basis to the Division of Forest Environment, is that the State is investing only enough manpower, money, and resources to minimally maintain its forestlands from both a stand and a facilities perspective. This minimalist approach creates a huge potential for catastrophe in the form of forest fire damage, injury, and loss of life; a major threat to fresh water quality and the water quality of Narragansett Bay; a major threat to air quality; a major threat to wildlife habitat; a major threat to the outdoor recreation economy; and a major threat to the economically important “quality of life” in Rhode Island. In addition, the State is passing on a significant source of revenues and jobs, in not scientifically harvesting and marketing a major, renewable, natural resource.

There was another general consensus that the State spends an inordinate amount of its resources directly on Narragansett Bay while neglecting the forest uplands that have a direct effect on the health of the Bay. Two respondents said it best, “Rhode Island’s forestlands are its lungs” and “Water quality in streams, ponds, aquifers, and the Bay is a by-product of good management in Rhode Island’s forests.” At very least, the bottom line is that there is a huge opportunity for improvement and to optimize the environmental and economic potential of Rhode Island’s forest resources.

19. How would you divide the State’s forest management dollar?

Given a list of twelve possible activities that DFE could fund, most respondents had a difficult time determining priorities and setting allocations across all the categories of expenditure. They also admitted that their choices were biased by their specific interests in forestlands. Some general consensus points were:

- A. Most agreed that DFE is the expert and trusted agency to make funding allocations for the overall benefit of Rhode Island’s State-owned and privately owned forestlands.



- B. The State should separate funds for acquisition of development / conservation rights and/or outright purchase of forestlands from the division's operating budget. Funds for rights or land acquisition should come from sources separate from RIDEM/DFE operating funds. However, all agreed that DFE should have funds to purchase rights or forestlands and be the final authority on deciding which rights or lands should be acquired by the State.
- C. The majority of operating funds should be spent on forest resource management of existing State forestlands. A general consensus was that, if the State could manage its own forestlands well it would yield:
 - a. A majority of the State's forestland being managed well,
 - b. Perhaps, enough income could be earned from DFE supervised timbering to yield funds to afford more foresters and to better manage stands and recreational facilities
 - c. State forestland management would be a model for private landowners.
- D. The third area of priority expenditure was public education. It was generally felt, that Rhode Island citizens, town, and State legislators, would support forest resource management with their votes and tax dollars if they were educated about the importance of forestlands to the total land, water, and air-quality of the State, and to the economy of the State.
- E. Another general consensus was that funds earned from permitting and licensing forestlands activities should be dedicated to forestland resource management and not placed in the State's general treasury.

20. Where do you get the greatest quantity and quality of information about forestland management?

There was a general consensus that there is a great quantity and quality of forest management information available from a wide-range of sources – but the sources are fragmented and information availability is not publicized. There was also a consensus that the State and other agencies should publish as much information as possible on as many forest topics as possible. One respondent put it this way, “ 80% to 90% of citizens have no connection to forestlands and don't know where their water comes from.”

Some sources noted were RIDEM / DFE, RIFCO (landowner-to-landowner, highly trusted information/experience exchange), federal agencies, non-government agencies such as the Audubon Society and the Nature Conservancy, private forester-consultants, commercial forestry companies, television programming, and the Internet.

Most respondents felt that the Co-operative Extension Service through the University of Rhode Island provided little or no support for forest management services in the State, although it is the State's land grant college.

Many respondents felt that Connecticut represented a model of State government and State University involvement in forestland resource management.

Some respondents thought that pooling the resources of several organizations that are doing fragmented communications might be utilized to afford a mass-media campaign. RIDEM / DFE would be the most logical organization to coordinate such a campaign.



21. Are you aware of the State's Forest, Farm and Open Space Program? (FF&OS Program)

Most respondents were aware for the FF&OS Program. Most also agreed that it is a topic that needs to be communicated to more forest, farm, and open space landowners. Some small landowners did not participate because they did not want to resource-manage their forestlands and/or develop a management plan. Most thought it was the only way that forestland owners could afford to hold onto their properties. Most thought that most towns are not rushing to make it a rule across all FF&OS properties, but would rather handle it on a case-by-case basis.

22. Should the FF&OS Program be made "mandatory" for all cities and towns in Rhode Island?

Most respondents agreed in principle that statewide tax limits on each category of land – forest, farm, and open space, would be a good thing, but most acknowledged that the type of land and its location had an effect on its intrinsic value and taxable value. One respondent noted, " There is a big difference between a five acre turf lot in Charlestown and a five acre, scrub-pine lot, over a rock bed in Foster." Most were concerned about the lost revenues to towns and how they would be made up. Several respondents, however, pointed out how much more expensive single-family house lots, with children in them, are to towns, as opposed to maintaining forest, farm and open spaces. Most thought it would be difficult to get through the General Assembly.

23. Should the State allow timbering on its properties?

Most respondents would consider limited timbering on State forestlands if it were planned and closely supervised by State foresters. Commercial forest operators were the biggest proponents, obviously.

The benefits they promoted were: Untapped sources of State income from contracts, leases and sales taxes on forest products; Job creation; Better long-term forest health; Scientific replenishment and re-distribution of profitable species; Clearance of forest fire fuels; Clearing of fire access trails deep into forests. There was an obvious concern about over-cutting, clear-cutting collateral forest damage, increased fire potential, and proper species re-distribution, but commercial forest users said that all of those concerns could be accommodated. They made it clear that accommodating all those issues were in their long-term best interests and the long-term best interests of forests.

Once again, commercial forest users referred to Connecticut as a model of effective forest resource management and noted that the income earned from timbering of State forestlands in Connecticut paid for additional State foresters and other forest management programs. Given the consistent complaint of not enough manpower, money, and resources to manage State forestlands, the commercial users' arguments were compelling.

24. Is the State adequately planning for the future of its forests?

The general consensus was that "there has been more planning in the past few years, than in the past twenty years." But, there is a general concern that if the State does not fund the manpower and resources to implement the planning, the planning will be wasted.

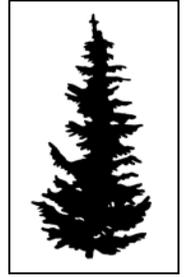
25. What would you do with RI's forests, if they were totally your responsibility? (Environmentalists)

Environmentalists put the highest priority on public education about the importance of forests in terms of the ecology and the economy of the whole state, in order to create awareness and support for forest issues. They would partner with other agencies to develop contingency plans in case of fire, major infestations, or threats to water supplies. And, they would accrue funds to purchase development/conservation rights or purchase key forestland parcels outright.





Rhode Island Forestland Owners



Survey 2003

Please complete and return this survey by December 18, 2003. Thank You.

PLEASE CIRCLE THE APPROPRIATE LETTER OR ANSWER IN THE SPACE PROVIDED.

1. In what town is the majority of your land located?

2. How much land do you own in RI?
_____ Acres

3. How many properties do you own?

4. How long have you owned forestland in RI? ____ Years

5. Has the size of your parcel(s) decreased or increased in the last ten years?
a) Increased
b) Decreased
c) Stayed the same

6. Are you:
a) The owner of the land
b) The owner's son or daughter
c) An attorney, trustee, or manager
d) Other (please specify)

7. How old were you on your last birthday?
_____ Years

8. What is your principal occupation? (If retired, what was your former occupation?)

9. The major portion of your forestland is owned by:

- a) Self and/or spouse
- b) Partnership or corporation
- c) Land trust
- d) Club or association

10. Is your forest enrolled under the Farm, Forest and Open Space Current Use Tax Program?
a) Yes b) No

If yes, how long has it been in the program? _____ Years

If yes, which category of the program is your property enrolled?
_____ Farmland _____ Forest
_____ Open Space _____ Do not know

11. If you have not applied for classification under the Rhode Island law for taxation of Farm, Forest, or Open Space Lands, what is the most important reason?
a) Don't know enough about the law
b) My town doesn't participate in the program
c) Not interested in active management
d) Not able to fulfill management requirements
e) Other (please specify)



12. How far do you live from your forest?
_____ Miles N/A

13. If you do not live on the major portion of your forestland year round, how often do you normally visit that land each year?
_____ Times a year. (Write "0" if none)

14. Why do you own forestland?
(Please circle the appropriate letter to indicate how important the following reasons are to you. Use this scale: 1) very important, 2) somewhat important, or 3) not important.)

- As investment (1) (2) (3)
- As part of residence/ farm (1) (2) (3)
- For hunting/ fishing (1) (2) (3)
- For motorized recreation (ATVs)(1) (2) (3)
- For other recreation (1) (2) (3)
- For firewood/ timber products (1) (2) (3)
- Other (please specify)

15. What are your long range plans for your forest?

- a) Protect from development with a conservation easement
- b) Will be left to heirs
- c) Will be donated to land trust or other conservation organization
- d) Sell for development
- e) Undecided
- f) Other (please specify)

16. Have you sold any of the following products from your forest during your ownership?

- a) Firewood
- b) Sawtimber
- c) Pulpwood
- d) Witch hazel
- e) Floral greens
- f) Maple syrup
- g) Wild mushrooms

- h) Cultivated mushrooms
 - i) Medicinal plants
 - j) Other (please specify)
-

17. While you have owned property, how many times have forest products (listed above) been sold? _____

18. Do you have a current (less than ten years old) written forest management plan?
Yes b) No

19. Do you actively manage your forestland?
a) Yes b) No

20. In the last 5 years, have any of the following activities occurred on your forestland in RI?

- a) Site preparation for planting
- b) Planted trees
- c) Commercial timber sale
- d) Harvest for own use
- e) Timber stand improvement (crop tree release, cull tree removal, pruning)
- f) Applied herbicides/ pesticides/ fertilizers
- g) Built or improved roads or trails
- h) Wildlife habitat/ fisheries improvement projects
- i) Alternative forest products harvested
- j) Other (please specify)

21. Do you have any unauthorized recreational use of your property?
a) Yes b) No

22. If yes, what unauthorized recreation is impacting your property? (Circle all those that apply and rate severity of impact please use: 1) least impact, 2) moderate impact,

3) severe impact)

- a) Motorbiking _____
- b) Snowmobiling _____
- c) Hunting _____
- d) Trapping _____
- e) Fishing _____
- f) Horseback riding _____
- g) Hiking _____
- h) Cross-country skiing _____
- i) Cross-country running _____
- j) Cutting firewood _____
- k) Off-road vehicles _____
- l) Picnicking _____
- m) Camping _____
- n) Mountain biking _____
- o) Other (please specify)

23. If you do not actively manage your forestland, what is the most important reason?

- a) Trees not large enough or the quality is too poor for a commercial harvest
- b) Not enough profit to make it worthwhile
- c) Need more information on forest management
- d) Opposed to management
- e) Not enough time
- f) Other (please specify)

24. Where do you get your information about forest management?

- a) Rhode Island DEM, Division of Forest Environment forester
- b) Other government agency
- c) Private consultant (forester, wildlife biologist, etc.)
- d) A forester from a company that produces forest products

- e) Employee of a non-profit group
- f) Other forest landowner/ neighbor/ friend
- f) Television/ video/ internet
- g) Books
- h) Brochures / Fact sheets
- i) Workshops
- j) Internet
- k) Other (please specify)

25. Do you allow the public use of your forestland for any of the following?

- a) Motorbiking
- b) Snowmobiling
- c) Hunting
- d) Trapping
- e) Fishing
- f) Horseback riding
- g) Study natural history of environmental education
- h) Hiking
- i) Cross-country running
- j) Cross-country skiing
- k) Cutting firewood
- l) Picnicking
- m) Camping

26. What are the key issues affecting the forest resources of Rhode Island. (Use this scale: 1) critical, 2) very important, 3) somewhat important, or 4) not important)

- a) Development (1) (2) (3) (4)
- b) Sustainability (1) (2) (3) (4)
- c) Wildfire (1) (2) (3) (4)
- d) State land management (1) (2) (3) (4)
- e) Recreation and tourism (1) (2) (3) (4)
- f) Forest Resource Management (1) (2) (3) (4)
- g) Forest health (insect & disease)(1) (2) (3) (4)
- h) Education (1) (2) (3) (4)
- i) Forest Products Marketing (1) (2) (3) (4)
- j) Water resources (watersheds) (1) (2) (3) (4)
- k) Other (please specify (1) (2) (3) (4)



27. What topics do think the Division of Forest Environment should develop informational programs, brochures/fact sheets about?
- a) Wood products
 - b) Alternative (non wood) forest products
 - c) Wildlife
 - d) Aesthetic benefits
 - e) Water quality
 - f) Forest health (insect and disease)
 - g) Recreation
 - h) Estate planning
 - i) Farm, Forest, and Open Space program
 - j) Forest Legacy Program
 - k) Forest fire control
 - l) Invasive species
 - m) Other (please specify)

Below are possible solutions to the issues that impact RI's forest resources. Please rate your opinion of each using the following key and mark your choice beside each number:

- 1. Strongly agree
- 2. Agree
- 3. Uncertain
- 4. Disagree
- 5. Strongly disagree

- 28. Local government should allow innovative and creative development techniques, such as family compounds, to conserve forest.
- 29. Property enrolled in the Farm, Forest, and Open space program should be assessed at a single rate statewide.
- 30. State and local government should make greater use of conservation easements as a tool to protect forest from development.
- 31. DEM, in partnership with other environmental organizations, should offer workshops and field demonstrations to

- educate landowners about forest management.
- 32. DEM, in partnership with other environmental organizations, should prepare and distribute pamphlets and booklets explaining forest management techniques to landowners.
- 33. Publicly owned forest should be managed as demonstration areas to promote sustainable forest management.
- 34. DEM should provide "on the ground" forestry advice to landowners to help refine their objectives and provide guidance toward sustainable forest management.
- 35. DEM should limit technical forestry assistance provided and actively seek forestry consultants to expand their services to more forest landowners in Rhode Island.
- 36. DEM should provide market information to keep landowners aware of market conditions for forest products.
- 37. RI DEM should promote incentive programs for landowners to increase the benefits for actively managing their forests.
- 38. DEM should provide training and support services to municipalities for wildfire control.
- 39. DEM should use mass media to educate rural homeowners about ways to reduce the risk of wildfire.
- 40. Communities should promote the use of fire leagues and mutual aid agreements to insure adequate manpower for larger wild land fires.
- 41. State and local governments should actively recruit additional volunteer firefighters in rural communities.
- 42. RI DEM should concentrate its efforts towards managing state-owned lands

rather than working with private landowners.

- ___ 43. DEM should focus management on state owned forestland to promote economic benefits.
- ___ 44. DEM should focus resource management on state owned forestland to enhance recreation and tourism.
- ___ 45. State Agencies should increase the use of mass media to reach larger audiences with information about the benefits (tourism, recreation) and threats (suburban sprawl and forest health issues) to Rhode Island's forest resources.
- ___ 46. DEM, in partnership with other environmental organizations, should inform and educate state and local government officials, as well as the general public, of the need to provide sound laws and ordinances for future forestry needs.
- ___ 47. RI DEM and the Cooperative Extension Service should coordinate public information efforts relating to the State's forest resources.
- ___ 48. The State should allocate funds to acquire important forestland or the development rights to important forestland in RI on an ongoing basis?
- 49. If an additional 100 dollars were made available for forest resource management in Rhode Island, how would you allocate funds among the categories listed below? (Indicate an amount in the space provided)
 - ___ Acquire key parcels of forest
 - ___ Broaden management of existing state and municipal forests
 - ___ Purchase development rights to forestland
 - ___ Provide on the ground technical assistance to landowners

- ___ Develop publications to educate forest landowners
- ___ Increase public education about the benefits of forests
- ___ Promote state forests for recreation and tourism
- ___ Promote expansion of the State's forest product industry
- ___ Survey forest health
- ___ Strengthen forest fire control
- ___ Enhance recreational opportunities on public forestland

50. What do you feel are other important issues facing forest resources in Rhode Island? (Please use a separate sheet if necessary.)



Purpose of the Survey

As part of the process to update the State Forest Resource Plan, the Department of Environmental Management conducted a survey of forest landowners. This information was used in developing guidelines and policies as part of the Rhode Island Forest Resource Plan. This plan is an update of a previous plan developed in 1984.

Private individuals own almost 75 percent of the forestland in Rhode Island⁵⁸. Since they own most of the forest, this group of stakeholders must be incorporated into the planning process since factors that impact them have the biggest impact on the future forests of Rhode Island.

Methodology

A stakeholder meeting was held to identify key issues and provide input on the scope of the plan's revision. It was agreed that both a mail survey of landowners and focus groups would be used to collect information to refine and focus the planning effort. The survey was an attempt to replicate the survey done for the previous edition of the Forest Resource Plan. The goal was to track changes since the last Plan and identify new issues.

The target group was landowners with more than ten acres in rural communities of Rhode Island⁵⁹. Tax Assessors were contacted for a mailing list. Some provided paper copies and others digital copies of their tax rolls. Tiverton didn't supply a list despite being contacted three times, so only 13 of the 14 rural communities were surveyed.

The survey was mailed to all landowners that could be identified to increase the response rate. The mailing list contained almost 3000 addresses. The survey (copy in the Appendix) was mailed in late November 2003 with responses requested by mid December. Some surveys were returned as undeliverable, but if possible a survey was forwarded to the new address. The corrected mailing list (with undeliverable removed) contains 2774 names.

One important point that should be noted, this was not a survey of all the forestland in the state just owners of larger (more than 10 acre) parcels in the 13 municipalities that supplied requested information for mailing of the survey.

- The target of the survey replicates a survey done as part of the previous plan so the results can be compared.
- Owners of larger parcels are more likely to manage their land.
- Larger parcels can be managed on a sustainable basis.

Selected Results

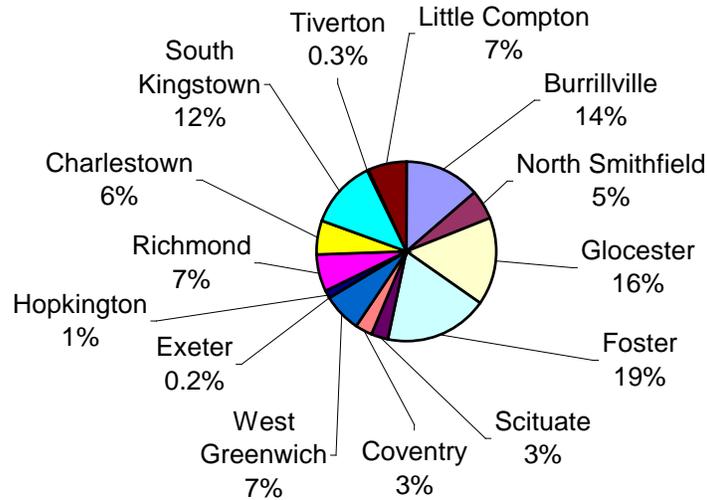
The question numbers correspond to selected survey questions. The percentages may not equal 100% due to rounding or more than one answer per question was given.

⁵⁸ *The Forests of Rhode Island*, USDA, US Forest Service, Northeast Research Station, NE-INF-155-02, September 2002, preface. (eds. Brett J Butler and Eric H. Warton)

⁵⁹ RI Statewide Planning defines rural communities as those with less than 500 people per square mile or a developed area of less than 25%. RI Land Use Trends and Analysis. Tech. Paper 149.



1. In what town is the majority of your land located?



2. How much land do you own in Rhode Island (acres)?

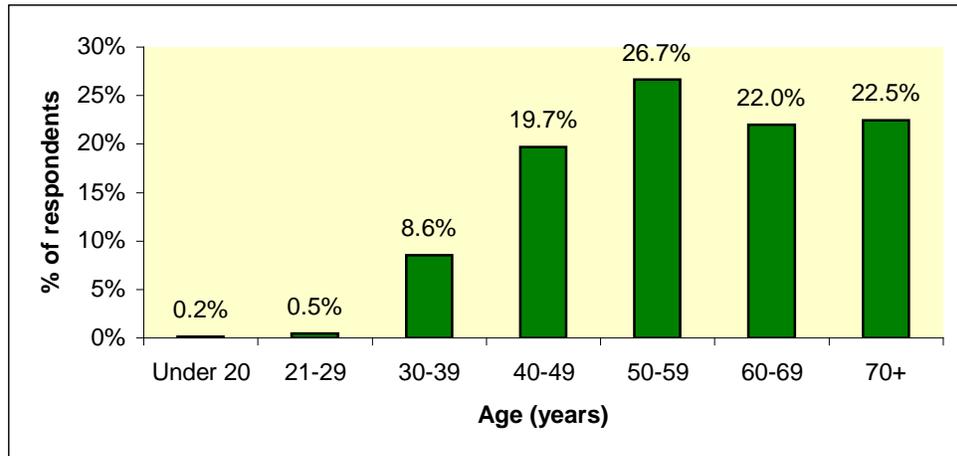
Category	Number of Respondents	% of total respondents
10-24 acres	279	44.1%
24-49 acres	165	26.1%
50-99 acres	116	18.4%
100 or more acres	72	11.4%
Total	632	100%

4. How long have you owned forestland in Rhode Island (years)?

Number of Years Owned	Number of Respondents	% of total respondents
Less than 5 years	95	15%
5-9 years	64	10%
10-24 years	196	31%
25-49 years	206	32%
50 years or more	68	11%
No response	5	1%
Total	634	100.0%



7. Age of owner (years)?



8. Land owner occupations:

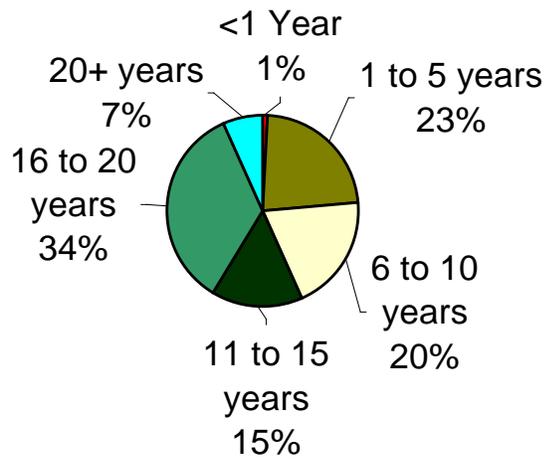
<i>Job Category</i>	Percent of Respondents
Skilled trades	18%
Office	10%
Education	10%
Life sciences - health and medicine	7%
Engineer	6%
Construction/inspector/contractor	5%
Self employed	5%
Marine/environmental	5%
Farming	5%
Defense/homeland security	4%
Other	4%
Business	4%
Financial services	3%
Public service	3%
Sales/retail	3%
Creative/advertising/media	3%
Law	2%
It/telecom	1%



9. Is your forest enrolled under the Farm, Forest, and Open Space Current Use Tax Program?

Yes	No	Do not know	Percent of properties enrolled
320	305	3	51%

If yes, how long has it been in the program?



If yes, in which category of the program is your property enrolled?

Farm	Forest	Open Space
12%	29%	59%

11. If you have not applied for classification under the Rhode Island law for taxation of Farm, Forest, and Open Space Lands, what is the most important reason?

Reason	Percent of respondents
Don't know enough about law	88%
Not interested in active management	5%
Not able to fulfill management requirements	4%
My town does not participate in the program	3%



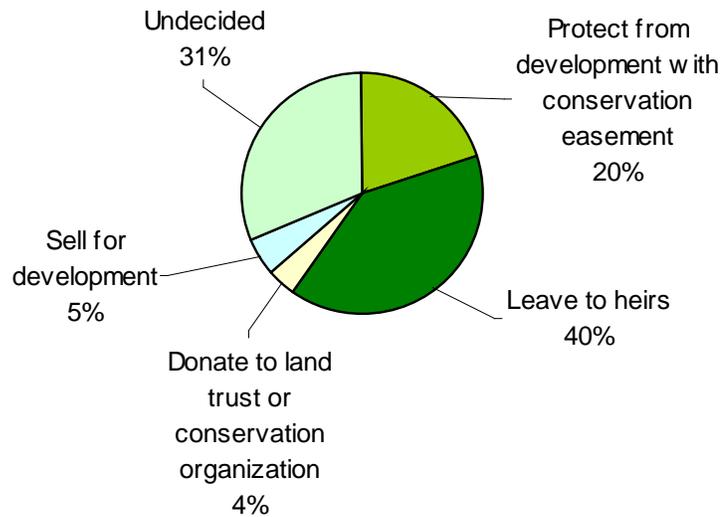
14. Why do you own forestland? Please rank the following. (1 = very important, 2 = somewhat important, 3 = not important)

Reason	Very Important (1)	Somewhat Important (2)	Not Important (3)
As part or residence/farm	90%	7%	2%
As investment	42%	34%	24%
For other recreation	41%	31%	28%
For firewood/timber products	33%	40%	27%
For hunting/fishing	19%	21%	61%
For motorized recreation (I.e. ATVs)	8%	6%	87%

Other Reasons:

1. Preserve Open Space
2. Privacy
3. Inherited the property

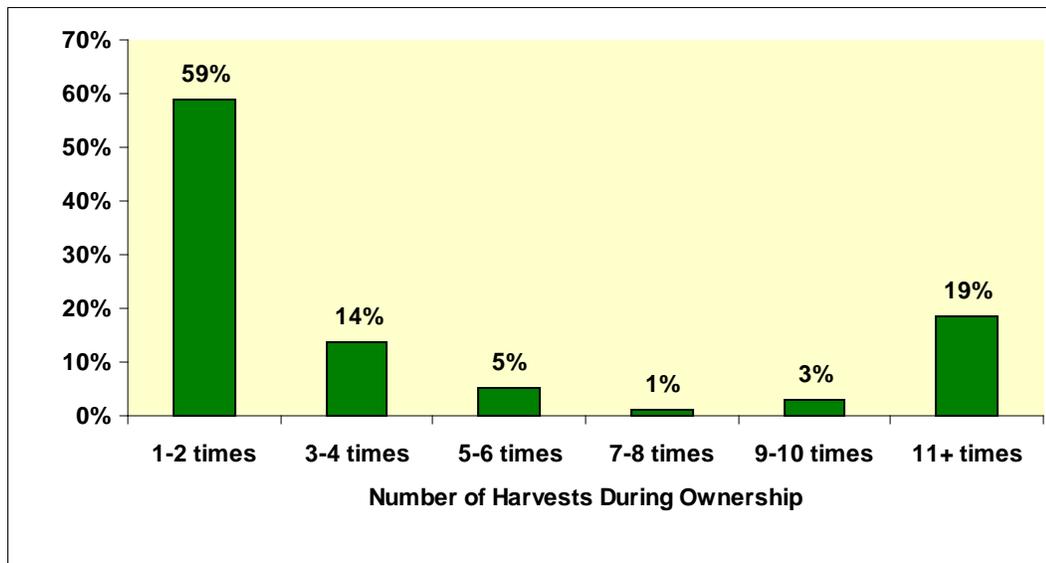
15. What are your long-range plans for your forest?



