Climate, Carbon and Resilience

Presented by the Land for Maine's Future Board

Land for Maine's Future LMF

1

Day 1 Agenda

Opening Speakers

- **Sarah Demers,** Director Land for Maine's Future Program
- **Bob Marvinney,** Director Bureau of Resource Information & Land Use Planning, DACF, Co-Chair of Science & Technical Sub-committee, ME Climate Council
- **Amanda Beal/Tom Abello**, Co-Chairs of Natural and Working Lands Sub-committee of the ME Climate Council
- **Ivan Fernandez,** UMaine Distinguished Maine Professor, Climate Change Institute & School of Forest Resources, Co-Chair of Science & Technical Sub-committee, ME Climate Council
- **Questions**
- **Break**

Data & Tools

- TNC Terrestrial Resiliency Data - Mark Anderson
- Sea Level Rise & Coastal Hazards, Marsh Migration, Coastal Resiliency - Pete Slovinsky/Kristen Puryear/Jeremy Bell
- Carbon Sequestration - Forests, Farms and Marine ecosystems - Bev Johnson/Mark Berry/ Adam Daigneault
- **Questions**
- **Introduction to Day 2**

2

LMF Climate, Carbon and Resilience Workshop Objectives

- Overview of climate science & Maine goals
- Learn about tools for conservation planning
- Understand how partners are using science & tools to inform priorities and management
- Brainstorm how LMF can further state climate goals

3

Land for Maine's Future
Climate, Carbon, Resilience

Current State of Climate Science

Robert G. Marvinney
Science and Technical Committee Co-chair

4

Outline

- Maine's Climate Goals
- Science and Technical Subcommittee of the Maine Climate Council
  - Process
  - Report
- Considerations for LMF

5

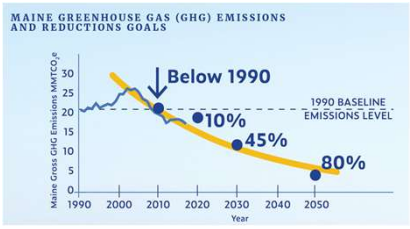
Maine's Climate Goals

Create a Climate Action Plan that:

Achieves carbon neutrality by 2045.

Reduces GHG emissions by 45% and 80% respectively in 2030 and 2050 below 1990 levels.

Ensures Maine people, industries, and communities are resilient to the impacts of climate change.



6

Science and Technical Subcommittee

28 Members from academic institutions, government, and the private sector.

Met on 8 occasions in 2019-2020.

Created a Phase 1 report in January 2020 that provided snapshots of climate status and forecasts for use by MCC Working Groups.

Finalized a report in September 2020 with assistance from more than 50 State and regional scientists.

7

Report Topics:

Climate
Hydrology
Fresh Water Quality
Ocean Temperature
Sea-level Rise, Storm Surge
Ocean Acidification
Marine Ecosystems
Biodiversity
Forestry and Forest Ecosystems
Agriculture and Food Systems
Maine's Economy

https://climatecouncil.maine.gov/reports

8

Key deliverables from the Scientific and Technical Subcommittee in this report include:

- A summary of climate change's impacts across the State and to Maine's human and animal health, economy, and forest and agricultural systems,
- Sea level rise projections to 2100,
- An initial estimate of the contribution of Maine's forests to the state's annual carbon budget,
- Identification of priority information and data gaps about conditions in or for Maine, and
- Identification of methods to build resilience to direct and indirect effects of climate change for the State's species.

9

Intersections with LMF: Biodiversity

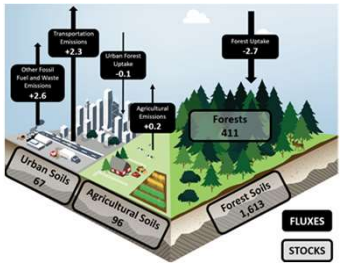
Iconic Maine species are experiencing multiple threats from climate change, including:

- shifting winter ice cover;
- shorter winters with less deep snow;
- a rapid expansion of pests;
- heat stress;
- lack of cold water refugia.

10

Maine Forest's Importance to State's Annual Carbon Budget

Carbon Pool	% of State's Annual Fossil Fuel Emission
Forest carbon stocks + annual growth	60%
Forest products	15%
Total forestry sector	75%
Net Land Sink	78%



11

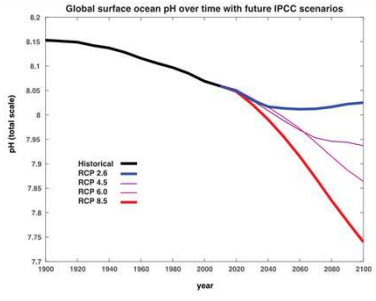
Ocean Acidification

Since 1800, the world's surface ocean pH has decreased from 8.2 to 8.1.

By 2100, ocean pH is expected to drop by 0.05-0.33 pH units.

Ocean and coastal acidification will most heavily impact those marine organisms that produce calcium carbonate to build shells.

Coastal acidification is impacted by inland activities that contribute nutrients to river discharge.



12

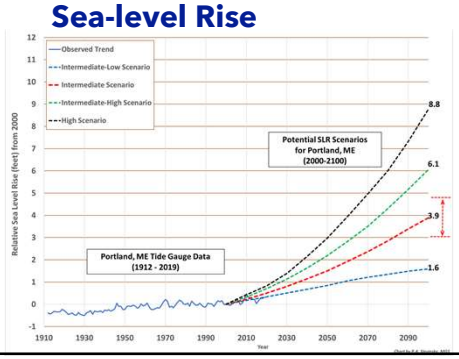
Sea-level Rise

Potential SLR scenarios for Portland.

Dashed lines represent the 50% probability of being met or exceeded under each scenario.

The intermediate-low scenario has a 73% and 96% probability of being exceeded in relation to RCPs 4.5 and 8.5, respectively.

Scenario data from the U.S. Army Corps of Engineers Sea Level Change Calculator (2019).



13

Sea-level Rise Policy Recommendation

1. Commit to manage for a likely range of sea-level rise associated with the intermediate scenario.

- Sea level may rise between 1.1 and 1.8 feet by 2050, and potentially between 3.0 and 4.6 feet by 2100.

2. Prepare to manage for a likely range of sea level rise associated with the high scenario.

- Sea level may rise between 2.6 and 3.2 feet by 2050, and potentially between 7.7 and 9.3 feet by 2100.

14

Possible LMF opportunities

Projects that improve habitat/connectivity for threatened species, thereby reducing other stressors.

