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**MEETING MAINE'S CLIMATE ACTION PLAN GOALS:
THE ROLE OF THE FOREST SECTOR
IN REDUCING GREENHOUSE GAS EMISSIONS**

Maine Department of Environmental Protection
17 State House Station
Augusta, Maine 04333-0017

January 2007



STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

JOHN ELIAS BALDACCI
GOVERNOR

DAVID P. LITTELL
COMMISSIONER

January 24, 2007

Senator John L. Martin, Chair
Representative Theodore S. Koffman, Chair
Joint Standing Committee on
Natural Resources

Senator John M. Nutting, Chair
Representative Wendy Pieh, Chair
Joint Standing Committee on Agri-
culture, Conservation and Forestry

123rd Maine Legislature
State House
Augusta, Maine 04333

Dear Senators Martin and Nutting, and Representatives Koffman and Pieh:

Attached you will find a report, "Meeting Maine's Climate Action Plan Goals: The Role of the Forest Sector in Reducing Greenhouse Gas Emissions." The Department of Environmental Protection is submitting this report as part of its responsibilities under P.L. 2003, Chapter 237, *An Act to Provide Leadership in Addressing the Threat of Climate Change*.

The original *Climate Action Plan for Maine 2004* recommended a number of actions to be undertaken in the forestry sector to meet Maine's statutory targets for greenhouse gas emissions reductions. These were produced by a sub-committee of the Stakeholder Advisory Group based on a strong policy consensus. However, at the time (12/04) there was recognition that the specifics of the forestry management options would need to be further refined and validated in order to assure implementation. The present report details the findings, in this regard, of a subsequent stakeholder group specifically convened for the purpose, together with recommendations for next steps. As you will read, a significant proposal is that the Maine Forest Service, Department of Conservation, take over continuing responsibility for these efforts. Commissioner McGowan and I are in agreement that this should occur.

We look forward to discussing this report with you and the other members of the Committees.

Sincerely,

David P. Littell
Commissioner

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Background

In December, 2004, the Department presented *A Climate Action Plan for Maine* to the Governor and the Legislature's Joint Standing Committee on Natural Resources. This report fulfilled an obligation in PL 2003 Chapter 337 to make recommendations necessary to achieve specified greenhouse gas emissions by 2010 and 2020. These included six recommendations related to forest lands and forest management practices.¹ These had originally been produced by a Working Group on Agriculture and Forestry as part of the stakeholder process that generated the *Plan*, and had been agreed for inclusion by the core Stakeholder Advisory Group.² The recommendations for action, called "Options" in the *Plan*, were as follows:

- Increased Stocking with Faster Growing Trees
- Forestland Protection
- Early Commercial Thinning
- Timber Harvesting to Capture More Anticipated Mortality
- Expanded Use of Wood Products
- Active Softwood Increase

All the recommended options are intended either to prevent the loss of carbon from forest biomass and soils, increase the uptake and retention of carbon in Maine's working forests, or displace fossil fuels or products with higher embedded energies. If all the recommended options were implemented as modeled, they would account for 13.5% of the 2020 statutory emissions reduction goals.

As originally developed, the six options above indicated some likely approaches to implementation, but without the specificity needed to guide forest land owners and state forestry officials in taking initial steps. Knowing this, the Department convened a follow-on stakeholder group in August, 2005, composed primarily of representatives of forest management interests, supported by DEP and Maine Forest Service (MFS) staff.³ The group was charged with re-evaluating the options with an eye toward their practicality and with recommending next steps toward implementation. This *Report* summarizes their conclusions.

During the same period, the MFS has been actively engaged in its own efforts to refine its understanding of carbon sequestration as influenced by management practices and related issues, such as the potential for so-called "greenhouse gas offsets." MFS is searching to find ways to reward forest landowners for carbon-friendly management (e.g., payments for carbon offset projects) while improving forest management and enhancing the forest's environmental values. It soon became apparent that at the end of the current stakeholder process referred to above, the Department would ask the MFS in the Department of Conservation to take over continuing responsibility for these efforts.

¹ See Appendix A for summaries of the forest-related options from the *Plan*.

² For the membership of the original working group, see Appendix B.

