

***** FORESTS *****
Our Best Allies in Fixing the Climate Problem

Earth Care Fair
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Outline of Presentation

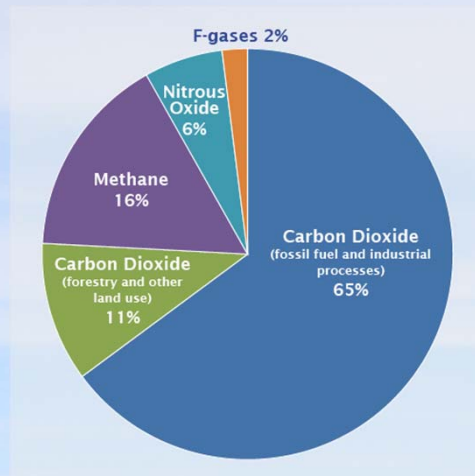
1. Climate change background
2. How to address climate change
3. Intact forests absorb and store more carbon;
logging reduces carbon storage
4. Progress toward protection of forests to mitigate
climate change
5. MA forests are critical for carbon storage
6. Global Warming Solutions Act and MA forest
management
7. Recommendations

1 - Climate Change Background

- President Obama in his 2014 State of the Union address: *“No challenge poses a greater threat to future generations than climate change.”*
- National Climate Assessment 2014:
 - “Climate change, once considered an issue for a distant future, has moved firmly into the present.”
 - Climate change impacts are increasing
 - Rapid warming of the past half-century is due primarily to human activities:
 - Burning coal, oil, and natural gas
 - Forest clearing and some agricultural practices
 - We can act to limit the extent of damaging impacts
- Climate assessments becoming more dire with time

http://s3.amazonaws.com/nca2014/low/NCA3_Climate_Change_Impacts_in_the_United%20States_LowRes.pdf

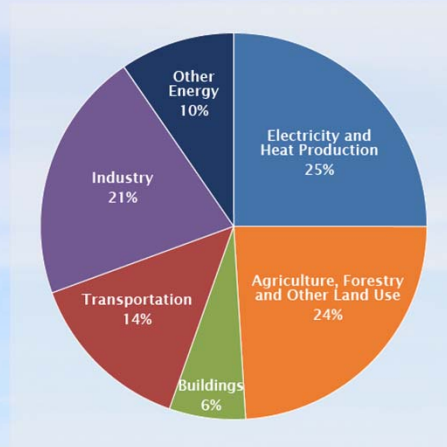
1 - Types of Greenhouse Gases (GHGs)



<http://www.epa.gov/climatechange/ghgemissions/global.html>

2 - Sources of GHGs

GHGs coming from land, not out of a pipe, are the second largest source



<http://www.epa.gov/climatechange/ghgemissions/global.html>

1 – Strategies for Fixing the Climate

- Decrease GHG emissions – many ways
- Increase removal of GHG from the atmosphere – only two viable ways:
 - Ocean acidification – damaging to ocean ecosystems
 - Living plants – beneficial
 - Take up sunlight and carbon dioxide (CO₂)
 - Make biomass and give off oxygen

2 - Not Just Tropical Rain Forests

America's forests sequester and store 12% of our GHG emissions each year

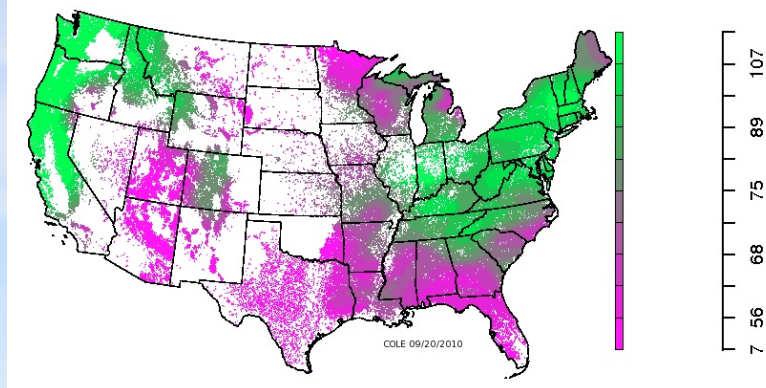
Quabbin Watershed Forest



<http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf>

2 – U.S. Forest Carbon Storage

COLE Map
Total Aboveground Carbon (metric tons/hectare)



