Maine Forestry Greenhouse Gas Mitigation Options

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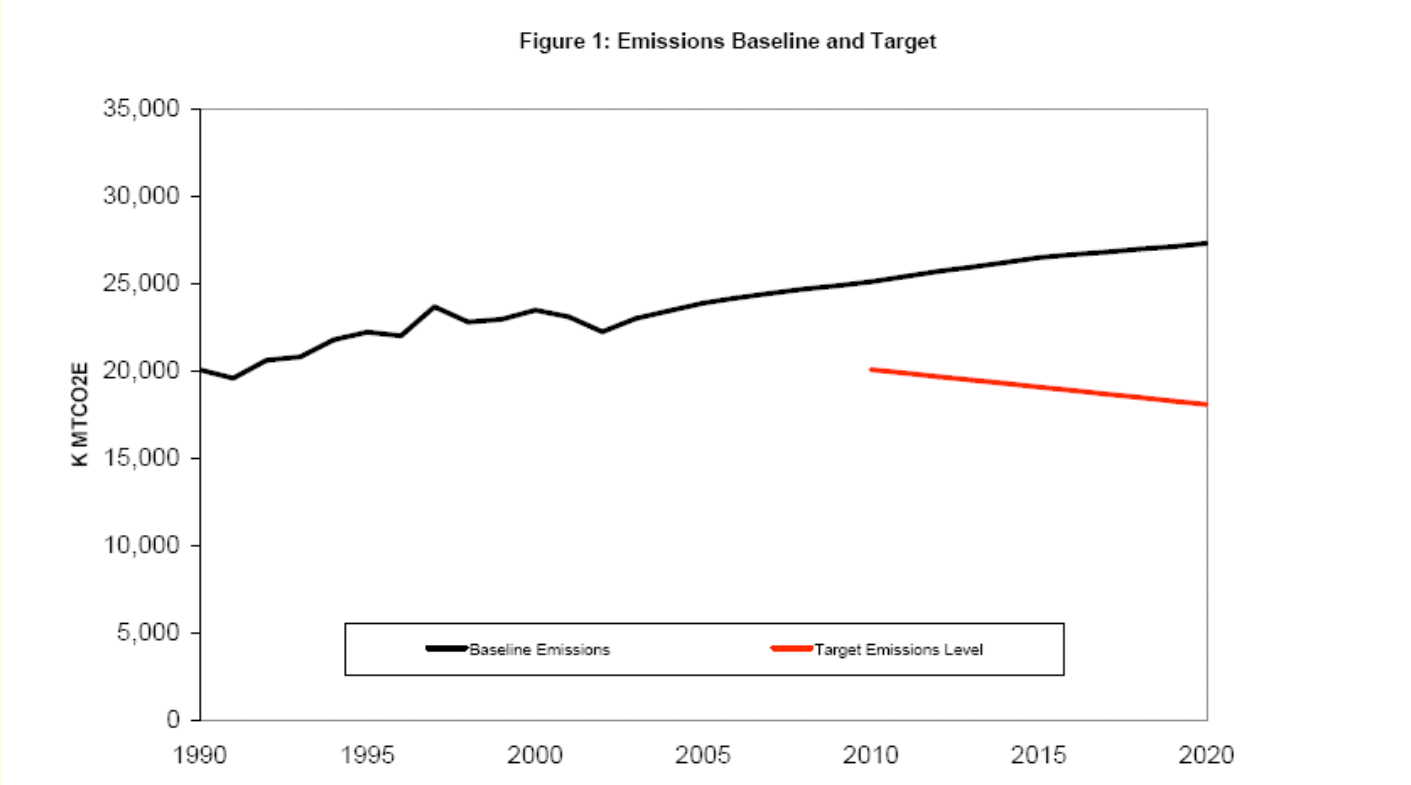
Maine PL 237

- Passed in 2003, first in nation
- State greenhouse gas mitigation plan
- Stakeholder process
- Forest carbon sequestration and other measures across all sectors
- NEG/ECP targets and timetables
- Consensus recommendations to legislature
- Non consensus recommendations to DEP

The challenge



End product = policy portfolio

Sector	Mechanism							
	Codes & Standards	Market Mechanisms	Funding Mechanisms	Voluntary Agreements	Technical & Financial Assistance	Information & Education	Pilots & Demos	Reporting & Disclosure
Agriculture								
Commercial, Residential And Industrial								
Energy Supply								
Forestry								
Transportation and Land Use								
Waste Management								
Cross Cutting Issues								

Forestry Group Participants

- Stakeholders
- Public
- Technical work groups
- Forest experts group
- Technical facilitator
- Lead consultant
- State agency observers

Consensus process

- Multi-party
  - Stakeholders and technical work groups
- Multi-issue
  - Variety of sectors, control strategies, objectives
- Science intensive
  - Preliminary and joint fact finding
- Evaluative facilitation
  - Process facilitation and technical consultants
  - Alternative solutions and scenarios

Technical process

- Decisions by stakeholder group
  - Final policy recommendations
- Advice by technical work groups
  - Joint fact finding and policy development
  - Joint model development (forestry group)
  - Iteration, sensitivity analysis and alternative policy design

Technical work plan

- Diagnosis
  - Emissions inventories from 1990 to 2000
  - Base case projections to 2010, 2020
  - Base actions and knowledge
  - Conceivable options beyond the base
- Evaluation
  - Priorities for analysis and preliminary impacts
  - Cost effectiveness estimates for options
  - Alternative policy design
  - Final option selection and design

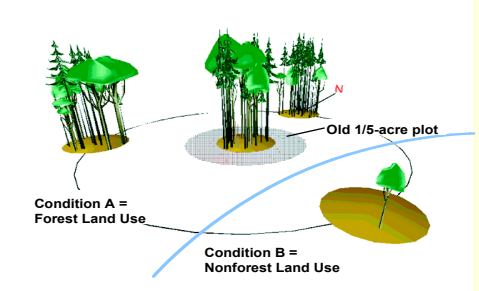
Accounting principles

- Comprehensive
  - Land use change, forest types, ownerships, etc.
  - Pre harvest and post harvest biomass
- Consistent
  - Across sectors
  - Across other jurisdictions (as possible)
- Consumption based
  - Include imports and exclude exports of HWP's
- Transparent
  - Data sources, methods, assumptions