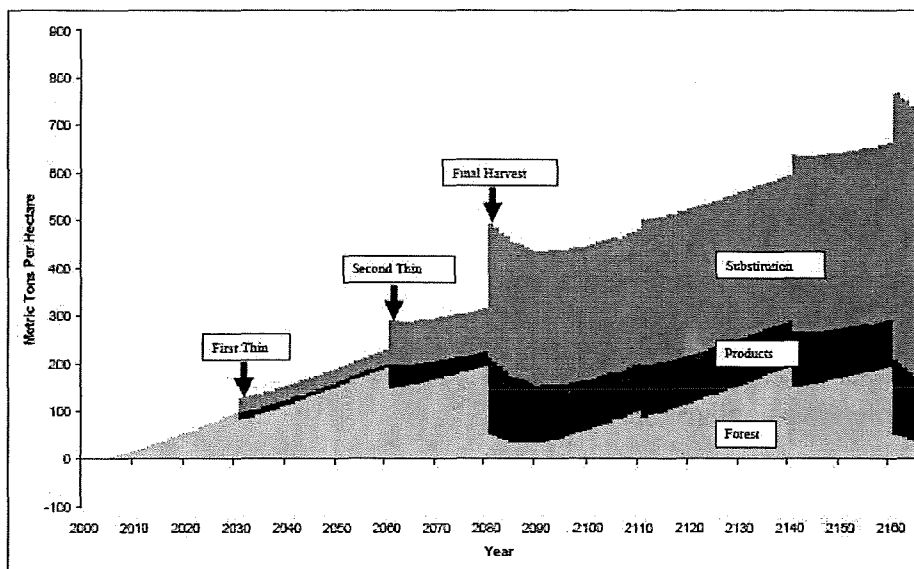
³ See Appendix B for a membership list.



This has been agreed by current MFS Director Alec Giffen. Thus, in submitting this *Report*, DEP will take on a supporting and collaborative role in the implementation of the *Climate Action Plan* forest-related options, while retaining active oversight of the *Plan* in its totality.

Stakeholder Group Recommendations: General Considerations

There was a significant consensus that actions to implement the direct forest management options should be understood as directly related to the “forest protection” option, and that in turn, all were related to the effort to retaining existing forests as forests. As can be seen in the chart below, a strong case can be made that by maintaining and enhancing the productivity of Maine’s forest through sustainable forest management practices that also enhance carbon storage, a “virtuous cycle” of protection and value-added practice is capable of accomplishing the greenhouse gas reduction goals in this sector. This perspective is witnessed in the recommendations below.



Carbon in forest, product, and substitution (avoided concrete) pools: 80-year rotation

This group reaffirmed the clear commitment of the earlier Ag/Forest working group, *viz.*, that activities implemented to increase carbon benefits must be carried out under conditions of sustainability⁴ and with no adverse impacts on biodiversity.

While the group generally agreed that the options originally presented in the *Plan* were valuable (with the exception of #28, “Active Softwood Increase,” which the group proposed to drop),⁵ there was consensus that in several cases, the underlying science was in need of further refinement before widespread implementation could be strongly recommended. Thus, the recommendations below specify several areas where additional research should be advocated and supported.

⁴ The best existing measure of sustainable forest management is third party certification.

⁵ Research data considered since the development of the option indicate that the soil carbon uptake rationale underlying this measure is not valid, so that no additional carbon would be stored in comparison with other stocking regimes.



At one point, the stakeholders asked staff to develop a mock “prospectus” that could potentially be of interest to someone wishing to purchase carbon credits derived from Maine silvicultural practice in the emerging carbon offsets market. While an outline of such a document was created, there was subsequent agreement that this group did not have the resources to fully realize such a complex instrument, particularly since other groups around the world are also wrestling with this issue. The MFS continues to work with Environment Northeast and the Pinchot Institute to explore this further.

Finally, as the circumstances of both the global carbon emissions, and the Maine forest industry, change and develop, there was agreement that other options not previously analyzed or modeled in full should be further investigated. Chief among these is the emerging interest in the production of bio-fuels from forest resources. If this proves as promising as recent indications would suggest, it could provide a major source of greenhouse emissions reduction credits for Maine.

Taken together, the stakeholder group believes that implementation of the following recommendations will promote the forest-related objectives of *A Climate Action Plan for Maine 2004*, and will likely result in carbon savings even greater than those originally modeled for this sector.

Specific Recommendations

I. Core Recommendations

Recommendations in this section apply to many aspects of forest management and protection.

Recommendation 1: Actively pursue, in partnership with Maine’s institutions of higher learning and other interested parties, research and development of relatively simple ways to assess the carbon value of different kinds of forest lands and forest management practices. Promote and make available to landowners research findings on the carbon effects of different forest management practices. A significant portion of Maine’s working forests are held by non-industrial owners with limited access to sophisticated assessment tools that would allow them to determine baseline carbon storage values and calculate the effects of changes. Robust tools to calculate sequestration potential are critically important to Maine forest managers’ ability to make silviculture decisions with long-term carbon implications.