16. Have you sold any of the following products from your forest during your ownership?

Product	Percent of respondents
Firewood	16%
Sawtimber	17%
Pulpwood	1%
Witch hazel	2%
Floral greens	1%
Maple syrup	1%
Wild mushrooms	0%
Cultivated mushrooms	0%
Medical plants	0%
No harvesting	61%

17. While you have owned your property, how many times have forest products (listed above) been sold?



18. Do you have a current (less than 10 years old) written forest management plan?

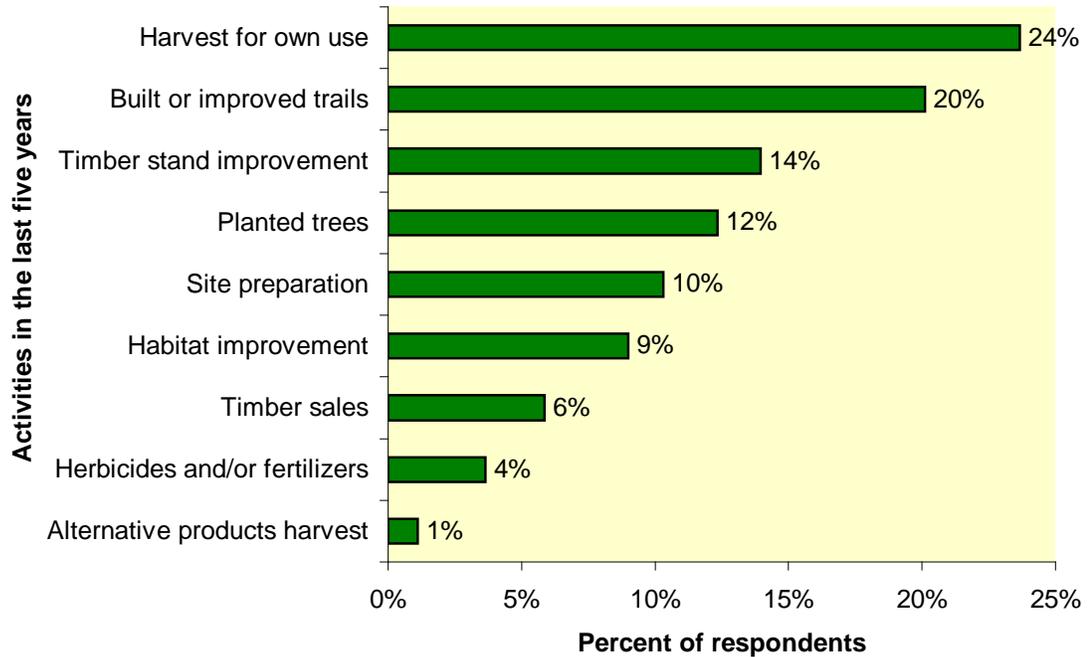
Yes – 14%, No – 86%

19. Do you actively manage your forest?

Yes – 34%, No – 66%



20. In the last five years, have any of the following activities occurred on your forestland in Rhode Island?



21. Do you have any unauthorized recreational use of your property?

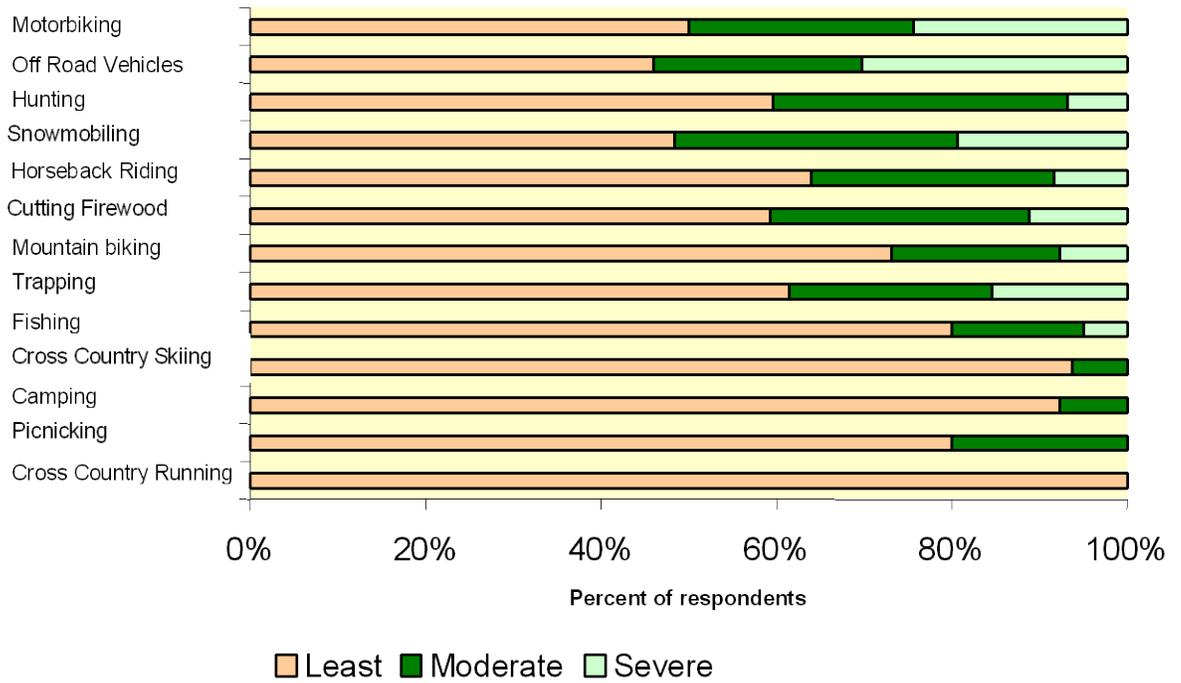
Yes – 31%, No – 69%

22. If yes, what unauthorized recreation is impacting your property?

Activity	Percent of respondents
Motor biking	20%
Off Road Vehicles	11%
Hunting	9%
Snowmobiling	5%
Cutting Firewood	4%
Horseback Riding	4%
Mountain biking	4%
Trapping	3%
Fishing	2%
Camping	2%
Cross Country Skiing	2%
Cross Country Running	1%
Picnicking	1%
None	33%



What impact do these activities have (1 = least impact, 2 = moderate impact, 3 = severe impact)



23. If you do not actively manage your forestland, what is the most important reason?

Reason	Percent of respondents
Need more information on forest management	35%
Not enough time	20%
Not enough profit to make it worthwhile	15%
Trees not large enough or quality too poor	14%
Opposed to management	5%
Other	11%

24. Where do you get most of your information about forest management?

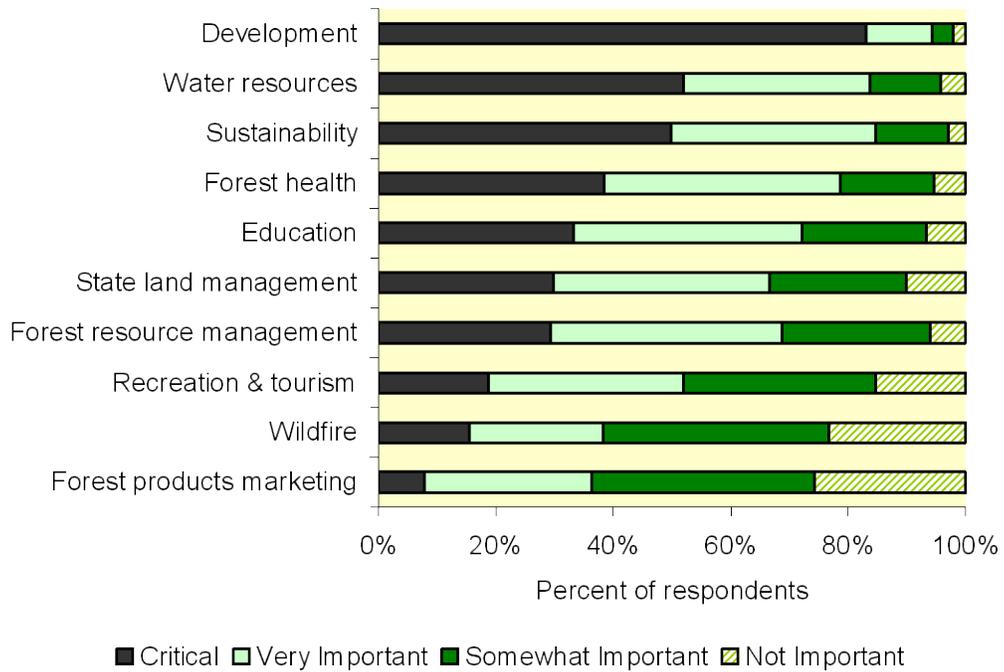
Information Source	Percent of respondents
RI DEM Service Forester	30%
Private Consultant	13%
Books	13%
Neighbor, landowner, friend	11%
Brochures/fact sheets	8%
Workshops	5%
Other Govt. Agency	4%
Television, video	4%
Procurement Forester	4%
Internet	4%
Non-profit group	1%
Other	3%
None	38%

25. Do you allow the public use of your forestland for any of the following?

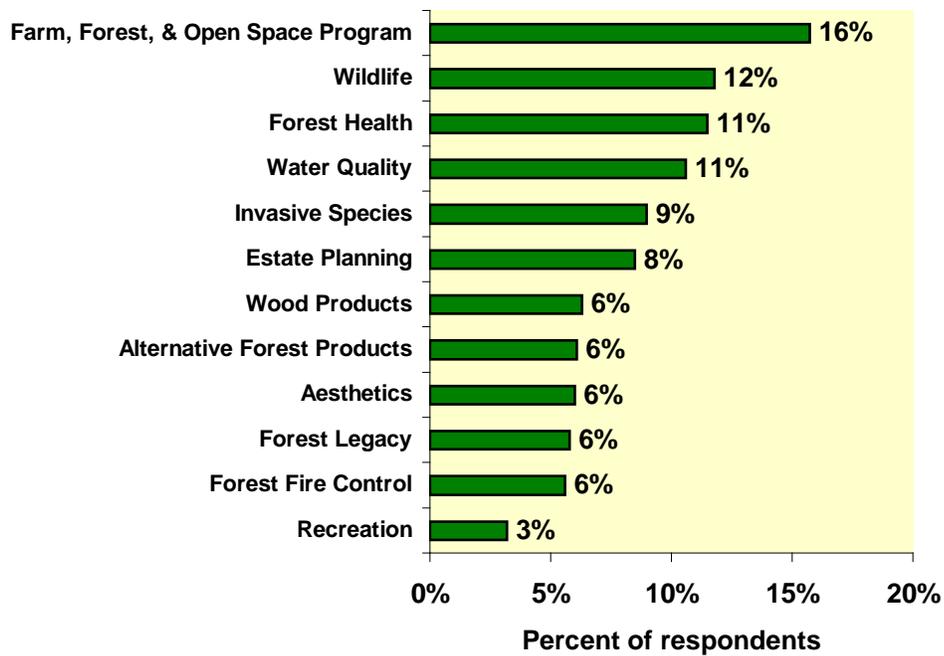
Activity	Percent of respondents
Hunting	18%
Nature study	7%
Hiking	7%
Horseback riding	7%
Cross country skiing	4%
Fishing	4%
Cutting firewood	3%
Cross country running	2%
Motor biking	2%
Picnicking	2%
Camping	2%
Snowmobiling	2%
Trapping	1%
None	41%



26. What are the key issues affecting the forest resources of Rhode Island (1 = critical, 2 = very important, 3 = somewhat important, 4 = not important)?



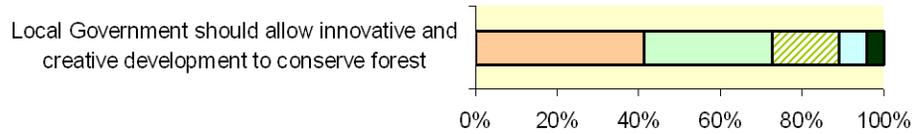
27. What topics do you think the Division of Forest Environment should develop informational programs/brochures about?



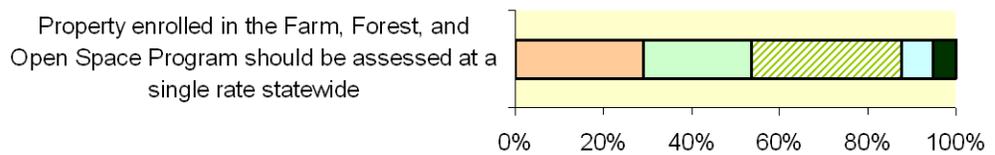
28-48 Below are possible solutions to the issues that impact Rhode Island's forest resources.
 Please rank your opinion of each using the following key and mark your choice beside each number. (1 = strongly agree, 2 = agree, 3 = uncertain, 4 = disagree, 5 = strongly disagree)

■ Strongly Agree
 ■ Agree
 ■ Uncertain
 ■ Disagree
 ■ Strongly Disagree

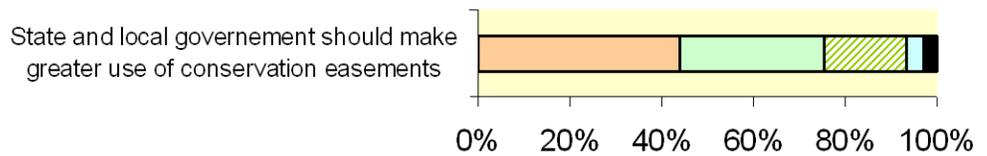
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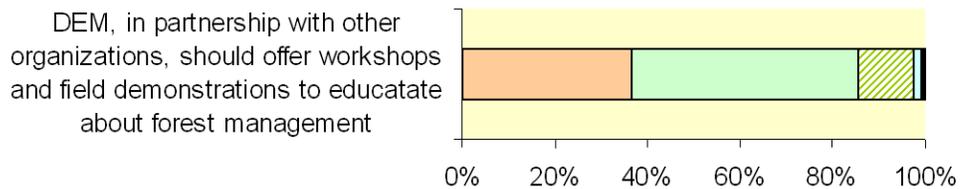
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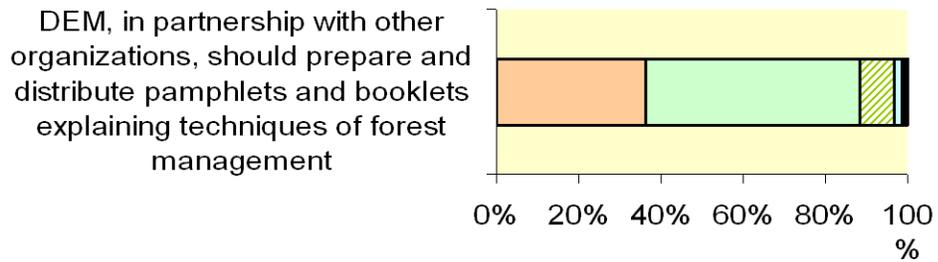


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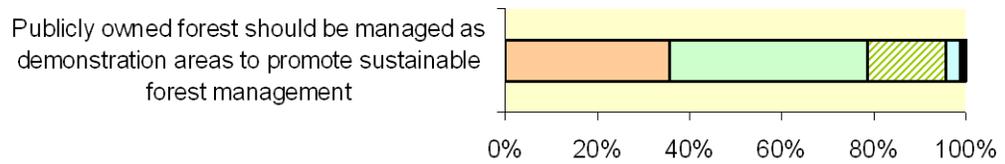


■ Strongly Agree
 ■ Agree
 ■ Uncertain
 ■ Disagree
 ■ Strongly Disagree

32.



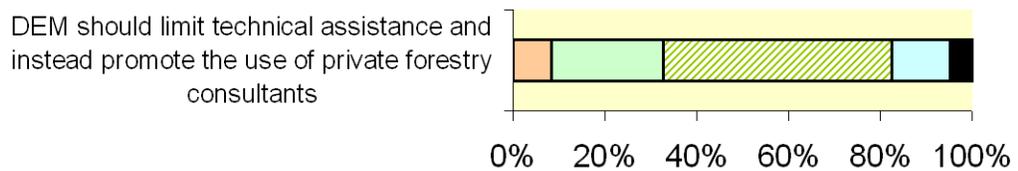
33.



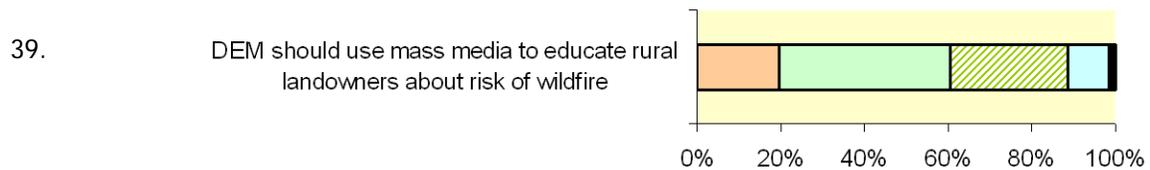
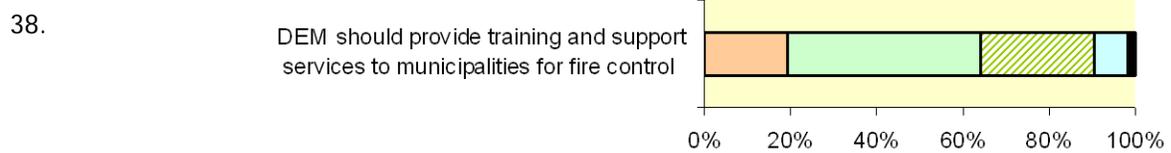
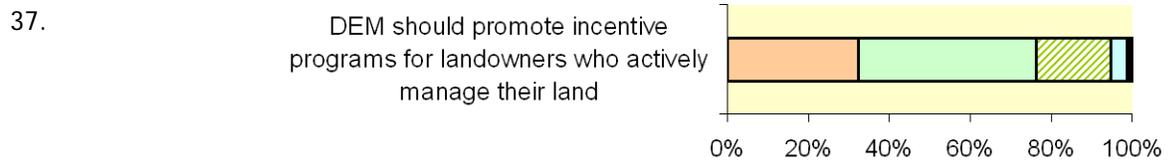
34.



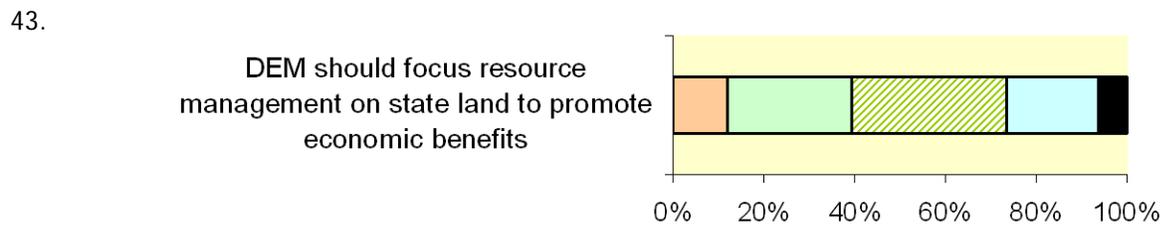
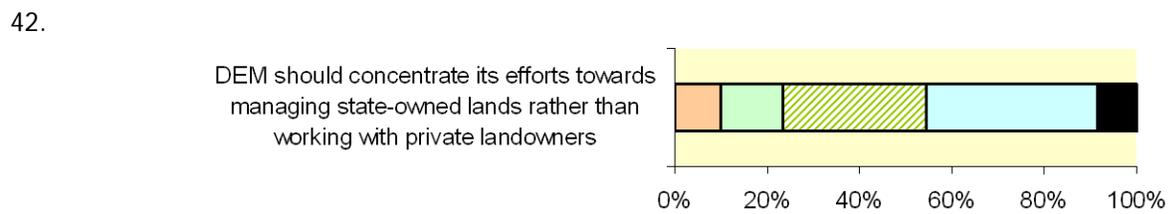
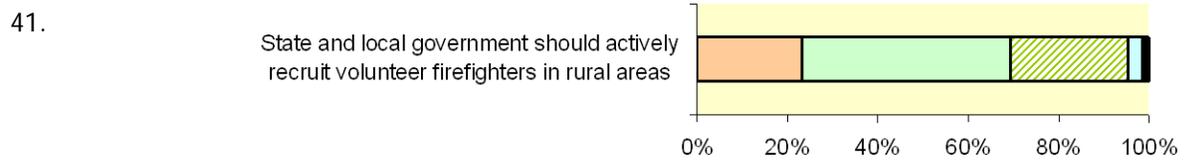
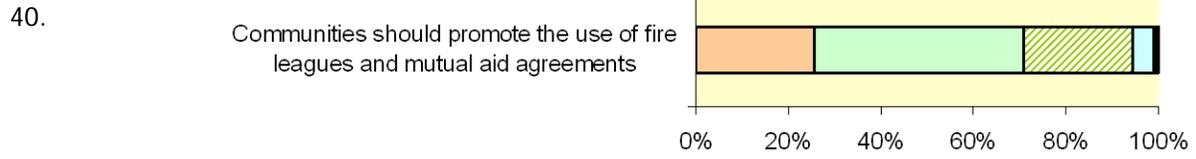
35.



■ Strongly Agree
 ■ Agree
 ■ Uncertain
 ■ Disagree
 ■ Strongly Disagree



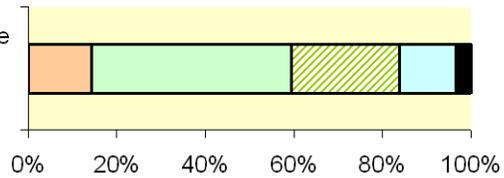
■ Strongly Agree
 ■ Agree
 ▨ Uncertain
 ■ Disagree
 ■ Strongly Disagree



■ Strongly Agree
 ■ Agree
 ■ Uncertain
 ■ Disagree
 ■ Strongly Disagree

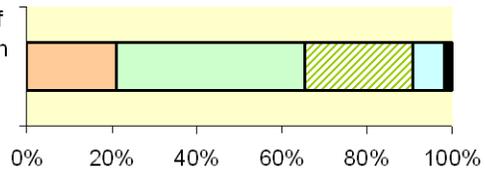
44.

DEM should focus management on state owned lands to enhance recreation and tourism



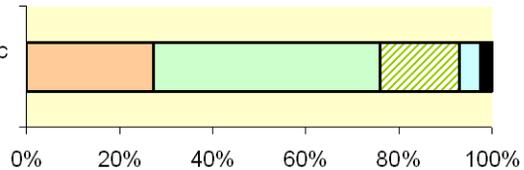
45.

State agencies should increase the use of mass media to reach larger audiences with information about the benefits of and threats to Rhode Island's forests



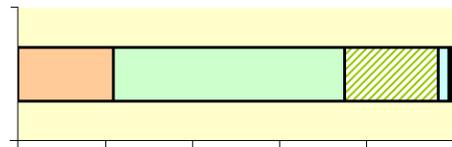
46.

DEM, in partnership with other organizations, should inform the public about the needs for sound laws and ordinances for future forestry needs



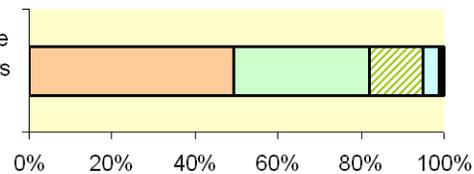
47.

DEM and the Cooperative Extension should coordinate public information efforts relating to the states's forests



48.

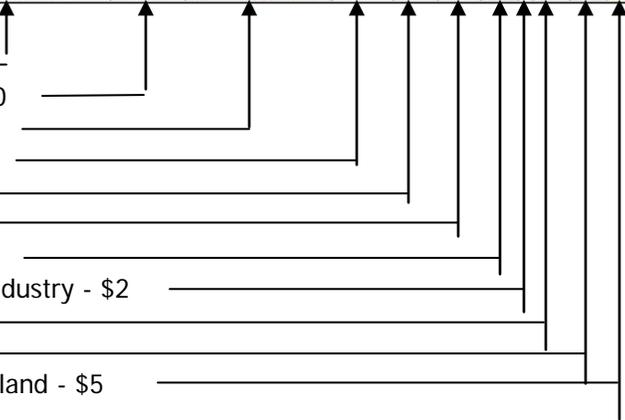
The State should allocate funds to acquire important forestland or development rights to important forest parcels



49. If an additional \$100 were made available for forest resource management in Rhode Island, how would you allocate the funds among the categories listed below?



- Acquisition - \$28
- Broaden Management - \$10
- Development Rights - \$20
- Technical Assistance - \$8
- Publications - \$6
- Public Education - \$6
- Promote State Forests - \$5
- Promote Forest Products Industry - \$2
- Forest Health - \$5
- Forest Fire Control - \$5
- Recreation on Public Forestland - \$5



Key Changes since the 1983 survey

Parcel size

As expected, the survey showed that the trend over the last twenty years has been the subdivision of large forest tracts into smaller parcels. Forty- four percent of the parcels are ten to twenty-four acres in size (in 1983 it was 26 percent). The average parcel size however was larger than reported by the USDA, Forest Service, most likely because their methodology considers a five-acre house lot in a wooded setting forestland while this survey only dealt with ownerships of more than ten acres. These results are consistent with the previous survey, which found a discrepancy between USDA, Forest Service reports and results from the questionnaire ⁶⁰.

Length of Ownership

Although many acres of forest have been divided into smaller parcels in the last twenty years, the tenure of ownership, at least in rural towns, has been stable; forty seven percent of respondents have owned their land more than 20 years (since the previous resource survey). This is most likely related to the landowners' age and has implications for Rhode Island's forest since it is likely many of these parcels will come to market in the future.

Reasons of Owning

The majority of survey respondents live on their land and gave "as a place to live" the most important reason for owning forest; this increased from 82 percent in the 1983 survey to 90 percent in the 2003 survey. "As an investment" and "recreational use" were key reasons for ownership in the previous survey, making up 84 and 82 percent of the responses but decreased to 76 and 73 percent of respondents in 2003. Only five percent of respondents relied on forestry or farming to provide a significant portion of their income implying that the quality of life afforded by living in the forest not profitability is an attraction for most forest landowners in Rhode Island.

Management

Fourteen percent of landowners have an up to date (within ten years) forest management plan and 34 percent actively manage their land. More landowners were involved in commercial harvesting activity than in the previous survey; 42 percent having harvested firewood and 43 percent sold sawtimber over the last ten years versus 24 percent sold and 15 percent in 1983. There is more interest in alternative (non-wood) forest products in recent times with 12 percent of respondents selling products (e.g. mushrooms, witch hazel, floral greens, or maple syrup) versus less than five percent who reported having sold non-wood products during the survey in 1983.

The Farm, Forest, and Open Space Program continues to be an effective tool for protecting land with twenty nine percent of forest landowners enrolled in the Farm, Forest, and Open Space versus 21 percent in the previous survey. According to the recent survey, an additional 59 percent of forest landowners have their land enrolled as open space. This information was not tracked in the previous survey. Lack of information continues to be the main reason landowners do not participate in the Program. Not knowing enough about the law was cited as the main reason by 88 percent of respondents to the recent survey, 55 percent cited this in the survey done 20 years ago.

⁶⁰ Rhode Island Woodland Owners Survey Report. Lyn White and Kathy Weber Jones. September 1980.

Lack of interest in management was a key barrier to management in the 1983 survey, as reported by 31 percent of respondents, but only an issue to 5 percent in 2003. Lack of profit being was a negative for 5 percent in the first survey but increased to 15 percent in 2003. Trees being too small or of poor quality discouraged active management by five percent of respondents in 1983 but was an issue for 14 percent in 2003.

Lack of information about forestry was the most common reason for not actively managing- given by 36 percent of respondents versus 11 percent in 1983. DEM Forester (30 percent), private consultants (13 percent), and books (13 percent), were the most common sources of information for landowners in the recent survey. Data on sources of forestry information were not collected in the 1983 survey.

Long range plans

Most respondents planned to leave their property to heirs (40 percent). This is consistent with previous surveys where it was listed as 54 percent.

Five percent intend to sell for development while 24 percent intend to protect it from development versus 16 percent and 20 percent in 1983.

The respondents to the most recent survey were less decisive about the long- term plans for their forestland with over 30 percent being undecided (6 percent undecided in 1983).

Both the 1983 and 2003 surveys were an attempt to encourage landowner involvement in the forestry planning process by seeking their input on a variety of issues.

Key issues (identified as critical or very important) were Development, Water resources, Sustainability (sustainable management), and forest health. Information on key issues was not collected in the 1983 survey.

The respondents also provided input into suggested solutions. Top recommendations (in order of importance).

2003

- The State should allocate funds to acquire important forestland or development rights to important forest parcels
- DEM, in partnership with other organizations, should prepare and distribute pamphlets and booklets explaining techniques of forest management
- DEM, in partnership with other organizations, should offer workshops and field demonstrations to educate about forest management
- State and local government should make greater use of conservation easements
- Publicly owned forest should be managed as demonstration areas to promote sustainable forest management
- DEM should promote incentive programs for landowners who actively manage their land



1983

- State and local government should make greater use of conservation easements
- Property enrolled in the Farm, Forest, and Open Space Program should be assessed at a single rate statewide
- DEM, in partnership with other organizations, should inform the public about the needs for sound laws and ordinances for future forestry needs
- Communities should promote the use of fire leagues and mutual aid agreements
- DEM should use mass media to educate rural landowners about risk of wildfire

Implications

According to the most recent USDA, Forest Service Survey, 70 percent of the forestland in Rhode Island is in private ownership. Therefore factors affecting these landowners have the greatest impact on Rhode Island forests.

The age of the typical landowner as reported in the survey is older than the general population and has increased since the previous survey. These properties are likely to be subject to development pressure as the existing landowners pass on. Although many of the landowners surveyed plan to protect the property from development, many are unsure of their long-term plans for their land. Uncertainty about the future of the land has increased since the last survey. Educating these landowners about estate planning provides an opportunity to reduce conversion of forestland to other uses.

Although the typical forested parcel is small (and continues to decrease between surveys) many landowners actively manage. The most common management activities are harvesting wood for their own use and building trails to improve access for recreation. About 30 percent have had commercial harvesting activity; wood products (timber and firewood) comprise 85 percent of the harvests but a wide array of other products (e.g. mushrooms, witch hazel, maple syrup, and floral greens) were reported demonstrating that resourceful forest landowners are seeking alternative income sources to pay property expenses.

The small parcel size also has implications for wildlife since less disturbance leads to an aging forest and lack of habitat for species that need young forest. The scale of management on small parcels may make management to improve habitat less effective.

Fewer DFE staff to serve landowners could have serious implications since landowners look to DEM to provide information. DEM is the primary source of technical assistance to forestland owners although many also use the services of private consultants. Staffing at DEM also has implications for the Farm, Forest, and Open Space Program since interest in the program has increased dramatically recently. The most common reason given by landowners for not enrolling in the Program is lack of knowledge. Clearly outreach by DEM, in cooperation with other partners, could result in a greater increase in the effectiveness of this Program.

The information gathered in this survey provided historical information background as to changes in the values and attitudes of forest landowners in the last 20 years as well as valuable insight into ways to address key issues affecting Rhode Island's forest resources.

The survey identified issues of concern and topics of interest to most landowners. The key issues identified in the survey (development, water resources, and sustainability) clearly indicate where forest landowners feel resources should be focused. When asked to allocate resources forestland owners suggested protecting land protection (outright purchase or development rights) receive 36 percent of the budget and forest landowner education (technical assistance, public education, and publications) receive 20 percent of the budget.



Since it is not possible (or desirable) for government and non-government organizations to own all of the State's forest, the protection and stewardship clearly lies in the hands of private landowners. The role of DEM and other environmental organizations is to inform these landowners to enable them to more effectively manage their property. Given the concerns raised by respondents to the survey, the focus of education efforts should include Information about tools to conserve forestland (e.g. estate planning, conservation easements, Farm, Forest and Open Space Program) as well as methods to preserve and protect water resources (e.g. the value of riparian forest buffers, best management practices, and wetland restoration).

Given limited budgets and staff shortages a cooperative effort is needed to effectively undertake this educational role but clearly the benefits both measurable (e.g. jobs, clean water, recreational opportunities) and non-measurable (e.g. aesthetics, quality of life) outweigh the costs.



Appendix C

Comparison of 2005 Survey and 2010 Survey Results



Recent changes in the Farm Bill in 2008 have redesigned the way the USDA Forest Service carries out the various programs. With the redesign, states are required to develop a Statewide Assessment and strategies for forest resources.

We are asking for your assistance in this new project. Your participation in this survey will greatly help the Forest Resource Assessment Committee and Division of Forest Environment craft a plan that reflects the wants and needs of the citizens of Rhode Island and help protect our treasured forest environment.

1. If you would like to be contacted, please enter your contact information below.

Name: _____

2. Email address: _____

3. What environmental organization contacted you to participate in the survey?

- Audubon Society of Rhode Island
- RI DEM Forest Environment
- RI DEM Water Resources
- Rhode Island Tree Council
- The Nature Conservancy, RI Chapter
- Grow Smart of Rhode Island
- Rhode Island Land Trust Council
- Statewide Planning & Development
- RI Resource Conservation & Development Area Council
- Society of American Foresters, RI Chapter
- RI Forest Conservator's Organization
- RI Tree Farm
- USDA Natural Resource Conservation Service

4. Do you own forested land in Rhode Island?

Yes No

As a forestland owner we would like your answers to the following questions to provide better service to you.

5. What community is your forestland located?

Community _____

6. How many acres of forestland do you own? _____ Acres

7. The ownership of this property is?

- Private ownership
- Corporation
- Non-profit organization
- Public Land Trust
- Private Land Trust
- Municipality
- Other (please specify) _____



8. Do you live on the property year round?

Yes No

Answers in this section will help us determine targeted programs.

9. Is your forest enrolled under the Farm, Forest and Open Space Current Use Tax Program??

Yes No

If yes, how many years _____

Your answers will help us target forestry programs needs.

10. Which category of the program is your property enrolled?

Farmland

Forest

Open Space

Do not know

11. If you have not applied for classification under the Rhode Island law for taxation of Farm, Forest, or Open Space Lands, what is the most important reason for not participating?

Don't know enough about the law

My town doesn't participate in the program

Not interested in active management

Not able to fulfill management requirements

Cost of forest management plan too expensive

Other (please specify)

12. Why do you own forestland?

Very important Somewhat important Not important

As investment

As part of residence/farm

For hunting/ fishing

For motorized recreation (i.e. ATVs)

For other recreation

For firewood/ timber products

For appreciation of nature

For scenic beauty For wildlife enjoyment

13. What are your long range plans for your forest?

Other (please specify)

Protect from development with a conservation easement

Will be left to heirs

Will be donated to land trust or other conservation organization

Sell for development

Undecided

Other (please specify)



14. Have you sold any of the following products from your forest during your ownership?
(Please check all those that apply).

- Firewood
- Sawtimber
- Pulpwood
- Witch hazel
- Floral greens
- Maple syrup
- Wild mushrooms
- Cultivated mushrooms
- Medicinal plants
- Other (please specify) _____

15. While you have owned property, how many times have forest products
(listed above) been sold? _____

16. Do you have a current management plan (less than 10 years old)?
Yes No

17. Do you actively manage your forestland?
Yes No

18. In the last 5 years, have any of the following activities occurred on your
forestland in RI?(Please check all those that apply.)