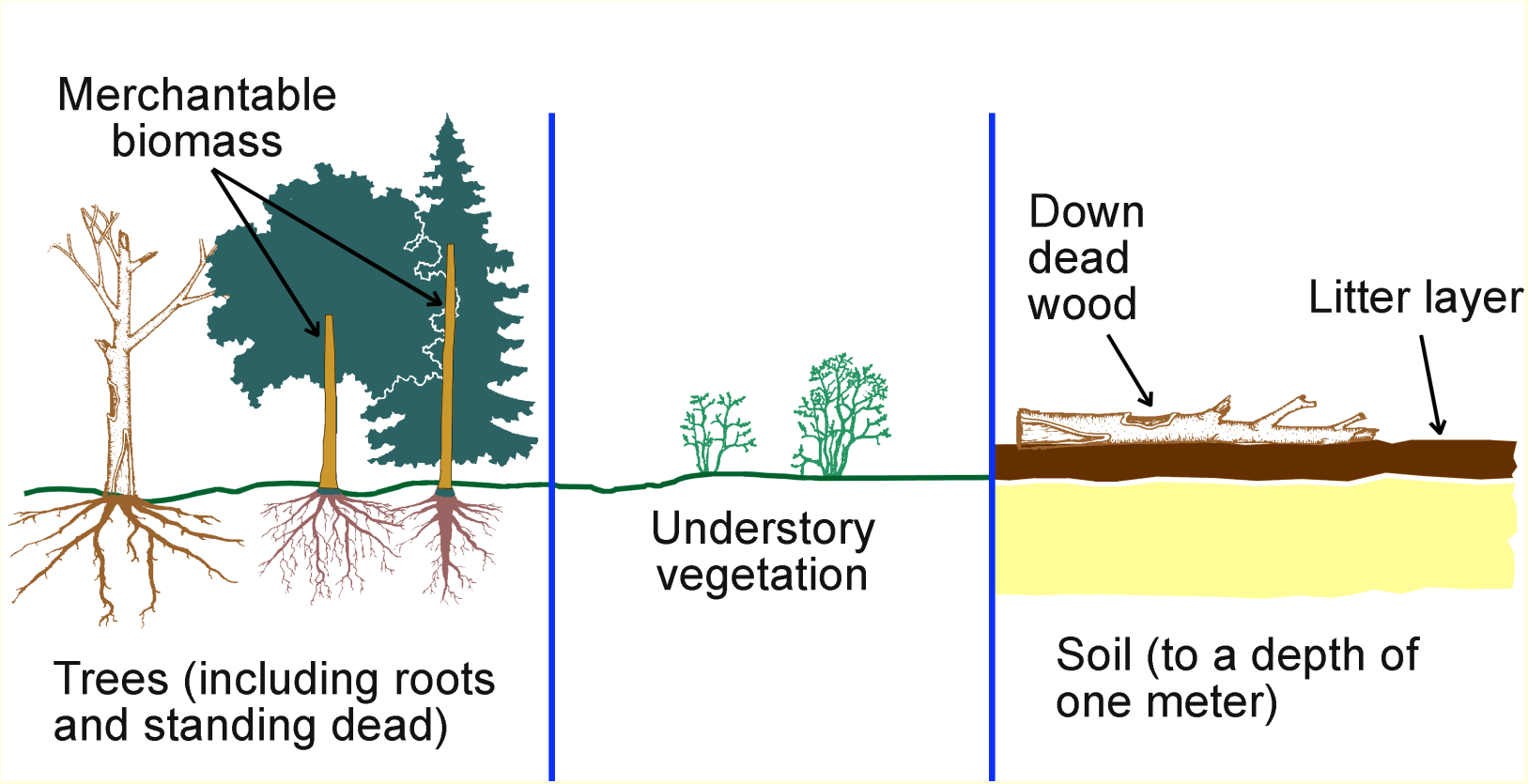
FORCARB accounts

- Ecosystem biomass
  - Live and dead standing trees
  - Understory
  - Forest floor and coarse woody debris
  - Forest soils
- Revisions
  - New tree growth and soil carbon equations
  - New protocol for land use change impacts
  - Use 1982 and 2003 data for a static baseline

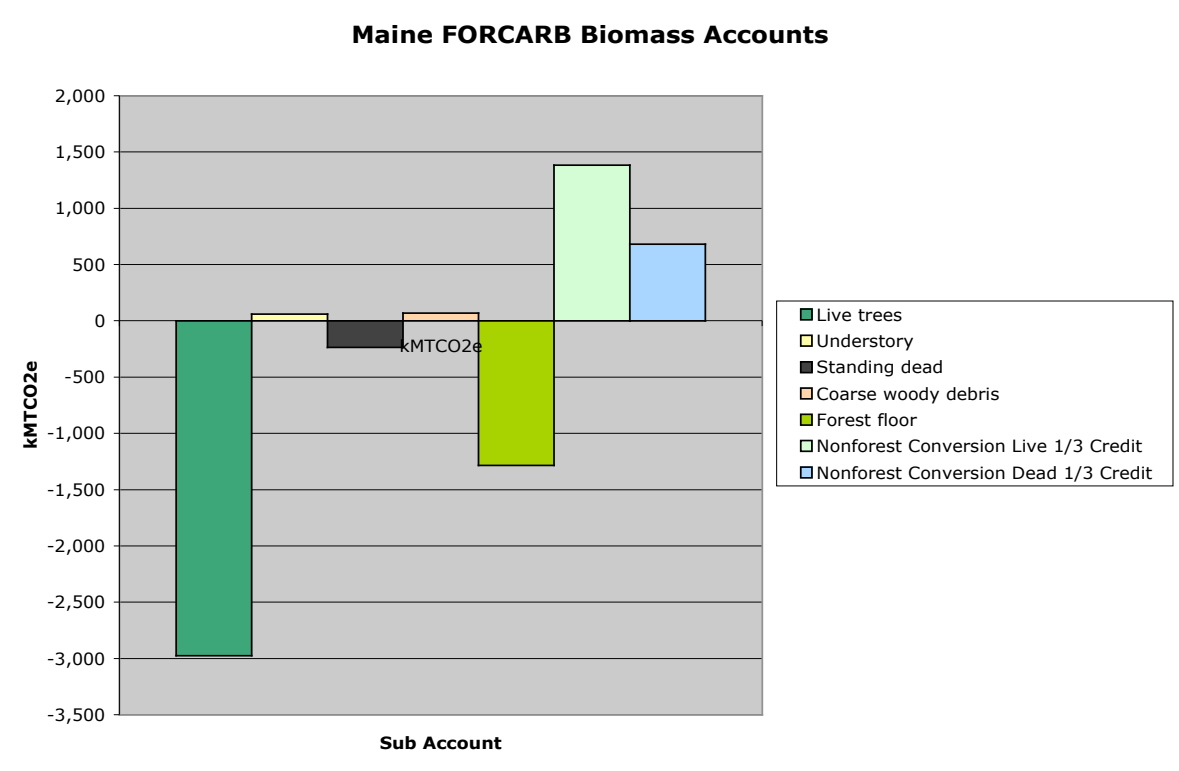
Maine survey data on FIA permanent plots available for 1982, 1995, and 2003



Carbon estimates are based on tree species and dimensions, forest type, volume of growing stock, and stand age.