Projects that maintain/improve carbon sequestration in forests and agricultural lands.

Projects that reduce nutrient loading to coastal waters.

Consideration of potential sea-level rise impacts on coastal and working waterfront projects.

Projects that provide space for salt marshes to migrate inland.

15


Questions?
Robert G. Marvinney, State Geologist
Science the Technical Subcommittee
robert.g.marvinney@maine.gov
207-287-2804

16


Maine Climate Council
Natural and Working Lands Working Group
Co-chairs Amanda Beal and Tom Abello

17


Natural & Working Lands Working Group Members
Co-chairs: Commissioner Amanda Beal, Department of Agriculture, Conservation and Forestry
& Tom Abello, Governor's Office
Senator Cathy Breen, Maine State Legislature
Representative Mary Anne Kinney, Maine State Legislature
Doug Baston, Town of Alna
Mark Berry, The Nature Conservancy
Hannah Carter, University of Maine
Phillip DeMaynadier, Maine Department of Inland Fisheries and Wildlife
Tom Doak, Maine Woodland Owners
Molly Docherty, Maine Department of Agriculture, Conservation and Forestry
Eliza Donoghue, Maine Audubon
Dana Doran, Professional Logging Contractors of Maine
Maureen Drouin, Maine Conservation Voters
Ivan Fernandez, University of Maine
Ellen Griswold, Maine Farmland Trust
Juan Hernandez, USDA Natural Resources Conservation Service
Ruby Jovin, Grace Pond Farm
Melissa Law, Bumbleroot Organic Farm
Ellen McAdam, McDougal Orchards
Heather Spalding, Maine Organic Farmers and Gardeners Association
Pat Strauch, Maine Forest Products Council
Carol Weymouth, Maine Association of Conservation Districts
Dave Struble, Maine Forest Service (retired)
Karin Tilberg, Forest Society of Maine
Nate Webb, Maine Department of Inland Fisheries and Wildlife
Andy Whitman, Manomet

18

Natural + Working Lands Working Group

Working Group Process

1. Held monthly Working Group meetings and additional sub-group meetings (November 2019 to June 2020)
2. Extraordinary participation and engagement by Working Group members and the public
3. 2-week public comment period was open in May
   - 93 comments received
   - All WG members reviewed comments and determined what to incorporate into NWL strategies

19

Community and Economic Resilience Opportunities

Natural climate solutions can be good business for Maine

Our natural and working lands are the base for multiple sectors of our economy, including agriculture, forestry, outdoor recreation and tourism

Forests, farmlands, and natural areas (including wetlands) provide essential ecosystem services such as carbon sequestration, drinking water protection, flood hazard protection, and wildlife habitat

20

CLIMATE CHANGE OPPORTUNITIES

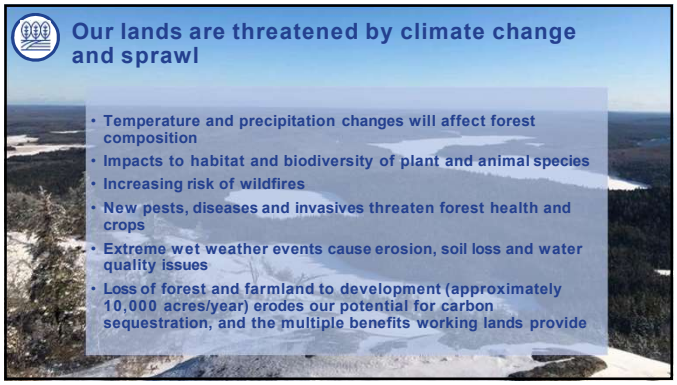
Sequester more carbon and offset Maine's emissions

Time-tested methods both effective and save $

Active management of forest/ag land for climate outcomes will bring Maine closer to its goal of carbon neutrality

Currently, Maine's working forests, natural lands and agricultural lands are estimated to capture ~13 million metric tons of CO2e per year, or 75% of Maine's GHG emissions.

21


Our lands are threatened by climate change and sprawl
• Temperature and precipitation changes will affect forest composition
• Impacts to habitat and biodiversity of plant and animal species
• Increasing risk of wildfires
• New pests, diseases and invasives threaten forest health and crops
• Extreme wet weather events cause erosion, soil loss and water quality issues
• Loss of forest and farmland to development (approximately 10,000 acres/year) erodes our potential for carbon sequestration, and the multiple benefits working lands provide

22


Natural & Working Lands Strategies
• STRATEGY #1 Conserve working and natural lands and waters through a dedicated, sustained funding source to support a robust forest products and agricultural economy, increase carbon storage opportunities, avoid future emissions, and enhance climate adaptation and resilience
• STRATEGY #2 Create new and update existing financial incentives and support for private land management and infrastructure that supports climate mitigation and adaptation
• STRATEGY #3 Provide technical assistance on natural climate solutions to landowners, land managers, and agricultural producers
• STRATEGY #4 Update and refocus state programs and policies to address climate mitigation and resilience
• STRATEGY #5 Strengthen research and development, and monitoring of climate mitigation and adaptation practices

23


STRATEGY #1 Protect and conserve working and natural lands and waters through a dedicated, sustained funding source to support a robust forest products and agricultural economy, increase carbon storage opportunities, avoid future emissions, and enhance climate adaptation and resilience
• Maintain Working Lands
• Invest in Natural Resource Based Economy
• Conserve valuable habitats
75% of Maine's emissions are captured by forests, natural and agricultural lands annually

24

STRATEGY #2 Create new and update existing financial incentives and support for private land management and infrastructure that supports climate mitigation and adaptation

- Capture more carbon on small woodlots
- Update current use tax policy
- Support for forestry and agriculture best management practices
- High-efficiency wood heating systems using wood fuels that produce the lowest possible carbon emissions
- "Wildlife-friendly" infrastructure for road crossings and bridges
- Investment in local food systems

93% of land in Maine is privately owned

25

STRATEGY #3 Provide technical assistance on natural climate solutions to landowners, land managers, and agricultural producers

- Outreach to landowners and land managers
- Encourage climate-friendly practices
- Coordinate with service-providers

26

STRATEGY #4 Update and refocus state programs and policies to address climate mitigation and resilience