- Site preparation for planting
- Planted trees
- Commercial timber sale
- Harvest for own use
- Timber stand improvement (crop tree release, cull tree removal, pruning)
- Applied herbicides/ pesticides/ fertilizers
- Built or improved roads or trails
- Wildlife habitat/ fisheries improvement projects
- Alternative forest products harvested
- Other (please specify) _____

19. If you do not actively manage your forestland, what is the most
important reason?
Trees not large enough or the quality is too poor for a commercial harvest
Not enough profit to make it worthwhile
Need more information on forest management
Opposed to management
Not enough time
Do not like the way the forest looks after some management practices (cutting)
Other (please specify) _____

20. Do you have unauthorized recreational use on your forestland?
Yes No

21. What unauthorized recreation is impacting your property?

(check all those that apply and rate severity of impact).

severe impact moderate impact least impact

Motorbiking

Snowmobiling

Hunting

Trapping

Fishing

Horseback riding

Hiking

Cross-country skiing

Cross-country running

Cutting firewood

Off-road vehicles

Picnicking

Camping

Mountain biking

Other (please specify) _____

22. Where do you get your information about forest management?

(Please check all those that apply.)

Rhode Island DEM, Division of Forest Environment forester

Other government agency

Private consultant (forester, wildlife biologist, etc.)

A forester from a company that produces forest products

Employee of a non-profit group

Other forest landowner/ neighbor/ friend

Television / video

Books

Brochures / Fact sheets

Workshops

Internet

Other (please specify) _____

23. Do you allow the public use of your forestland for any of the following?

(Please check all those that apply.)

Motorbiking

Snowmobiling

Hunting

Trapping

Fishing

Horseback riding

Study natural history of environmental education

Hiking

Cross-country running

Cross-country skiing

Cutting firewood

Picnicking

Camping

Other (please specify) _____



As multiple use demands increase on the forests of Rhode Island the answers to the following questions will help us determine where to put our efforts to better serve the citizens of Rhode Island and protect the environment we all depend on for our daily existence.

24. What are the key issues affecting the forest resources of Rhode Island.

Critical Very important Somewhat important Not important

Development

Sustainability

Wildfire

State land management

Recreation and tourism

Forest Resource Management

Forest health (insect & disease)

Education

Forest Products

Marketing

Water resources (watersheds)

Property taxation

Regulations

Other (please specify)_____.

25. What topics do think the Division of Forest Environment should develop informational programs, brochures/fact sheets about?(Please check all those that apply.)

Wood products

Alternative (non wood) forest products

Wildlife

Aesthetic benefits

Water quality

Forest health (insect and disease)

Recreation

Estate planning

Farm, Forest, and Open Space program

Forest Legacy Program

Forest fire control

Invasive species

Biomass

Carbon credits

Other (please specify)_____

Below are issues that impact RI's forest resources. Please rate your opinion of each.

Please rate using the following:

Strongly Agree Somewhat Agree Somewhat Disagree Strongly Disagree Uncertain

26. Climate change is an important issue and State environmental agencies should allocate funds to work on mitigating this problem.

27. The State should allocate funds to acquire and manage forestland rather than spend funds in tree planting programs in urban areas to reduce the effects of climate change.

28. The federal and state government should reallocate up to 20% of present Urban and Community Forestry funding to care and maintain larger older trees in urban areas to reduce the effects of climate change.
29. Local government should allow innovative and creative development techniques, such as family compounds, to conserve forest.
30. Property enrolled in the Farm, Forest, and Open space program should be assessed at a single rate statewide.
31. State and local government should make greater use of conservation easements as a tool to protect forest from development.
32. DEM, in partnership with other environmental organizations, should offer workshops and field demonstrations to educate landowners about forest management.
33. DEM, in partnership with other environmental organizations, should prepare and distribute pamphlets and booklets explaining forest management techniques to landowners.
34. Publicly owned forest should be managed as demonstration areas to promote sustainable forest management.
35. DEM should provide "on the ground" forestry advice to landowners to help refine their objectives and provide guidance toward sustainable forest management.
36. DEM should limit technical forestry assistance provided and actively seek forestry consultants to expand their services to more forest landowners in Rhode Island.
37. DEM should provide market information to keep landowners aware of market conditions for forest products.
38. RI DEM should promote incentive programs for landowners to increase the benefits for actively managing their forests.
39. DEM should provide training and support services to municipalities for wildfire control.
40. DEM should use mass media to educate rural homeowners about ways to reduce the risk of wildfire.
41. Communities should promote the use of fire leagues and mutual aid agreements to insure adequate manpower for larger wild land fires.
42. State and local governments should actively recruit additional volunteer firefighters in rural communities.
43. RI DEM should concentrate its efforts towards managing state-owned lands rather than working with private landowners.
44. DEM should focus management on state owned forestland to promote economic benefits.
45. DEM should focus resource management on state owned forestland to enhance recreation and tourism.



46. State Agencies should increase the use of mass media to reach larger audiences with information about the benefits (tourism, recreation) and threats (suburban sprawl and forest health issues) to Rhode Island's forest resources.

47. DEM, in partnership with other environmental organizations, should inform and educate state and local government officials, as well as the general public, of the need to provide sound laws and ordinances for future forestry needs.

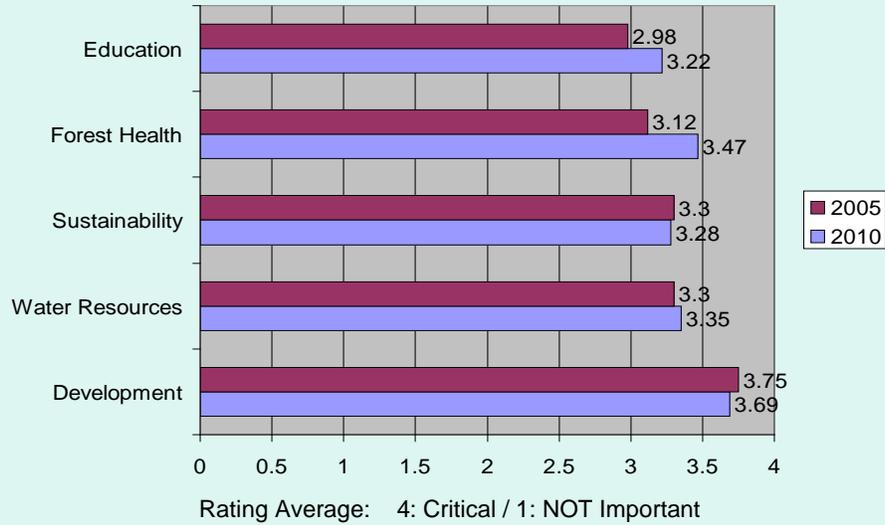
48. RI DEM and the Cooperative Extension Service should coordinate public information efforts relating to the State's forest resources.

49. The State should allocate funds to acquire important forestland or the development rights to important forestland in RI on an ongoing basis.

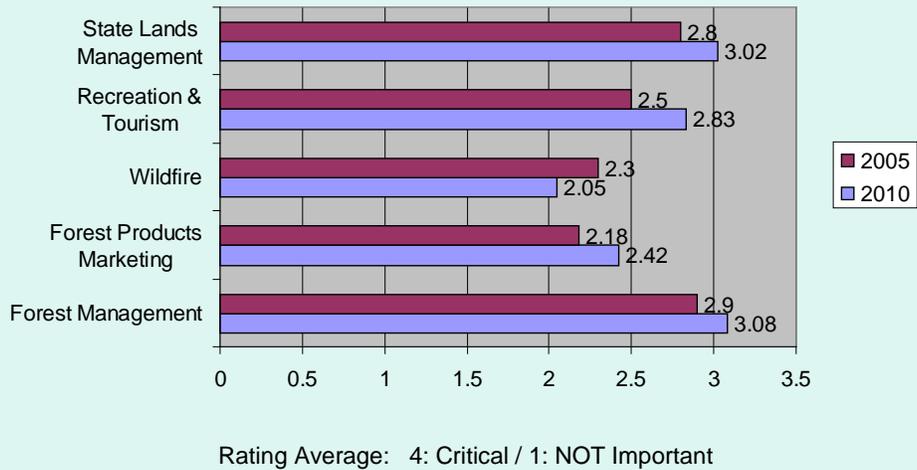
50. What do you feel are other important issues facing forest resources in Rhode Island?



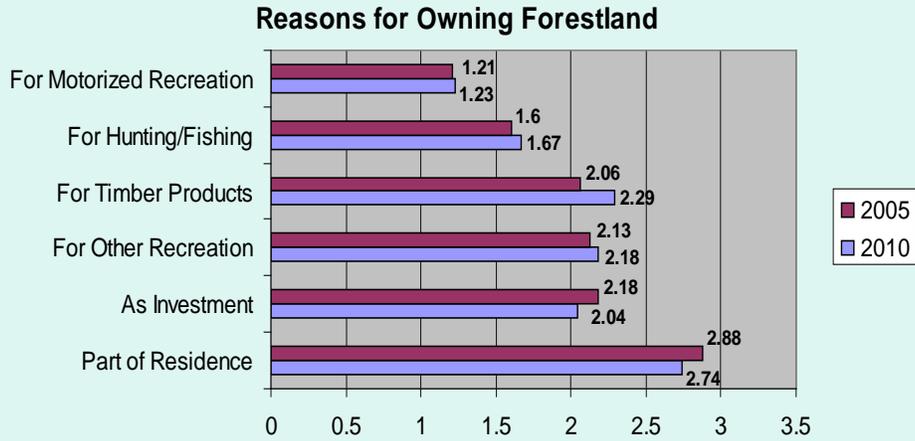
Issues Critical to Forest Resources in Rhode Island



Issues Critical to Forest Resources in Rhode Island

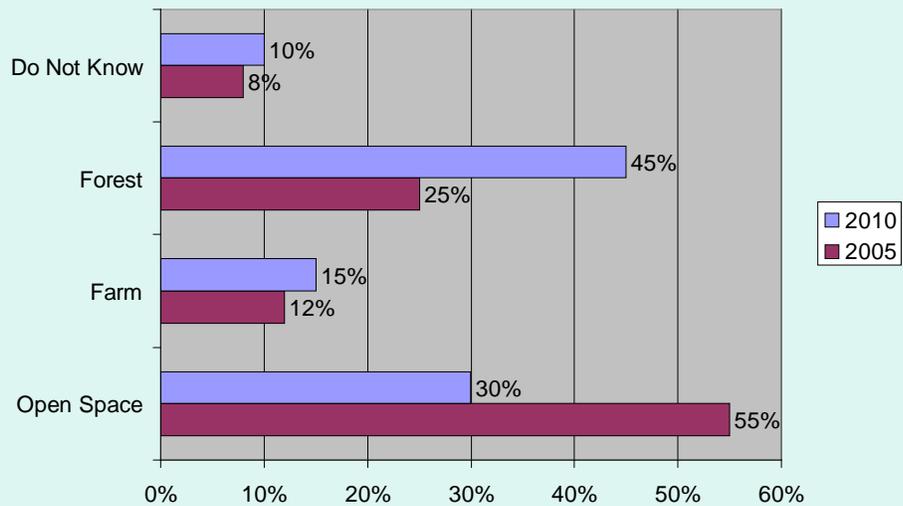


Reasons for Owning Forestland

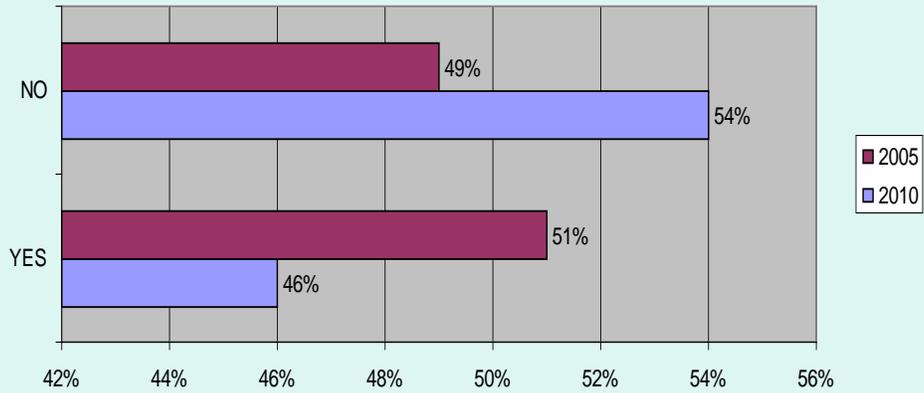


Rating Average 3: Very Important / 1: NOT Important

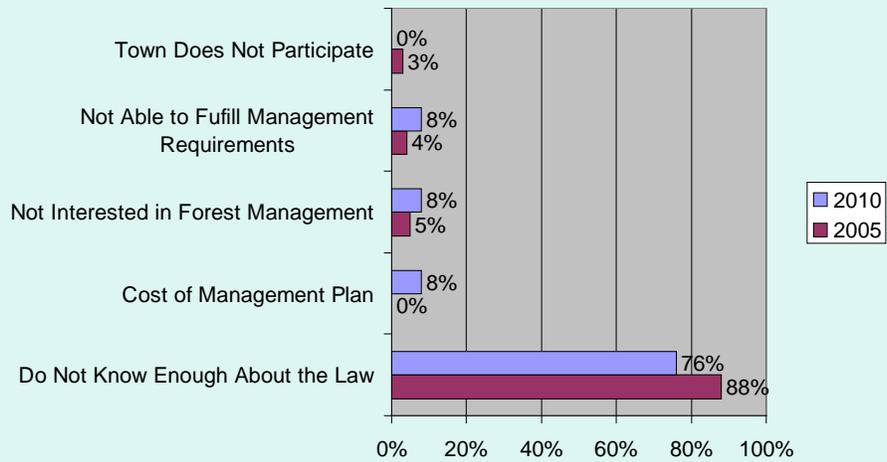
What Tax Program Is Your Property Enrolled?



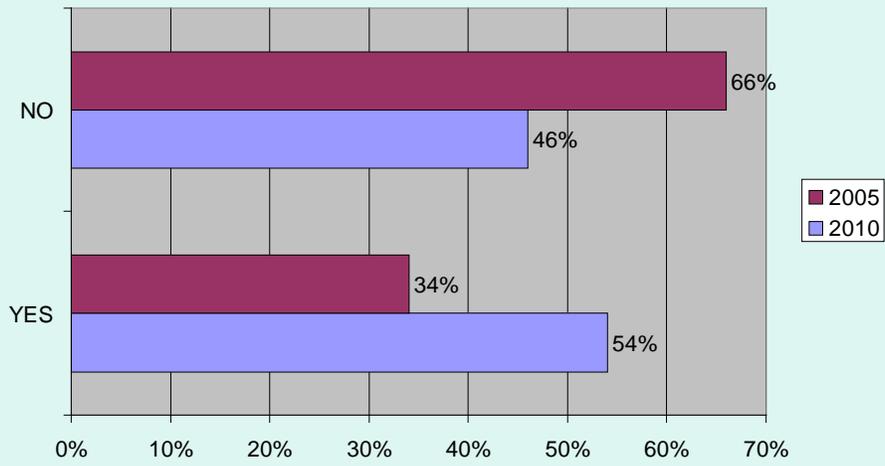
Is Your Property Enrolled in the Farm, Forest, Open Space Program?



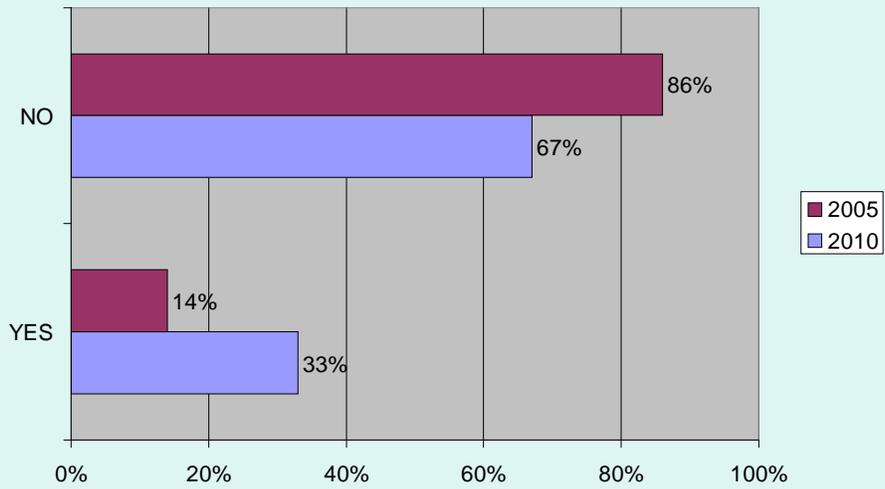
Reasons for NOT Enrolling in the Farm, Forest & Open Space Tax Program



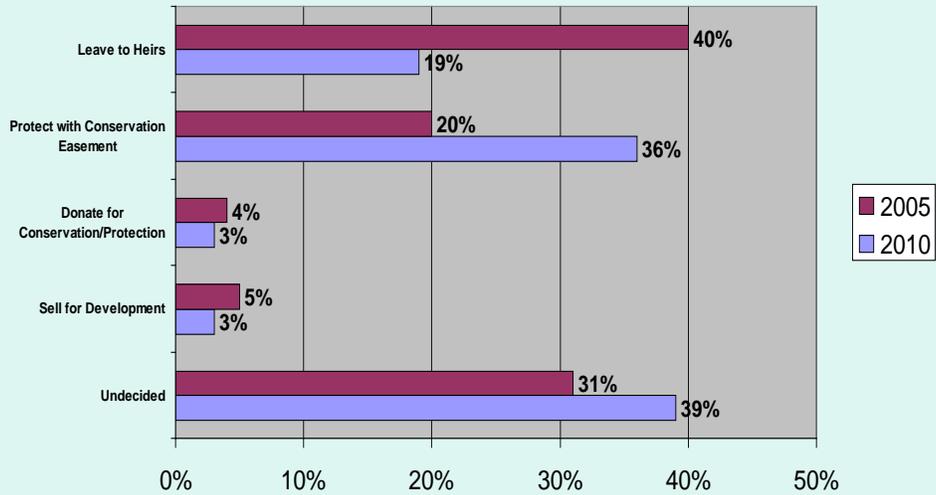
Do You Actively Manage Your Forestland ?



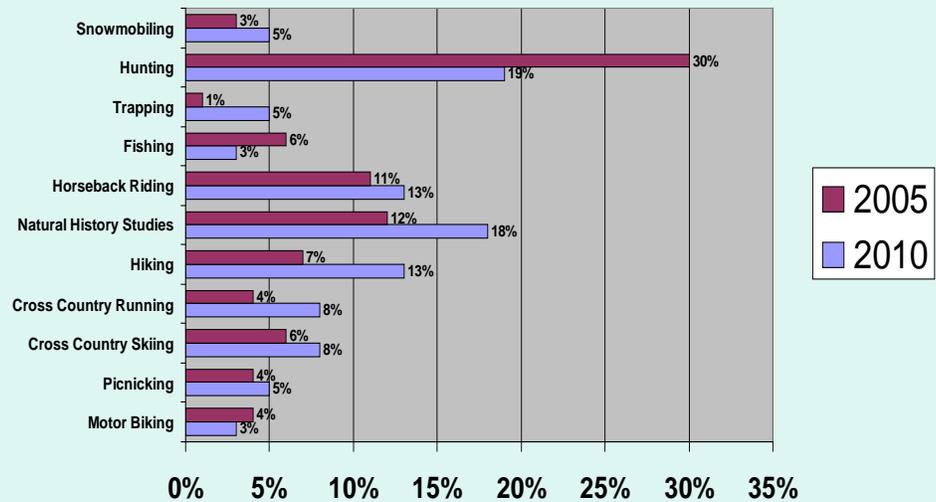
Forest Management Plans Less Than 10 Years Old



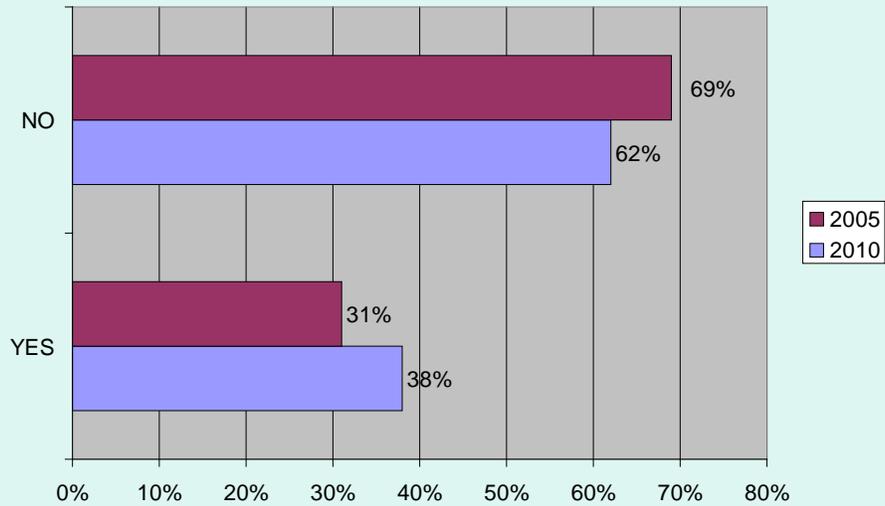
Long Range Plans for Property



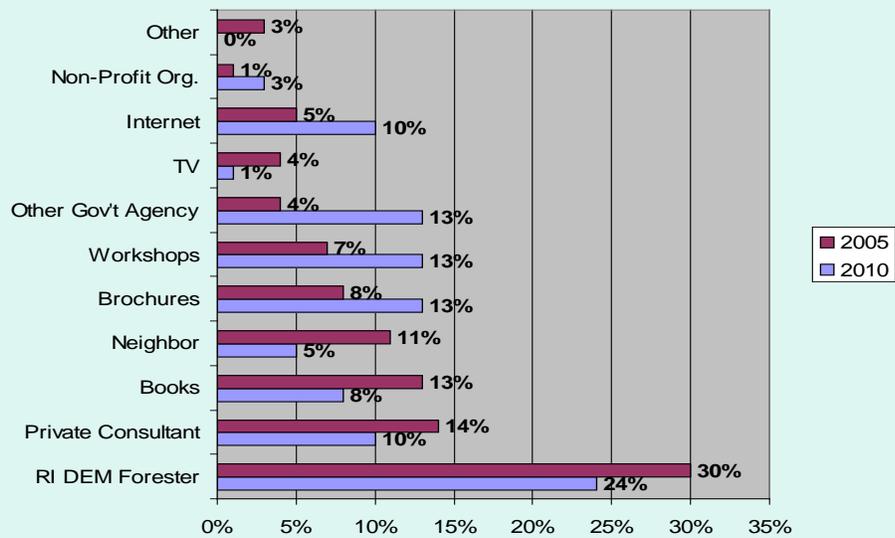
Allowed Recreational Uses on Private Forestlands



Do You Have Unauthorized Recreational Use on Your Property?

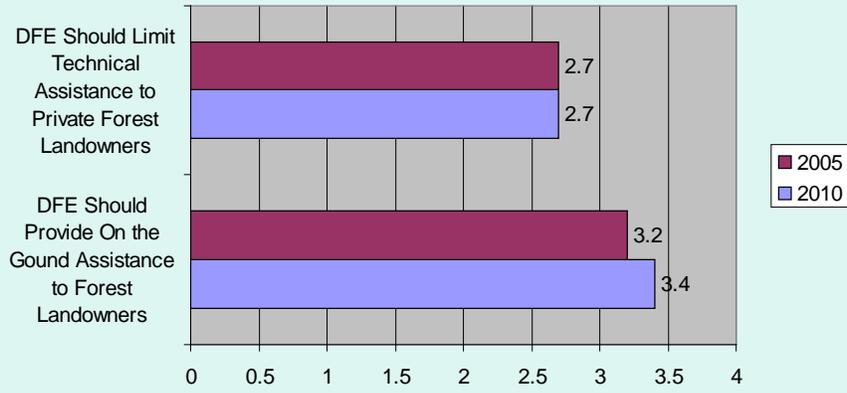


Where Forest Landowners Obtain Information on Forest Management



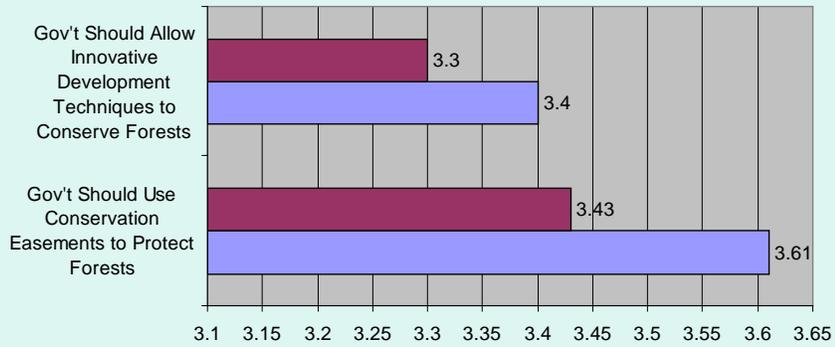
DFE Service Forestry Efforts

Service Forestry Efforts



Rating Average 4: Strongly Agree / 1: Strongly Disagree

Government Forest Conservation Efforts



Rating Average 4: Strongly Agree / 1: Strongly Disagree



Appendix D

The Forestry, Agriculture and Land Use Change Strategies for Reducing Greenhouse Gas Emissions in Rhode Island



FORESTRY, AGRICULTURE, AND LAND USE CHANGE STRATEGIES FOR REDUCING GREENHOUSE GAS EMISSIONS IN RHODE ISLAND

A Report to the Forestry Working Group of the
Rhode Island Greenhouse Gas Process

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May 17, 2004

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Note on units:

For consistency with the RI Greenhouse Gas Action Plan, we present greenhouse gas emissions in terms of metric tons of carbon (tC) or carbon equivalents (tCe). The latter term includes other greenhouse gases where relevant, such as nitrous oxide (N₂O) from fertilizer applications or methane (CH₄) from anaerobic decomposition of biomass, converted to carbon equivalents based on their Global Warming Potentials as published by the Intergovernmental Panel on Climate Change. Emissions can also be presented in terms of carbon dioxide (tCO₂ and tCO₂e). For reference, 1 tC = 3.67 tCO₂. Conversely, \$3.67/tC is the same as \$1/t CO₂.



Summary

For the past three years, the Rhode Island Department of Environmental Management (DEM) and the State Energy Office have convened stakeholders from business, industry, citizen groups, environmental organizations, and other government agencies to address what the state and citizens can do to address the challenge of global climate change. The Rhode Island GHG Process stakeholders have initiated actions across a number of fronts including the development of renewable energy sources, the reduction of vehicle fuel use, and the improvement building and appliance energy efficiency. Stakeholders have also indicated high interest in forestry and land use activities, such as urban and community forestry and open space protection, which can provide key opportunities to reverse the rise in Rhode Island's emissions of greenhouse gases.

This report examines a suite of potential forestry and land use actions that might help Rhode Island meet its goal of reducing GHG emissions goal (1990 levels by 2010, and 10% below that level by 2020) while providing an array of benefits to state residents and businesses. We find that:

- **The state's forests, both urban and rural, appear to be important carbon sinks.** In other words, each year they grow and accumulate more carbon than is lost through harvest and conversion of forest to development and other uses.
 - Using more recent USDA studies than available at the time that the RI GHG Action Plan was prepared (2002) we conclude that **the state's net emissions are likely to be about 3% lower than previously calculated.**
 - The future rate of carbon emissions/sequestration from RI forests is uncertain. The ongoing increase in pine component of Rhode Island forests will tend to increase carbon sequestration, since pine tends to hold more carbon. On the other hand, forest maturation, land clearing, harvest, and disease could lead to decreases in the rate of carbon uptake or even net emission. If we assume that forests continue to sequester carbon at recent rates, meeting the state's overall GHG emissions target for 2020 is likely to require about 10,000 metric tons carbon (tC) fewer emissions reductions than previously projected. This is a relatively small amount, subject to significantly larger uncertainties. Further research and analysis on the state's carbon stocks and trends could provide useful insights for both foresters and GHG process stakeholders.
- **New forestry and land use initiatives, could, together, yield about 50,000 tC/year in carbon sequestration and emissions reductions by 2020.** For many of these measures, such as urban and community forestry and pine enhancement, the larger gains occur well after 2020, as tree mature and provide greater energy savings and carbon sequestration. As outlined in Table ES-1, individual strategies vary considerably in timing of emissions savings (or removals), costs, benefits, funding requirements, and implementation challenges. Specifically, we find that:
 - **Urban and community forestry** efforts could be expanded beyond current levels, especially with increased focus on yard trees, as well as vacant lots and other open spaces. Experience from other areas suggests a goal of planting 200,000 new trees in the next ten years is achievable, and that new sources of funding could be tapped. For example, by locating trees where shading can reduce air conditioning costs and where windbreaks can lower heating bills, typically on private property, consumers could save nearly \$1.3 million per year by 2020, and the state's net carbon dioxide emissions could be reduced by about 3,000 metric tons carbon in 2020 and almost double that level in future years.

A 10-year, 200,000-tree program might cost \$1.5 to \$2 million annually. This is a significant sum. However a combination of funding sources and policy tools could be leveraged to achieve this goal. Support from traditional sources such as the State, USDA, and foundations could be expanded, and utilities, homeowners, and businesses could each contribute in return for the



many benefits of an expanded urban forest.

For example, electric and gas utilities could invest in tree planting as a demand-side management activity, as they increasingly do in many California communities. Unlike in California, however, where higher cooling loads (and lower heating loads) make tree shading more clearly beneficial, the energy cost reductions are not sufficient in Rhode Island's climate to render a tree planting program cost-effective on the basis of energy payback alone. Trees can provide some reduction of winter heating costs, but these are likely to be rather small overall. Nonetheless, municipalities may wish to leverage utility and consumer cost savings to expand urban forestry programs, and partnerships with utilities are worth exploring.

Policy mechanisms to increase canopy cover, such as ordinances and zoning laws in place in Providence and Warwick, could also enhance tree planting and maintenance at limited expense to individual towns. And with added support for effective outreach, more homeowners and businesses might be tapped to contribute to tree planting efforts, as they do in Newport. The DEM's Forestry division has already helped to train over 400 tree stewards who are already contributing in similar efforts across the state.

The multitude of other benefits from urban and community forestry suggest that this option should be investigated further, perhaps by bringing the many individuals involved in RI urban forestry together with experts and program managers from other regions, and by better documenting the many economic and other benefits that urban forestry can provide.

- o **Forest protection** encompasses a variety of potential activities. We examine two of these: a) "conservation development" to promote more compact development patterns and b) voluntary development limits through current use taxation or public purchase of development rights.

The practice of conservation development involves retaining more forest area per dwelling (or commercial) unit created. RI DEM is seeking grant funding to support additional assistance to local planning officials. Our calculations suggest that enhanced conservation development, by avoiding forest loss, could save 16,000 metric tons per year of carbon emissions by 2020. Conservation development practices may also save building and infrastructure cost (e.g. by reducing land clearing and landscaping requirements, and by reducing the roads and utility service line lengths), and can reduce travel costs and GHG emissions from travel. However, these cost savings are difficult to estimate, and are not reflected here. Costs of implementing the program are expected to be \$200,000 per year for five years, for outreach materials and additional staff to work with municipalities. If 20% of clearing can be avoided, average cost will be \$4/tC.