Pre-harvest carbon flux



HARVCARB accounts

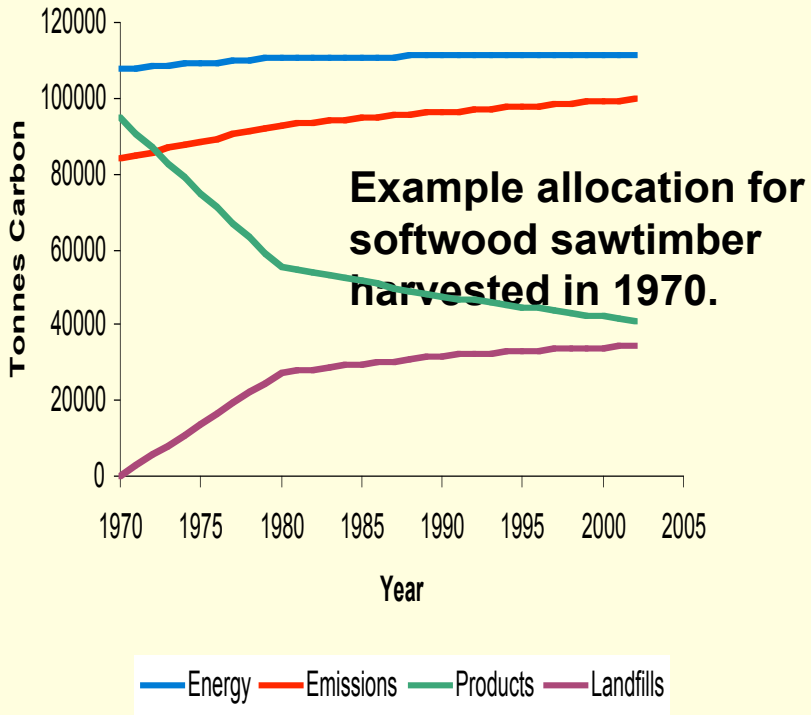
- Harvested wood products biomass
  - Durable wood products
  - Landfills
  - Energy recapture
  - Decay
- Revisions
  - Use state based HWP estimates
  - Imports/exports from Maine Wood Processor Reports
  - Add energy displacement from building materials

Maine Carbon in Harvested Wood Products

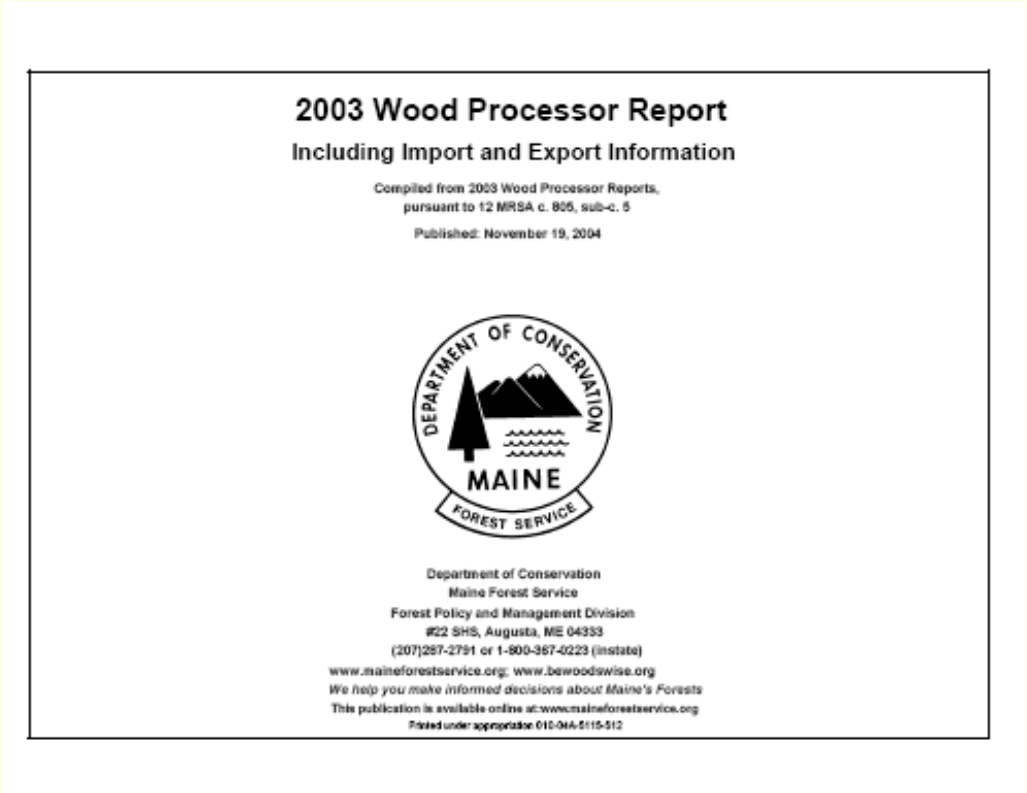
- Carbon sequestered in products in use and landfills (HARVCARB)
- Energy displacement from building materials displacement (CORRIM)
- Maine annual Wood Processor Reports
- Stock change accounting approach

HARVCARB

- Allocates carbon over time since harvest
- Based on quantity of roundwood harvested
  - softwood versus hardwood
  - pulpwood versus sawtimber



Maine roundwood data



2003 Wood Processor Report

Including Import and Export Information

Compiled from 2003 Wood Processor Reports,
pursuant to 12 MRSA c. 805, sub-c. 5

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FOREST SERVICE

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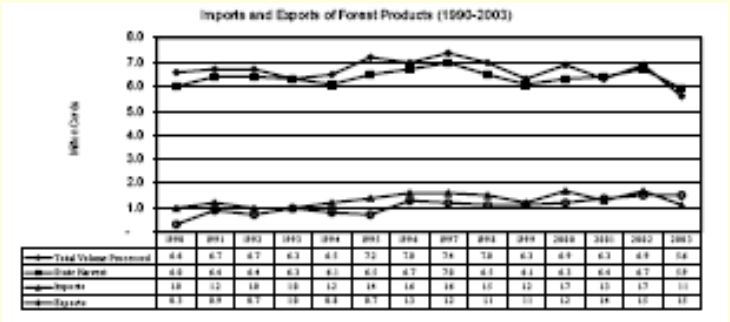
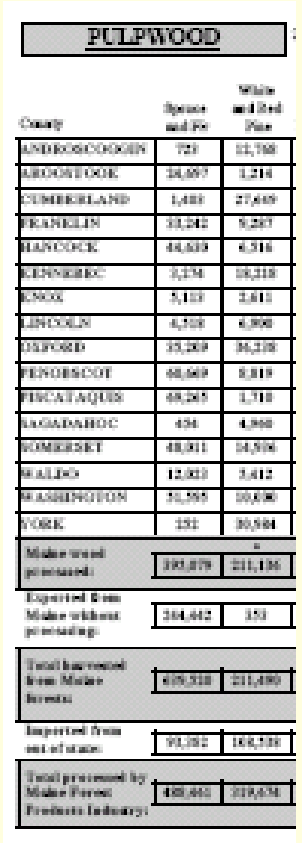
Volumes classified according to product and species group