Recommendation 2: Continue to explore ways in which the emerging carbon markets, incentive payments for improved forest management, and other mechanisms can produce additional financial resources that allow Maine forest landowners to invest in carbon-friendly, sustainable forest management activities.

Recommendation 3: Develop and publicize to Maine forest landowners clear rules for modeling, calculating, and registering forest management activities intended to be eligible for carbon credits. Such rules will need to be developed as part of the larger multi-sector regional effort to quantify common standards for third-party verification and trading of carbon credits and offsets. Once these are in place, MFS would be called on to disseminate the information to Maine forest landowners.



Recommendation 4: *Encourage the inclusion of carbon considerations into existing forest certification standards.* As noted above, third-party certification is needed to assure that forest sustainability is maintained. Adding this element will link existing standards to the needs of the emerging carbon markets.⁶

II. Forestland Protection

Recommendations in this section focus on actions that will provide new incentives for forest landowners to maintain those lands for forest use, and/or reduce the incentives that currently drive landowners to sell lands for non-forest uses.

Recommendation 5: *Increase the emphasis in land conservation efforts toward lands most likely to be at risk of conversion to other uses.* Pressure to convert forest land to developed uses is high in central and southern Maine, whereas much of the conservation funding appears to be directed to northern Maine, where development pressure is relatively low.

Recommendation 6: *Amend the state's Constitution to change the state's property taxation policy from ad valorem to current use and allow the imposition of a change of use fee when land is converted from forest management or agriculture to a developed use.* This would encourage landowners to keep working forests and farms in their current use without cumbersome current use taxation programs.

Recommendation 7: *Actively promote permanent conservation easements that include carbon considerations as part of the value.* This may be included in the larger emerging interest in so-called "ecosystem services" as a way of creating value.

III. Increasing Use of Wood Products

Recommendation 8: *Actively promote the production and market development of fuels derived from wood products that might otherwise be utilized in lower value applications.* Maine DEP should develop a new *Climate Action Plan* option that specifically models forest-product biofuels.

Recommendation 9: *Continue to promote the substitution of wood products for materials with higher embedded energy and/or non-renewable components.* This approach maintains much of the value of the carbon already accumulated in bio-mass for an additional period likely to be much longer than if the standing bio-mass is allowed to die and decay.

⁶ Some stakeholders expressed concerns that adding carbon to certification standards could have the effect of increasing landowner costs, and that any such effort must take this potential barrier into consideration.



IV. Forest Management

Recommendation 10: *Secure funding for, and implement, a series of research-driven pilot projects to document carbon sequestration technologies and develop forest management protocols, including but not limited to, Climate Plan Options 10 (Increased Stocking with Faster Growing Trees); 16 (Early Commercial Thinning); and 20 (Harvesting to Capture More Anticipated Mortality) can be actively promoted.* These projects would also include identification of specific incentives related to each.

V. Increasing Carbon Storage Potential

Recommendation 11: *Develop and implement a state-level plan to accelerate reforestation of agricultural lands that go out of production.* Action on this recommendation would need to be coordinated with efforts in the agricultural sector to restore some land currently not in production to carbon accumulative uses. See page 15, item F.10, for earlier discussion of this Option.



APPENDIX A: FORESTRY MANAGEMENT GREENHOUSE GAS
REDUCTION OPTIONS
OPTION #10 – Increased Stocking with Faster Growing Trees

Carbon Savings Potential: High

Costs / savings: Low cost

Category	Description
Working group	Agriculture / Forestry: Forestry 2.0
Option name	<i>Increased Stocking Of Poorly Stocked Forest Stands With Faster Growing Trees</i>
Sector(s)	Forestry
Policy / program elements	Manage and promote 25,000 acres per year from the Poorly Stocked Class (10-34% stocked) to Moderately Stocked Class (35-64% stocked) stands over the next 15 years through the use of select faster-growing nursery stock.
Rationale	Increasing coverage in existing stands increases active carbon storage in both standing timber and forest soils.
Existing policy/program	Public and private reforestation is required on many lands and practiced routinely in the state, but does not always result in full stocking of all stands.
Significant co-benefits	Harvest value of increased stocking.
Carbon saved 2020	531.7 ⁷
Cost <i>per</i> unit saved carbon	1
Performance measure	MFS annual forest inventory.
Implementation method(s)	Specific projects for enrichment and inter-planting; education and outreach; cost sharing.
Implementation / outreach considerations	All landowner groups can participate. May be a good candidate for pilot project funding support for planning and evaluation.