The Farm, Forest, and Open Space current use taxation program allows owners of forest land to pay property tax on land valuation that would be supported by potential revenues from forestry, rather than potential revenue from development. In exchange, the landowner commits to not developing the land for 15 years. Costs for this program are forgone tax revenue and cost of program administration. These costs have not been tallied.

State open space bond funds leverage federal and private foundation funds. These funds can be used to acquire development rights or acquire land at risk of clearing. The Governor's proposed \$35 million bond authorization, currently named the "environment and groundwater protection" bond, is a central element of this strategy. This strategy could avoid 7,000 metric tons of carbon emissions in 2020. If the entire cost of the program is assigned to GHG offsets, the price per ton would be high. The average price per ton as of 2020 would be \$870, declining to \$345/tC by 2050 as more carbon accumulates on lands acquired prior to 2020. However, it is misleading to view these as incremental costs needed to achieve GHG reductions. The state has a multi-



decade history of using open space bonds to provide a variety of benefits including quality of life, water quality, and wildlife habitat, benefits that are not reflected in the \$/tC.

- **Land restoration** sequesters carbon by rebuilding forests and soils. Two types of land restoration are analyzed here: restoration of riparian (river side) trees and restoration of meadows on former gravel mines.

Riparian restoration is included because of its large co-benefits in the form of improved water quality and visual amenities. Riparian restoration yields modest amounts of carbon sequestration because the areas restored tend to be narrow strips and small portions of urban lots. We estimate that achieving the 500 acre restoration goal of the RI DEM 2015 can store 600 tC annually by 2020 at a cost of \$570/tC.

Gravel mine restoration involves hauling topsoil or compost and establishing desired plant species. Creating grass meadow on 1100 acres by 2015 could store 1,000 tC annually by 2020. Sequestration would nearly stop about 30 years after restoration, as soil carbon levels reach equilibrium. 18,000 tC could be stored by 2050 with most of the gain occurring before 2040. Cost through 2020 would average \$210/tC, declining to \$100/tC by 2050.

Restoration of soil and grass meadow on unused gravel pits would provide early successional meadow habitat, a goal of the state and federal wildlife management and soil conservation programs. The amount of meadow habitat in the state has decreased dramatically over recent decades as former pastures revert to forest and urban development spreads into formerly rural areas.

The bulk of funding for restoration projects is expected to come from federal conservation incentive programs. Federal funds would pay for land leases, conservation easements, and much of the cost of implementing restoration actions. Support for the RIDEM to do planning work would be required to access federal funds. Additional support may be needed to provide grants for landowner portions of cost shares required by federal programs.

- **Enhanced management of existing forests.** This measure represents a much larger long-term potential resource for carbon sequestration, and a much less expensive one from GHG mitigation cost perspective. It increases outreach to forest landowners, and encourages improvements in forest management. Three changes in management are expected to mitigate greenhouse gas emissions: Improving estate planning to decrease harvest and land conversion following estate transfer, encouraging private landowners to grow and hold more large trees, and encouraging landowners to favor white pine on appropriate sites. Of these changes, the one most likely to generate large amounts of emission mitigation is pine enhancement. In many locations pines can be established merely by timing harvests to occur during heavy pine seed years or scraping away plant litter and duff to expose mineral soil, making a suitable seedbed for pine, and allowing seeds from nearby trees to establish. For the most part, pines can be established in existing forest gaps. Facilitating establishment of white pines across the equivalent of a slightly over 4000 acres each year for 10 years could ultimately store over 1.4 million tC by 2050, an amount equal to about 60% of a year of Rhode Island's current total GHG emissions. Implementation involves additional expenditures for outreach to landowners, estimated be an average of \$120/tC by 2020, declining to \$13/tC by 2070 as trees grow. When interspersed with hardwoods, enhancement of the pine component of existing forests could improve forest diversity, increase winter resting cover for wildlife, and reduce the risk of future forest loss due to pathogens, such as sudden oak disease. Implementation would require dealing with at least several hundred landowners, which would require significant effort. This workload appears feasible because Rhode Island have had good success in communicating with forest land owners,



as the recent surveys on the state forestry plan and on the wooly adelgid infestation both suggest.

- o **No-till agriculture and fertilizer management options** offer very limited opportunities for GHG emissions reductions, likely amounting to less than 500 tC annually by 2020.

If viewed only through the lens of GHG cost-effectiveness or cost of saved carbon, many of these measures might appear rather expensive, with costs ranging from \$10 to over \$800 per metric ton of carbon sequestered, as shown in the right hand column of Table ES-1. In contrast, most of the higher-priority transportation, energy supply, and buildings and facilities options in the RI GHG Action Plan were estimated to have negative costs (i.e. net benefits). However, there is an important distinction between forestry and energy projects. Energy-related GHG mitigation measure typically provide a stream of readily quantifiable fuel or electricity cost savings that quite often pay back the cost of measure. The major “paybacks” for forestry and land use options are typically more difficult to quantify: habitat restoration, stormwater management, community aesthetics, enhanced property values, and/or increased forest product revenue (where relevant), among others. The fact that many of the forestry and land use options discussed here, such as open space protection, are already being pursued, suggests that these paybacks are indeed very significant. Therefore, **decisions regarding which options to pursue, and the extent to pursue them, should not focus too narrowly on the reported cost of saved carbon.** Rather, they should consider on equal footing, these other key benefits, along with other factors such as ease of implementation, and the feasibility of obtaining funding from new and existing sources.

This report begins by providing an overview of key concepts in carbon accounting, current and projected carbon stocks in Rhode Island, and our overall analytical approach. The sections that follow provide detailed analysis of the strategies summarized here, along with more specific findings and recommendations.



Table ES-1. Forestry and land use change strategies for mitigating Rhode Island greenhouse gas emissions

Option	Implementation Pathways	Annual GHG Savings	Cumulative GHG Savings	GHG Cost-Effectiveness
Higher Potential				
Urban and Community Forestry	<ul style="list-style-type: none"> - Consider a major statewide program to support enhanced capacity at the municipal level and ability to achieve a goal of 200,000 trees planted in 10 years - Focus on yard trees and lots to maximize energy and carbon benefits - Seek quantification and funding based on energy savings - Promote stronger ordinances and state enabling legislation 	3,000 tC (2020)	16,000 tC (through 2020) 190,000 tC (through 2050)	\$760/tC (through 2020) \$38/tC (through 2050)
Forest Protection	Conservation Development - Seek full implementation of Conservation Development efforts	16,000 tC (2020)	260,000 tC (through 2020)	\$4/tC (through 2020)
	Current Use Taxation & Open Space Bond - Support legislative authorization of a new open space and recreation bond (currently named "environment and groundwater protection" bond) - Current use taxation costs and tons not estimated here	7,000 tC (2020)	110,000 tC (through 2020) 304,000 tC (through 2050)	\$870/tC (through 2020) \$340/tC (through 2050)
Land Restoration	Riparian Restoration - Increase target acreage for riparian restoration to 500 acres by 2015 and support to existing DEM programs to achieve this target	600 tC (2020)	7,000 tC (through 2020) 16,000 tC (through 2050)	\$570/tC (through 2020) \$240/tC (through 2050)
	Gravel Mine Restoration - Target restoration of 1100 acres of inactive gravel mines to grasslands by 2015, extending the on ongoing NRCS wildlife habitat program	1,000 tC (2020)	9,000 tC (through 2020) 18,000 tC (through 2050)	\$210/tC (through 2020) \$100/tC (through 2050)
Enhanced Forest Management	- Increase outreach to forest landowners by DEM Division of Forest Environment enhancing pine, encouraging growing larger trees, and estate planning	23,000 tC (2020)	150,000 tC (through 2020) 1,400,000 tC (through 2070)	\$120/tC (through 2020) \$13/tC (through 2070)



Option	Implementation Pathways	Annual GHG Savings	Cumulative GHG Savings	GHG Cost-Effectiveness
ALL OF THE ABOVE		50,000 tC (2020)	>550,000 tC (through 2020) >2 million tC (through 2050)	
Lower Potential				
No-till cropping	- Switch 4000 acres from conventional plowing	Negligible by 2020	6,000 tC (through 2020)	Not calculated
Farm fertilizer management	- Outreach to smaller farmers	< 1000 tC (2020)	Not calculated	Not calculated
Lawn fertilizer management	- Outreach to homeowners	< 1000 tC (2020)	Not calculated	Not calculated



1. Introduction

1.1 Role of land use and forestry in the GHG process

Global climate change presents a major challenge for Rhode Island. With its many coastal areas, the state faces major risks of flooding, contamination of drinking water supplies, and extreme weather events. Human-caused climate change also presents added threats to local agriculture and forest health. At the same time, Rhode Islanders have many opportunities to reduce their emissions of the heat-trapping or “greenhouse” gases (GHG), reductions that will ultimately be required to avoid dangerous interference with the global climate.

For the past three years, the Rhode Island Department of Environmental Management (DEM) and the State Energy Office have convened stakeholders from business, industry, citizen groups, environmental organizations, and other government agencies to address what the state and citizens can do to address this challenge. During Phase I, stakeholders developed a GHG Action Plan and prioritized a list of options for reducing the GHG emissions, most notably carbon dioxide (CO₂).

Forestry and land use activities present key opportunities for mitigating Rhode Island’s rising GHG emissions. Nationally, and in other regions, tree planting efforts and improved forest and agricultural management practices are recognized as significant opportunities to sequester CO₂ from the atmosphere, reduce fossil fuel use for heating and cooling, and limit emissions of other gases with potent heat-trapping effects (methane and nitrous oxide). Rhode Island municipalities, state agencies, foundations and others already pursue a variety of land conservation, forestry, and urban tree planting activities, with many notable accomplishments, as noted in this report. Further enhancing urban tree cover, conserving and restoring forests, and other strategies can enrich biological diversity, reduce air pollution, and provide jobs and other community benefits. In addition, forestry and land use strategies can also enlarge the number of participants in climate change mitigation and leverage new sources of revenue for forestry programs and landowners. Despite Rhode Island’s small land area and high land values, these strategies may nonetheless be quite significant and highly attractive, given their other environmental and social benefits.

1.2 Key concepts

Forestry, agriculture, and land use change affect greenhouse gas emissions in a variety of ways, leading to both emissions to, and removals of, greenhouse gases from the atmosphere. Land use affects three greenhouse gases: carbon dioxide, methane, and nitrous oxide. When plants grow they take carbon dioxide out of the atmosphere, return the oxygen to the atmosphere, and keep some of the carbon in their tissues. Roughly half of a tree’s dry weight is carbon. A small fraction of plant carbon enters the soil and becomes soil organic matter, which is stored for many centuries.

Depending on management strategies, harvesting forests (on existing forest lands) may increase or decrease total net sequestration. Extending rotation lengths can significantly increase the total amount of sequestered carbon, though by decreasing short-term wood supplies, it may shift harvest pressures to other lands. On lands where rotation lengths are largely unchanged, the total amount of carbon sequestered still increases over time, as a fraction of previously harvested wood remains stored in wood products. Substantially shortening rotations generally reduces total sequestration because the total amount of carbon in products and live trees remains less than in the previous, older stand. See Appendix A for quantitative illustrations. If biomass is used for energy purposes, it can avoid the fossil fuel combustion and carbon dioxide emissions.

Methane and nitrous oxide are the two other principal greenhouse gases affected by forestry, agriculture, and land use change. They are emitted in much smaller amounts, but on per weight basis are from 23 (CH₄) to over 300 (N₂O) times more potent heat-trapping gases than carbon dioxide, and their dynamics



are very complex. As a result, small changes in methane or nitrous oxide emissions can have significant impacts.

Nitrogen is an essential nutrient in ecosystems, and nitrogen cycles through many complex pathways in ecosystems. At some points in this cycling, nitrogen may leak from ecosystems in the form of nitrous oxide. This leakage generally increases when nitrogen fertilizer is applied, and N₂O emissions are higher in warm, wet conditions. Nitrous oxide emissions can be reduced by reducing the total amount of fertilizer applied to lands, changing what form of nitrogen is applied, and changing when and how it is applied.

Soils that are saturated with water typically emit methane from anaerobic decomposition. Soil methane emissions can be reduced by reducing saturated soil conditions, reducing pathways for diffusion of methane produced deeper in the soil to the atmosphere, and encouraging growth of bacteria that break down methane in soils.

When considering strategies for mitigation of greenhouse gas emissions, decision makers should take into account their potential reversibility. For example, concerns have been raised that carbon sequestered in forests could be rapidly lost in the case of forest fires (RI has an exemplary plan for and record of containing forest fires to less than 200 acres per year) or disease, risks that may well be magnified by climate change itself. However, simply because a particular mitigation activity (like tree planting) present permanence risks does not mean that the activity is not worth implementing. Steps can be taken to minimize permanence risks (e.g. by diversification of strategies across sectors and locations). Furthermore, even if greenhouse gas savings are reversed (i.e. planted forests burn and do not regenerate), there is distinct climate value in removing emissions for many years.

Another concern commonly raised for GHG mitigation projects is emissions leakage. For instance, a land conservation strategy might seek to remove certain lands from development pressures, land clearing, and forest loss. However, in some cases, if proper steps are not taken, such a strategy might simply lead to land clearing, forest loss, and carbon emissions in another location. Like permanence, leakage concerns can be addressed through appropriate policy designs (e.g. by directing development to lower impact lands).

1.3 Land use trends and forest conditions – Implications for GHG emissions

From the mid 1600s through the late 1800s, land clearing, logging and crop tillage released a significant fraction of the carbon previously stored in Rhode Island's forests and soils. Over the past century, forest re-growth has made lands a net sink. As of 1998 (the most recent date for which data are compiled) about 59% of the land in Rhode Island is forest.⁶¹ Over the past four decades the area of forest in Rhode Island has generally been decreasing as forest land is converted to residential and urban use. Depending on the time period and definition of forest used in each study, the rate of loss has changed over time, ranging from rapid loss to slow and intermittent loss of forest. The general trend is movement of forest land out of large parcels into smaller parcels, and significant losses of area in timberland while there area in urban forest increases. From 1973 to 1993, the average size of forest ownerships in the state declined from 26 acres to 13 acres.⁶²

Future land management—including continued forest growth and land clearing for urban and suburban development—could cause the lands of Rhode Island to be either a net source or net sink of greenhouse gases. Even today, there is some uncertainty as to whether Rhode Island lands are a net source or sink

⁶¹ USDA Forest Service Forest Inventory Analysis program. State summary tables. <http://www.fs.fed.us/ne/fia/states/ri/tables/t01.6.p.htm>. Last accessed 16 February 2004.

⁶² USDA Forest Service. 2002. *The Forests of Rhode Island*. Report NE-INF-155-02. Newtown Square, PA: Northeastern Research Station, USDA Forest Service.



of carbon dioxide emissions. The inventory prepared for the RI GHG Action Plan suggested that the state is currently a net source of 26,000 metric tons carbon per year, based on a draft USDA Forest Service assessment, which suggested that loss of forest to development (averaging 1450 acres per year from 1985-1997) outpaced forest growth.⁶³

However, more recent USDA Forest Service estimates (by the same authors) indicate that forests have actually been increasing carbon stored by about 53,000 metric tons carbon per year.⁶⁴ This more recent analysis includes several key improvements.⁶⁵ Though these changes provide a more accurate estimate of net forest carbon flux for the state, there are still many uncertainties. The most recent USDA carbon estimates are based on sampling of the forests through 1985, and may not adequately reflect the area of land converted to non-forest use. The Rhode Island Division of Forest Environment (DFE) estimates that, over the next 15 years, RI forests will grow at a rate that would store 76,000 tC/year, 44% more sequestration than USDA Forest Service historical figures would suggest.⁶⁶ It should be noted that achieving these levels of carbon sequestration would require no major increases in rates of land clearing, harvest, and disease.

These annual changes are small compared with the total carbon stored in Rhode Island forests, 12.7 million metric tons carbon.⁶⁷ The carbon stored in forests is equivalent to nearly four years of Rhode Island greenhouse gas emissions (3.43 million metric tons carbon equivalent in 2000). This ratio suggests that even modest changes in forest stock can have a significant effect on total state emissions.

⁶³ The draft USDA assessment uses simplifying assumptions that a) all soil carbon in areas going out of forest use is immediately emitted as carbon dioxide, and b) that forest floor and understory carbon pools do not change in density with tree carbon density. Despite a calculated gain in tree carbon of 51,000 metric tons carbon per year, the calculated losses in soil, forest floor, and understory pools were even larger, leading to a net emission.

⁶⁴ Birdsey, RA and GM Lewis. 2003. *Carbon in U.S. Forests and Wood Products, 1987-1997: State-by-State Estimates*. General Technical Report NE-310. USDA Forest Service, Northeastern Research Station.

⁶⁵ When addressing land use change, the more recent assessment makes the more reasonable assumption that soil carbon remains stored at amounts that are typical for non-forest uses. It also uses non-linear regression analysis to develop ratios of non-tree forest carbon stocks as a function of tree carbon stock, and includes carbon stored in wood products but does not include carbon in mineral soil.

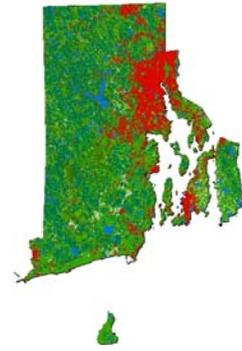
⁶⁶ DFE anticipates that the existing standing stock of about 1.8 billion board feet will gain an additional half billion board feet in the next 15 years. (Tom Dupree, Chief, RI Division of Forest Environment, personal communication 13 April 2004.) This gain would mean an average annual gain of 33.3 million board feet per year. The Forest Service Forest Inventory Analysis program measured 494 million cubic feet of growing stock on Rhode Island timberland, which implies a ratio of 3.65 board feet per cubic foot. Dividing results in a gain of 9.1 million cubic feet per year. (USDA Forest Service, Northeast Forest Inventory and Analysis Program, Table 34, accessed at <http://www.fs.fed.us/ne/fia/states/ri/tables/t34.8.1.htm>). Multiplying by 18.43 pounds of carbon per cubic foot*, and dividing to get metric tons, yields an estimated gain of 76,000 metric tons of carbon per year. This projected rate of sequestration is 44% higher than the rate calculated by the Forest Service for the period 1987 to 1997. (*This rate is the average of pine, oak-hickory, and maple-beech-birch provided by Birdsey, Richard A. 1996. Carbon Storage for Major Forest Types and Regions in the Conterminous United States (with appendices). In Sampson, R. Neil and Dwight Hair, eds. *Forests and Global Change Volume 2: Forest Management Opportunities for Mitigating Carbon Emissions*. Washington, DC: American Forests, averaging rates given for pine and hardwood in Northeast states.)

⁶⁷ Biomass from USDA Forest Service Forest Inventory Analysis state summary tables, accessed at <http://www.fs.fed.us/ne/fia/states/ri/tables/t57.6.1.htm>, converted assuming that half of dry biomass weight is carbon. This estimate does not include soil carbon. Birdsey and Lewis (2003) estimate that an additional 1.3 million tons of carbon harvested from RI forests remain stored in forest products.



Figure 1. Urban land area in Rhode Island (Nowak, 2001)

Forest carbon estimates tell only part of the story. These USDA studies (Forest Inventory Analysis) consider only the carbon stored in “forests” as technically defined—undeveloped lands amounting to 393 thousand acres in 1997—which cover 59% of the state. Much of the rest of Rhode Island is in some sort of developed use. The use covering the largest proportion of area is residential. Other uses include roads, and various types of commercial and industrial uses. About 7% of the state land area remains in agricultural use.⁶⁸



Box 1. The dynamics of carbon in Rhode Island forests

Despite the general trend forest area loss, the total amount of carbon in Rhode Island forests and wood products has been increasing. The increase in total forest carbon stock results from an interaction of long-past land conditions and more recent usage patterns. Much of the current forest originated early in the 20th century. About 75% Rhode Island's forests are dominated by trees 50 to 90 years old (as of 1998).⁶⁹ In recent years, the rate of growth has exceeded logging rates; from 1984 through 1997, wood volume removed from forests by harvest was only 12% of wood growth of live trees, even after deducting for trees that died or decayed. In addition, a portion of this harvested wood remains sequestered in long-lived wood products, such as lumber and furniture. Conversion of forest land to other uses during this time period resulted in a loss of biomass and carbon equal to about 57% of net wood growth. The net effect was that Rhode Island forests accumulated about 2.5 million cubic feet of wood per year. This net gain of wood, plus gains in the amounts of carbon in forest soils, the forest floor, understory plants, and wood products resulted in average sequestration in forests at the rate of 53,000 metric tons carbon per year.^{70,71}

According to census definitions and as illustrated in Figure 1, 23% of Rhode Island is “urban”, among the highest percentages in the US. Of this urban land, only 9% is covered by trees, among the lowest urban tree cover rates in the US. Nonetheless, it has been estimated that Rhode Island's urban trees store about 760,000 metric tons of carbon, and that this stock is increasing by 18,000 metric tons annually.⁷² While the standing stock is only about 6% of rural forest biomass, carbon could be accumulating in urban lands at nearly half the rate of rural forests. This finding suggests that although urban forests store only

⁶⁸ Rhode Island Department of Planning. 2000. *Rhode Island Land Use Trends and Analysis (Including Land Use Surveys for the Period 1970-1995)*. Technical Paper 149. Providence, RI: Statewide Planning Program, Rhode Island Department of Administration.

⁶⁹ USDA Forest Service. 2002. *The Forests of Rhode Island*. Report NE-INF-155-02. Newtown Square, PA: Northeastern Research Station, USDA Forest Service.

⁷⁰ Birdsey, RA and GM Lewis. 2003. *Carbon in U.S. Forests and Wood Products, 1987-1997: State-by-State Estimates*. General Technical Report NE-310. USDA Forest Service, Northeastern Research Station.

⁷¹ We have assumed these trends and calculations, conducted on data from the 1980s and 1990s are still relevant.

⁷² Nowak, David J. and Daniel E. Crane. (2002) Carbon Storage and Sequestration by Urban Trees in the USA. *Environmental Pollution*; 116(3): 381-389. The lead USFS researcher in this analysis (David Nowak) acknowledges some large uncertainties with these data and is currently working to resolve their estimates with more recent, finer grained GIS data. He cautions that the current analyses for coastal city states is thrown off somewhat by the 1km grid resolution used in states like Rhode Island, where towns frequently border water bodies. The resulting numbers are likely to be low estimates, and should be improved with 30m grid resolution data now being processed. Nowak (2001) actually reports 25,000 tC/year of *gross* sequestration. We reduced this estimate by nearly 30% to reflect carbon released by tree death and decay.



a fraction of the carbon in the state's traditional forests, they are of high relative importance in terms of the state's carbon balance, and in terms of GHG mitigation strategies within the state.

Table 1 compares the overall contributions of urban areas and traditional forests to the state's biomass carbon stocks. As noted earlier, these estimates differ from the analyses completed several years ago for the RI GHG Plan.

Table 1. Current (business-as-usual) contributions of rural and urban forests

	Fraction of RI land	Trees	Tree Cover	Carbon stored (tC)	Carbon sequestered (tC/year)
Forests	59%			13,000,000	53,000 to 76,000
Urban areas	23%	4.1 million	9%	760,000	18,000*

Table 2 shows the effect of revising these estimates based on these updated numbers (a negative number indicates net removal of CO₂ from the atmosphere). We show the effects of using the more conservative (lower) USDA Forest Inventory Analysis historical estimates for rural forests described above. The net change is decrease in 2000 emissions by about 3%. Use of the higher estimates derived from the RI DFE analysis would decrease the state's emissions by another 1%.

Table 2. Effect of revised estimates on Rhode Island GHG emissions for the year 2000

	Million tC
GHG Action Plan (2001)	
Total Emissions	3.53
of which Forests	0.03
Revised analysis (2004)	
Forests	-0.05
Urban Areas	-0.02
Revised Total Emissions	3.43

How do these changes in baseline emissions affect meeting Rhode Island's target?

First, they reduce estimated emissions for 1990, as these estimates were in fact derived from data from the 1980s and 1990s. Second, since 1990 is the index year of the Northeast Governors' and Premiers' GHG reduction target that Rhode Island has adopted, these revised estimates lower the emissions levels that the state must achieve in 2010 and 2020.⁷³ As illustrated, in Figure 2 target drops by 3.2% in both 2010 and 2020.

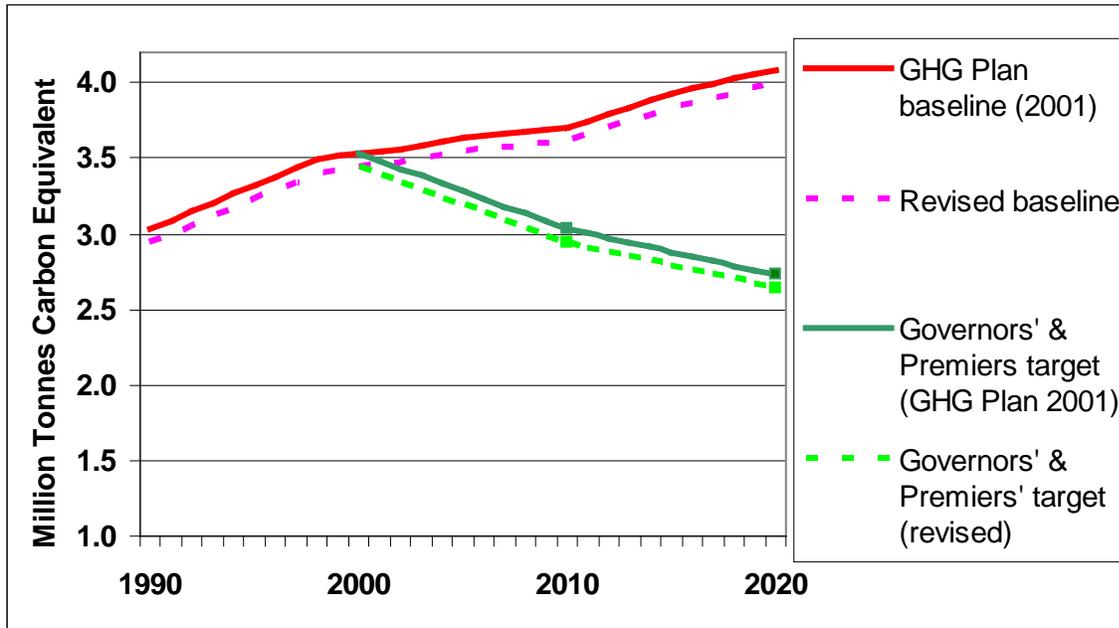
If we assume that forests continue to sequester carbon at recent rates, meeting the state's overall GHG emissions target for 2020 is likely to require about 10,000 metric tons carbon (tC) fewer emissions reductions than previously projected. As noted above, however, the future rate of carbon sequestration from RI forests however, is rather uncertain. The ongoing increase in pine component of Rhode Island forests, which would increase carbon sequestration, may not be adequately reflected in USDA inventory estimates. At the same time, forest maturation, land clearing, harvest, and disease could lead to decreases in the rate of carbon uptake.

⁷³ During Phase I, the Stakeholders accepted the New England Governors and Eastern Canadian Premiers' regional Greenhouse Gas Reduction target of reducing GHG emissions to the 1990 level by 2010 and 10% below 1990 levels by 2020 as a reasonable goal for now, on which to base a Rhode Island GHG Action Plan.



Further review on the state's carbon stocks and trends could provide useful insights for both foresters and GHG process stakeholders. The USDA is currently revising their estimates based on input by RI DFE staff and others. However, since the USDA analysis relies on historical sampling data, it must be complemented by the insights of RI foresters.

Figure 2. Effect of revised estimates on Rhode Island baseline and target



1.4 GHG reduction and sequestration opportunities: Analysis issues and approach

In the RI GHG Action Plan, the stakeholders identified two high priority forestry and land use options: urban and suburban forestry and open space protection as well as several low priority options including conversion of marginal cropland to forest and wetlands, low-input agriculture, improved cropping systems, and forest management. Based on these decisions as well as more recent input from the RI DEM and ongoing Stakeholder deliberations, we prepared an initial list of more specific implementation options. This list was further refined by the Rhode Island Forest Working Group in October 2003, and during subsequent discussions with forestry and land use professionals in Rhode Island and nationally. The resulting list of options is shown in Table 3 below.

Based on our analysis, we consider four types of options as higher potential in terms of emissions removal/reduction potential and/or environmental or social co-benefits: urban and community forest, open space protection, land restoration, and pine enhancement in existing forest areas. The first two replicate the Phase I higher priority options, and our analysis of these options focuses on more detailed quantification of costs, emissions reductions, and possible implementation pathways. Land restoration emerged because it is already being pursued in Rhode Island for habitat, water quality and aesthetic reasons, and potential funding sources exist to further the work. Analysis of forest management options revealed enhancement of the pine component of existing forests to be ecologically desirable, tractable to implement, capable of generating a significant carbon sink.



Table 3. Forestry and land use strategies considered

Option
Higher Potential
Urban and Community Forestry
Forest Protection – Current Use Taxation and Farm and Forest Bond
Forest Protection – Conservation Development
Land Restoration – Riparian
Land Restoration – Gravel Mines
Enhanced Forest Management
Lower Potential
No-till Cropping
Farm Fertilizer Management
Lawn Fertilizer Management

We describe each of the higher potential options in detail in Sections 2-5 below. Analysis of each option faced a common challenge—limited experience and data upon which to estimate costs and benefits. While urban forestry, open space protection, and land restoration, are already being implemented in Rhode Island and elsewhere, they have rarely been pursued for their greenhouse gas benefits. Thus modeling of carbon sequestration and other benefits has required considerable research, and estimates of emissions reduction and cost-effectiveness (\$/tC removed or reduced) retain considerable uncertainty. The principal metrics used to evaluate options are shown in Table 4 below. We provide a much briefer analysis of the lower potential options in Section 6.



Table 4. Evaluation metrics

Metric	Unit (if quantified)	Definition/Rationale
Annual GHG Impact (2020)	tC (metric tons carbon equivalent)	Total greenhouse gas emission removals (sequestration) or reductions in 2020, expressed in metric ton carbon equivalents. 2020 is the final target year of the RI and Governors'/Premier's goal.
Cumulative GHG Impact (2004-2020 and 2004-2050)	tC (metric tons carbon equivalent)	Cumulative emissions reductions is a better indicator of climate impact than a single year's emissions, since greenhouse gases accumulate in the atmosphere and many forestry and land use strategies yield savings that can change considerably from year to year.
Cumulative Net Present Value (2004-2020 and 2004-2050)	\$ present value	Cumulative discounted cash flow analysis of costs and benefits.
Cost-Effectiveness (to 2020 and to 2050)	\$/tC	Typically this is equal to the NPV divided by the cumulative GHG impact (discounted or undiscounted). It is the metric commonly used to compare among various options for mitigating emissions. These amounts include total program spending and do not attribute portions of the cost to other co-benefits.
Stakeholder Interest, Public and Political Support/Concern, Feasibility		Expected support and or concern from the general public and from policymakers. Ease of implementation and administration by implementing parties.
Ancillary Costs and Benefits		Environmental, job, community and other impacts other than GHG emissions reductions, including public health and ecosystem impacts. These are often difficult to quantify, though some estimates have been made for the many benefits of urban forestry.