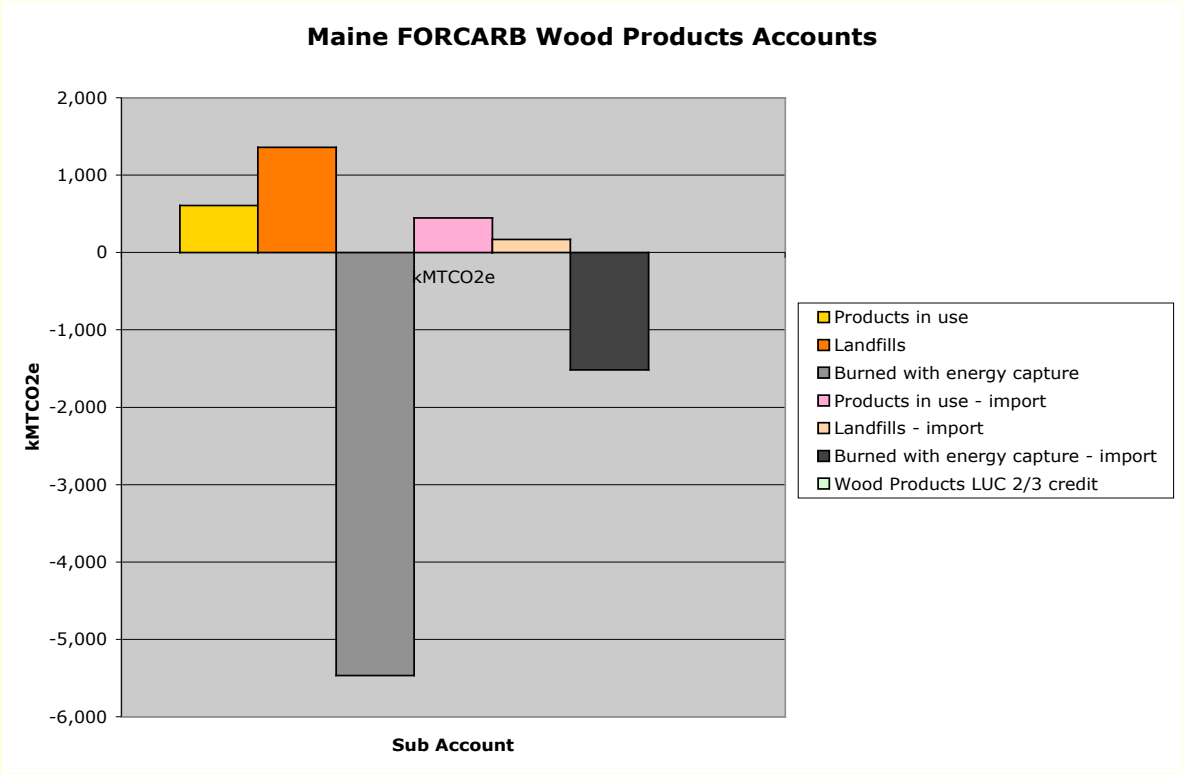
Imports and Exports



PULPWOOD

County	Spruce and Fir	White and Red Pine
ANDROSCOGGIN	727	11,760
AROOSTOOK	26,697	1,214
CUMBERLAND	1,481	27,469
FRANKLIN	33,242	9,287
HANCOCK	44,639	4,518
KENNEBEC	3,174	18,218
KNOX	5,113	2,611
LINCOLN	4,519	4,998
OXFORD	35,209	34,218
PENOBSCOT	68,669	8,819
PISCATAQUIS	69,265	1,710
SAGADAHOC	434	4,968
SOMERSET	48,011	14,506
WALDO	12,013	3,612
WASHINGTON	31,595	10,630
YORK	151	30,504
Maine wood processed:	393,879	211,136
Exported from Maine without processing:	214,442	153
Total harvested from Maine forests:	609,318	211,490
Imported from out of state:	91,282	168,188
Total processed by Maine Forest Products Industry:	488,661	379,674

Post-harvest carbon flux



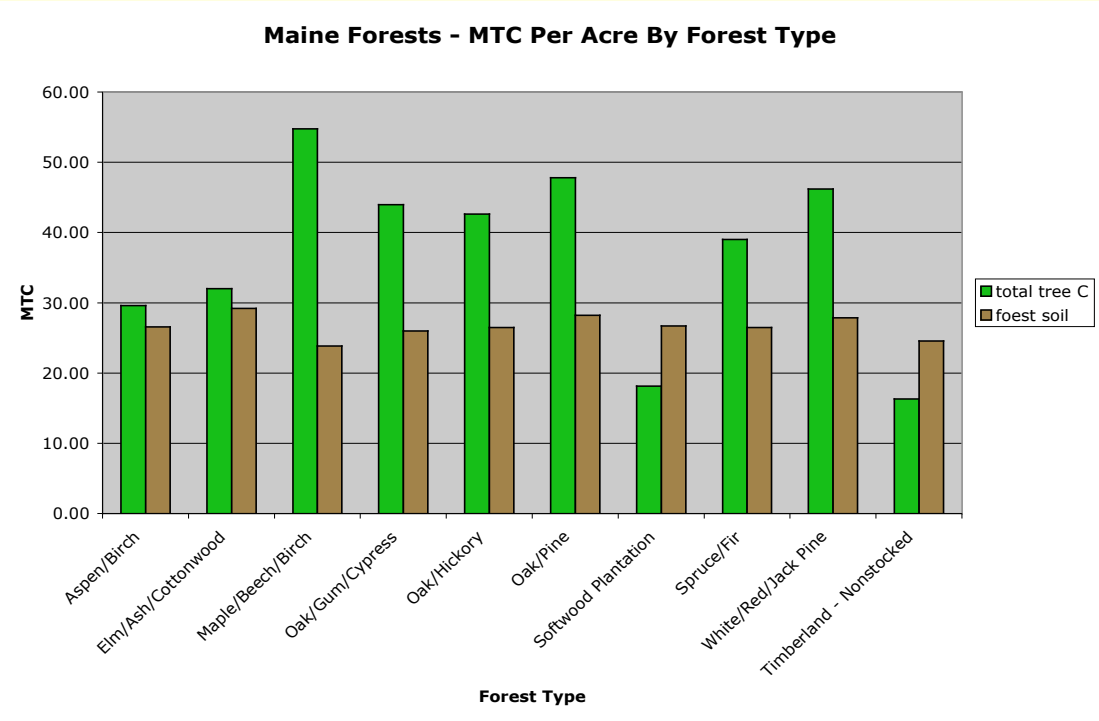
Maine Forest Carbon Baseline

Carbon Pool	**Annual Flux**
	(Mt/year)
Forest, biomass	**-0.796**
Nonforest conversion credit	0.379
Forest, non-living	**-0.396**
Nonforest conversion credit	0.187
Soil, forest type change	-0.206
Nonforest conversion credit	-0.071
HWP, produced & processed in ME	0.539
HWP, imported then processed in ME	0.169
Maine forest carbon baseline	-0.196