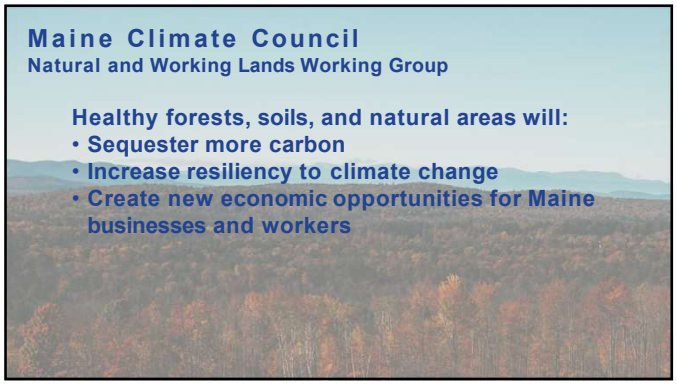
- Lead by example
- Effective environmental review and permitting
- Coordinated land use planning to address climate issues
- Marketing innovative wood-based technology
- Education and outreach

"Maine people are working to break the cycle, and state government will lead by example. Wherever possible, we will make buildings more energy efficient and we will tap into renewable energy, helping us fight climate change and saving taxpayer money in the long-run." – *Gov Janet Mills*

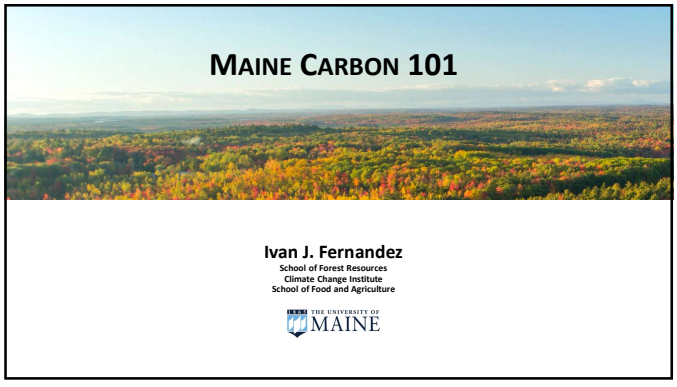
27


STRATEGY #5 Strengthen research and development, and monitoring of climate mitigation and adaptation practices
• We can't manage what we don't measure
• Better metrics for carbon sequestration from natural and working lands
• Research on carbon mitigation and resiliency

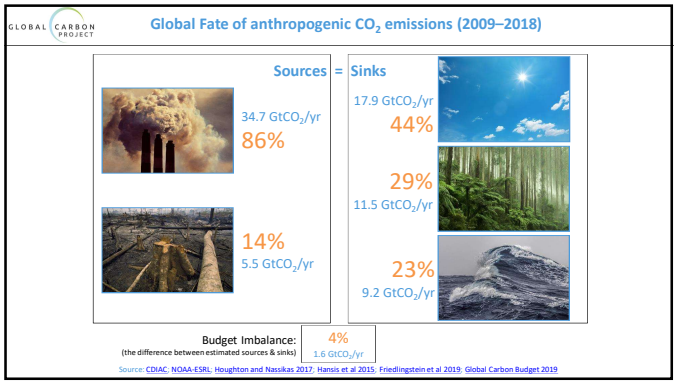
28


Maine Climate Council
Natural and Working Lands Working Group
Healthy forests, soils, and natural areas will:
• Sequester more carbon
• Increase resiliency to climate change
• Create new economic opportunities for Maine businesses and workers

29


MAINE CARBON 101
Ivan J. Fernandez
School of Forest Resources
Climate Change Institute
School of Food and Agriculture
THE UNIVERSITY OF MAINE

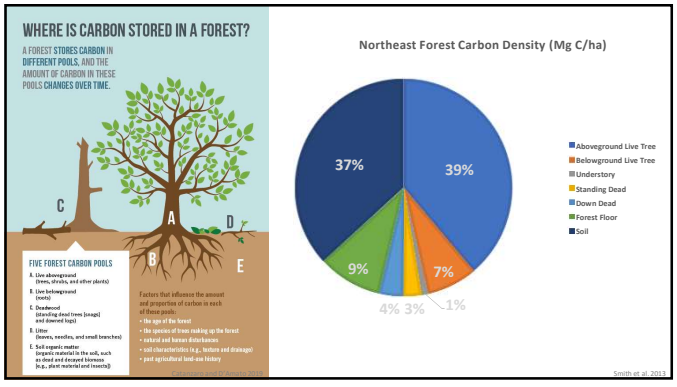
30


GLOBAL CARBON PROJECT
Global Fate of anthropogenic CO_2 emissions (2009–2018)
Sources = Sinks
34.7 $GtCO_2$/yr
86%
14%
5.5 $GtCO_2$/yr
17.9 $GtCO_2$/yr
44%
29%
11.5 $GtCO_2$/yr
23%
9.2 $GtCO_2$/yr
Budget Imbalance:
(the difference between estimated sources & sinks)
4%
1.6 $GtCO_2$/yr
Source: CDIAC; NOAA-ESRL; Houghton and Nassikas 2017; Hansis et al 2015; Friedlingstein et al 2019; Global Carbon Budget 2019