2. Urban and community forestry (New tree plantings)

Given their many and varied benefits, urban and suburban tree planting and maintenance programs are pursued throughout the US, and Rhode Island is no exception. Urban and community trees reduce local air pollution, stormwater runoff, and urban heat island effects. They enhance community aesthetics, raise property values, and provide biological diversity. And with respect to carbon emissions, they can provide a dual benefit: carbon sequestration and lowered energy use for heating and cooling buildings, through shading and evapotranspiration in the summer, and windbreaks in the winter. One recent study estimates the full value of Rhode Island urban forests at \$2.6 billion.⁷⁴

In developing the State's GHG Action Plan, participating Stakeholders identified urban and community forestry as one of 30 highest priority options for removing GHG emissions. This determination was based on an initial assessment of the potential for reducing statewide emissions, of cost-effectiveness (calculated as the cost per ton of carbon saved or removed), and other factors that influence feasibility and attractiveness (such as the many co-benefits noted above).

In the case of urban and community forestry, the Action Plan suggested that as much as 30,000 to 120,000 metric tons carbon per year could be removed by increasing canopy cover by 5-20%. These estimates were based on the extrapolation of national figures to Rhode Island, figures that ascribed the majority of the carbon savings to reducing cooling and heating loads, rather than carbon sequestered by the trees themselves. However, recent studies suggest that combined cooling and heating benefits in the Northeast US may be far lower than in other parts of the US (see Boston case study below), especially given older urban landscapes and cooler-than-average climates. With this in mind, we have conducted a closer examination to get a better grasp of potential GHG emissions benefits.

To develop these estimates, identify implementation issues, and arrive at some concrete implementation strategies, we have consulted with numerous local, state, and national urban foresters and planners.⁷⁵ We reviewed available literature and modeling studies on the energy (references), which are rather scant with respect to the Northeast specifically. Much of the activity aimed at capturing energy benefits of urban forestry has occurred in the West and South, given the clearer estimation of benefits from tree shading in warm, sunny climates.

A prime example is the Sacramento experience, where the municipal utility (SMUD) continues to invest \$1.5 million annually in a shade tree program that has planted 350,000 trees since 1990. Though their success is spreading throughout California and the Southwest, there have been no equivalent programs to date in the cooler, temperate climates of the Northern and Eastern US. While several Northeastern municipalities, such as Burlington, have adopted tree planting programs as elements of the climate change action plans, they have focused almost exclusively on the carbon sequestration benefits, which are typically rather small, especially for programs that focus on street and near-street trees. For example, Burlington's expects a mere 45 metric tons carbon per year from its program. A CITY GREEN analysis for Buffalo found that an initiative to increase canopy cover to 50% in vacant parcels would sequester about

⁷⁴ Nowak, David J. and Daniel E. Crane, and John F. Dwyer. (2002) Compensatory Value of Urban Trees in the United States. *Journal of Arboriculture*; 28(4): 194-199

⁷⁵ Including, among others: Paul Dolan, Urban and Community Forestry, RI Department of Environmental Management; John Campanini, retired City Forester, Providence Parks Dept.; Scott Wheeler, Newport Parks Dept.; Margie Ryan, Warwick Planning Dept.; Michael Bartlett, City of East Providence; Tom Willett, Pawtucket Planning and Redevelopment; Jim Lucht, Community Planner/GIS Specialist, The Providence Plan; Jennifer Cole Steele, Providence Neighborhood Planting Program; David Nowak, USFS, Syracuse; James Simpson and Greg McPherson, USFS, Davis; Cheryl Kollin, Director, Urban Forestry, American Forests; Milton Marks, Friends of the Urban Forest; Misha Sarkovich, Project Manager, Sacramento Municipal Utility District; Baldeo Singh, Sacramento Tree Foundation.



200 metric tons carbon per year. These indicative results confirm that street tree (and vacant lot) programs provide an important but most likely quite limited opportunity for carbon gains.

Therefore, for urban and community forestry to provide significant new CO₂ emissions reductions and removals, three elements are necessary:

- Targeting spaces where trees can grow to sizes where carbon sequestration can be significant, such as yards, parks, vacant lots, and open spaces. Street tree locations are inherently limited by size constraints, high mortality, relatively high costs, and frequently proximity of power lines.
- Locating trees and selecting species where energy benefits can be maximized. For instance, a large evergreen tree sited on the south side of a house in Rhode Island might actually increase overall CO₂ emissions through winter shading and increased home heating requirements.
- Developing implementation strategies, along with the institutional capacity and funding, that can achieve a large increase in tree planting and maintenance activity.

In addition, preserving and enhancing existing and urban forests is absolutely essential, especially in terms of achieve emission targets by 2020. With new planting activities, it will take many years before trees grow to a size where their carbon sequestration and energy saving benefits are substantial.

2.1 Current status, issues, and options

The Rhode Island DEM provides support to urban and community forestry activities across the state. It administers a grant program, which it has reoriented to support the development of municipal tree ordinances and help communities reach Tree City USA status, a designation of the National Arbor Day Foundation⁷⁶. Ten communities have achieved Tree City USA status, which requires a tree board or department, a tree care ordinance, and a community forestry program with an annual budget of at least \$2 per capita. The DEM recognizes the widely varying capabilities among the state's 38 cities and towns, and the importance of establishing the necessary foundations for successful urban forestry efforts (ordinances, tree wardens, city foresters and/or landscape architects that can review development plans, and provide effective guidance on planting strategies).

Many Rhode Island communities have gone well beyond these minimum requirements, with well-established and successful tree planting and maintenance activities, ranging from Providence's cutting edge tree ordinances and to Newport's unique bareroot yard tree program. Examples include, but are not limited to:

- **Providence's canopy cover requirements.** Building permits are issued only if plans are in place to achieve canopy coverage targets -- 25% for residential permits or 15% for commercial/industrial -- or if fees are paid (as offsets) to cover tree planting elsewhere.⁷⁷ Similar initiatives are also possible at the statewide level, such as Maryland's Forest Conservation Act, which provides guidelines for the canopy retained or planted after the completion of development projects.⁷⁸ New Jersey has enacted similar requirements under the Whitman administration. The key to effective implementation of canopy cover ordinances or legislation is enforcement capability.
- **Newport's bareroot program.** For several years, Newport has offered homeowners the option of ordering a bareroot shade tree for \$55. These trees are planted by the city in front of the house, in the public right-of-way or up to 20 feet within the property line. This program is notable in a number of respects. It is one of the few, significant programs that can plant in private property, avoiding conflicts with utility lines, and often enabling trees to grow larger, thus providing greater shade tree

⁷⁶ <http://www.arborday.org/programs/TreeCityBenefits.html>

⁷⁷ Present canopy coverage in Providence is 16% for residential and 4-5% for commercial/industrial sites.

⁷⁸ http://www.dnr.state.md.us/forests/healthreport/act.html#Forest_Conservation_Act



benefits for the public (including more carbon sequestration and energy benefits). Second, the use of bareroot tree stock may lower tree purchase and planting costs, and may reduce tree mortality (due to less soil disturbance, subsidence, and crown burial), particularly in comparison with balled and burlapped trees.

- **Warwick's zoning laws** that were rewritten to require 5% of commercial parking lots and 10% of commercial sites (overall) to have tree cover. With two checks in the process – an approved plan to commence construction and an inspection to get a certificate of occupancy – there is a high certainty of implementation.
- **Providence's ambitious goals**, which include planting 40,000 new trees in 4 years to achieve its overall canopy cover target of 25%. Though funding and implementation plans are not yet established, the rough plan is to plant 10,000 street, 10,000 yard, 10,000 public space, and 10,000 vacant lot trees.

Ambitious urban forestry goals, like Providence's, have also been articulated at the statewide level. The state's Urban and Community Forest Plan, developed by the DEM's Division of Forest Environment, RI Tree Council, and the Statewide Planning Program and adopted in May 1999, sets out an overall goal of enhancing tree canopy by 5-8% by 2020 in 24 communities (See Box 1). Taking the lower end of this range, and applying it to the full estimate of 4 million trees currently in Rhode Island urban areas as noted in Section 1, this would suggest the addition of at least 200,000 new trees. Given that young trees would provide only a fraction of the canopy cover of mature trees, this estimate is on the low end of the number of trees needed.



**Box 2: The Rhode Island urban and community forest plan
(excerpted from the Appendix to the RI GHG Plan)**

According to the Plan, “Rhode Island’s urban and community forests face a variety of challenges. Among the key issues are lack of knowledge of the value of trees, insufficient data on tree resources, little or no legal protection for tree resources, insufficient investment in tree resources, and lack of foresight and planning for protection of tree resources in concert with new development.”

To tackle these challenges, the Plan has laid out a set of targets and strategies, among them, strengthened legal protection for tree resources. For example, only one quarter of Rhode Island municipalities have tree ordinances, which require that significant tree resources be identified, maintained, and replaced if damaged or removed. Municipalities in some parts of the US are now extending these ordinances to include trees on private lands. The plan suggests several enhancements to ordinances, legislation, and zoning to enhance the urban and community tree resource.

Rhode Island and its communities should seek to manage the state’s urban and community forests as follows:

- the state as an entirety should seek to maintain forest land cover at approximately 55 percent of total land area through the year 2020.
- communities having 50 percent or higher forest land cover in the 1995 land use survey, should seek to avoid a more than 2 percent decrease below their 1995 baseline of forest land cover through the year 2020.
- communities having 20-49 percent forest land cover in the 1995 land use survey should seek to increase their forest land cover by 4 percent over the 1995 baseline by the year 2010 and by 8 percent over the 1995 baseline by 2020.
- communities having less than 20 percent forest land cover in the 1995 land use survey should seek to increase their forest land cover by 2 percent over the 1995 baseline by 2010 and by 5 percent over the 1995 baseline by 2020.

Overall, the plan is to enhance tree canopy by 5-8% by 2020 in 24 urban/suburban communities. The Urban and Community Forestry Plan targets limiting canopy loss to 2% in 15 rural communities.

In keeping with these types of goals, it is possible to envision an overall statewide effort that might deliver the substantial carbon gains that the RI GHG Process is targeting, building upon the existing foundation of activity and innovation spread across the state, while yielding many of the urban forestry benefit long sought by municipalities and other institutions (RI DEM, Tree Council and others) in Rhode Island.

Along these lines, students at Brown University have prepared an interesting analysis and highly informative website that examines the potential carbon and other benefits of initiatives to plant 250,000 new trees throughout the state in the coming 5-10 years. Many of their comments and insights are also reflected here.



Bigger trees, yard trees. Encouraging homeowners to grow large yard trees can sequester significant amounts of carbon.⁷⁹ Newport and Warwick will plant near-street trees within 20-25 feet of a right-of-way. Other towns have considered, but not pursued planting on private property (e.g. Pawtucket), as it can entail additional concerns and communication efforts. However, Sacramento's program provides an example of how tree programs can succeed in getting large numbers (350,000) of trees planted in front, back, and side yards (See Box 3 below).⁸⁰

Location, Location, Location. While the carbon a tree sequesters depends largely on its size, energy

Box 3: Key features of the Sacramento shade tree program

- Now in its 14th year, the program has reached 130,000 SMUD customers, and planted over 350,000 trees.
- The utility now spends \$1.5 million, and sponsors 21,000 trees annually.
- The program is marketed through electricity billing inserts. It provides an introductory free video, followed by a home visit with tree selection and location recommendations.
- Residents plant their own trees.
- The value of electricity savings (30 year present value) roughly matches the cost of tree planting. Thus, program is considered an effective utility Demand-Side Management (DSM) program.
- Los Angeles and other California communities are emulating the program, at a larger scale.
- Most utility sponsors are publicly-owned; the exception thus far is San Diego Gas and Electric. (Note that there are far more public than private utilities in California).
- SMUD has conducted numerous evaluations, and has refocused its program to maximize benefits (limiting number trees/household, prioritizing locations). Tree planting teams carry lookup tables that indicate the energy savings associated with 30 different combinations of species, location, and other factors.

benefits are another story. A tree's azimuth, or cardinal direction from houses, will dictate the extent it will provide shade in summer, winter, spring, and fall, and the extent to it will lessen prevailing winds. Figure 3 illustrates that in the Eastern US climate, the overall carbon benefits of an urban tree depend critically on size, tree species, and azimuth, and distance from a house.⁸¹ This figure also serves to illustrate the complexity of calculating urban tree carbon benefits.

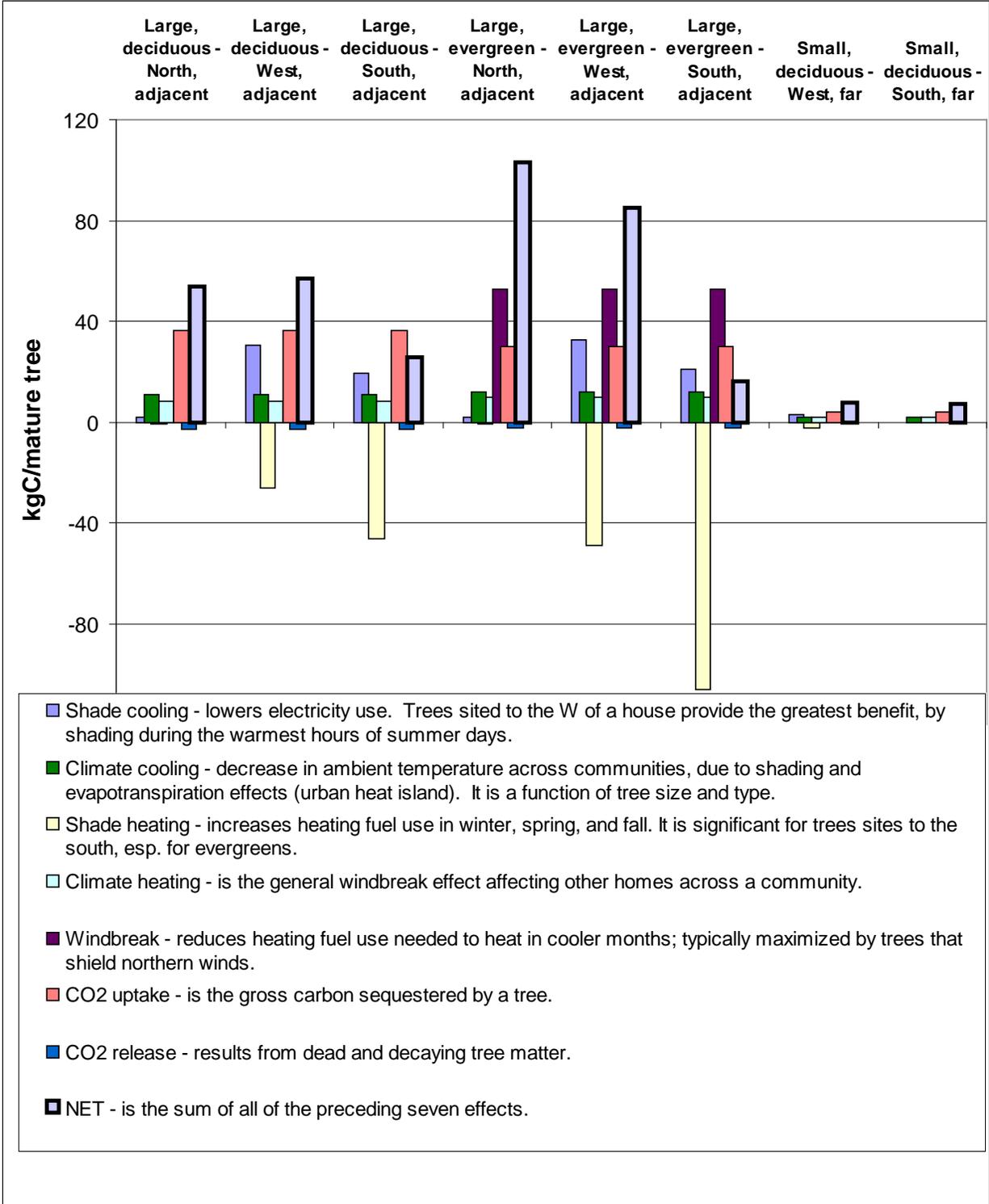
⁷⁹ Growing a single six-inch diameter tree to a foot in diameter can sequester approximately one ton of carbon dioxide. According to Nowak, D. and Crane, D, *Environmental Pollution*. 2001. 116(3): 381-389: "Total carbon storage and sequestration within cities generally increases with increased urban tree cover (city area multiplied by % tree cover) and increased proportion of large and/or healthy trees in the population. Large healthy trees greater than 77 cm in diameter sequester approximately 90 times more carbon than small healthy trees less than 8 cm in diameter (Nowak, 1994). Large trees also store approximately 1,000 times more carbon than small trees (Nowak, 1994). Moreover, large trees with relatively long life spans will generally have the greatest overall positive effect on carbon dioxide as fossil fuel carbon emissions resulting from tree planting and removal will happen less frequently."

⁸⁰ For more details on the Sacramento program, see <http://www.smud.org/residential/saving/trees/index.html>.

⁸¹ These data and insights are drawn from McPherson, E.G. and J.R. Simpson. 2000. Carbon dioxide reductions through urban forestry: guidelines for professional and volunteer tree planters. PSW GTR-171. Albany, CA: USDA Forest Service, Pacific Southwest Research Station. http://cufu.ucdavis.edu/products/cufr_43.pdf.



Figure 3. Effects of location and tree type on carbon uptake, release, and avoided fossil fuel emissions (based on reference data for mid-Atlantic region, McPherson and Simpson, 1999)



This analysis of factors influencing urban forestry energy benefits – developed largely by USDA Forest Service researchers in California and New York – has been practically applied by planners and outreach agents in Sacramento to select tree planting locations and species that maximize energy saving benefits.

This type of information could also be used in Rhode Island to maximize the overall carbon benefits of urban forestry strategies. For instance, to maximize energy bill reductions and carbon savings, urban planting programs can maximize wind protection and solar control by:

- Locating trees close enough to buildings to provide shade without creating root or limb problems.
- Favoring large, fast-growing, solar-friendly tree species, especially on the South and East of building. McPherson and Simpson (1999) provide a useful listing of solar-friendly trees. See also the Brown students' urban forestry website.⁸²
- Planting windbreak trees to the north and northwest, using evergreens where possible.
- Selecting locations and species that enabling larger, mature trees.

These factors are not always well-integrated into tree selection and planting decisions (of course in part because few programs have focused on yard trees and energy benefits). A recent modeling study of existing tree cover in Boston demonstrates this clearly.⁸³ This USFS study suggests that, given the rather haphazard locations of existing trees, their net energy benefits are limited. Aggregated across the entire city, the cooling effect of Boston's tree cover appears to save residents about \$3 million annually in avoided air conditioning bills. However, these trees also provide considerable shading in the cooler months, adding to heating bills, negating the cool season windbreak benefits.⁸⁴ These results suggest that if tree locations and species were better optimized, the net energy benefits could be far greater.

\$, \$, \$. The final issue, and the key one raised by nearly every urban forester and planner contacted, should be no surprise. Funding available for tree planting is hard to come by, even more so given the recent local and state budget crunches. Therefore, to achieve the types of goals embodied in the state and providence's urban forestry plans, new sources of funding along with innovative planting and outreach strategies are needed, to both increase available resources (both staff and budgets) and lower the effective cost of planting trees. Traditional street tree plantings can cost upwards of \$200 per tree. Recent experience suggests that various strategies including possibly the greater use of bareroot tree stock, greater resident participation, and enhanced outreach efforts (e.g. use of electricity bill inserts) might be able to lower costs per tree.

Yard trees, in particular, present an interesting challenge. Though public benefits may be less obvious, experience in some communities (such as Newport or Sacramento) suggest that residents are willing to devote money or time to tree planting. As noted by those active in tree planting efforts, Rhode Islands larger and older communities can present particular challenges, where prevailing attitudes are not always favorable to larger trees (as evidenced by pollarding) or trees in general.

2.2 Assessment of costs and potential

Based on data and relationships drawn from US Forest Service research⁸⁵, we constructed a spreadsheet model to estimate the costs and benefits of a planting program. We assumed a planting target of 200,000 trees in 10 years, roughly consistent with the state urban and community forest plan as noted above, also equivalent to a scale-up of Providence's 40,000 in 4 goal to other Rhode Island communities.

⁸² <http://envstudies.brown.edu/classes/es201/2003/Forestry/intro.htm>.

⁸³ http://www.fs.fed.us/ne/syracuse/Data/State/data_MA_bos_ufore.htm.

⁸⁴ Winter/spring/fall shading costs residents about \$3 million, while the general windbreak effect saves about \$3 million.

⁸⁵ Most notably McPherson and Simpson, 1999, Nowak, 2001, and the current USFS Boston UFORE study.



The rate of planting is similar to Sacramento's, where 21,000 trees are being installed annually. We also assumed a similar cost per tree planted, \$75, on the notion that this level of activity could yield significant economies of scale compared with activities in Rhode Island today. Although these estimates are drawn from a program that focused on residential yard trees, we assumed this was a reasonable proxy for an expanded program that also would seek to plant trees along streets, and in parks and vacant lots.

Model results are shown in Table 5 below. It is assumed that 23,000 trees would need to be planted annually for 10 years to achieve 200,000 trees, given mortality rates for young trees, even where carefully planted.⁸⁶ The annual costs for such an effort are considerable, over \$1.7 million; however, cost sharing among homeowners, businesses, state and local government and other sources could mitigate the cost burden for municipalities and tree planting programs.

Table 5. Summary results for urban forestry effort (200,000 trees in 10 years)

	Years		
	2005-2014 avg.	2020	2050
Trees Planted Annually	23,000		
Annual costs	\$1,725,000		
Annual Carbon removal/savings (tC)	582	2,910	5,291
Annual energy bill savings	\$145,420	\$727,100	\$1,322,000
Cumulative Carbon removal/savings (tC)		16,402	189,679
Cost-effectiveness (\$/tC)		\$762	\$38

Assumes 15% early mortality for trees planted, 75 kWh/tree in reduced cooling load, 0.1MBtu/tree in reduced heating loads and 13 kgC net sequestration for mature trees, and 20 years from planting to reach mature tree benefits.

In early years, CO₂ benefits are very modest, averaging less than 600 metric tons carbon over the first 10 years. With tree planting, it takes many years to achieve significant savings as trees get established and grow to heights where they can effectively shade and provide wind and other climate benefits. A ten-year effort starting in 2005 would yield its maximum carbon benefits, 1400 metric tC/year starting in 2029, with over half this level achieved by 2020.

Rhode Island consumers could see energy cost reductions of over \$700,000 per year by 2020, rising to \$1.3 million by 2035, mostly in lower electricity bills.⁸⁷ From a utility and fuel supplier perspective, the 30 years NPV of avoided supply costs adds up to \$4.5 million.⁸⁸ Unlike in California and other warmer climates, these savings, however, would fall short of levels needed to pay back tree planting costs (\$14 million, NPV). Nonetheless, they represent a major economic benefit, and suggest that energy supplier savings might be leveraged to cover up to one-third of a major tree planting program. Note that from a consumer perspective, the present value of energy bill savings is roughly considered equal to planting costs, when considered over a 45 year horizon.

Carbon sequestration remains the largest contributor to net carbon gains. The ratio of carbon benefits due to net sequestration vs. avoided energy use is 60:40, similar to that found for Boston. With a tree planting program, improved location and species selection can yield significantly greater per tree energy savings, while at the same time, new trees sequester more carbon per tree than an existing stand that is more mature.

⁸⁶ Note that later tree mortality and CO₂ release is captured in a simple factor reflecting the average percent of gross sequestration (27%) that is released due to loss and decay (based on Boston case study). This assumption tends to understate sequestration in early years and overstate in later years.

⁸⁷ Assuming retail prices of 11c/kWh for electricity, and \$10/MBtu for heating fuels.

⁸⁸ Assuming utility and fuel supplier avoided costs of \$50/MWh and \$5/MBtu, delivered.



2.3 Implementation options

The indicative analysis and experience for major tree planting programs (e.g. Sacramento) suggests that a major urban and community forestry effort on the order of 200,000 trees in 10 years can be successful, yield modest but important carbon savings, and significant energy benefits even in a Rhode Island context. Yet it also poses some major questions given the challenges noted by those involved in tree planting efforts across Rhode Island:

How can tree planting activities be scaled up to levels that are over 10 times higher than current levels?

- **Shift focus beyond street trees.** The traditional focus on street and near street locations makes sense, given the obvious public benefits. However, overall urban forest benefits, and particularly in this context, energy and CO₂ savings, can be greatly enhanced by considering yards, as well as vacant lots and parks.
- **Consider new program models,** such as the Sacramento approach, which uses utility funding, foundation implementation (similar to Providence), and homeowner labor for tree planting.
- **Incent and compel new construction and renovation to maximize tree planting,** with good species selection for climate benefits, through ordinances, zoning laws, and other leverage points. Warwick's zoning laws and Providence's canopy cover ordinances are good examples. In other cases, tree planting can be included as a negotiating point in major construction and development activities (e.g. airport expansion or new subdivisions).
- **Support funding for town foresters in all larger communities.** General Law 2-14 requires towns to have tree wardens to enforce protection of trees on public lands. However, only a few currently have planners or foresters able to track and maintain tree cover, especially with respect to new developments.⁸⁹ One possible funding mechanism would be for developers who fall short of meeting tree canopy cover or other zoning requirements to pay into a fund supporting town foresters and tree wardens.
- **Provide an educational component** that encourage proper care and siting.

How can communities afford these efforts?

- **Investigate cost sharing with electric utilities and fuel suppliers.** In many California communities, tree planting programs are now considered as utility demand side management programs, with major funding and marketing provided by utilities. As indicated above, a major tree planting effort could yield nearly \$4 million in avoided utility power acquisition costs (30 year net present value).
- **Reduce cost per tree planted.** Consider greater use of bareroot stock to lower purchase costs and mortality rates, and developing stronger markets for container trees of regionally-appropriate and maximum benefit species (instead of solar-unfriendly, small, and often regionally inappropriate species often carried by big box retailers). Container trees are also easier for programs that encourage homeowner planting.
- **Seek greater contributions in time and effort by home owners and businesses.**
- **Use ordinances and planning processes** to leverage tree planting as part of routine residential and commercial development and renovation.
- **Explore foundation and other new sources of support.** A truly innovative and ambitious program might draw the attention and support from funders across the region.
- **Establish a state-funded seed program** to get this overall effort moving. Communities are currently at very different levels of awareness, capacity, and action.

⁸⁹ Technical Advisor Rhode Island Tree Council, personal communication.



How can residents and business owners be motivated?

- **Better quantification of energy cost savings.** This analysis suggests that a consumer that a typical yard tree can yield \$25 or more in energy savings over 20 years, and over 5 times more for trees planted in optimal locations.
- **Outreach efforts,** possibly extending to new media, such as electricity billing inserts.

We recommend, as a next step, that tree program representatives from communities across the state – possibly along with regional urban forestry experts (Nowak) and staff from other large scale programs (Sacramento) – be gathered to refine goals, to define good practices for future activities, and discuss implementation strategies.



3. Forest protection

3.1 Current status, issues, and options

Forest protection and conservation development are distinct land protection strategies, with different GHG emission mitigation benefits. Forest protection includes a variety of strategies that keep land in forest or agricultural use, in either private or public ownership. Tax reduction programs give private landowners an incentive to keep lands in forest use. Conservation development is an approach to private land development where ecological and cultural values of properties are evaluated, and development is arranged and concentrated to preserve much of these values. Acquisition of development rights can keep private land in forest or agricultural use when development pressure would otherwise result in hardening of surfaces or clearing of forest. Acquisition of title to land by a conservation minded owner or public entity can maintain forest or agricultural use on land that otherwise would be developed.

Clearing of forest and conversion of pasture to buildings or roads results in the loss of carbon stored in wood and soils. Comprehensive surveys of land cover in Rhode Island show increasing area in developed uses.⁹⁰ From 1988 through 1995, Rhode Island gained an average of 1476 acres of developed land each year. Most of this land, about 1404 acres per year, came from forest, with the remainder from agriculture, unvegetated areas (sand, rock outcrops) wetlands, and brush areas. Most of the increase in area of developed use, about 1376 acres, went to residential use.

One driver of this conversion is the increase in residential land area per Rhode Island inhabitant. In recent years, the amount of land in residential use has grown over twice as fast as population. These trends clearly place greater pressures on existing open space and forests.⁹¹

Rhode Island is currently encouraging conservation development practices that conserve rural land while allowing the number of housing units to increase. Conservation development should not be confused with cluster development.⁹² Conservation development concentrates development onto a small portion of the lot while the remainder (at least 50% of the parcel) is left in a natural state. A deed restriction is placed on the parcel so the open space remains undeveloped in perpetuity. This open space land is subject to a community approved management plan. In rural areas, during subdivision of land, individual houses can be located along a few roads while leaving much of the land in forest. Conservation development promotes location new housing units on smaller footprints of developed land, and blocking conserved portions of lots.⁹³ In Rhode Island, conservation development attempts to reduce

⁹⁰ Rhode Island Department of Planning. 2000. *Rhode Island Land Use Trends and Analysis (Including Land Use Surveys for the Period 1970-1995)*. Technical Paper 149. Providence, RI: Statewide Planning Program, Rhode Island Department of Administration.

⁹¹ From 1990 to 2000, Rhode Island's population increased by 4.5%. Perry, Marc J. and Paul J. Mackun. 2001. *Population change and distribution 1990 to 2000: Census 2000 in Brief*. U.S. Department of Commerce, Economics and Statistics Administration, U.S. Census Bureau. Publication C2KBR/01-2. Accessed at <http://www.census.gov/prod/2001pubs/c2kbr01-2.pdf>. Linearly extrapolating (no compounding) the rate of increase in land area in residential use observed from 1988 to 1995 to a decade, the increase in area in residential use would be 10.7%.

⁹² The Growth Centers Executive Order is a separate project from Conservation Development (although it was linked in the draft Land Use Strategy Plan). This concept could protect open space and reduce greenhouse gas emissions by concentrating growth in urban areas; greenhouse benefits of this program would be calculated within the transportation portion of this stakeholder process. Visit the Growth Centers project website at: <http://www.state.ri.us/DEM/programs/bpoladm/suswshed/gpc.htm>.

⁹³ Flinker, Peter. 2003. *The Rhode Island Conservation Development Manual*. Ashfield, MA: Dodson Associates, with Rhode Island Department of Environmental Management and EPA, New England. Accessible at <http://www.state.ri.us/dem/programs/bpoladm/suswshed/pdfs/ConDev.pdf>.



development at two acre minimum lot size and instead promote placing new homes on lots one acre or smaller, with preservation as open space, the remaining land that would have been included in two-plus acre lots. Three communities have adopted this concept, four more are in the planning stage and DEM is soliciting a consultant to provide technical assistance to five more communities. The Manual and companion brochure are available for download from the project website: <http://www.state.ri.us/DEM/programs/bpoladm/suswshed/ConDev.htm>.