For this and a number of following options in the Forestry area (14, 16, 20, 21, 25, 28), the Working Group reached consensus in recommending them according to the following standard:

1. There is a carbon benefit gained over the long-term in actual on-ground implementation;
2. There is no adverse impact on bio-diversity and sustainability;
3. There is ongoing research and adaptive management conducted to determine the appropriate site specifications and realized Carbon benefits of the mitigation technique.
4. The mitigation technique is economically feasible for forest landowners.⁸

For this option in particular, some stakeholders raised concerns about the possible effects of introducing genetically-altered species.

⁷ See above, p. 14, for the methodology used to calculate carbon savings for this and the other Forestry options.

⁸ At the 9/29 SAG meeting, there was some discussion of whether the above standard should include other issues discussed at WG meetings, e.g., introduction of “non-native” species. However, the minutes as approved by the stakeholders include only the four items above.

OPTION #14 -- Forestland Protection

Carbon Savings Potential: High

Costs / savings: Low costs

Category	Description
Working group	Agriculture/Forestry: Forestry 1.0
Option name	<i>Protection of Forestland from Conversion to Non-forested Land Uses</i>
Sector(s)	Forest; Land Use Planning
Policy / program elements	Reduce ten percent of forestland conversion by 2010, and 20 percent by 2020 (against a baseline rate of 141,600 acres projected loss from 2005-2020).
Rationale	Protection of forestland cover from conversion to developed uses significantly reduces the atmospheric conversion of carbon stored in biomass and soils on undeveloped lands.
Existing policy/program	Large number of existing programs, including Land for Maine's Future ⁹ ; USDA Forest Legacy Program; Tree Growth Tax Law; etc.
Significant co-benefits	More efficient growth patterns: it may have the effect of directing growth to more efficient locations and reducing transportation emissions. Future opportunities for production and use of biomass for energy and wood products are also protected. Habitat protection. Supports Maine's forest-based economy.
Carbon saved 2020	376
Cost <i>per</i> unit saved carbon	-6
Performance measure	Documented accounting of land protected from loss.
Implementation method(s)	A number of potential implementation mechanisms exist, including regulatory and market-based land use standards and goals; direct incentive payments (easements and acquisitions); cluster zoning requirements or incentives (also known as conservation design or low impact development); revised transportation infrastructure investments; improvements to forest management profitability; and education.
Implementation / outreach considerations	Would need further state agency and stakeholder planning to adopt a comprehensive approach.

Implementation of this option would translate into protection of 2832 acres of natural forest cover *per* year that otherwise would have been lost to development. The Working Group did not recommend a specific implementation approach.

According to recent calculations by Thomas D. Peterson, the total volume of carbon lost from forestland conversion to non-forest uses in Maine from 1990-2000 was 18.53 MMTC compared to growth in emissions from all sectors of about 22 MMTC during the same period. In other words, the carbon emitted from forestland conversion was almost

⁹ Currently not funded.

as large as that off all other sectors combined. Fortunately, some of this was mitigated through afforestation and stand recovery, but the flow of carbon from forestland conversion appears to be significant.

Calculation of cost savings is based on the assumption of savings from the costs of public infrastructure and services not expended away from urban centers. See Appendix 5.4 for further discussion.

OPTION #16—Early Commercial Thinning

Carbon Savings Potential: High

Costs / savings: Very low costs

Category	Description
Working group	Agriculture / Forestry: Forestry 3.0
Option name	<i>Early Commercial Thinning</i>
Sector(s)	Forestry
Policy / program elements	Intentional thinning takes advantage of anticipated mortality, and concentrates growth on the better remaining timber. Treat 50% of available acreage to this practice over next 5 years.
Rationale	Carbon sequestration, with remainder used as a renewable energy source, or as building materials that displace higher emissions alternatives (steel and concrete).
Existing policy/program	A number of existing programs support improved management of private non-industrial forests in Maine.
Significant co-benefits	Enhanced value of longer-standing timber. Reduction in dead and dying timber through improved overall forest management. Expanded economic development options in rural economies.
Carbon saved 2020	331.7
Cost <i>per</i> unit saved carbon	1
Performance measure	
Implementation method(s)	Voluntary, supported by education and outreach. Market development needed.
Implementation / outreach considerations	Federal cost share programs support the development of forest and harvest management plans for Maine woodlot owners on acreage of 10-999 acres include) the Forest Land Enhancement Program (FLEP); and Forest Stewardship Assistance Program (FSA).