<http://www.ncasi2.org/COLE/>

2 – Benefits of Intact Forests

- Carbon uptake and storage
- Cleaner air and water
- Less soil erosion
- Wildlife habitat
- Flood storage and water cycle moderation
- Shade and temperature moderation
- Nature and wilderness for humans
- Intrinsic value unrelated to human benefits

2 – Damage Caused by Logging: Deforestation



2 – Dangers of Burning Wood

- Double-whammy damage to the climate
 - Logging and burning release CO₂ from forest soils and trees
 - Logging destroys the trees that otherwise could have removed CO₂ from the atmosphere
- Yes, we need to reduce burning of fossil fuels
 - Burning trees instead is not the answer
 - Burning wood to produce electricity releases more CO₂ than coal
 - Burning wood also releases conventional air pollutants

<http://www.usnews.com/science/articles/2010/06/11/wood-power-worse-polluter-than-coal>
<http://www.mass.gov/eea/docs/doer/renewables/biomass/manomet-biomass-report-full-lorenz.pdf>
<http://energy.gov/energysaver/articles/wood-and-pellet-heating>
http://www.huffingtonpost.com/ellen-moyer-phd/burning-trees-to-make-ele_b_1601275.html

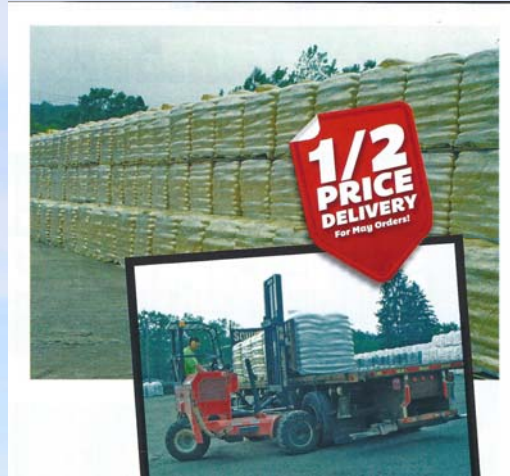
2 - Biomass Power Plant - Burlington VT



2 – Increasing Threat: Burning Wood for Heat

Recent flyer
received in my
mailbox
*“Spring Wood
Pellet and Coal
Prebuy!”*

Carbon awaiting
release to the
atmosphere



2 – Manomet Carbon Modeling

Massachusetts Carbon Recovery Summary Emissions from Continuous Operation

Years to Achieve Equal Flux with Fossil Fuels				
Harvest Scenario	Fossil Fuel Technology			
	Oil (#6), Thermal	Coal, Electric	Gas, Thermal	Gas, Electric
Mixed Wood	15-30	45-75	60-90	>90
Logging Residues Only	<5	10	10	30

Mixture of whole tree and forestry residue green chips: takes **15 - 30 years** for forest regrowth to re-sequester enough carbon so net biomass emissions are the **same** as from an oil burner. Pellet emissions are even higher because more wood is required per unit of heat energy.

<http://www.mass.gov/eea/docs/doer/renewables/biomass/manomet-biomass-report-full-lorenz.pdf>

2 – Other Drivers of Increased Logging

- Not counting economic benefits of forest services
- Not recognizing rights of nature
- Subsidizing logging
 - Allowing private entities to log public forests at public expense
 - Tax and credit incentives
- Using wood wastefully – e.g., single-use pallets
- Failing to reuse/recycle wood products
- Example – buy 10 reams of 8.5x11 copy paper at Staples:

0% recycled	\$45.99
30% recycled	\$56.99
50% recycled	\$84.99
100% recycled	\$125.80