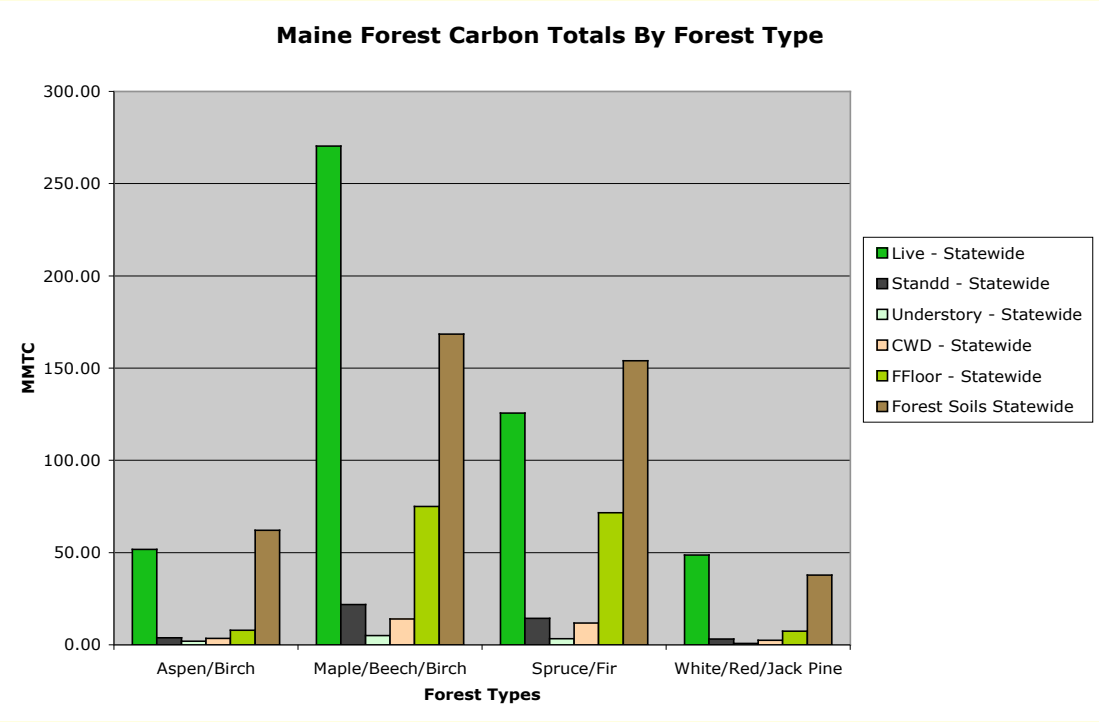
Key findings

- Carbon focused in maple v. spruce systems
- Carbon focused in trees and forest floor
- Age of converted forests greater than average
- Net carbon impacts of land use change (permanent land clearing) very large
- Species shifts have low impact on soil carbon
- Average age of all stand types declined significantly