By definition this option meets market criteria and does not involve new costs to producers beyond planning and evaluation. Based on estimated Forest Product Output, products of thinning are directed to 20% durable wood products; 60% pulp/OSB (oriented strand board), and 20% biomass energy.

This and other forest management options may be linked to the development of emerging markets for sequestration as described in Options 1, 3, and 7. See Option 10 for the standard for implementation recommended by the Forestry Working Group.

OPTION #20 – Timber Harvesting to Capture More Anticipated Mortality

Carbon Savings Potential: High

Costs / savings: Low costs

Category	Description
Working group	Agriculture/Forestry: Forest 7.0
Option name	<i>Timber Harvesting to Capture More Anticipated Mortality</i>
Sector(s)	Forestry
Policy / program elements	Remove standing biomass with minimal impact on forest floor and soils. Goal: within 15 years capture 50% of tree biomass that otherwise is lost to natural mortality and decays on forest floors. Apply to all forest types and all landowner classes on 1,700,000 total acres over a 15-year period (113,333 acres per year).
Rationale	Reducing volume of decaying wood enhances carbon sequestration. Increased use of forest biomass for energy generation, paper production, and building materials displaces fossil based energy use of conventional alternatives.
Existing policy/program	Some support from federal cost-share programs
Significant co-benefits	Use of forest biomass to displace non-renewable energy and material sources. Improved forest management and health. Expanded economic development opportunities.
Carbon saved 2020	239.5
Cost <i>per</i> unit saved carbon	3.5
Performance measure	MFS forest sustainability benchmarking (Criterion 3, Timber Supply and Quality)
Implementation method(s)	This program potentially will require new administration and program costs associated with education and technical assistance to landowners, managers, and businesses, and identification or expansion of markets for low quality wood.. Program costs include the need for planning, implementation, and evaluation of programs and, potentially, individual projects.
Implementation / outreach considerations	By definition this option meets market criteria and likely will not involve new costs to landowners and managers. Timber harvests will remove anticipated mortality if it is more profitable than alternative management options.

This option is intended to support timber harvesting that removes anticipated mortality from the forest with minimal impact to the forest floor and soils, and to use the harvested wood for energy generation, paper and solid wood production to reduce carbon dioxide emissions from energy generation and materials production.

See Option 10 for the standard for implementation recommended by the Forestry Working Group.

OPTION #25 – Expanded Use of Wood Products

Carbon Savings Potential: Medium

Costs / savings: Low costs

Category	Description
Working group	Agriculture / Forestry: Forestry 6.0
Option name	<i>Increase Wood Products Use</i>
Sector(s)	Forestry
Policy / program elements	This option is the simple addition of biomass to wood products sub-options evaluated under forest management options, including: early commercial thinning (16), more lighter harvests (20), and active management of stands for softwood reestablishment (25).
Rationale	Durable wood products in construction of furnishings and buildings can sequester carbon for long periods of time depending on the type of harvesting practices and end use of the wood products. The substitution of wood products building materials for steel and concrete reduces embedded energy and carbon dioxide emissions.
Existing policy/program	None at present.
Significant co-benefits	Wood products are often less energy-intensive in production and use than other materials. Supports Maine's forest products-based economy.
Carbon saved 2020	129.8
Cost <i>per</i> unit saved carbon	3
Performance measure	
Implementation method(s)	
Implementation / outreach considerations	The carbon savings associated with this option may be increased if additional technologies and markets for wood products come into active use.

The policy options that contribute to expanded wood products use assume marketable harvests of biomass and no additional costs of market penetration. The only additional costs are those associated with stewardship and harvest planning by landowners.

See Option 10 for the standard for implementation recommended by the Forestry Working Group.