2 – Myths to Justify Logging

MA citizens and experts refuted 22 phony excuses for logging, which prevented logging at Robinson State Park

- To treat fungus-infested red pine
- For forest health
- To create biodiversity
- To preserve existing biodiversity
- To promote age class diversity
- Because its trees are reaching “maturity”
- Because trees might fall and hurt people
- Because young trees are needed to continue the forest cycle
- To remove large diameter trees most susceptible to extreme wind
- To reduce risks from forest insects and diseases
- To reduce fuel buildup and risks of fire
- To benefit wildlife
- To enhance water quality
- To benefit the local economy
- To remove fire fuel buildup along boundaries with abutters
- To prevent forest takeover by red maple
- And don’t worry – the logging will be done sustainably

http://www.huffingtonpost.com/ellen-moyer-phd/science-to-stop-logging_b_1799800.html

2 – Example in 2015: Westford Town Forest



<http://westford.wickedlocal.com/article/20150722/NEWS/150728502/13406/NEWS>

2 - Forest Carbon Myths Used to Justify Logging

- Young forests absorb more carbon than old
- Wood products store carbon better than trees
- Logging promotes carbon absorption
- Fires and other disturbances make forests not good places to store carbon
- Temperate forests do not store much carbon
- Forests hurt the climate by absorbing the sun's energy
- Climate change will stress trees, which will then release carbon
- Allowing wood to rot in the woods will release more methane than if wood is removed
- It's better for the climate to use wood than steel or cement

<http://www.slideshare.net/dougoh/forest-carbon-climate-myths-presentation/>

3 – Reality: Intact Forests Absorb and Store More Carbon

- **Undisturbed, mature forests in the Northeast are carbon “sinks”**
 - Continuing to absorb and store carbon from atmosphere for 400 years or more¹
- **Large, old trees absorb and store more carbon than small trees**
 - One big tree can absorb as much carbon in a year as is contained in an entire mid-sized tree.²
- **Unlogged northern hardwood forests absorb 39% to 118% more carbon** in trees and vegetation than logged forests³

1. https://www.uvm.edu/giee/pubpdfs/Keeton_2011_Forest_Science.pdf
http://web.natur.cuni.cz/fyziol5/kfrserver/gztu/pdf/Luyssaert_et_al_2008.pdf
2. <http://pubs.acs.org/doi/pdfplus/10.1021/es902647k>
<http://andrewsforest.oregonstate.edu/pubs/pdf/pub4835.pdf>
3. http://www.uvm.edu/giee/pubpdfs/Nunery_2010_Forest_Ecology_and_Management.pdf

3 – Reality: Intact Forests Absorb and Store More Carbon (continued)

- **At least 50% of total ecosystem carbon is stored in soils** in intact northeastern U.S. forests¹
- **Protecting high-biomass forests from logging avoids significant carbon emissions** to the atmosphere.²
- **Eliminating logging on U.S. public lands would increase carbon storage by 43%** over current levels³

1. <http://onlinelibrary.wiley.com/doi/10.1111/gcbb.12221/abstract>
2. <http://www.pnas.org/content/106/28/11635.full.pdf>
3. <http://naldc.nal.usda.gov/download/21039/PDF>

3 – Logging Reduces Carbon Storage

- Old forests that are logged **can take 200 years or more to recover original carbon storage capacity**¹
- Only **~23% of carbon in logged trees ends up in long-term storage**
 - Mostly incorporated into buildings or buried in landfills²
- Wood products **manufacturing discards 45% to 60% of original carbon in trees as waste**
 - Rapidly decomposes or is burned²

1. <http://andrewsforest.oregonstate.edu/pubs/pdf/pub1046.pdf>
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.335.6609&rep=rep1&type=pdf>

2. <http://andrewsforest.oregonstate.edu/pubs/pdf/pub2101.pdf>

3 – Logging Reduces Carbon Storage (continued)