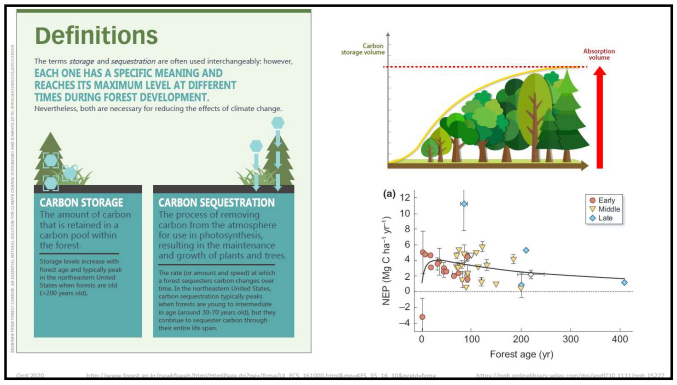
31


Forest Carbon

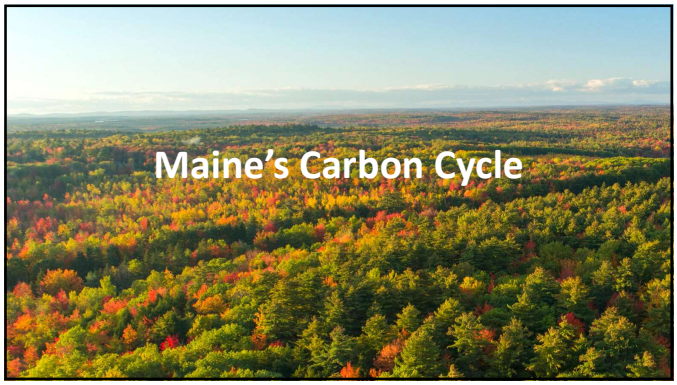
32


WHERE IS CARBON STORED IN A FOREST?
A FOREST STORES CARBON IN DIFFERENT POOLS, AND THE AMOUNT OF CARBON IN THESE POOLS CHANGES OVER TIME.
A
B
C
D
E
FIVE FOREST CARBON POOLS
A. Live aboveground (trees, shrubs, and other plants)
B. Live belowground (roots)
C. Deadwood (standing dead trees [snags] and downed logs)
D. Litter (leaves, needles, and small branches)
E. Soil organic matter (organic material in the soil, such as dead and decayed biomass [e.g., plant material and insects])
Factors that influence the amount and proportion of carbon in each of these pools:
• the age of the forest
• the species of trees making up the forest
• natural and human disturbances
• soil characteristics (e.g., texture and drainage)
• past agricultural land-use history
Northeast Forest Carbon Density (Mg C/ha)
37%
39%
9%
7%
4%
3%
1%
Aboveground Live Tree
Belowground Live Tree
Understory
Standing Dead
Down Dead
Forest Floor
Soil
Smith et al. 2014

33



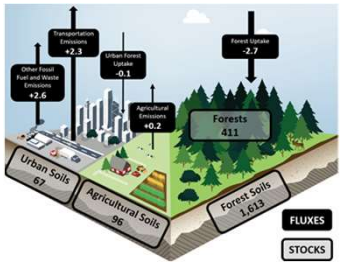
34



35

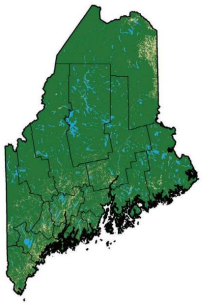
Maine Forest's Contribution to Maine's Annual Carbon Budget

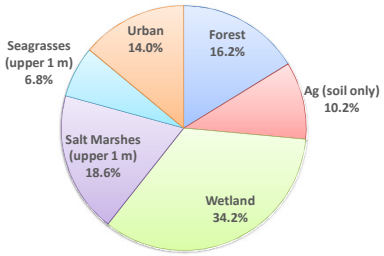
Carbon Sinks	% of State's Annual Fossil Fuel Emission
Forest carbon stocks + annual growth	60%
Forest products	15%
Total forestry sector	75%
Net Land Sink	78%



36

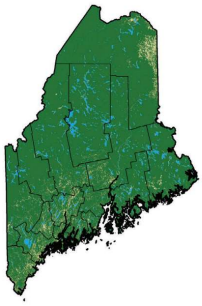
Maine Carbon Density by Land Use (Mg C/acre)

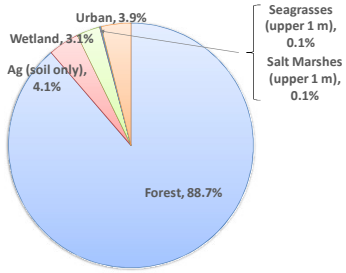




37

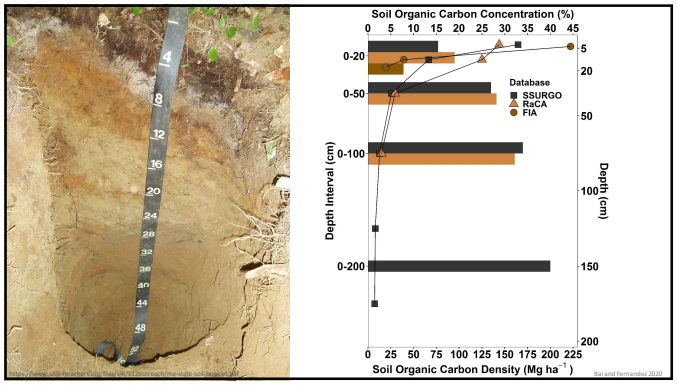
Maine Carbon Storage by Land Use (Mg C)





38

39



40

CLOSING THOUGHTS

Regarding Maine forest carbon…

1. **…don't ruin a good thing,**
2. **…unique moment in time for investment in our forests,**
3. **…value the full spectrum of ecosystem services,**
4. **…build carbon opportunities on the best available science,**
5. **…recognize that our forests are changing, and**
6. **…business as usual is not an option.**