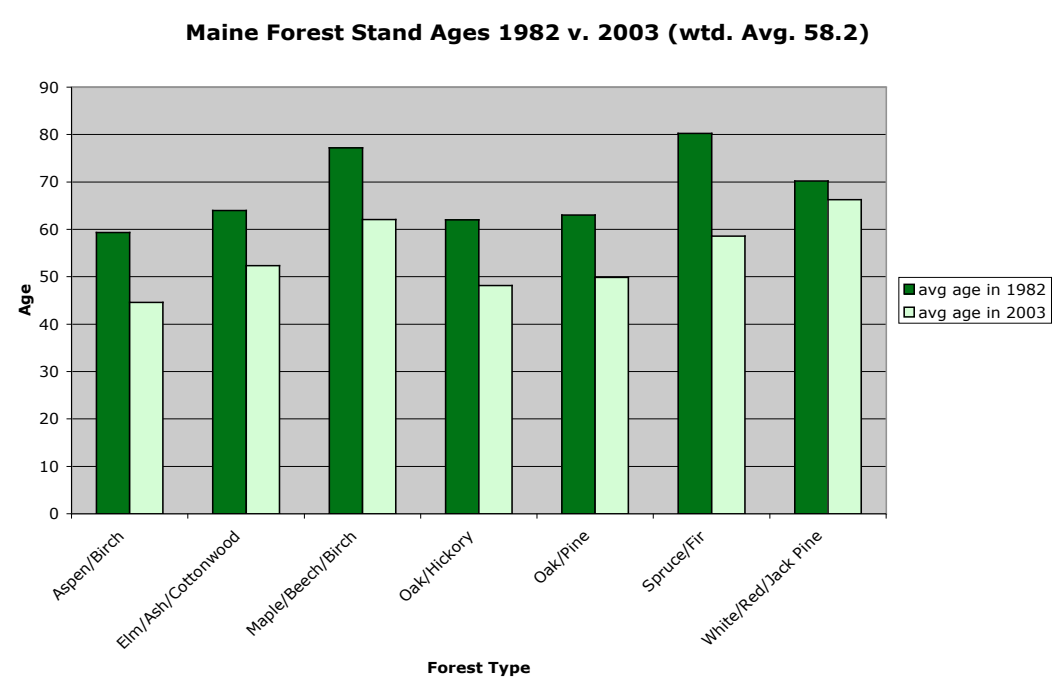
Carbon densities by stand type



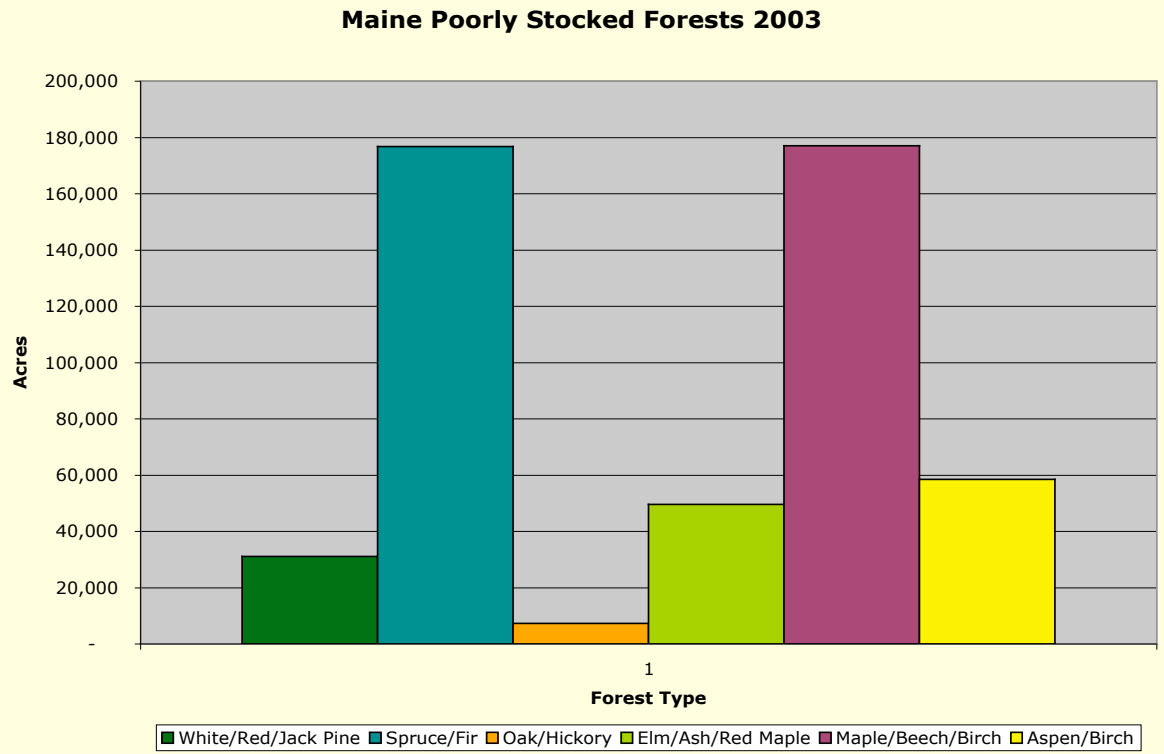
Carbon accounts for major types



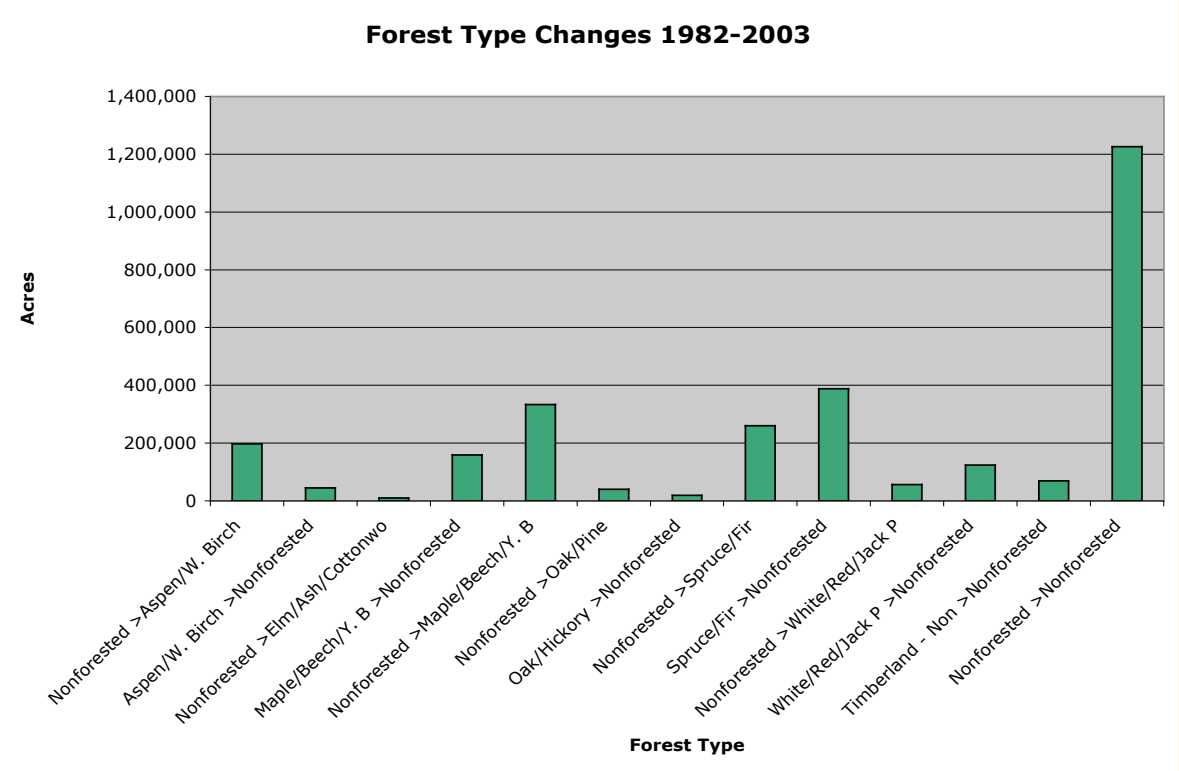
Age of forest stands 1982 v. 2003



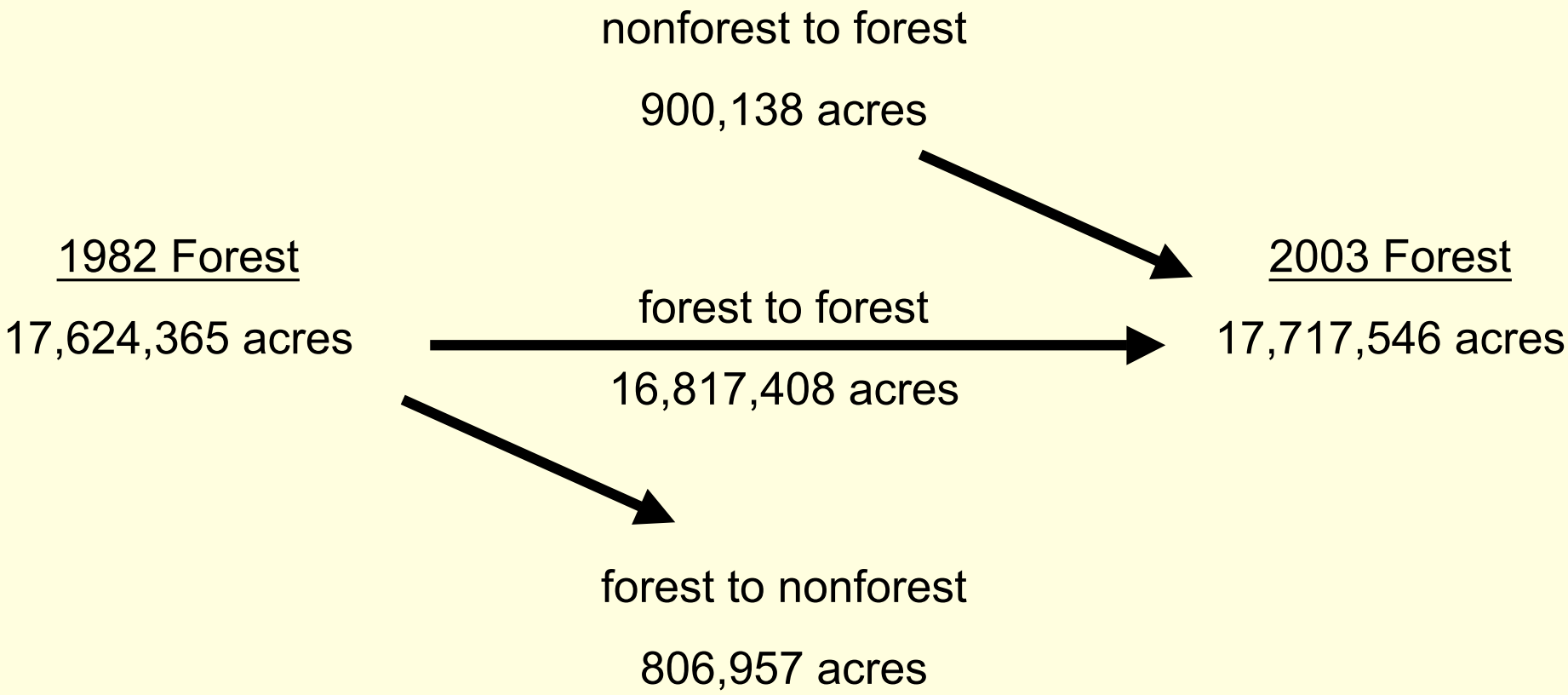
Poorly stocked acres v. species



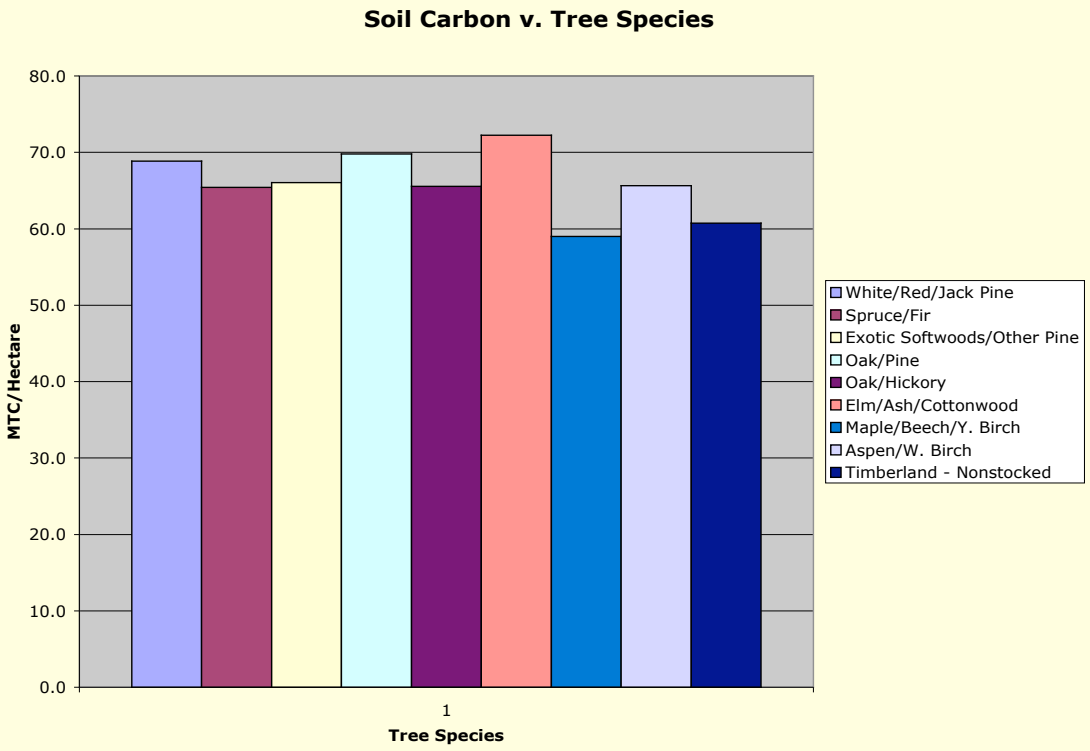
Shift in forest types 1982 v. 2003



Land Use Change



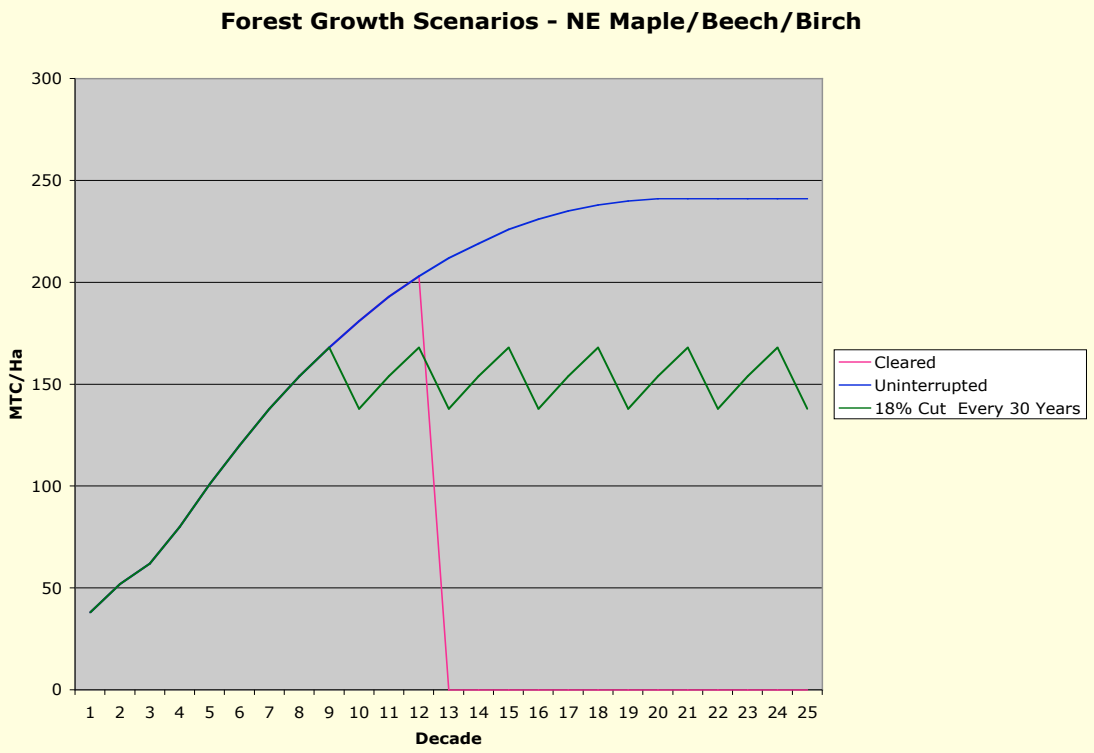
Soil carbon v. species



Base case projections

- Linear extrapolation of 1982 v. 2002 stock changes (flat line projection)
  - FORCARB2 biomass accounts
  - FIA trend analysis with confirmation by NRI
  - HARVCARB coefficients
  - Imports/exports from Maine Wood Processor Reports
- Assumptions
  - No change in management practices or markets
  - No change in land use trends
  - No forest health or climate change