- Cutting and burning a forest for **biomass energy creates a carbon “debt”**
 - **Not offset by regrowth for 20 to 90 years or more**¹
- Logging a forest **quickly releases ~30% of carbon stored in shallow forest floor soils to the atmosphere**²
- Also, the forest’s deeper mineral **soils gradually continue to release carbon after logging**
 - May contribute to climate change over decades³

1. <http://www.mass.gov/eea/docs/doer/renewables/biomass/manomet-biomass-report-full-lorenz.pdf>

2. <http://soilslab.cfr.washington.edu/publications/Nave-et-al-2010-SoilCarbon.pdf>
http://www.nrs.fs.fed.us/pubs/jrnl/2010/nrs_2010_johnson_001.pdf

3. http://www.eurekalert.org/pub_releases/2014-12/dc-ldf120214.php

4 – Progress Toward Protection of Forests to Mitigate Climate Change

- **2010 UN-REDD and REDD+** (Programme on Reducing Emissions from Deforestation and Forest Degradation)¹
- **2013 President’s Climate Action Plan** for the U.S.
– Includes protection of forests²
- **2013 Northeast and Mid-Atlantic RGGI** (Regional Greenhouse Gas Initiative)

1. <http://www.usaid.gov/sites/default/files/documents/1865/2010-USG-SL-REDD-Strategy-Brochure.pdf>
2. <http://www.whitehouse.gov/sites/default/files/image/president27climateactionplan.pdf>

5 – MA Forests: High Carbon Storage Capacity

- High-biomass forests protected from logging **store more carbon, emit less GHG**¹
- New England forests **among highest in U.S. for biomass and carbon density**²
- New England’s **public forests have highest biomass density**³
- **MA has 41% of highest biomass density forests** in New England³
- Protecting MA forests as unlogged reserves **could significantly increase carbon storage**⁴



1. <http://www.pnas.org/content/106/28/11635.long>
2. <http://www.cbmjournals.com/content/pdf/1750-0680-8-1.pdf>
http://www.researchgate.net/profile/Sandra_Brown10/publication/223252799_Spatial_distribution_of_biomass_in_forest_of_the_eastern_USA_Forest_Ecol_Manag/links/542ad48c0cf27e39fa9175a2.pdf
3. <http://www.treeseearch.fs.fed.us/pubs/34576>
4. <http://onlinelibrary.wiley.com/doi/10.1029/2010GB003947/full>
https://www.uvm.edu/giee/pubpdfs/Keeton_2011_Forest_Science.pdf
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3637820/pdf/1750-0680-8-4.pdf>

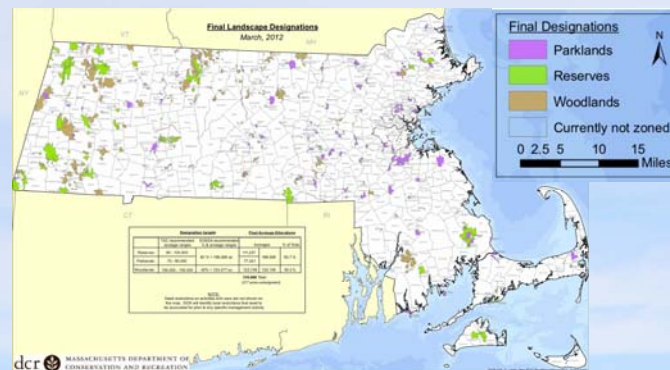
5 – MA Forests: High Carbon Storage Stability

- Major natural disturbances are rare
 - Catastrophic windthrow every **1,000-3,000 years**¹
 - Large-scale fires every **1,000 years** in northern hardwoods²
 - Long-lived species — white pines to **400 years**³



1. <http://www.maforests.org/Lorimer%20and%20White%20-%20ES%20Habitat.pdf>
2. http://harvardforest.fas.harvard.edu/sites/harvardforest.fas.harvard.edu/files/publications/pdfs/Parshall_JBiogeography_2002.pdf
3. <http://bioscience.oxfordjournals.org/content/51/11/967.full>