Land enrolled in the Farm, Forest, and Open Space program is assessed and taxed according to its current use, and development is restricted for the duration of the 15 year long enrollment. This program conserves forest because landowners are not forced to sell for development due to high property taxes. A publication describing this program is available for download at <http://www.state.ri.us/DEM/programs/bnatres/forest/pdf/citgui03.pdf>.

Several land preservation programs are now operating in Rhode Island. Counting state, federal, and private efforts, at least 6,537 acres were put into conservation status in 2002 and 3,938 acres in 2003.⁹⁴ In each of the past two years, somewhat less than half of the acreage put into preservation status was accomplished by the state DEM, with smaller amounts preserved by a variety of other organizations. The four main preservation programs operated by the DEM's Division of Planning and Development are a general state land acquisition program (using funds from a variety of state, federal, and foundation sources), the Forest Legacy Program (using federal funds), the agricultural Land Preservation Program (which acquires development rights), and acquisitions under the North American Wetland Conservation Act.

Many funders of land preservation require state matching funding. The bulk of state matching funds for land preservation have been generated by sale of bonds for funding open space acquisition. The amounts authorized under the current bond authorization have largely been spent. The Governor has proposed an environmental bond issue that includes \$35 million for land protection.

3.2 Assessment of costs and potential

Conservation development and land preservation mitigate greenhouse gas emissions in different ways. By reducing the land area cleared for a given number of dwelling units, conservation development can lower the carbon emissions by leaving more trees standing and less soil disturbed. Similarly, land preservation can protect the carbon in trees and soil. But unlike conservation development, there is the risk that land preservation might simply displace development to other locations, thereby creating emissions "leakage". Thus our assessment addresses the two approaches separately.

Conservation Development. Conservation development uses planning to fit a given amount of development into a smaller footprint on the ground. By clearing less land to meet a given need for new housing (or other developed uses) conservation development can keep some land in forest that would have been cleared under traditional development. Reducing land clearing reduces greenhouse gas emissions from cleared forest. The final amount of avoided clearing depends on parcel sizes, developer preferences, and how rules are applied by local planning authorities. We estimate that full implementation of conservation development policies could maintain in forest from 10% to 50% of the land typically converted to development each year.

Because the amount of clearing that can be avoided is uncertain, we analyze high, low, and midrange rates of avoided clearing. Summary tables in this report give the midrange option, which assumes that 20% of clearing will be avoided. This range translates to 140 to nearly 700 additional acres of retained in

⁹⁴ Department of Environmental Management. 2002. Land Conservation in Rhode Island, Fiscal Year 2002. Department of Environmental Management. 2003. Land Conservation in Rhode Island, Fiscal Year 2003. Current report available at <http://www.state.ri.us/dem/programs/bpoladm/plandev/index.htm>.



forest annually, with a median estimate of 280 acres per year of avoided clearing. These forests, in turn, represent from 10,000 to 40,000 metric tons carbon retained annually, with a median estimated savings of 16,000 tons carbon annually. These retained forest acres will also continue to grow, sequestering additional carbon. However, because we analyze sequestration from business-as-usual forest growth, and propose achieving additional sequestration through pine enhancement we do not include tree growth on conserved acres, in order to avoid any double counting of tons or counting sites as used for two different programs.

At the annual rates presented here, through 2020 the low rate of conservation would avoid 129,000 metric tons carbon emissions. The median estimated conservation rate would avoid 258,000 tC of emissions and reducing clearing by 50% would avoid 645,000 tC.

Avoided emissions were calculated as follows. On average, from 1988 through 1995, 1404 acres per year went out of forest use.⁹⁵ 1376 acres per year were added to residential use, and additional acres were added to commercial and industrial uses. This estimate assumes continued conversion of 1376 acres per year. Interviews with practitioners and searches for documents revealed no studies showing what area is actually cleared under conservation vs. conventional development. The Rhode Island Conservation Development Manual states that half the conventional lot size is a starting point for choosing lot sizes under conservation development. We took this estimate to be the high end of the range of possible accomplishment because, under conventional development, new development typically leaves a portion of the lot in forest cover.

On a per-acre basis, avoided emissions are the difference between the stock of carbon in the standing forest, minus the amount of carbon remaining if the land is cleared. The difference in carbon stock between a typical stand of northeastern U.S. hardwood forest at age zero and age 65 was taken as the average amount of carbon not emitted from each acre saved from clearing by conservation development. This difference is 32 metric tons carbon per acre.^{96 97} Multiplying yields annual avoided emission estimates.

Because Rhode Island has been working on implementing conservation development for several years, and because we are assuming what we think is a moderate rate of implementation, this analysis assumes implementation beginning in 2004. A constant rate of avoided clearing is assumed through the analysis period.

The estimated avoided emission was checked by calculating the avoided emission from information on timber removed from Rhode Island forests by change of land use out of forestry. Estimates of avoided emissions made from Forest Service data about wood volumes removed during land use change yielded savings sufficiently greater than the amounts reported here. We believe the method used here is more robust than calculating potential emission reductions from wood removed from land use change because of the small sample size in the Forest Service study and because expansion from the Forest Service data requires use of expansion factors that are not well fitted to Rhode Island forests. Also, using a lower estimate of savings is more conservative.

⁹⁵ Rhode Island Department of Planning. 2000. *Rhode Island Land Use Trends and Analysis (Including Land Use Surveys for the Period 1970-1995)*. Technical Paper 149. Providence, RI: Statewide Planning Program, Rhode Island Department of Administration.

⁹⁶ Birdsey, Richard A. 1996. Carbon Storage for Major Forest Types and Regions in the Conterminous United States (with appendices). In Sampson, R. Neil and Dwight Hair, eds. *Forests and Global Change Volume 2: Forest Management Opportunities for Mitigating Carbon Emissions*. Washington, DC: American Forests.

⁹⁷ Note: This carbon stock change estimate assumes no change in soil carbon amounts.



The estimated financial costs of conservation development should be refined. The DEM is expending staff time to provide technical assistance to town planners and planning boards, to promote use of conservation development practices. Further funding would be needed to continue or expand these efforts. It is not clear whether using conservation development approaches changes the workload of town planners. Costs could be increased for developers in that they might have to hire a landscape architect or other expert to do planning, instead of simply dividing land parcels into rectangular lots. However, conservation development can reduce costs borne by developers by reducing costs of land clearing, running utility lines, road building and possibly construction. The costs included in this analysis are \$200,000 per year for five years, for additional outreach materials and staff to work with municipalities. It is assumed that after the five year period municipalities would have adopted conservation development as standard practice, and no further costs would be incurred.

Over time, conservation development should reduce costs borne by homeowners, by reducing maintenance costs. Reducing net construction costs allows builders to sell homes for less. Costs of providing public services that require travel should also be reduced. For example, less travel will be required for school transportation, mail delivery, and snow plowing. If conserved areas can be located around streams, many of the ecological benefits of forest can be retained, including maintaining water quality and a significant proportion of wildlife habitat functioning.

Land Preservation. This analysis applies to both preservation of forest on private lands through the Farm, Forest, and Open Space current use tax program and various land acquisition programs including authorization of a new open space bond. Land preservation can store carbon and offset greenhouse gas emissions. However, land preservation does not mitigate emissions in the way that many people think. Many people believe that the avoided emission is equal to the amount of carbon in preserved forest. However, unless a project address the demands for land or products satisfied by land clearing, merely putting some land in conservation status does not substantially reduce total emissions. Economic analysis shows that, instead, clearing is displaced to other locations and almost as much clearing occurs as would have occurred in absence of land preservation.⁹⁸ Emissions are mitigated by land preservation when trees on the preserved land continue to grow, and store more carbon per acre than unpreserved acres. The emission mitigation is the carbon stock on the preserved lands, minus the average stock on the same area of typical unpreserved lands.

A primary mechanism for open space preservation in Rhode Island is issuance of bonds to provide funding for open space acquisition. Rhode Island voters have approved seven bond issuances since 1985. Currently approved funding is running out. The governor has proposed a referendum on \$35 million of new bonding authority for land preservation. Conservation groups are advocating various larger amounts. The amount put before voters will be selected by the General Assembly. For this analysis, we consider the potential benefits of passing a new \$35 million state open space bond that would enroll new lands starting in 2005. This analysis also assumes that for every state dollar three other dollars are matched from federal, foundation, private, and municipal sources. Land is assumed to be acquired for an average of \$8,000 per acre.⁹⁹ 75% of the preserved land that is assumed to be forest, so only 75% of total preservation costs and 75% of preserved acres are counted in this analysis.¹⁰⁰ All lands are enrolled over four years, which as a rate of enrollment about 80% of the average 2002-2003 rate in the state.

⁹⁸ In the U.S., for forest land preservation, the amount of timber harvest that occurs elsewhere through displacement is 85% of the amount that would have occurred on the preserved lands. See: Murray, Brian C, Bruce A McCarl, and Heng-Chi Lee. 2004. Estimating leakage from Forest Carbon sequestration programs. *Land Economics*. 80(1):109-124.

⁹⁹ This land cost is based on costs of recent land preservation projects, as calculated by Rhode Island's Quality of Place Coalition for a 2004 Open Space & Recreation Bond

¹⁰⁰ Much of the land put into conservation status in Rhode Island is forest. Detailed information about exactly how much preserved land is forest is not readily available. However, a reasonable estimate can



Continuing the Farm, Forest, and Open Space current use taxation program can provide a greenhouse benefit. A survey of landowners with more than ten acres in Rhode Island's rural communities found 50% of eligible landowners are enrolled in the program. Twenty-nine percent of this property is enrolled under the forestland classification, which requires a (DEM approved) written forest management plan and active management. The main reason non-participating landowners gave for not participating in the program (89%) was that they didn't know enough about the law. 5% said they are not interested in active management and 4% said they did not think they could fulfill the requirements of the law. These survey results indicate that additional outreach effort could bring more lands into the program.

Even if the total amount of development is not decreased, land preservation can result in net carbon sequestration. This occurs if forests on reserved lands grow to ages older than the typical age on unreserved lands, because older forests store more carbon than younger forests (for a given forest type and site productivity). Mitigation is calculated as the amount of carbon on preserved forest minus the amount found on an equal area of average, non-preserved forest.

Detailed data on the age classes and stocking levels of reserved forests is not available. Consequently, this analysis assumes that reserved forests have the same age and density as the average forest in the state. This analysis assumes that unreserved forests would remain at their current mass.¹⁰¹ With these assumptions, open space protection through purchase of development rights or land is projected to store 110,000 metric tons carbon through 2020. The average cost per ton is high, at roughly \$870 per ton, discounted. Because all costs occur in the first four years of the program, yet tons continue to accrue for decades, the average cost per ton declines as time goes on. Considering sequestration and costs through 2050, 304,000 tons are expected to be sequestered, while the average cost drops to \$340 per ton carbon. Costs of per ton of sequestration resulting from the current use taxation program are not estimated here. Costs include forgone tax revenue and costs of administering the current use taxation program. Further, Rhode Island may wish to claim only a portion of the additional stored carbon as greenhouse gas emission mitigation because the commitment to maintain forest is only for 15 years and after that time the forest could be cleared and the carbon emitted.

3.3 Implementation options

Rhode Island has done considerable work on conservation development. In addition to providing a design manual, the state offers model ordinances that towns can enact to encourage conservation development during land subdivision and permitting of development.¹⁰² The Rhode Island Department of

be made. In recent years, 3-6% of the total area conserved has been agricultural. In recent years, in Rhode Island, the NRCS Wetland Reserve program reports preserving only a few dozen acres. Land cover analyses of Rhode Island have shown that 60% of the total state land area is forest. Dividing the amount of area of forest as calculated by the Forest Service (excluding urban forest) but the area of land counted by the state as undeveloped land, suggests that 75% of the undeveloped land area is forest. Because the information about types of lands preserved appears to correspond to this ratio, this analysis assumes that 75% of acres preserved are forest.

¹⁰¹ Forests would remain at current mass if cumulative removals from harvest, disease, and fire equaled growth. The forests of Rhode Island are increasing in mass because recent harvests and other removals have been less than growth. However, total increases in carbon stock in Rhode Island forests, plus wood products appear to be at a rate less than 0.3% per year. Over the analysis period, baseline growth should be less than the amount of clearing that is not displaced. Consequently, the combination of the very conservative assumption of total displacement of development and constant baseline stock yields a relatively conservative combination of assumptions.

¹⁰² Bobrowski, Mark, and Andrew Tietz. 2001. *Model Zoning Ordinances*. South County Watersheds Technical Planning Assistance Project. Providence, RI: Rhode Island Department of Environmental Management, Office of Strategic Planning and Policy. Accessible at <http://www.state.ri.us/dem/programs/bpoladm/suswshed/pdfs/modords.pdf>.



Environmental Management provides training to town planners and planning commissions on how to do conservation development.

The DEM has already conducted a cooperative project to explore creative ways to guide commercial and residential growth in a more environmentally sensitive manner in southern Rhode Island. Products helpful to protecting open space, including an environmental design manual, transfer of development rights report, and farming and forestry strategies, were developed as part of this project.¹⁰³ The DEM is seeking additional funding to enhance outreach efforts to local planners and planning boards. If this funding is not obtained, the state might assist in seeking funding, or allocate state funds for this work. Outreach to developers, land surveyors, architects, and landscape architects could increase the use of conservation development practices. The DEM Office of Strategic Planning and Policy could advise or facilitate identification of an appropriate institutional home for this work.

One of the challenges to conservation development is managing conserved lands. In subdivisions, it is possible to make the conserved lands a condominium owned by property owners in the subdivision. Alternatively, a local land trust may accept the land and hold it as open space. There are 46 land trusts operating in Rhode Island.¹⁰⁴ The local municipality or the state may be willing to accept the land as a park or conservation land, if it offers exceptional recreational value, or important water protection or habitat qualities.

As with all programs, it is highly desirable to measure the efficacy of the program. Most simply, the achievements of the program could be indicated by using building permit information to tally the average lot size of parcels with new residential construction for some five to ten year period in the recent past, and measure the same information in the future. If resources are available for more discriminating assessment, building inspectors could assess the area cleared for development (including buildings, yards, driveways and roads, and road rights of way), and this information could be tallied annually and watched to see if the average area decreases over time.

Rhode Island has a strong history of open space protection. Renewing the open space bond would provide funding to continue operation of existing land conservation programs. Foundation support for open space protection continues, and federal farm bill support for land conservation programs has increased over recent years. State open space bond renewal provides funding for matching, to bring federal and foundation dollars to the state.

Activities of The Nature Conservancy may provide greenhouse gas emission mitigation substantially greater than the amounts estimated here. In particular, The Nature Conservancy's "Borderlands" program seeks to conserve a large block of forest land in western Rhode Island and eastern Connecticut. The core area would be 20,000 acres that would be restored to older forest.¹⁰⁵ This forest could store substantially more carbon than "business as usual" forest that is not preserved. The amount of carbon greater than unpreserved forest represent removals of carbon dioxide from the atmosphere.

¹⁰³ These products are available at the project web site:

<http://www.state.ri.us/DEM/programs/bpoladm/suswshed/sctpap.htm>.

¹⁰⁴ Rupert Friday, Director, Rhode Island Land Trust Council, personal communication February 20, 2004.

¹⁰⁵ Kathleen Wainright, Director, Conservation Programs, Rhode Island Chapter, The Nature Conservancy, personal communication, May 18, 2004.



4. Land restoration

4.1 Current status, issues, and options

In general, land restoration increases carbon stocks in vegetation and soil, and thus it offers a potential greenhouse gas mitigation option. However, because most lands in Rhode Island are in relatively good condition, opportunities for restoration are limited. Most lands with impaired ecological functioning are already in high value use, such as commercial development or transportation infrastructure, where restoration is not a viable option. Nonetheless, several opportunities for land restoration still exist, particularly among riparian areas and inactive gravel pits.

Rivers and associated floodplains provide a wide variety of ecological services, including moderating floods, removing pollutants, and providing habitat for a wide variety of aquatic and terrestrial species. Because of Rhode Island's history of water-powered industrial development prior to the 20th century, many urban stream banks and floodplains were lined with buildings, hardened banks, or other constructed features that reduce the ecological functioning of the river system. Many riparian developments have since been abandoned, or are in low value uses such as parking lots, especially in light of flood risks.

As redevelopment of these areas occurs, the state actively encourages restoration of stream functioning and riparian vegetation.¹⁰⁶ This, in turn, yields the incidental benefit of increased carbon storage. However, capacity and funding for riparian restoration are limited, and opportunities are going untapped. Efforts to increase restoration could meet both the state's objectives for riparian function and reducing overall greenhouse gas emissions.

Similarly, restoration of soil and grass meadow on unused gravel pits can achieve a dual purpose: providing early successional meadow habitat, a goal of the state's wildlife habitat and wetland reserve program, and increasing carbon storage in soil. In the uplands of Rhode Island, as pastures have been abandoned and developed or returned to forest, the amount of meadow habitat has decreased dramatically. Maintaining meadow and other early successional habitats is a now state priority.¹⁰⁷ Of the approximately 5,500 acres of gravel pits and quarries exist in the state, many are no longer in use and could be restored to meadow habitat.

4.2 Assessment of costs and potential

Riparian restoration. Riparian restoration in Rhode Island offers the potential to mitigate a modest number of tons of greenhouse gas emissions. However, because of the tremendous ecological and aesthetic benefits resulting from riparian restoration, the Forestry Working Group has indicated that restoration programs should be a high priority.

¹⁰⁶ Personal communication, Fred Presley, Supervising Environmental Planner, Rhode Island Department of Environmental Management.

¹⁰⁷ Natural Resources Conservation Service. 2003. Wildlife Habitat Incentives Program and Wetland Reserve Program Rhode Island State Plan. Warwick, RI: USDA Natural Resources Conservation Service.



The DEM has a target of restoring 300 acres of riparian area by year 2015, which averages about 27 acres per year. The Governor has established a goal of restoring 200 acres of riparian buffers in the Narragansett Bay Watershed by 2015. This is an ambitious goal considering most of these riparian areas are small and in private ownership. DEM has initiated planning studies in the Woonasquatucket Watershed that have resulted in identification of potential restoration sites and implementation of some restoration activities.¹⁰⁸

Several issues, including the small size of the parcels, cost of restoration, and limited availability of technical assistance make restoration difficult. The nature of riparian buffers lead most restoration projects to be long and linear. Coordinating restoration on multiple ownerships is difficult so the acreage of most projects is small. Restoration efforts in the Chesapeake Bay Area have found that their most successful (large acreage) restoration projects are in rural areas. Typically a farmer will plant a 100- foot wide buffer for hundreds of feet along a stream. In Rhode Island buffer widths may be 35 feet or less.

Degraded riparian areas typically contain little soil carbon, thus restoration could sequester carbon in both soil and growing vegetation. The only readily available analysis of restoring Northeastern forest on formerly degraded soil predicts sequestration at a rate of 1.2 metric tons carbon per acre per year for the first 50 years.¹⁰⁹ At this rate, achieving the DEM target would remove 7,000 metric tons carbon cumulatively through 2020, and 16,000 tons through 2050.¹¹⁰

The cost of restoring riparian areas is likely to be significant. This analysis uses a cost of \$9,300 per acre restored. This amount is provided by the DEM as the cost of a project in the Smithfield area. This is a substantial cost, but not unreasonable given that the sites that provide carbon sequestration benefits are sites where woody vegetation is restored, and restoration typically includes substantial plant costs, and may include substantial costs for removal of invasive or competing vegetation. Based on this estimate, the cost-effectiveness of mitigation achieved by 2020 would be \$570 per metric ton carbon, dropping to \$240/tC, if the time horizon is extended to 2050.

Gravel pits. For gravel mine restoration, we consider a target of restoring 110 acres per year to grasslands for 10 years. This rate is similar to the rate implied in the Natural Resources Conservation Service plan, under its Wildlife Habitat Incentives Program, which set a target of restoring 1000 acres of Rhode Island grassland from 2002 to 2005.¹¹¹ The Conservation Service is actively pursuing gravel mine restoration, but only an unspecified portion of the 1000 acre target would be implemented on former gravel mines. We assume that this program is continued for an additional 10 years, and consider what this might yield if 1100 acres of gravel mines – about 20% the state total – were converted to grassland.

Restoring 1100 acres per year at a cost of \$2000 per acre (NRCS estimate) would require annual spending of \$220,000 per year. The cost per ton of carbon stored is substantial, but not as high as one might think. Meadow grasses store significant amounts of carbon during the first 30 years after

¹⁰⁸ For information see <http://www.state.ri.us/DEM/programs/bpoladm/suswshed/RBDP.htm> and <http://www.state.ri.us/DEM/programs/benviron/water/wetlands/wetplan.htm>.

¹⁰⁹ This amount includes carbon in soil, trees, and vegetative debris. See Birdsey, Richard A. 1996. Carbon Storage for Major Forest Types and Regions in the Conterminous United States (with appendices). In Sampson, R. Neil and Dwight Hair, eds. *Forests and Global Change Volume 2: Forest Management Opportunities for Mitigating Carbon Emissions*. Washington, DC: American Forests.

¹¹⁰ Because the restored areas are typically narrow – generally about 25 feet wide and very rarely more than 70 feet wide – this analysis assumes planting only tree species that do not grow large. Consequently, this analysis assumes that from years 2020 through 2050 that the lands store carbon only at the rate of a typical upland hardwood stand regenerating after clearcutting, not at the faster rate predicted for the first 15 years of growth.

¹¹¹ Natural Resources Conservation Service. 2002. 2002 Wildlife Habitat Incentives Program, Rhode Island Summary. Warwick, RI: USDA Natural Resources Conservation Service.



establishment, roughly 16 metric tons of carbon per acre in the top 30 centimeters (11.8 inches) of soil.¹¹² This large gain is possible because the initial soil carbon content is extremely low. After 30 years, the rate of sequestration declines to a very low rate. Restoring 1100 acres would sequester 9,000 tC by 2020, with annual sequestration in 2020 of 1,000 tC. By 2050 cumulative sequestration would be 18,000 tC.

As with the riparian restoration project, costs are incurred during the first years of the project, and the benefits accumulate over a relatively long time horizon. The cost-effectiveness of gravel mine restoration, from a GHG perspective alone, is \$210/tC through 2020 and drops to \$100/tC by 2035. Because the rate of sequestration is very low after the 30th year of the project, the average cost would only decline a small amount after this time, and the 2035 price is a reasonable approximation of the average cost of all tons achieved through 2050.

4.3 Implementation options

Both the riparian restoration and gravel mine restoration programs analyzed here are extensions of existing programs operating in Rhode Island, both in time span (to 2015 for gravel mine restoration) and extent (riparian acres). In terms of riparian restoration, the Governor's Narragansett Bay and Watershed Planning Commission proposes a goal of restoring 200 acres by 2015. No statewide assessment of need has been conducted but watershed staff estimate statewide need greater than 1000 acres, and believe the Watershed Planning Commission goal can be exceeded. We have analyzed the GHG benefits of achieving a target of 500 riparian acres by 2015, a rate that is considerably faster than what resource constraints currently allow. To expand riparian restoration programs would likely require additional staff to manage additional project workloads, and increasing matching funding from federal conservation programs.

The rate of grassland restoration analyzed here appears to be about 10% of the rate currently being achieved by all NRCS habitat restoration activities in the state, and the Rhode Island NRCS has a goal of restoring 1000 acres of grassland by 2005. However, only a small portion of the current grassland restoration is occurring on abandoned gravel mines or other sites currently lacking topsoil. The program level analyzed here both continues the grassland restoration program an additional ten years, and focuses grassland restoration activities on gravel mines. The total annual number of acres restored is similar to the existing target rate, but this analysis would require that restoration occur on sites denuded of topsoil. NRCS programs require cost sharing by landowners and achieving the target area of restoration may require grants to owners to offset owner cost share expenses. Although NRCS supports and is doing gravel mine restoration, dropping other types of restoration would be incompatible with continuing to make progress on the agency's full range of goals. Also, the per-acre costs of riparian restoration work are high and it is not clear how competitive these projects will be in federal program funding decisions. Accessing federal funds requires cost sharing. It may be more difficult to obtain cost share funding than it is to obtain federal conservation incentive program funding. Possibly one of the existing land conservation programs could support cost sharing payments, because of the habitat value of meadows created by the restoration.

¹¹² Akala, V. and R. Lal. 2002. Soil organic carbon sequestration rates in reclaimed mine soils. In Kimble, JM, R Lal and RF Follett, eds. *Agricultural Practices and Policies for Carbon Sequestration in Soils*, pp. 297-304. Boca Raton, FL: Lewis Publishers.



5. Enhanced forest management

5.1 Current status, issues, and options

Prior to the 20th century, most of the state's land area was cleared of forest for farming. Over the past century, much of the cleared land has returned to forest. The peak extent of forest cover in the 20th century was in the 1950s and 1960s when about two thirds of the state area was in forest cover. With land conversion to developed uses, the proportion of forest had declined to about 59% in 1998 (the latest year for which statistics have been compiled).¹¹³ Calculated either area or by wood volume, the forests of Rhode Island are dominated by hardwood species, with about 57% of the hardwood volume in oaks and about 25% in maple.¹¹⁴ About 23% of the total forest volume is in conifers, with about 80% of the conifer wood volume composed of white pine (*Pinus strobus* L.).¹¹⁵ Existing surveys of change in forest land over time show differing results but agree on some trends. The most comprehensive survey available, by the RI Department of Planning, shows declining area of forest, increasing area of developed land cover, and relatively constant area of other uses.¹¹⁶ Despite the decline in acres, studies show an increase in standing timber volume¹¹⁷ and total forest carbon stock.¹¹⁸

The existing age class structure of Rhode Island forests, and typical management activities, provide opportunity for enhanced management to increase forest carbon stocks by increasing the number of large trees, increasing the pine component of forests, and reduce cutting and land development resulting from estate transfers.

Although enhancing forest management offers opportunities to provide multiple greenhouse benefits, this analysis only estimates benefit that may result from pine enhancement. We do have reliable studies of the effect of education on reducing land clearing or conversion following estate transfers. As a result, we do not estimate any greenhouse benefits that might accrue from improved estate planning. Also, this program is expected to increase the amount of carbon stored in trees in Rhode Island forests, by increasing the number of large trees. At this time we do not have data on the effect of education on landowners growing more large trees. We have data showing that growing fully-stocked stands with uneven age management, including large trees, can yield more timber over time than short rotation clear cutting or "high grading" that removes only the largest trees. Also, we have studies showing that a major motivation of owners of forested parcels smaller than 20 acres is the aesthetic value of the forest. However, growing and holding more large trees involves deferring some harvest income. Given this financial incentive, we are reluctant to predict further sequestration other than the baseline sequestration and that attributed to pine enhancement.

¹¹³ USDA Forest Service Forest Inventory Analysis program. State summary tables. <http://www.fs.fed.us/ne/fia/states/ri/tables/t01.6.p.htm>. Last accessed 16 February 2004.

¹¹⁴ USDA Forest Service Forest Inventory Analysis program. State summary tables. <http://www.fs.fed.us/ne/fia/states/ri/tables/t30.8.l.htm>. Last accessed 18 February 2004.

¹¹⁵ As of 1998 (the most recent year for which data are available) 63% of the forest area in Rhode Island was oak/hickory type. Only about 8% of the forest area is dominated by pine although 18% of the total wood volume is pine. USDA Forest Service. 2002. *The Forests of Rhode Island*. Report NE-INF-155-02. Newtown Square, PA: Northeastern Research Station, USDA Forest Service. Also see http://www.fs.fed.us/ne/fia/states/ri/ri_view.html.

¹¹⁶ Rhode Island Department of Planning. 2000. *Rhode Island Land Use Trends and Analysis (Including Land Use Surveys for the Period 1970-1995)*. Technical Paper 149. Providence, RI: Statewide Planning Program, Rhode Island Department of Administration.

¹¹⁷ USDA Forest Service. 2002. *The Forests of Rhode Island*. Report NE-INF-155-02. Newtown Square, PA: Northeastern Research Station, USDA Forest Service.

¹¹⁸ Birdsey, RA and GM Lewis. 2003. *Carbon in U.S. Forests and Wood Products, 1987-1997: State-by-State Estimates*. General Technical Report NE-310. USDA Forest Service, Northeastern Research Station.



Prior to European settlement, white pine was a major component of the forest. Forest surveys from that time do not exist, so we do not have quantitative information about the extent of pine. Currently, with little management effort the pine component is increasing, although it is still only about 18% of the total forest, by volume.

Increasing the white pine component of Rhode Island forests can, over several decades, store several million tons CO₂ more than would be stored by continuing present trends. Rhode Island forests are predominantly hardwood and, over time, pine can store much more carbon per acre than hardwoods. On all but poor sites, pine grows more slowly than hardwoods for about the first five years after establishment. After about age five, pine generally grows much more quickly than hardwoods, and grows to much larger sizes. Pine wood is significantly less dense than hardwood, and stores less carbon per cubic foot of wood. However, because pine stands several decades old hold much more wood volume than hardwood stands of the same age, on the same quality site, total pine sequestration is greater.

The pine component of Rhode Island forests could be increased by enhancing existing DEM Division of Forestry landowner education programs. This effort would include educating landowners about forest management options that have (among other things) the potential to encourage the sequestration of carbon including: estate planning to conserve open space and avoid the need to harvest to pay estate taxes, promoting white pine regeneration on appropriate soils, and or encouraging trees to grow to large sizes. It is likely a high percentage of forest landowners would choose a management strategy that will meet the goal of increased sequestration.

In many existing stands, pine could be enhanced during forest management operations planned for other purposes. Also, Forest Service Forest Inventory and Analysis field surveys find that approximately 53% of the timber land in the state is poorly or moderately stocked,¹¹⁹ which means that trees canopies cover between 10% and about 60% of the ground area within the stand. However, the Rhode Island Division of Forest Environment staff suggest that most of the forest land in the state is fully stocked or overstocked.¹²⁰ Our analysis used the Forest Service stocking rates. However, if most of RI forest land is already fully stocked, then adding pine to the area proposed in this analysis would displace some existing hardwoods, reducing the net sequestration achieved. Assuming an average stocking of 35%, increasing stocking to 80% would be the rough equivalent to having over 80,000 acres of bare land available for establishing trees.¹²¹

5.2 Assessment of costs and potential

Expanding DFE's landowner education activities does not represent a departure from current strategies since DFE already provides technical assistance to forest landowners. A recent survey of forest landowners done as part of updating the forest resource plan found over 30 percent of forest landowners receive forest management information from DFE Foresters. Consultants, books, neighbors/friends and brochures/fact sheets were other means landowners obtained forestry information. Almost 38 percent of

¹¹⁹ USDA Forest Service, Forest Inventory and Analysis Program. Rhode Island Statistical Tables. http://www.fs.fed.us/ne/fia/states/ri/ri_view.html. Last accessed February 17, 2004.

¹²⁰ Tom Dupree, Chief, RI Division of Forest Environment, personal communication 12 April 2004.