41

42

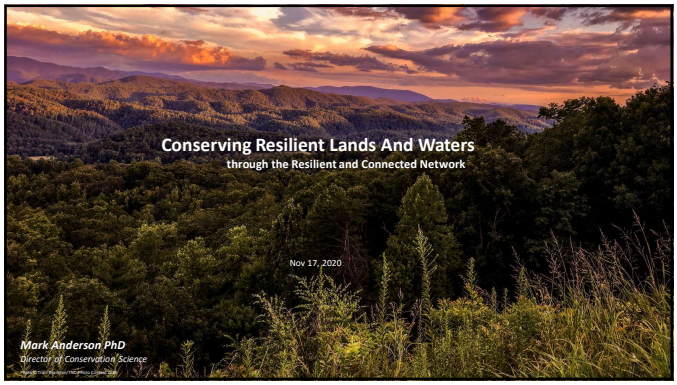
Climate, Carbon and Resilience

Presented by the Land for Maine's Future Board

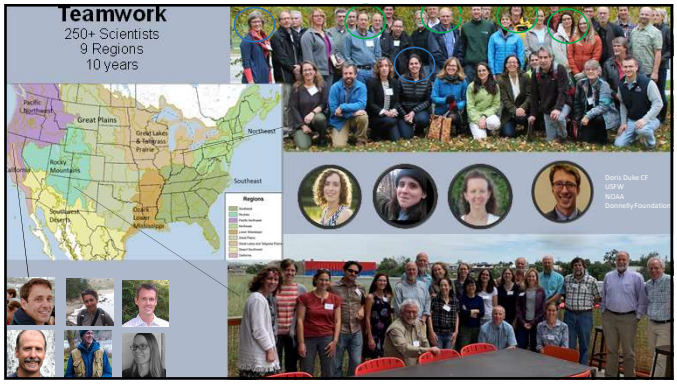
Land for Maine's Future

LMF

43



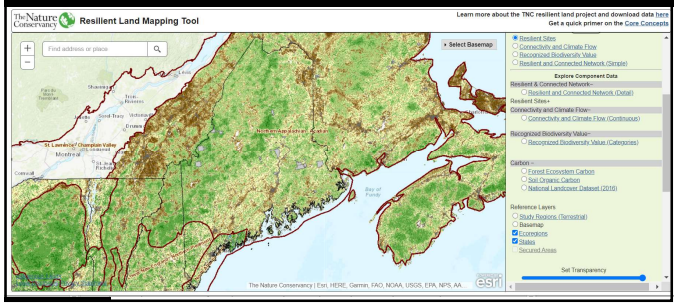
44



45

Resilient Land Mapping Tool

maps.tnc.org/resilientland



46

Abundance crisis

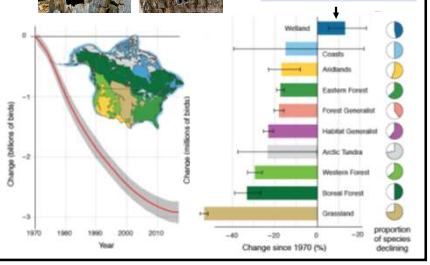
Native Species
Biomass down 20%/1900

Amphibians
30% now T&E

Butterflies
Abundance down 35%/40yr

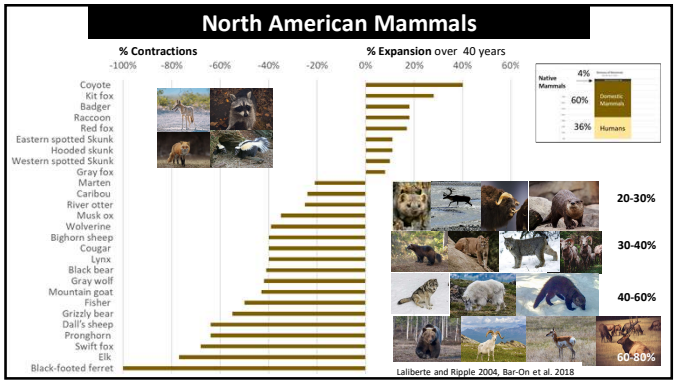
NA Birds
Abundance down 29%
or 3 Billion birds since 1970

Wetland Birds Up
Thanks to Adaptive Harvest Management and billions $ on wetland protection and restoration



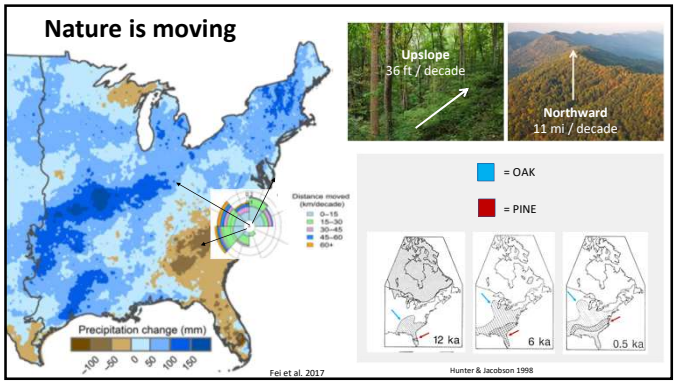
47

North American Mammals

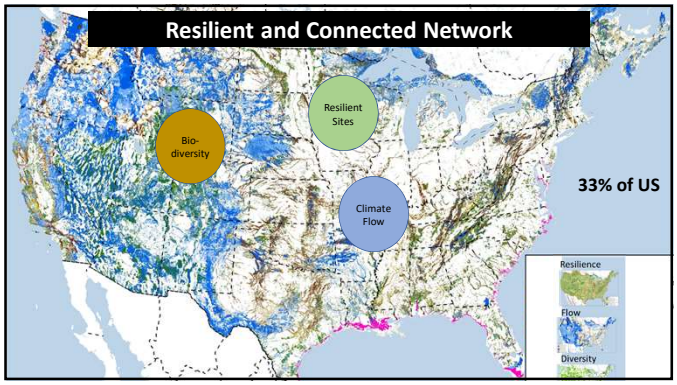


Laliberte and Ripple 2004, Bar-On et al. 2018

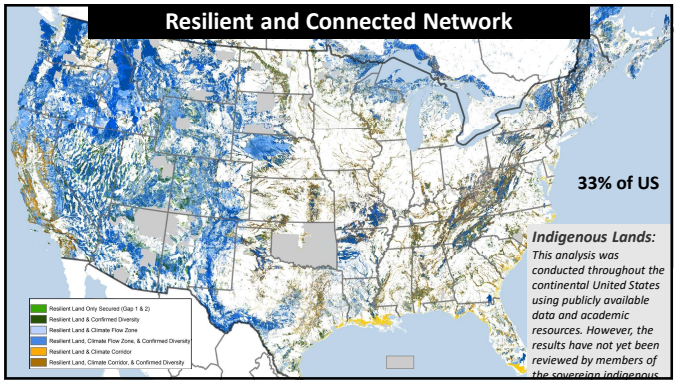
48


Nature is moving
Upslope
36 ft / decade
Northward
11 mi / decade
= OAK
= PINE
12 ka
6 ka
0.5 ka
Precipitation change (mm)
Fei et al. 2017
Hunter & Jacobson 1998

49


Resilient and Connected Network
Bio-diversity
Resilient Sites
Climate Flow
33% of US
Resilience
Flow
Diversity

50


Resilient and Connected Network
33% of US
Indigenous Lands:
This analysis was conducted throughout the continental United States using publicly available data and academic resources. However, the results have not yet been reviewed by members of the sovereign indigenous

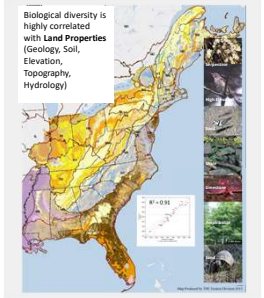
51

Conserving Nature's Stage

REPRESENTATION

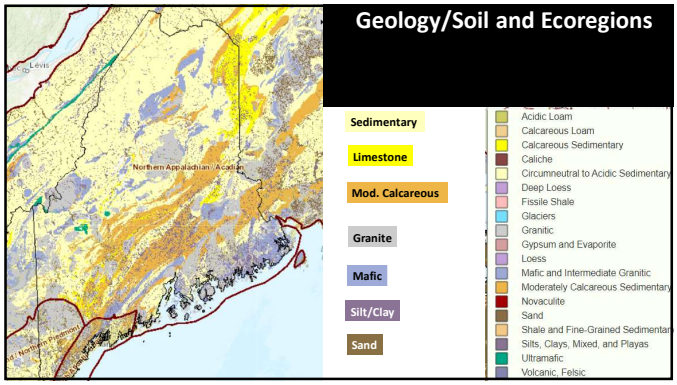
RESILIENCE

Biological diversity is highly correlated with **Land Properties** (Geology, Soil, Elevation, Topography, Hydrology)