5 – But: MA Forests Poorly Protected



- Two departments manage most of State's 650,000 acres of public lands: Conservation and Recreation (DCR) (450,000 acres)¹ and Fish and Game (DFG) (200,000 acres)²
 - **Only 29% in Parklands and Reserves currently off-limits to logging** (189,000 acres)³
 - **0% is permanently protected from logging**⁴

1. <http://www.massaudubon.org/our-conservation-work/advocacy/land-advocacy/protecting-forests-parks/massachusetts-state-forests-parks>
2. <http://www.mass.gov/eea/agencies/dfg/dfw/wildlife-habitat-conservation/land-acquisition-and-protection.html>
3. <http://www.mass.gov/eea/docs/dcr/ld/ld-map-final.pdf>
4. <http://www.mass.gov/eea/docs/dcr/ld/acreage.pdf>

6 – Global Warming Solutions Act (GWSA) and MA Forest Management

GWSA¹ (2008) requires the Department of Environmental Protection (DEP) to:

- Publish a **State GHG emissions inventory**²
- Including **biogenic GHG emissions**, such as, “CO₂ from biomass combustion,” “landfill,” “forest sequestration,” and “land use change”

1. (Chapter 298 of Acts of 2008) <https://malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter298>

2. (Ch. 21N, Sec. 2(c)) <http://www.mass.gov/eea/docs/dep/air/climate/ghg10ind.pdf>

6 – GWSA and MA Forest Management

[DEP responsibilities continued]

- Establish statewide GHG **goals that will achieve emission reductions of:**
 - Between **10% and 25%** below statewide 1990 GHG emissions levels by 2020³
 - **80%** below statewide 1990 GHG emission levels by 2050⁴

3. Ch. 21N, Sec. 4(b)

4. Ch. 21N, Sec. 3(b)(4)

6 – GWSA and MA Forest Management

[DEP responsibilities continued]

- **Collaborate with other State agencies to achieve** the GHG emission limits⁵
- **Oversee State agency efforts to address and diminish** the climate change impacts⁶
- **Monitor and regulate emissions** of GHGs with the goal of reducing those emissions⁷
- Ensure GHG emissions sources **maintain comprehensive records** of all reported GHG emissions⁸

5. Sec. 1(f)

6. Sec. 3

7. Ch. 21N, Sec. 2(a)

8. Ch. 21N, Sec. 2(a)(7)

6 – State Agencies Disregarding Public Concerns

- Decisions on public lands logging programs are made primarily by logging advocates, with **little public involvement or responsiveness to public concerns about climate impacts**

6 – Public Subsidizes Climate Damage

- Example: State costs greatly exceed projected State revenues for the **Western Connecticut Valley District logging program**, covering 15,582 acres of land (just 3% of State lands open to logging)

Total projected 10-year logging revenue to State: \$545,820

Total estimated 10-year logging costs to State: \$1,693,000

Total 10-year logging plan loss to State taxpayers: **-\$1,147,180**

- **DCR has not disclosed such information statewide**
- Subsidizing logging, **even though State is cutting agency budgets and reducing access** to public land
- Management plan, updated in 2015, **provides no data showing how its logging program complies with the GWSA**

Western Connecticut Valley District Forest Resource Management Plan Draft Update, Department of Conservation and Recreation
Division of State Parks and Recreation, July 30, 2015
<http://www.mass.gov/eea/docs/dcr/stewardship/forestry/manage/wcv-resource-management-final.pdf>

7 – Recommendations for MA

1. Immediately reinstate the moratorium on logging on State lands until actions below are completed
2. Immediately institute a moratorium on logging on municipal watershed and other forest lands until actions below are completed
3. Immediately remove State incentives for wood burning
4. Ensure regulatory compliance of public agencies with the GWSA, regarding climate impacts of logging
5. Provide the public with a comprehensive comparison of the costs and benefits of forest preservation with those of forest logging – both financial and non-financial
6. Involve climate scientists and the public in decisions on the administration of public lands
7. Explore the potential for creating a system of permanent, publicly-owned forest preserves

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