¹²¹ Different inventories of Rhode Island lands use different definitions of forest, and consequently find different total forest area within the state. The USDA FIA (above) calculates that, in 1998, there were 340,000 acres of timberland in Rhode Island. Other definitions yield counts ranging from 301,000 acres in 1995 to a count that includes urban forests and tallies 393,000 acres in 1998. We assume the area of poorly and moderately stocked timberlands is 180,400 acres. See also Rhode Island Department of Planning. 2000. *Rhode Island Land Use Trends and Analysis (Including Land Use Surveys for the Period 1970-1995)*. Technical Paper 149. Providence, RI: Statewide Planning Program, Rhode Island Department of Administration.



landowners who replied to the survey have received no forestry information, indicating a significant opportunity to increase communication.

Growing white pine on one acre, to age 60, starting from bare land, would store 255 metric tons carbon dioxide. This amount is in live trees only, and does not include dead trees, underbrush, down wood and leaf litter, or any increases in soil carbon. These other components could store additional carbon, but one would need to know the initial amounts of these other components to be able to predict whether they would remain constant or increase. If starting from previously tilled crop land, the sequestration in these other components could be more than the sequestration in live trees.^{122 123}

Adding the equivalent of 81,180 acres of new pine forests would sequester 5.7 million tC in 60 years. However, under business-as-usual conditions, it is likely that existing trees would continue to spread, and within 60 years, much of the currently under-stocked area would become fully stocked. Therefore, the effect of greater pine stocking of forests must be measured relatively to a fully stocked, typical stand of similar age. Expansion of trees in existing stands could be expansion of hardwoods or pine. There is some gain from converting expansion from hardwood to pine. An oak/hickory stand contains slightly more than half of the carbon of a white pine stand of site index 60. (37 tC/acre vs. 70 tC/acre) Thus the net effect of pine stocking is to ultimately increase carbon storage by 23 tC/acre. If the stand would have regenerated to pine anyway, there is no additional carbon benefit to actions facilitating pine establishment. This analysis makes the more conservative assumption that the areas that would have regenerated anyway would have regenerated to pine, not hardwood.

We evaluate a potential program that would stock pines over the next ten years, at a rate of 4,059 acres per year, eventually covering about half of the state's under-stocked forest area. This analysis assumes that only half the existing space could be utilized because not all forest sites are suitable for pine, and not all landowners would accept pine enhancement on their lands.

Based on a series of assumptions¹²⁴, by the end of year 2020 the program would store an additional 150,000 tC, compared to business-as-usual. (See also Appendix B.) Over 60 years, the total additional sequestration would be 1.4 million tons of carbon. Additional sequestration would continue to occur for at least another 60 years, but would occur at a slower rate.

Costs of this program would occur during the first years of the program. Costs are involved in identifying sites, communicating with landowners, and providing technical assistance to help landowners plan and

¹²² Birdsey, Richard A. 1996. Carbon Storage for Major Forest Types and Regions in the Conterminous United States (with appendices). In Sampson, R. Neil and Dwight Hair, eds. *Forests and Global Change Volume 2: Forest Management Opportunities for Mitigating Carbon Emissions*. Washington, DC: American Forests.

¹²³ Also, this calculation assumes Site Index 60. Site index is a measure of the productivity of a site. Site Index 60 means that an average tree will be 60 feet tall at age 50 years. Site Index 60 is a moderate quality site. On a site that has a site index of 60 for pine, the site index for hardwood would be about 58 or 59.

¹²⁴ Of the lands that are enrolled, these calculations assume that half the enrolled area would have regenerated to hardwood. On clay soils and very productive sites, hardwood can out-compete pine. On sandier soils and less productive soils hardwoods are slow to establish and, if pines are established on bare mineral soil, the pines can out-compete the hardwoods and form a pine-dominated stand. Because of the different competitive strengths of the different species, pine sites would not necessarily regenerate to hardwood. This analysis assumes that half of the pine sites would have regenerated to hardwood in absence of this project. Furthermore, the calculations make the very conservative assumption that all of this natural hardwood regeneration would occur within the next ten years. These calculations do not count any changes in carbon stock that may occur on lands that are already stocked.



implement forest management activities. No costs are allocated to implementation of forest management activities as landowners would bear any of these costs.

This analysis assumes that the program is initiated in 2004, and continues for 10 years at a constant rate. Costs for developing educational materials and conducting outreach activities are assumed to be \$300,000 per year for two additional service foresters (salary, benefits, office, and vehicle costs) and funding for outreach material development and distribution. Rhode Island forests are owned in small parcels, and the average size is decreasing. If the program addresses parcels down to 20 acres in size, the program would address 77% of the forest area and 3,700 owners. Beyond this amount, a large increase in the number of owners involved would only yield a modest increase in the proportion of total forest acres addressed. Implementing activities on 86% of the land would require addressing all parcels of 10 acres and larger, and would encompass 5,800 owners.¹²⁵

With costs accruing during the first ten years of the project, and sequestration benefits stretching over several decades, the cost per ton is high if one considers only the first few years of the project. Average cost per ton sequestered declines spectacularly if one considers the benefits accruing over several decades. The present value of spending, averaged over the total number of metric ton of carbon sequestered, is expected to be \$120 through year 2020, falling to \$13 per ton if calculated over a 60 year time span.¹²⁶ The average price per ton sequestered would continue to decline for many more decades.

This program would provide other environmental benefits, which depending on circumstances, these benefits could be moderate or quite large: increased forest diversity, improving habitat, and increasing winter resting cover for wildlife. Establishing pine in open—largely upland—spots in existing forest that is largely hardwood would create a fine-scale mosaic of forest types, and provide both horizontal and vertical forest diversity. This type diversity could become very important to maintaining Rhode Island's forests. A newly-identified disease, called sudden oak death, is killing tens of thousands of oak trees in infection sites in California and Oregon. The dynamics of the disease are not well understood, but red oaks and intermediate oaks are susceptible while white oaks often are not infected. Deaths occur in clumps, and correlate to periods of warm, wet conditions.¹²⁷ In laboratory tests, eastern tree species northern red oak (*Quercus rubra*) and pin oak (*Quercus palustris*) have been shown to be susceptible to the pathogen. The pathogen has not been identified in pines. If this pathogen becomes widespread in Rhode Island, like Dutch Elm Disease and Chestnut Blight, the effect on Rhode Island forests would be devastating. Mechanisms of spreading of the Sudden Oak Death pathogen are not well understood, but wind blown spores are suspected. It is possible that clumping oaks between pines might decrease spreading of infection. Having a large pine component well distributed through Rhode Island forests provides insurance against broad-scale loss of forest cover caused by sudden oak death.

This program could also provide financial benefits to the citizens of Rhode Island that are not quantified in this analysis. Water quality could be enhanced, reducing water treatment costs or reducing medical costs of health problems caused by polluted water. Cleaner water could enhance sport and commercial fisheries. Assuming an average annual cost of \$100,000 per forestry job, eight jobs would be supported by this project, for a period of ten years. In future decades, thinning or other harvest of pines established by this project could provide revenue to landowners, jobs for forest workers, and raw materials for wood products manufacturing.

¹²⁵ USDA Forest Service. 2002. *The Forests of Rhode Island*. Report NE-INF-155-02. Newtown Square, PA: Northeastern Research Station, USDA Forest Service.

¹²⁶ Costs are discounted at an annual rate of 4%. Sequestration is not discounted.

¹²⁷ Rizzo, David M and Matteo Garbelotto. 2003. Sudden oak death: endangering California and Oregon forest ecosystems. *Frontiers in Ecology and the Environment*. 1(5): 197-204.



5.3 Implementation options

DEM Division of Forest Environment has service forestry as a key part of its activities. Implementing this program would require restoring some of the capacity that has been cut over the past several years but would not require development of a new program. Implementation would require educating service foresters about the carbon implications of various forest management activities, and development of new communication materials for landowners. Biologically, expansion of the pine component of Rhode Island forests is relatively easy. The major challenge to implementation would be coordination with landowners.

Fragmentation of properties is occurring in Rhode Island. The general trend is movement of forest land out of large parcels into smaller parcels, and significant losses of area in timberland while there area in urban forest increases. From 1973 to 1993, the average size of forest ownerships in the state declined from 26 acres to 13 acres.¹²⁸ One consequence of the decrease in the size of ownerships is that few owners pay attention to actively managing their lands, and even fewer have expertise to predict the effects of alternative management practices. As a result, carrying out a program that implements forest management activities on many small ownerships will require a great deal of time to do outreach to many owners of modest parcels. As noted in the cost section above, if the program addresses parcels down to 20 acres in size, the program would address 77% of the forest area and 3,700 owners. Increasing the coverage to 86% of the land would require addressing all parcels of 10 acres and larger, and would encompass 5,800 owners.¹²⁹

Using several different methods to reach landowners is likely to have greater effect than using a single mechanism of communication. The two organizations with the largest capacity for reaching forest owners are the DEM Division of Forest Environment (DFE) and the Southern New England Forest Consortium. These organizations could send informational mailings about the program to forest landowners, and in their contacts with landowners could supply information about forest management.

Existing programs promote development of forest management plans and provide cost sharing of plan implementation that could include pine enhancement. Service foresters who assist in preparation of plans and filing cost share paperwork would have to be made aware of the issue, and encouraged to include pine enhancement in management plans. Federal cost share programs already in use by DFE include the NRCS Forestry Incentives Program and the Forest Service Stewardship Incentives Program.

DFE has tracked the number of landowners who have written management plans. This is an inexpensive way to get an indication of the effectiveness of forestry outreach activities. However, there is no data about the extent to which landowners carry out actions necessary to achieve goals stated in their plans. It would be desirable to have data about rates of implementation of management activities. Ongoing Forest Inventory Analysis surveys are not sufficiently intensive to provide a reliable indicator of rates of implementation of management activities, and it would take many years for the results of management actions to manifest in timber volumes measured by FIA.

Not all management activities will sequester carbon during the time period addressed by this report. When trees are harvested for wood products, through thinning, clear cutting, or uneven aged management, not all the carbon in those trees goes into wood products. Part remains in the forest as decomposing slash. Typically, part of the tree carbon is emitted within a year of harvest, from burning bark and sawdust as hog fuel, burning of fuel wood, or from decay of post-consumer product waste. Until growth exceeds these emissions, harvest is a net emission. With thinning to reduce competition in a vigorously growing stand, it can take only a few years for net sequestration to become positive again. See Appendix A for more detailed discussion of this matter.

¹²⁸ USDA Forest Service. 2002. *The Forests of Rhode Island*. Report NE-INF-155-02. Newtown Square, PA: Northeastern Research Station, USDA Forest Service.

¹²⁹ USDA Forest Service. 2002. *The Forests of Rhode Island*. Report NE-INF-155-02. Newtown Square, PA: Northeastern Research Station, USDA Forest Service.



Some elements of a large pine enhancement program would require increased funding of DFE, either from state budgets or grants. These additional costs include preparation of outreach and educational materials, mailing costs, adding service forester capacity. University of Rhode Island Cooperative Extension has not focused on forestry issues. With sufficient state interest, it may be possible to increase Extension capacity to address forest issues.

6. Lower-potential options

6.1 No-till cropping.

Some traditional agricultural practices can be modified to reduce greenhouse gas emissions or sequester carbon. In general, these practice changes also have other environmental benefits such as reducing erosion, improving soil quality, improving water quality, and decreasing air pollution. However, only limited opportunities exist for changing agricultural practices in Rhode Island in ways that mitigate greenhouse gas emissions. Relatively few acres in Rhode Island are farmed using practices amenable to changes that reduce greenhouse gas emissions. Throughout the U.S., the two main agricultural practice changes for mitigation of greenhouse gas emissions are switching from conventional plowing to no-till direct seeding, and more efficiently managing nitrogen fertilizer.

A rough rule of thumb is that a moderate amount of sequestration resulting from switching from plowing to no-till is 1-2 metric tons carbon per acre, achieved over ten to fifteen years. Some crops that are prominent in Rhode Island, such as sod and potatoes, are not amenable to no-till systems. Only about 4,000 acres appear to be in crops amenable to no-till management. Even if all suitable acres are converted to no-till, the cumulative mitigation over 15 years or more would be 4,000 to 8,000 metric tons of carbon sequestration. Nationally, after years of encouragement and equipment development, the rate of use of no-till and strip tillage practices is still less than 20%.¹³⁰ If Rhode Island could double this rate, the greenhouse gas mitigation would be a few hundred tons per year, tapering to almost near zero after about ten years of sequestration. Switching from conventional tillage to no-till also reduces fuel usage. However, the rate of emission reduction is small, possibly totaling a couple dozen tons of carbon per year for the entire state.

6.2 Farm fertilizer management

Reducing nitrogen fertilizer use can reduce greenhouse gas emissions because a portion of nitrogen fertilizer applied to fields is emitted to the atmosphere as nitrous oxide (N₂O) and N₂O is a potent greenhouse gas. The combination of strong competitive pressure on commodity prices and increasing regulation of fertilizer for water quality reasons means that larger farmers are generally knowledgeable about the current state-of-the-art of nutrient management and do a reasonable job of limiting excess fertilizer application. Smaller farmers, particularly those who make the bulk of their income from some occupation other than farming, are often less efficient at managing nutrients, but also typically the hardest to reach and convince to change.

Pound for pound, nitrous oxide has a much greater warming effect than carbon dioxide. However, only a small percentage of nitrogen applied as fertilizer ends up as nitrous oxide, and—as noted above—only a modest number of acres in Rhode Island are in agriculture. Assuming any plausible rate of convincing farmers to reduce nitrogen use, the net reduction in greenhouse emissions would be no more than a few hundred metric tons carbon equivalent per year, at most.

¹³⁰ Annual survey information available through the Conservation Tillage Information Center, <http://www.ctic.purdue.edu/CTIC/CTIC.html>.



6.3 Lawn fertilizer management

Just as nitrogen fertilizer applied to fields release nitrous oxide, so does fertilizer applied to lawns. Agricultural extension agents and lawn management experts often assert that homeowners often apply fertilizer at rates that are much higher than needed. However, after substantial searching, we could find no measurements of actual rates of fertilizer application by homeowners. As a result, we are unable to provide any authoritative estimate of the potential greenhouse gas reductions that could be achieved by getting homeowners to apply fertilizer at proper rates. Guessing at the potential scope of the problem indicates that potential mitigation amounts are modest. If 10% of lawns and gardens are fertilized at rates several times what is needed, and somewhere between 10% and 30% of those who are over fertilizing can be convinced to fertilizer at the proper rate, then the annual reduction in state greenhouse gas emissions would be a few hundred metric tons carbon equivalent.¹³¹

Appropriate fertilization could be encouraged by providing a brochure with every retail fertilization sale. The brochure could provide recommended rates of fertilization in easy-to-understand terms, and describe negative effects of over-fertilization. Negative effects include wasted money, possible plant damage, water quality impairment, possible human health impairment, and greenhouse gas emissions. An existing water quality programs might implement a fertilizer use education program, to help achieve water quality targets.

¹³¹ This calculation assumes that on quarter of the state land in residential use is in lawn or garden, that 10% is over fertilized by 175 pounds of nitrogen per acre per year. If 10% of the over fertilized area is switched to a proper fertilization rate, emission reduction would be about 70 metric tons carbon equivalent per year; getting 30% of the over fertilized area to the proper application rate would avoid 210 metric tons carbon equivalent each year.



Glossary

Key issues, concepts, and definitions

Analyses of mitigation of greenhouse gas emissions use a variety of terms having specific meanings. Major concepts are outlined here.

Emission reductions. Claiming a greenhouse benefit from reducing emissions is based on reducing an ongoing stream of emissions. For example, an electricity company may serve its load by generating electricity by burning coal, and may switch to generating power by burning natural gas. With natural gas, the same number of megawatt hours of electricity can be produced with less emission of greenhouse gases. Common types of emission reductions from land management include slowing deforestation, increasing fuel efficiency of farm equipment or farming practices, and reducing methane emissions from growing rice by switching to cultivars that require less flooding or that are less efficient at transporting methane from below the soil surface to the atmosphere.

Global warming potential (GWP). A variety of gases allow solar radiation to enter the atmosphere, but trap energy emitted from the earth. These gases are called greenhouse gases. Three gases are emitted from land: carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). Each greenhouse gas has a different half life in the atmosphere, and a pound of one gas free in the atmosphere will cause a different amount of radiative forcing than the other gases. The relative effects of different gases are compared calculating their cumulative radiative forcing for a period of 100 years following release into the atmosphere, relative to carbon dioxide. Current GWP values are given in Table 1.¹³² For example, one ton of methane has the warming effect of 23 tons of carbon dioxide.

Table 6. Global warming potentials of greenhouse gases emitted from land

Gas	Global Warming Potential
Carbon dioxide	1
Methane	23
Nitrous oxide	296

Leakage. Leakage refers to effects caused by a project that occur outside the boundary of the project. The classic example of leakage is where a project preserves a parcel of forest that would have been logged to produce wood products. If the project does nothing to serve the continuing demand for wood, the economics of supply and demand show that most of the protected amount of wood will be replaced by increased cutting somewhere else.

Sequestration. Sequestration refers to removing a greenhouse gas from the atmosphere. The gas may be converted to other substances that do not cause greenhouse warming, or may be stored outside the atmosphere. The most common form of sequestration is plants removing carbon dioxide from the atmosphere through photosynthesis, returning the oxygen to the atmosphere, and retaining carbon in plant tissue. Restoring previously cleared land to forest generally sequesters carbon. Reducing tillage disturbance of soil or increasing carbon inputs to soil by increasing plant productivity can sequester carbon by causing soil carbon levels to rise.

Baseline. The emissions baseline for an activity is used to calculate net emissions reductions. For an emissions reduction activity, achieved emissions are subtracted from baseline emissions. Any remaining

¹³² Intergovernmental Panel on Climate Change. 2001. *Climate Change 2001: The Scientific Basis*. Cambridge University Press. Note that these GWP values have not yet been adopted by the Conference of Parties to the Kyoto Protocol of the United Nations Framework Convention on Climate Change and as a result calculations made under the Kyoto Protocol rules still use GWP values published by the Intergovernmental Panel on Climate Change in 1995.



positive amount is mitigation. Baselines may be a stock, such as a carbon stock in a forest. Baselines may be an amount during a specified period of time. For example, the baseline emissions against which project achievements might be the emissions from the project facility (or lands or process) the year prior to the project. The baseline for a forest carbon sequestration project might be the carbon stock present immediately before the start of the sequestration project. Baselines may change over time. For example, a reforestation project might assume that some amount of natural regeneration of forest would have occurred in the absence of the project, and the baseline could change over time as the expected natural regeneration would have stored carbon. Baselines are net of any adjustments for additionality within the project, and adjustments for leakage outside the project boundary.

Reversibility and Permanence. Emission mitigation may be reversible or permanent. In general, sequestration is reversible. Forests that store carbon as they grow can continue to hold that carbon indefinitely, as individual trees die and are replaced by other individual trees. But the forest can be logged, or burn, which would emit the stored carbon. If emission mitigation is reversible, accounting must address this reversibility. One way to address reversibility is to continue to monitor the mitigation, and if it reverses to count that emission. Alternatively, one can monitor for a specified length of time and then assume that the mitigation is reversed after that time. The only way mitigation can be totally irreversible is for the mitigation to be generated by having emissions lower than a baseline emission amount or emission allowance. For example, if a coal fired power plant had been emitting one million tons of carbon dioxide to serve its load for the year 2003, and it switches fuel to natural gas and serves the same load while emitting only 900,000 tons in 2004, if all other things are equal, it has mitigated 100,000 tons in 2004. In later years its emissions may rise or fall, but it can not go back in time to 2004 and increase 2004 emissions. Therefore, the 2004 emission mitigation is irreversible.



Appendix A: Effect of Rotation Length on Carbon Sequestration

In general, establishing on previously non-forested land sequesters carbon, with the total amount of sequestered carbon growing over time until some disturbance causes some loss of carbon. When trees are harvested, a portion of the carbon in those trees is converted to wood products and remains sequestered for many decades. As the forest regrows, eventually, the total amount of sequestration could be greater than the amount stored prior to harvest. Depending on initial conditions, durability of wood products, rate of regrowth, and number of rotations counted, the total amount of carbon stored after harvesting an existing stand may be more or less than the initial amount of carbon present before harvest. Except over very long periods or situations with very fast rates of reaching maximum live carbon stock, reducing rotation lengths will reduce the total amount of carbon stored.

We constructed a model to illustrate these outcomes for Rhode Island forests. In the model, tree carbon accrues at the average rate for Northeastern U.S. pine and hardwood forests.¹³³ Of the tree volume harvested, 50% is used for fuel wood and assumed to be burned within one year, 32% is removed as logs for wood products, and 18% is assumed to remain in the forest as residue.¹³⁴ Of sawlogs harvested, 60% is assumed to go into products. This proportion varies by log size and quality and type of product produced. 60% is a relatively high proportion, and would be appropriate for a sound log 15" diameter inside bark at the small end of the log.¹³⁵ A portion of wood products is landfilled and is anaerobically decayed and emitted as methane.¹³⁶ Methane has 23 times the warming effect as an equal mass of carbon dioxide. This model does not account for the additional warming effect of converting some carbon to methane. The proportion of total tree biomass relative to merchantable stock (in cubic feet) is 2.1665.¹³⁷ Cubic feet of merchantable timber is converted to pounds of carbon at a rate of 18.43, which is the average of rates given for pine, oak-hickory, and maple-beech-birch in the Northeast.¹³⁸ The number of pounds in a metric ton is rounded to 2205. Wood products are assumed to decay at an annual rate of 0.0085.¹³⁹ Logging debris, stumps, roots, and other woody residue is assumed to decay at a rate of 0.125 per year, which is midrange in the distribution of decay rates for these components.¹⁴⁰

¹³³ Birdsey, Richard A. 1996. Carbon Storage for Major Forest Types and Regions in the Conterminous United States (with appendices). In Sampson, R. Neil and Dwight Hair, eds. *Forests and Global Change Volume 2: Forest Management Opportunities for Mitigating Carbon Emissions*. Washington, DC: American Forests.

¹³⁴ USDA Forest Service. 2002. *The Forests of Rhode Island*. Report NE-INF-155-02. Newtown Square, PA: Northeastern Research Station, USDA Forest Service.

¹³⁵ Row, Clark and Robert B. Phelps. 1996. Wood carbon flows and storage after timber harvest. In Sampson, R. Neil and Dwight Hair, eds. *Forests and Global Change Volume 2: Forest Management Opportunities for Mitigating Carbon Emissions*. Washington, DC: American Forests.

¹³⁶ Skog, Kenneth E. and Geraldine A. Nicholson. 1998. Carbon cycling through wood products: The role of wood and paper products in carbon sequestration. *Forest Products Journal*. 48(7/8): 75-83.

¹³⁷ Birdsey, Richard A. 1996. Carbon Storage for Major Forest Types and Regions in the Conterminous United States (with appendices). In Sampson, R. Neil and Dwight Hair, eds. *Forests and Global Change Volume 2: Forest Management Opportunities for Mitigating Carbon Emissions*. Washington, DC: American Forests, averaging rates given for pine and hardwood in Northeast states.

¹³⁸ Birdsey, Richard A. 1996. Carbon Storage for Major Forest Types and Regions in the Conterminous United States (with appendices). In Sampson, R. Neil and Dwight Hair, eds. *Forests and Global Change Volume 2: Forest Management Opportunities for Mitigating Carbon Emissions*. Washington, DC: American Forests.

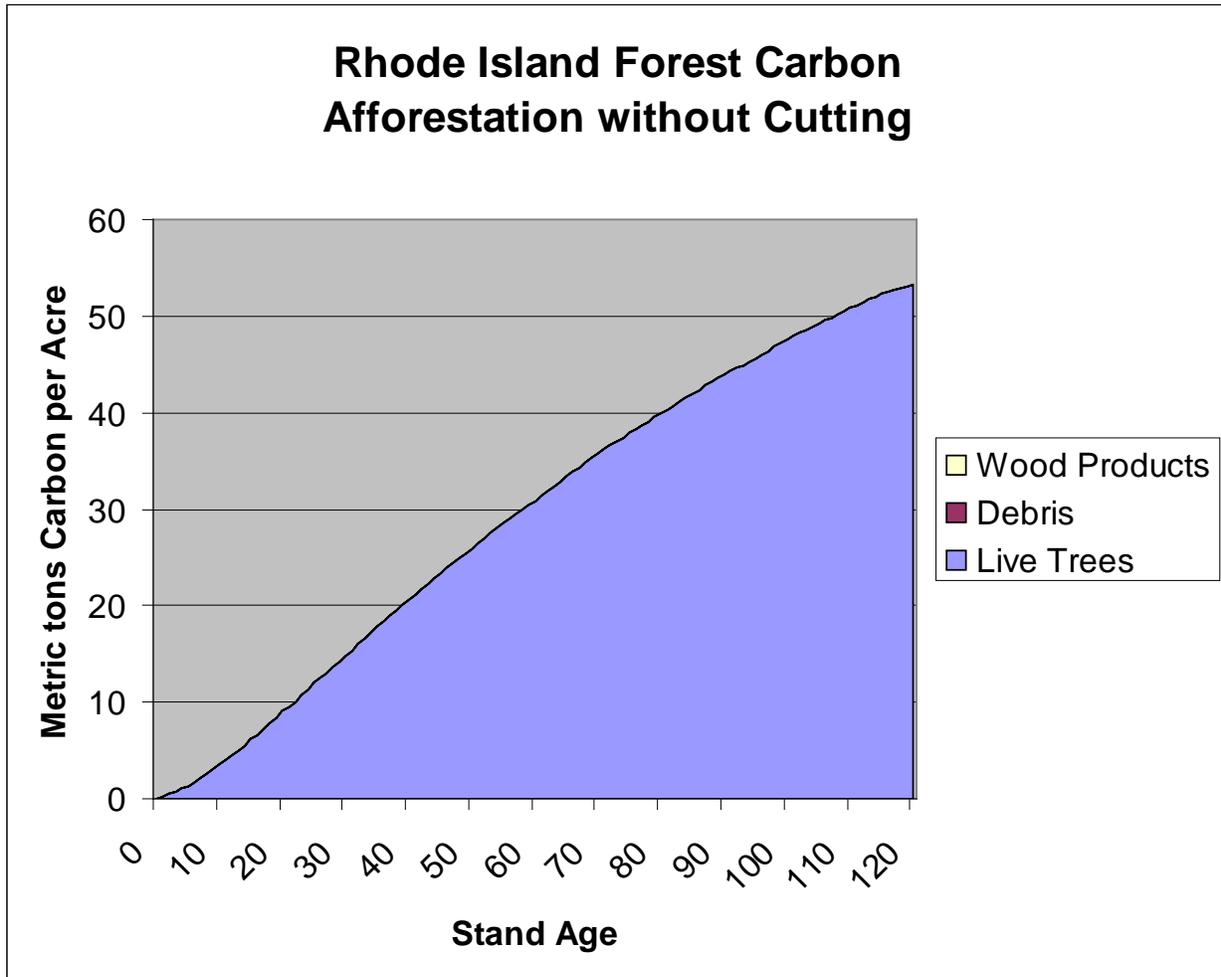
¹³⁹ Harmon, ME, JM Harmon, WK Ferrell, and D Brooks. 1996. Modeling the accumulation of forest products in the Pacific Northwest. *Climactic Change*. 33: 521-550.

¹⁴⁰ Harmon, Mark E. and Barbara Marks. 2002. Effects of silvicultural practices on carbon stores in Douglas-fir – western hemlock forests in the Pacific Northwest, U.S.A.: results from a simulation model. *Canadian Journal of Forest Research*. 32: 863-877.



The model was run for three different forest management scenarios that illustrate situations in Rhode Island. The simplest scenario is establishing forest on bare ground, such as a previously tilled field, is presented in Figure 4. In this scenario, there is no carbon in products or debris because there is no prior forest stand to serve as a source for this carbon. Eventually, the carbon stock will reach an equilibrium and remain there until some sort of disturbance reduces the stock and provides an opportunity for new growth.

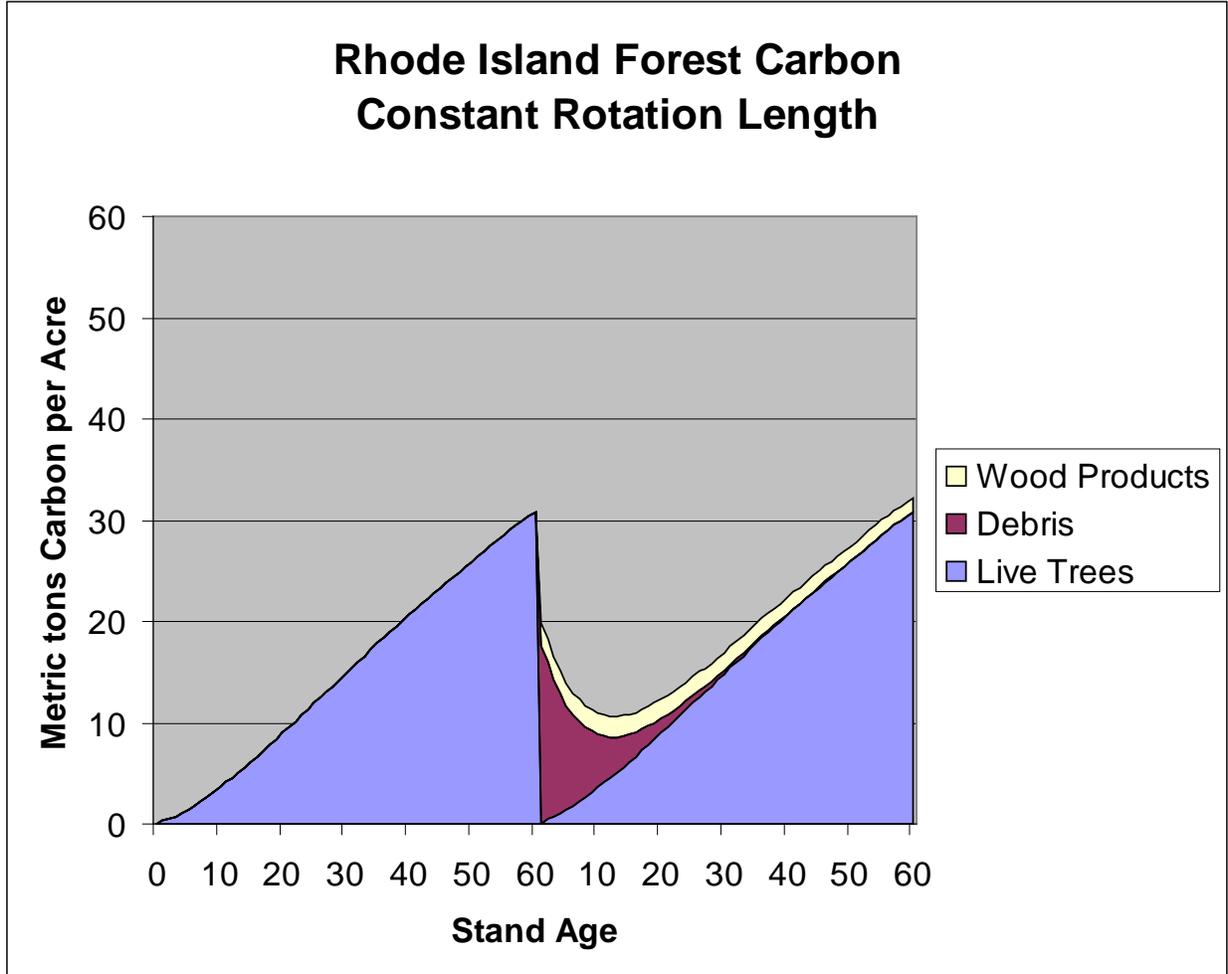
Figure 4.