52

Geology/Soil and Ecoregions

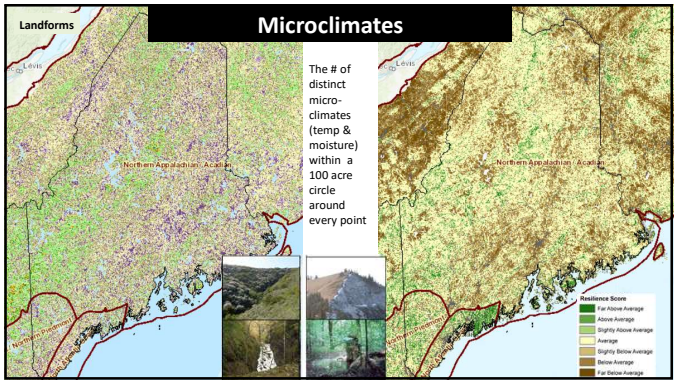


53

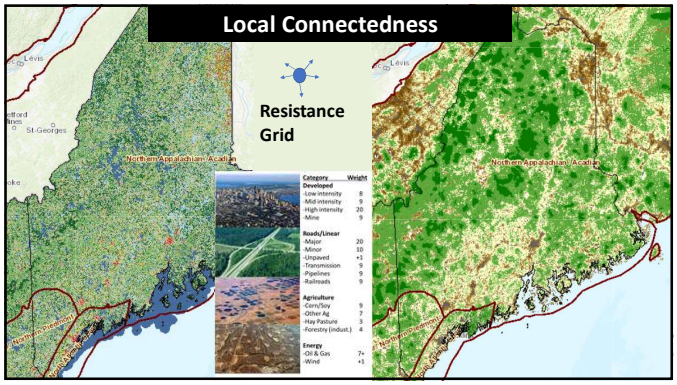
Microclimates

Landforms

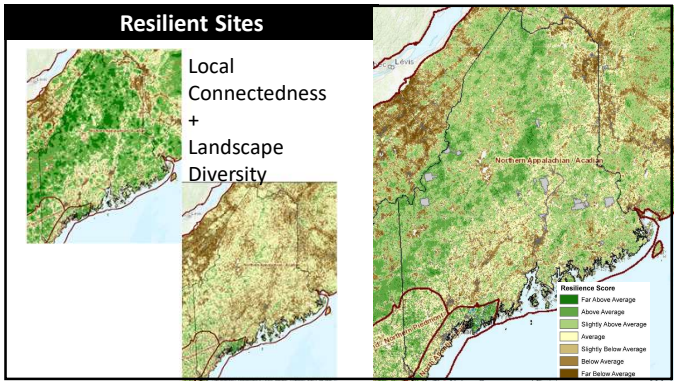
The # of distinct micro-climates (temp & moisture) within a 100 acre circle around every point



54


Local Connectedness
Resistance Grid
Northern Appalachian/Acadian
Northern Appalachian/Acadian

55

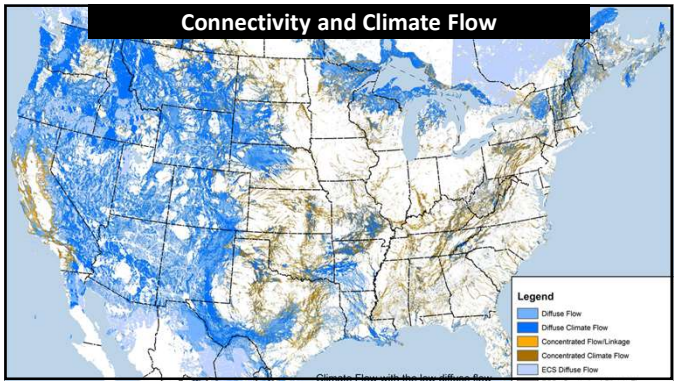

Resilient Sites
Local Connectedness + Landscape Diversity
Northern Appalachian/Acadian
Resilience Score
Far Above Average
Above Average
Slightly Above Average
Average
Slightly Below Average
Below Average
Far Below Average

56


Conserving Nature's Stage Resilient Sites
where Nature can Persist and Thrive
Resilience & Representation based on Soils, Geology, Topography, Microclimates Human Modification
Resilience Score
Far Above Average
Above Average
Slightly Above Average
Average
Slightly Below Average
Below Average
Far Below Average

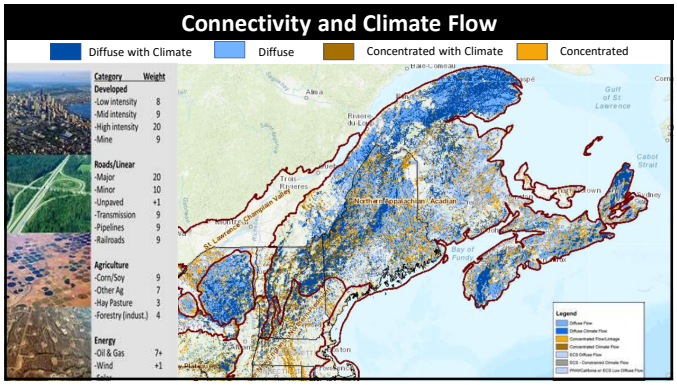
57

Connectivity and Climate Flow



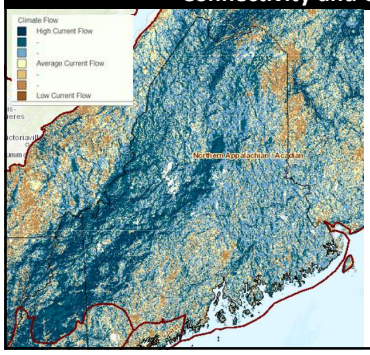
58

Connectivity and Climate Flow

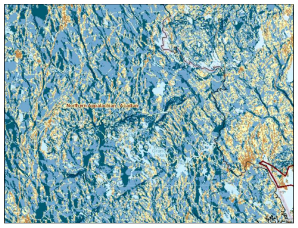


59

Connectivity and Climate Flow



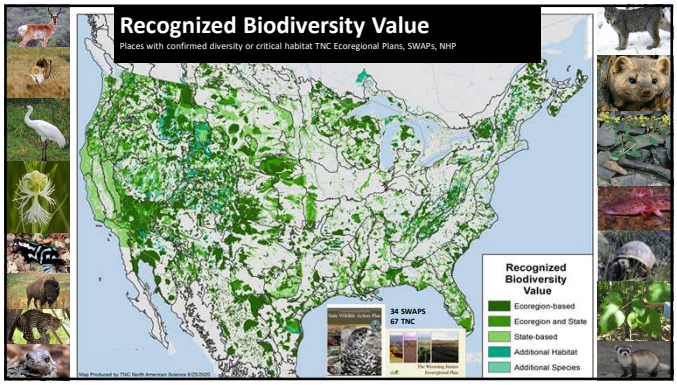
Continuous Version has a lot of useful Detail