OPTION #28 -- Active Softwood Increase

Carbon Savings Potential: Medium

Costs / savings: Low costs

Category	Description
Working group	Agriculture / Forestry: Forestry 4.0
Option name	<i>Maintain and Increase the Softwood Component of Forest Stands</i>
Sector(s)	Forest
Policy / program elements	Structured conversion from lands currently classified as hardwood to softwood to increase soil sequestration values. Goal: transition 33,333 acres per year over 15 years currently classified as a hardwood forest type on native softwood sites to a softwood forest type by 2020.
Rationale	Softwood stands provide higher merchantable biomass use rates and can reduce greenhouse gas emissions by increasing biomass use rates for energy generation and building materials. Biomass removals can also reduce emissions from decay of dead and dying timber.
Existing policy/program	Non-industrial forests: various MFS, etc., technical and financial assistance programs to promote better forest management practices; Tree Growth tax law
Significant co-benefits	Generation of additional bio-mass for wood products or energy; mitigate forest health risks as a result of improved forest management practices. Supports Maine's forest-based economy.
Carbon saved 2020	73.2
Cost per unit saved carbon	3 ¹⁰
Performance measure	Acres converted from hardwood to softwood classification: MFS annual inventory
Implementation method(s)	Implementation of appropriate practices by large industrial forest managers; utilization of existing non-industrial forest initiatives (see above)
Implementation / outreach considerations	By definition this option meets market criteria for the acreage involved in biomass harvest, and does not involve new costs to producers.

Significant percentages of Maine's original softwood forests have shifted to hardwoods as a result of forest practices. With long-term forest succession they are likely to return to softwoods in the very long term, but this process can be accelerated with practices that remove hardwood stocks by thinning or harvest and replace them with longer-lived softwoods.

See Option 10 for the standard for implementation recommended by the Forestry Working Group. There were significant differences of opinion in the Working Group as to the efficacy of this Option, particularly due to the possibility of herbicide use.

¹⁰ This option also includes application of herbicides to 3,000 acres of hardwood to promote natural stand release and regeneration of softwoods. Costs here (\$200/acre est.) would increase the cost per unit of carbon saved, but are not included in the above calculation since they would be incurred whether or not saving carbon is a goal.

Additional Forestry Options Considered by the Original Working Group but not included in the Recommendations

F 9.0	Short Rotation Woody Cropping	Over the next 15 years, explore the use of short rotation woody crops using hybrid willow or poplar species on non forested sites, including cropland, riparian zones, eroded lands, rights of ways, and pasture. Manage crops for wood products and bio-energy to displace fossil energy emissions. Use waste manure where possible for fertilization to minimize nitrous oxide emissions from synthetic fertilizers.	Additional research and development and commercialization programs may be needed. Costs of producing carbon credits have not yet been estimated for Maine, although preliminary investigation in New Brunswick suggests use of hybrid poplars sequesters 30-75 metric tons of CO ₂ <i>per</i> acre-year at a cost of \$2-3 <i>per</i> tonne. This Option could be utilized with the following one (F 10.0, Afforestation).
F 10.0	Afforestation	This option calls for establishment of forests on under-utilized or abandoned cropland and pastureland.	The Maine Woods WISE program estimates tree planting costs for afforestation at \$170 per acre. ¹¹ Total future carbon sequestration from increased stocking of faster growing trees on poorly stocked sites is estimated at 26.90 MT carbon per acre. This translates into a cost of saved carbon of \$1.72 per ton CO ₂ saved.

¹¹ Guidelines and data from the Woods Wise program to support private forestland owners are available at: <http://www.maine.gov/doc/mfs/woodswise/steward.html>

APPENDIX B: STAKEHOLDER LISTS

Current Forest Management Implementation Group

<u>Name</u>	<u>Affiliation</u>
Patrick Strauch*	Maine Forest Products Council
Andy Shultz	Professional forester
Michael Stoddard*, Michelle Lichtenfels	Environment Northeast
John Gunn	Trust to Conserve New England Forestland
Chuck Kraske*	International Paper
Walter Emrich*	J.D. Irving Corporation
Peter Triandafillou	J.M. Huber Corporation
Linda Heath	US Forest Service
Robert Wagner	University of Maine
Donald Mansius*, Alec Giffen, Dave Struble	Maine Forest Service
Malcolm Burson (convener)	Maine Department of Environmental Protection

* = member of the previous working group

Climate Action Plan Agriculture / Forestry Working Group

[Forestry members]

Walter Emrich	J. D. Irving Corporation
Michael Stoddard, Dan Sosland	Environment Northeast
John Williams	Maine Pulp and Paper Institute
Sue Jones	Natural Resources Council of Maine
Pat Strauch	Maine Forest Products Council
Donald Mansius, Dave Struble	Maine Forest Service
Jim Smith	US Forest Service
Ivan Fernandex	University of Maine
Mark Battle	Bowdoin College
Kate Dempsey	The Nature Conservancy
Sherry Huber	Mainewatch Institute
Judith Merck	SWOAM
Thomas Peterson	Technical facilitator
Jack Kartez	University of Southern Maine (process facilitator)
Michael Karagiannes	DEP convener