The next scenario assumes a constant rotation length of 60 years, also starting from bare ground (Figure 5). In this scenario, at any year in the rotation, the second rotation stores more carbon than the first. This is because live tree growth is assumed to be the same in all rotations, and carbon stock in the second rotation includes carbon in debris and products retained from the prior rotation. Over time, on average, this scenario continues to gain carbon, until the product pool reaches equilibrium. Because of the very slow decay rate of products, this equilibrium would not be reached until several centuries have passed. However, even with products, after the first harvest, the carbon stock would still remain less than in the no-cut scenario illustrated in Figure 4.



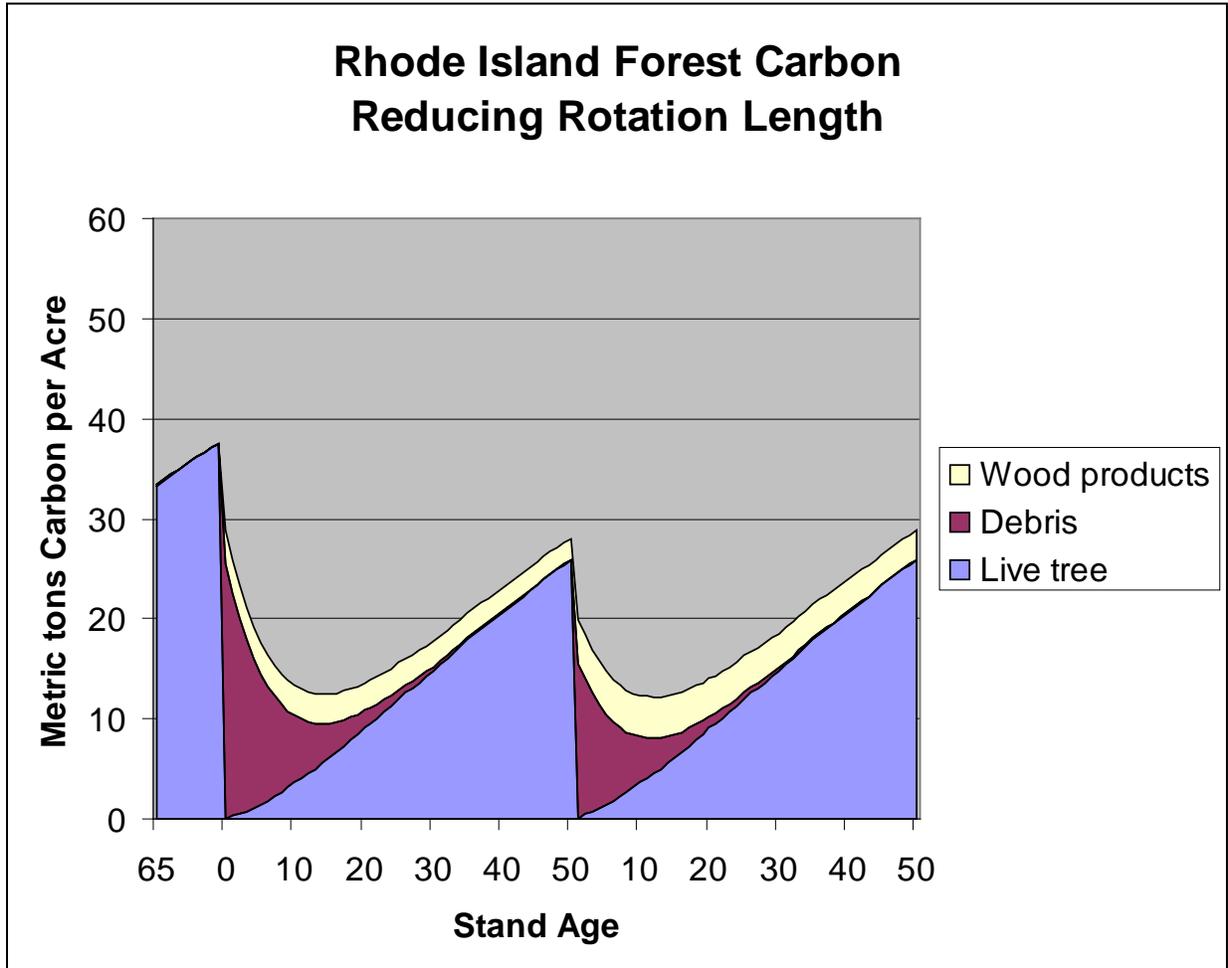
Figure 5.



The third scenario modeled is an intensification of management. This scenario assumes starting with a 75 year old stand that regenerated from a farm field early in the 20th century. This existing stand is harvested and regenerated using 50 year rotations (Figure 6). Note that as rotations pass, the amount of carbon in the product pool increases. However, because the rotation is shortened, the peak and average carbon stocks in live biomass is reduced relative to stocks in the original stand that grew to age 75. Because only a small proportion of carbon harvested from live trees enters the long-term product pool, the total amount of carbon stored remains less than the amount stored by the original stand. It is possible that after several rotations, the accumulated carbon in products could bring the total amount sequestered up to the amount present immediately before the initial harvest. However, this amount would be less than the amount that would be stored without any harvest, as shown in Figure 4.



Figure 6.



There may be conditions where it is possible to have greater total carbon sequestration with harvest than without harvest. If the proportion of live tree carbon that goes into the long-term product pool can be made large, and if the forest type would rapidly reach maximum biomass without harvest, it is possible that the total amount of carbon stored with harvest would be greater than without harvest. Forest management actions that increase the rate of forest growth or maximum carbon stock will increase carbon storage with or without harvest, relative to the amount stored without the management action. Pine enhancement of hardwood stands is one example of such an action. Thinning that retains rapid stand volume growth might also increase total carbon storage.



Appendix B: Pine enhancement calculations

Projecting sequestration likely to result from establishing pine in gaps in Rhode Island forest involves a number of calculations. First, typical yields for white pine¹⁴¹ and northern hardwoods,¹⁴² as a function of stand age, were obtained from Forest Service publications. These volumes were in cubic foot measure, per acre. Amounts were converted to cubic meters per hectare using direct linear conversion. Stand volumes were converted to total tree biomass using equations developed from Forest Service Forest Inventory Analysis plot data using non-linear regression.¹⁴³ Equations used in these calculations were for the northeastern U.S. region, for the oak-hickory forest type and the white-red-jack pine forest type. The equation form is:

$$\text{Live-tree mass density} = F * (G + (1 - e^{(-\text{volume}/H)}))$$

Where mass is in metric tons per hectare, volume is in cubic meters per hectare, F, G, and H are regression coefficients, and e is a constant that is the base of the natural logarithm and is approximately equal to 2.71828182845904. The values of regression coefficients are in the table below.

Table 7. Model coefficients

Forest Type	F	G	H
Oak-Hickory	488.2	0.0509	312.8
White-Red-Jack Pine	415.6	0.0349	276.1

Biomass was converted to carbon at the proportion of 0.521 for pines and 0.498 for hardwoods.¹⁴⁴ Carbon mass per hectare was converted to carbon dioxide equivalent per acre. Generally, annual sequestration between ages where stand volumes were given was interpolated linearly. The exception to this general extrapolation is the first five years after establishment of pine. Pine grows slowly for the first five years, so no carbon was assumed to be stored during those years. This is a conservative assumption that somewhat understates actual achievement of sequestration. Relative sequestration by the two forest types is shown in Figure 7 below. Over time, adding a pine component to existing hardwood forests can substantially increase total sequestration.

¹⁴¹ Lancaster, Kenneth F and William B Leak. 1978. *A Silvicultural Guide for White Pine in the Northeast*. Forest Service General Technical Report NE-41. Broomall, PA: USDA Forest Service, Northeastern Forest Experiment Station.

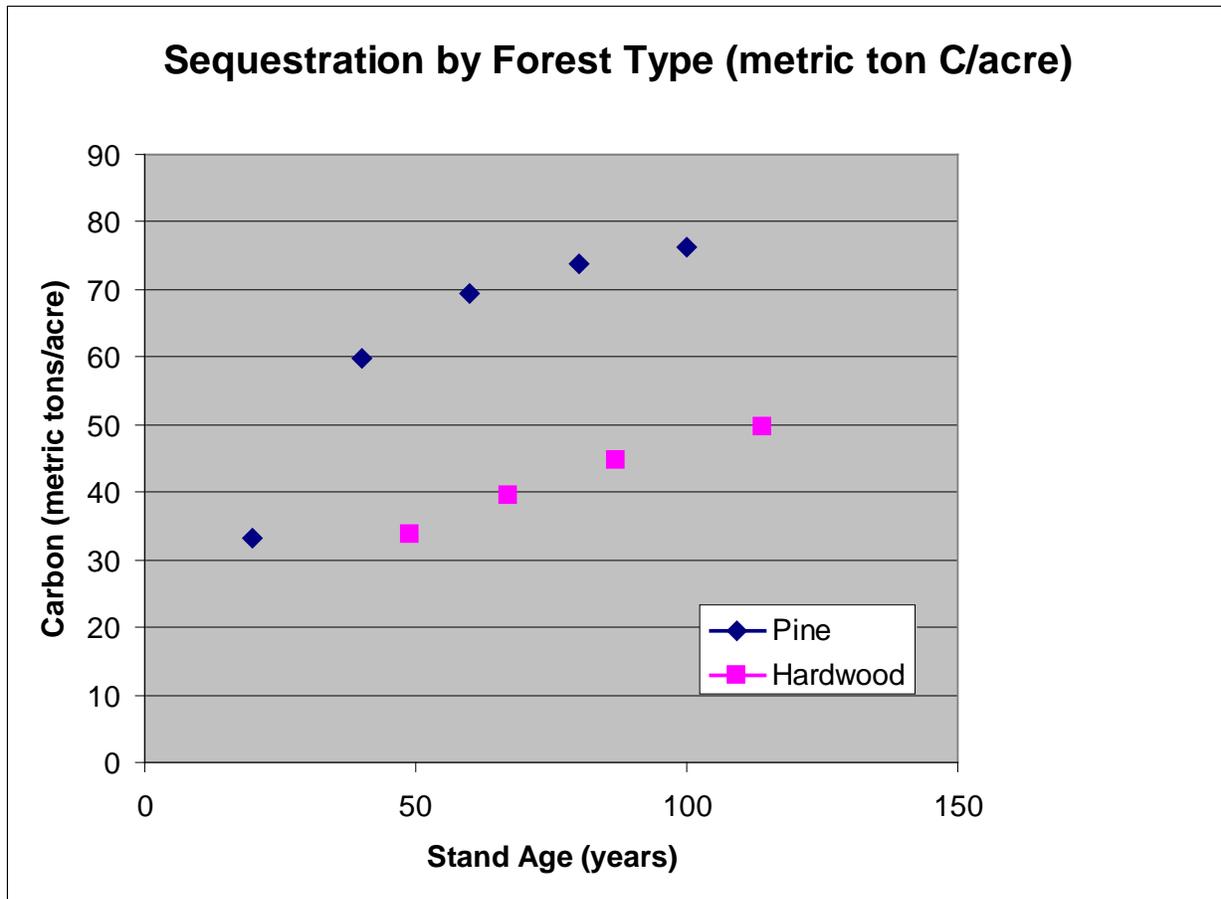
¹⁴² Leak, William B, Dale S Solomon and Paul S DeBald. 1987. *Silvicultural Guide for Northern Hardwood Types in the Northeast (revised)*. Research Paper NE-603. (No location): USDA Forest Service, Northeastern Forest Experiment Station.

¹⁴³ Smith, James E, Linda S Heath, and Jennifer C Jenkins. 2003. *Forest Volume-to-Biomass Models and Estimates of Mass for Live and Standing Dead Trees of U.S. Forests*. General Technical Report NE-298. USDA Forest Service, Northeastern Research Station.

¹⁴⁴ Birdsey, Richard A. 1996. Carbon Storage for Major Forest Types and Regions in the Conterminous United States (with appendices). In Sampson, R. Neil and Dwight Hair, eds. *Forests and Global Change Volume 2: Forest Management Opportunities for Mitigating Carbon Emissions*. Washington, DC: American Forests.



Figure 7.



There is conflicting information about how much area is available for establishing pine in gaps in existing hardwood stands. Forest Service Forest Inventory Analysis survey plot measurements find that 53% of the total timberland area in the state is moderately stocked or poorly stocked.¹⁴⁵ However, the Rhode Island Division of Forest Environment suggests that most acres in the state are fully stocked or overstocked, and thus less area of canopy gaps would be available for adding new trees without displacing existing trees.¹⁴⁶ If existing hardwood trees are displaced with pine, over time the total carbon stock would increase, but in the short term net sequestration would be decreased by emissions from decay of logging residue and emission of carbon from a portion of any trees harvested to make room for pine.

The calculations presented here use Forest Service stocking measurements. Area eligible for additional stocking was calculated from Forest Service Forest Inventory Analysis report summaries for 1998, the most recent year available. Forest Service definitions are that an area must be at least 10% stocked to count as stocked. The proportion of canopy cover generally considered to be full stocking varies slightly from species to species, but generally is about 60%. The average stocking of stands classed as moderately or poorly stocked was assumed to be the midpoint in the range encompassed by the categories. Although full stocking is generally considered to be any stocking rate up to 100%, 80% canopy cover was selected as the target stocking level because this is more realistic for a healthy stand that is not managed intensively. The change in stocking cover was assumed to be equal to the area that

¹⁴⁵ USDA Forest Service, Northeastern Forest Inventory and Analysis Program, Rhode Island state summary table 16. Accessed at <http://www.fs.fed.us/ne/fia/states/ri/tables/t15t16.6.p.htm>.

¹⁴⁶ Tom Dupree, Chief, RI Division of Forest Environment, personal communication 12 April 2004.



could be occupied by new trees, so the change in stocking level was multiplied by the total area of poorly and moderately stocked timberland to obtain the potential area available for establishing pines.

It would be unrealistic to assume that pines could be established in all canopy openings. Even though pine can be established on sites where it would not naturally out-compete other species, by using silvicultural interventions, it cannot be established on all sites. On some sites soils or moisture conditions are not appropriate. Also, even if Rhode Island offered to establish pines at no cost to landowners, not all landowners would accept the management intervention. Funding available for this analysis did not permit site specific investigations to evaluate rates of owner acceptance or actual proportions of unstocked timberland that will support white pine. In the absence of this detailed data, only half unstocked area was assumed to become established with pines as a result of the program. These inputs result in a calculation of 40,590 acres being established in pine by the program.

The active establishment program was assumed to start in 2004, and continue for 10 years. The area treated and established was assumed to be constant each year at 4,059 acres.

Only carbon that is stored as a result of the program is counted as mitigation of greenhouse gas emissions. Carbon that would have been stored anyway, without the program, should be counted in the state emissions inventory and counted as the baseline condition. The forests of Rhode Island have been accumulating carbon at the rate of 53,000 metric tons carbon per year.¹⁴⁷ Some of this increase in carbon stock comes from growth of existing trees and some comes from expansion of trees into previously unstocked areas. Forest Inventory Analysis plots show that 91% of the net increase in stocking is white pine, because much of the growth of hardwoods is removed by harvesting for wood products or land clearing for development.¹⁴⁸ Because the lands of Rhode Island are generally suitable for trees, and trees naturally regenerate on suitable soils near other trees, one should assume that this trend of increasing stocking rates will continue. On much of the forest land of Rhode Island, either white pine or hardwoods can grow. On much of the land, the environment allows hardwoods to out-compete pine under unmanaged conditions. Pine does relatively better than hardwoods on sandier, less productive sites.

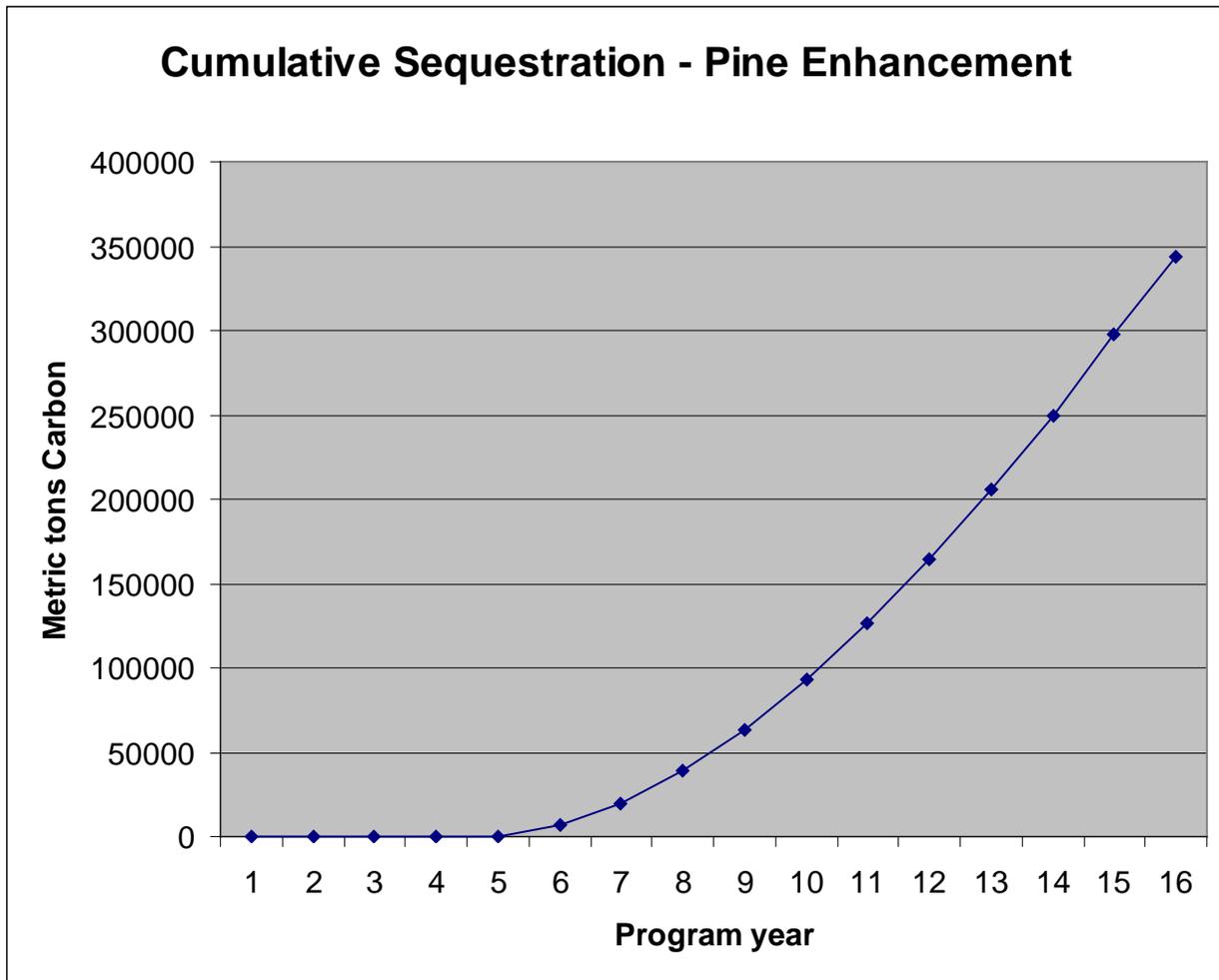
Because of the existing substantial rate of natural pine regeneration, this analysis assumes that half of the area established in pine would have been colonized anyway, without the program. This assumption is used because a pine enhancement program would focus on sites that are suitable for pine and it is not possible to predict exactly which of these sites would have been colonized by pine in the absence the enhancement program. As a result, this "business as usual" sequestration is assumed to be already counted in the expected "business as usual" carbon gains of Rhode Island forests. This analysis assumes that half of the areas where enhancement is performed would have regenerated to pine without the enhancement actions. If the program were implemented in 2004, the cumulative sequestration achieved through year 2020 is shown in Figure 8. These amounts are only the additional sequestration attributed to enhancement actions, and do not include amounts expected to have occurred anyway, in absence of the program. Sequestration would continue to increase for several decades as a result of expenditures made in the first few years of the program.

¹⁴⁷ Birdsey, RA and GM Lewis. 2003. *Carbon in U.S. Forests and Wood Products, 1987-1997: State-by-State Estimates*. General Technical Report NE-310. USDA Forest Service, Northeastern Research Station.

¹⁴⁸ These numbers may not be correct because they show no pine harvesting in the state.



Figure 8.



Costs are presented in present value terms. The annual discount rate used in the analysis is 4% using standard methods. Costs are not discounted for the year in which they are incurred, but only for years after project initiation but before the year of expenditure. Costs per ton represent the present value of all program investments, divided by the number of additional tons expected to be sequestered in the period reported.



Greenhouse Gas Forestry Work Group

Name	Organization
Mike Bartlett	City of East Providence
Hans Bergey	Private Consultant
Paul Boisvert	RIFCO
John Campanini	Rhode Island Tree Council
Kevin Essington	TNC's Pawcatuck Borderlands Program
Robert MacMillan	Providence Water
Eugenia Marks	Audubon Society of RI
Chris Modisette	SNE Forest Consortium, Inc.
Bruce Payton	RI Division of Forest Environment
Scott Rabideau	Natural Resource Services
Jason Ringler	Natural Resource Services
Margie Ryan	City of Warwick
Milt Schumacher	RIFCO
Peggy Sharpe	RI Tree Council
Nanda Shewmangal	National Network of Forest Practitioners
Robert Swanson	Farm Service Agency, Executive Director
Marc Tremblay	Land Management Services
Kathleen Wainwright	The Nature Conservancy
Dexter Miller	RI RC&D Council
<i>RI DEM</i>	
Terri Bisson	RI DEM
Gregg Cassidy	RI DEM Watersheds Office
Tom Dupree	RI DEM-Forestry
Paul Dolan	RI DEM-Forestry
Melinda Hopkins	RI DEM
Janet Keller	RI DEM
Mickie Musselman	RI DEM
<i>Consultants / Facilitators</i>	
Michael Lazarus	Tellus
Gordon Smith	Ecofor
Jonathan Raab	Raab Associates, Ltd.,
Peter Wortsman	Raab Associates, Ltd.,



Appendix E

Forest Legacy Documentation



DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20250

December 30, 1993

MEMORANDUM TO: F. DALE ROBERTSON, CHIEF, FS

FROM: Mike Espy *Mike Espy*
Secretary

SUBJECT: Approval of Rhode Island Assessment of Need,
Eligibility Criteria, and Two Forest Legacy
Areas Under the Forest Legacy Program

Pursuant to Section 1217 of Title XII of the Food, Agriculture, Conservation and Trade Act of 1990 (Public Law 101-624:104 stat. 3359), I hereby approve the establishment of a Forest Legacy Program in the State of Rhode Island.

The Assessment of Need approved by the State Lead Agency, the Division of Forest Environment of the Rhode Island Department of Environmental Management, is hereby approved as fulfilling the requirements set forth in the Law and implementation guidelines.

The Eligibility Criteria for forest lands qualifying for the Forest Legacy Program, as set forth in the Rhode Island Assessment of Need, are hereby approved.

The two (2) proposed Forest Legacy Areas, as described in the Rhode Island Assessment of Need, are hereby instituted as approved Forest Legacy Areas. The two (2) areas are: Mainland and East Bay.

RECEIVED

FEB 16 1994

DIVISION OF FOREST ENVIRONMENT

DIVISION OF FOREST ENVIRONMENT
1037 HARTFORD PIKE
NORTH SCITUAULT, RI 02857

AN EQUAL OPPORTUNITY EMPLOYER





STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
OFFICE OF THE DIRECTOR
9 Hayes Street
Providence, R.I. 02903

September 27, 1991

Mr. Dale Robertson, Chief
U.S.D.A. Forest Service
14th and Independence SW
P.O. Box 96090
Washington, DC 20090-6090

Dear Chief Robertson:

Please be apprised that I am designating the Department of Environmental Management as the state's lead agency for U.S.D.A.'s Forest Legacy Program as authorized under Section 1217 of Title XII of the Food, Agriculture, Conservation and Trade Act of 1990 (P.L. 101-624:104 stat. 3359).

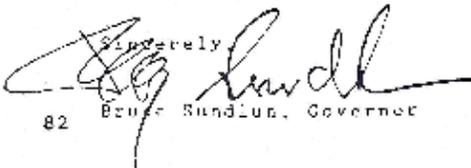
I am asking that all information and other pertinent materials be forwarded to two specific divisions within the Department of Environmental Management. Henceforth, all information should be sent to Thomas A. Dupree, Chief, Division of Forest Environment, 1037 Hartford Pike, North Scituate, RI 02857 and Judith Benedict, Chief, Division of Planning and Development, 83 Park Street, Providence, RI 02903.

Because all conservation land acquisitions are coordinated by the Division of Planning and Development and the Division of Forest Environment plays the critical role of directing the state's Stewardship Committee, I feel it necessary to have two points of contact.

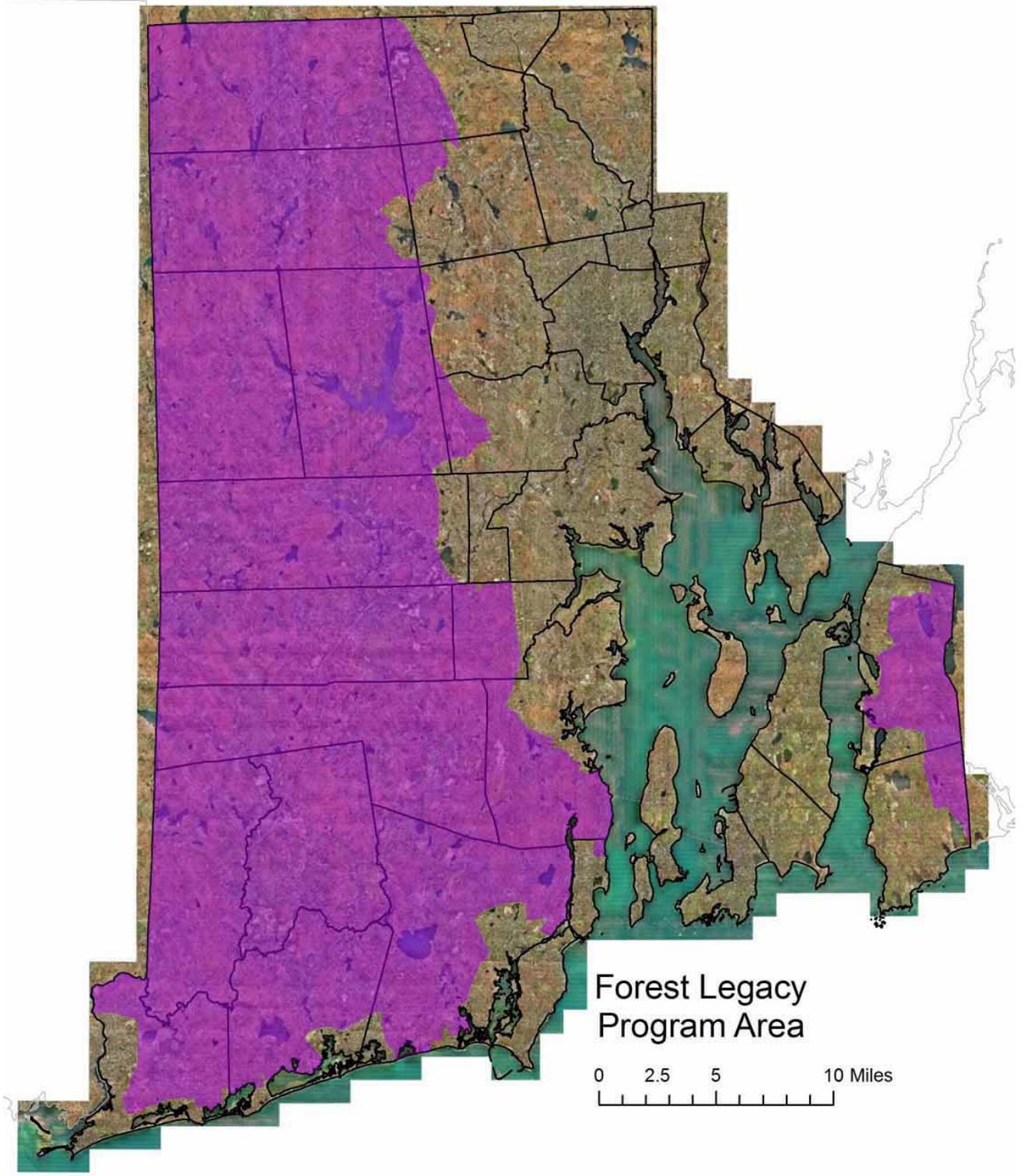
I have instructed the Department of Environmental Management to proceed with an assessment of need as required by the statute. I am also pleased that Southern New England has been selected as a project area for this timely forest-conservation program.

I want to thank you for support of state and private forestry programs, as these programs improve our local environment and contribute significantly to a healthier, cleaner planet.

Best personal wishes.

Sincerely,

82 Bruce Sundlun, Governor





Forest Legacy
Program Area

0 2.5 5 10 Miles

Appendix F

World Wide Web Links

World Wide Web Links

United States Department of Agriculture (USDA)
Forest Service

<http://www.fs.fed.us/spf/>

<http://na.fs.fed.us/spfo/ce/index.cfm>

<http://na.fs.fed.us/pubs/misc/flg/>

USDA - Natural Resource Conservation Service
(NRCS)

<http://www.ri.nrcs.usda.gov/>

Department of Environmental Management (DEM)

<http://www.dem.ri.gov/>

Division of Forest Environment (DFE)

<http://www.dem.ri.gov/programs/bnatres/forest/index.htm>

Department of Administration (DOA)
Rhode Island Statewide Planning Program (RISPP)

<http://www.planning.gov.ri.us>

R.I. Forest Conservators' Organization (RIFCO)

<http://www.rifco.org>

Rhode Island Tree Farm

<http://www.treefarmssystem.org>

Society of American Foresters (Rhode Island
Chapter)

<http://www.safnet.org>

The Nature Conservancy (Rhode Island Chapter)

<http://nature.org/wherewework/northamerica/states/rhodeisland>

Audubon Society of Rhode Island, (ASRI)

<http://www.asri.org/index.html>

Rhode Island Tree Council

<http://www.ritree.com/>

Rhode Island Land Trust Council

<http://www.rilandtrust.org/>

Smokey Bear

<http://www.smokeybear.com/>

FireWise

<http://www.firewise.org/>

Project Learning Tree

<http://www.plt.org/>

URI Master Gardeners Program

<http://www.uri.edu/ce/ceec/mastergardener.html>

NOTES