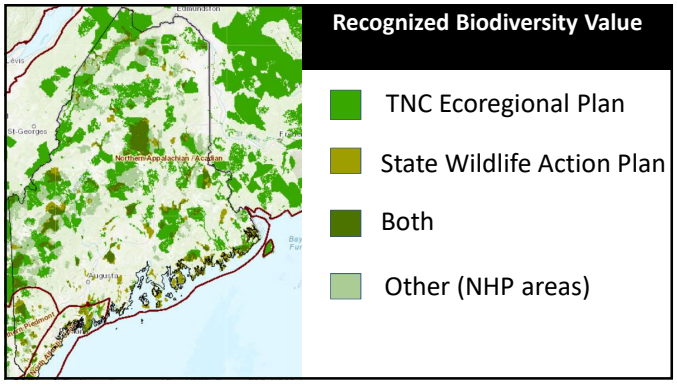
60


Recognized
Biodiversity
Value

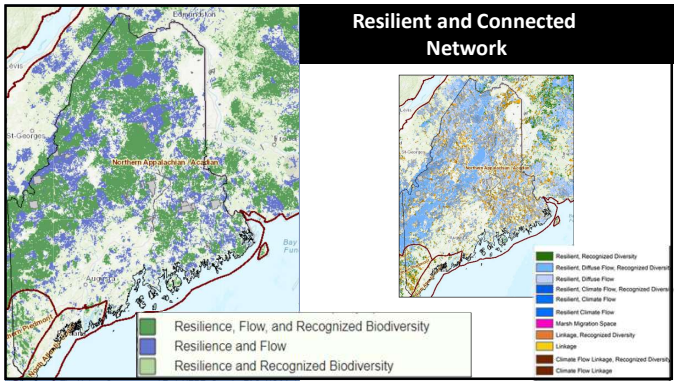
61


Recognized Biodiversity Value
Places with confirmed diversity or critical habitat TNC Ecoregional Plans, SWAPs, NHP
Recognized Biodiversity Value
Ecoregion-based
Ecoregion and State
State-based
Additional Habitat
Additional Species
34 SWAPS
67 TNC

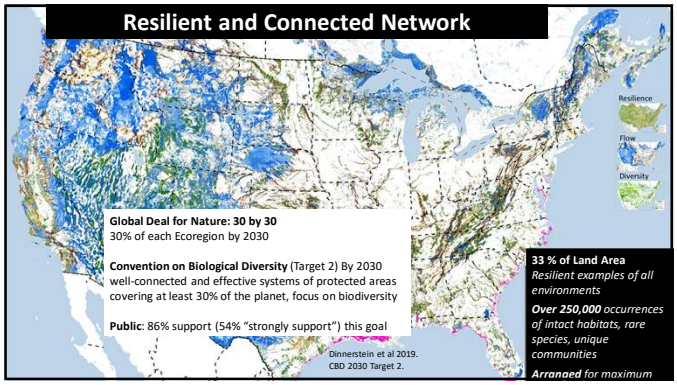
62


Recognized Biodiversity Value
TNC Ecoregional Plan
State Wildlife Action Plan
Both
Other (NHP areas)

63


Resilient and Connected Network
Resilience, Flow, and Recognized Biodiversity
Resilience and Flow
Resilience and Recognized Biodiversity

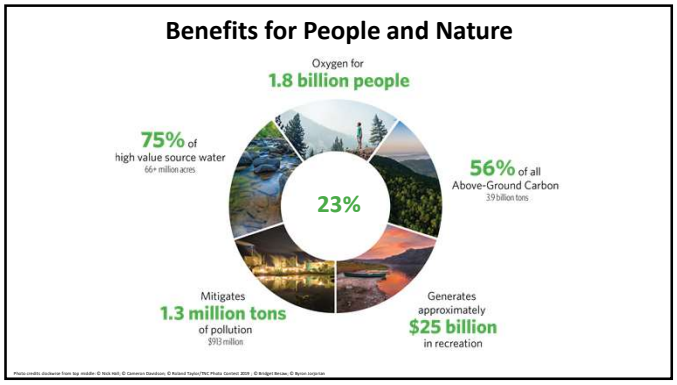
64


Resilient and Connected Network
Resilience
Flow
Diversity
Global Deal for Nature: 30 by 30
30% of each Ecoregion by 2030
Convention on Biological Diversity (Target 2) By 2030 well-connected and effective systems of protected areas covering at least 30% of the planet, focus on biodiversity
Public: 86% support (54% "strongly support") this goal
Dinnerstein et al 2019.
CBD 2030 Target 2.
33 % of Land Area
Resilient examples of all environments
Over 250,000 occurrences of intact habitats, rare species, unique communities
Arranged for maximum

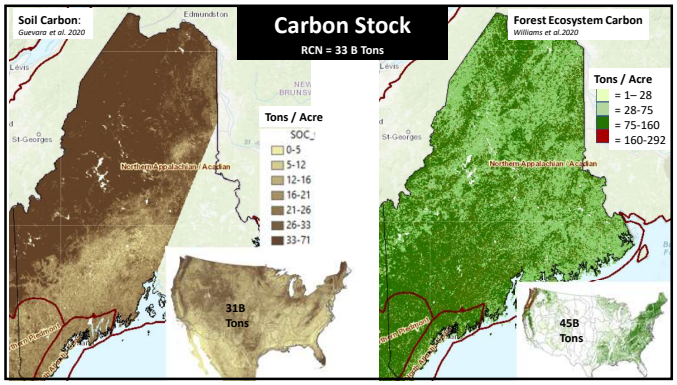
65


OUR CHALLENGE
Accelerate the pace and scale of conservation and conserve a representative network of resilient, connected lands and waters that will allow nature to adapt to climate change.