Forest stand growth scenarios



Policies considered

- Pre harvest biomass
  - Forestland protection
  - Afforestation, reforestation, increased stocking
  - Density management
  - Rotation age
  - Fertilization
- Post harvest biomass
  - Durable wood products
  - Biomass feedstocks

Policies quantified

- Reduced conversion of forestland cover (carbon storage)
- Increased stocking of poorly stocked stands (carbon storage)
- Density management through early commercial thins & regular light harvests (carbon storage and energy displacement)
  - Expanded wood products use
  - Expanded biomass energy feedstocks

Policies for further consideration

- Afforestation (carbon storage)
  - Low acreage potential
- Extended rotation age (carbon storage and energy displacement)
  - Complex modeling, mixed effects
- Short rotation woody crops (carbon storage and energy displacement)
  - Uncertain acreage and techniques

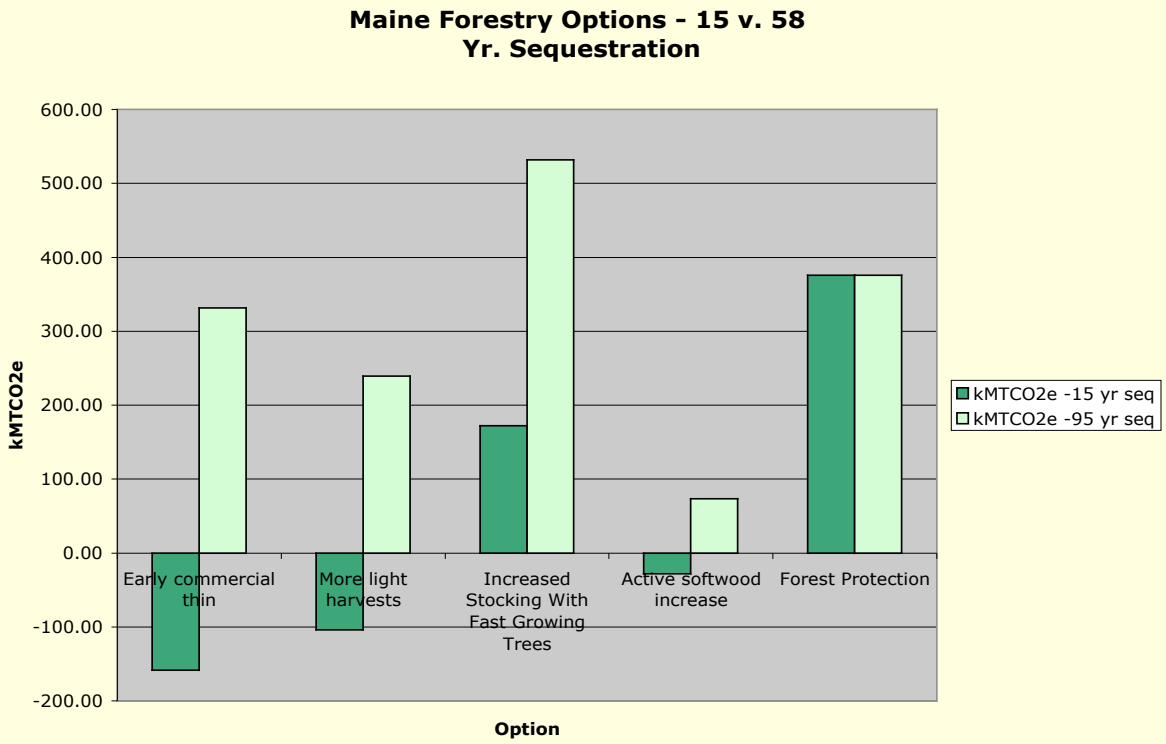
Full life cycle analysis

- Time period - two scenarios
  - Effects within 2010-2020 compliance period
  - Effects beyond compliance period (full generation)
- Direct and indirect impacts
  - Direct/within sector: all carbon accounts and categories
  - Indirect/outside sector: energy supply, buildings, waste management, transportation
- Discounting
  - No discounting of GHG impacts
  - Costs discounted

Forestry calculator

Proposed Forestry Option: X	**MTCO2e**
Acres treated by forest type 2005-2020	Proposed
Cords removed/reserved per acre	Proposed
MTCO2e removed/reserved per acre (2.079 MT CO2e/cord)	›
Annual MTCO2e removed/reserved	›
% Harvested Biomass To/From Wood Products	Proposed
MTCO2 to/from saw timber (durable wood), or pulpwood	›
Products in use – carbon storage	+
Landfill – carbon storage	+
Biomass energy – carbon emission	-
Displaced energy **– carbon reduction**	+
Other WP emission (processing residue) – carbon emission	-
Forest Sequestration – carbon storage	+
Logging residue – carbon emission	-
Building materials substitution – carbon reduction	+
Stand mortality **– carbon emission or reduction**	+ -
Forest floor/CWD decay **– carbon emission**	+ -
Total GHG Savings	**SUM**
% Biomass To/From Energy Recapture	Proposed
Biomass energy – carbon emission	-
Displaced energy **– carbon reduction**	+
Forest Sequestration – carbon storage	+
Logging residue – carbon emission	-
Stand mortality **– carbon emission or reduction**	+ -
Forest floor/CWD decay **– carbon emission**	+ -
Total GHG Savings	**SUM**
Option Total GHG Savings	**SUM**

Short v. long period of analysis



GHG reductions and costs

State Forestry Mitigation Policy Option	Annual GHG Reductions In 1000's MTCE	Annualized Dollar Costs Or Savings Per MTCE
Reduced Conversion Of Forest To Nonforest Cover	376	$-23.75 (cost savings) - $21.85
Increased Stocking Of Poorly Stocked Forestlands	531	$3.72
Early Commercial Thins, Regular Light Harvests	239 - 332	$2.20 – $11.88

Cumulative impacts of forestry

- 17 percent of total planned state emissions reductions in Maine across all sectors
  - Full life cycle analysis
  - Sustainability assumptions
  - Long time period (full generation tree growth)
- Closed the gap to meet the NEG/ECP target

Regional applicability

- Consensus building process
- Policy framework
  - Integration of pre harvest and post harvest biomass
- Options and policy designs
  - Can be scaled to new states for preliminary analysis
- Carbon flux modeling system
  - FORCARB in all states, HARVCARB in all regions
- Forest carbon calculator
  - Regional data provides a default; data can be calibrated to the state level

Information gaps

- Developed lands carbon flux
- Wetlands carbon flux
- HWP storage and displacement
- State v. regional data
- Substate mapping
- Other?

Why bother?

- Diagnosis leads to better policy design and direction
  - Counterintuitive findings are common
  - Customers are built into solutions
- Consensus policies reduce conflict and risk
  - Two heads are better than one
  - Flexibility and diversification happen
  - Agreements beat tribalism

Significant contributions

- Ken Laustsen, Maine Forest Service
  - helped interpret survey data and provided LUC estimates
- Linda Heath, USDA Forest Service
  - ongoing development of FORCARB and national forest carbon budgets