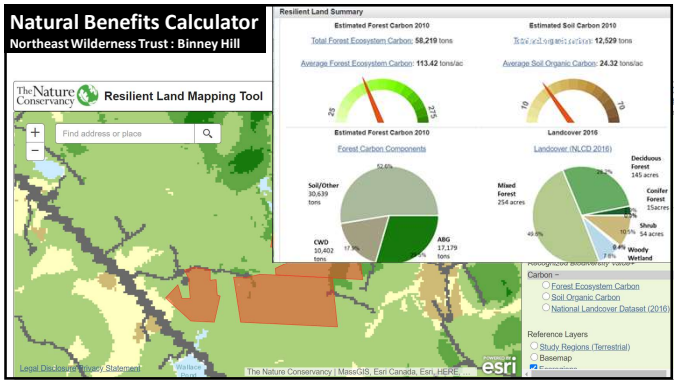
66


Benefits for People and Nature
Oxygen for
1.8 billion people
75% of
high value source water
66+ million acres
56% of all
Above-Ground Carbon
39 billion tons
23%
Mitigates
1.3 million tons
of pollution
$93 million
Generates
approximately
$25 billion
in recreation

67

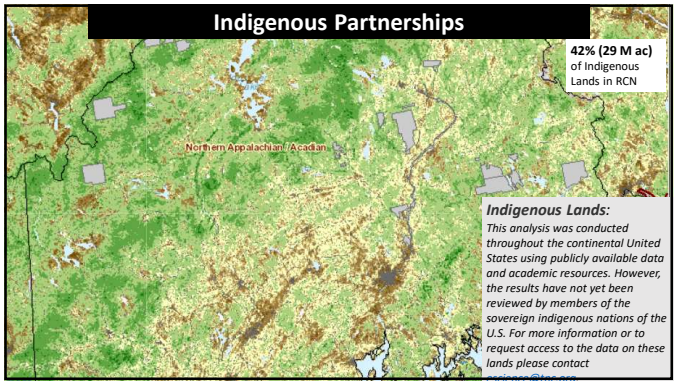

Soil Carbon:
Guevara et al. 2020
Carbon Stock
RCN = 33 B Tons
Forest Ecosystem Carbon
Williams et al.2020
Tons / Acre
SOC
0-5
5-12
12-16
16-21
21-26
26-33
33-71
Tons / Acre
= 1– 28
= 28-75
= 75-160
= 160-292
Northern Appalachian / Acadian
31B
Tons
45B
Tons

68


Natural Benefits Calculator
Northeast Wilderness Trust : Binney Hill
The Nature Conservancy
Resilient Land Mapping Tool
Find address or place
Resilient Land Summary
Estimated Forest Carbon 2010
Total Forest Ecosystem Carbon: 58,219 tons
Average Forest Ecosystem Carbon: 113.42 tons/ac
Estimated Soil Carbon 2010
Average Soil Organic Carbon: 24.32 tons/ac
Forest Carbon Components
Soil/Other
30,639
tons
CWD
10,402
tons
ABG
17,179
tons
Landcover 2016
Landcover (NLCD 2016)
Deciduous Forest
145 acres
Mixed Forest
254 acres
Coniferous Forest
15acres
Shrub
54 acres
Woody Wetland
Carbon
Forest Ecosystem Carbon
Soil Organic Carbon
National Landcover Dataset (2016)
Reference Layers
Study Regions (Terrestrial)
Basemap
Legal Disclosure | Privacy Statement
The Nature Conservancy | MassGIS, Esri Canada, Esri, HERE
esri

69

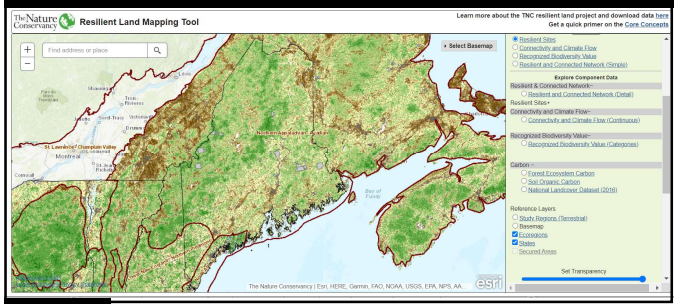
Indigenous Partnerships



70

Resilient Land Mapping Tool

maps.tnc.org/resilientland



71

Case Studies

Innovative ways Land Trusts have been using Resilience Science

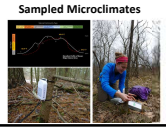
Open Space Institute
Resilient Landscape Initiative

USFW: Microclimate Walk

MA Audubon: Losing Ground Report

North Quabbin Regional Landscape Partnership
Set Priorities

Students: VT TNC Sampled Microclimates

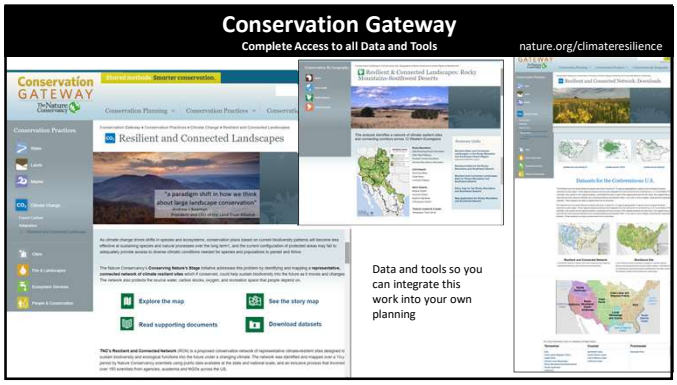


State Wildlife Action Plans

Restoration: Red Spruce

The key seems to be working this information into your own planning process

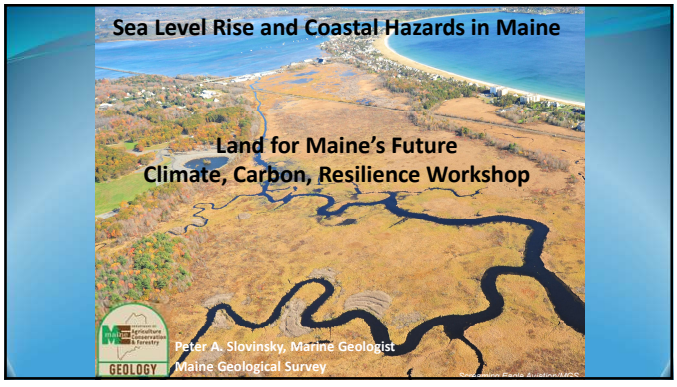
72


Conservation Gateway
Complete Access to all Data and Tools
nature.org/climateresilience
Resilient and Connected Landscapes
Explore the map
See the story map
Read supporting documents
Download datasets
Data and tools so you can integrate this work into your own planning

73

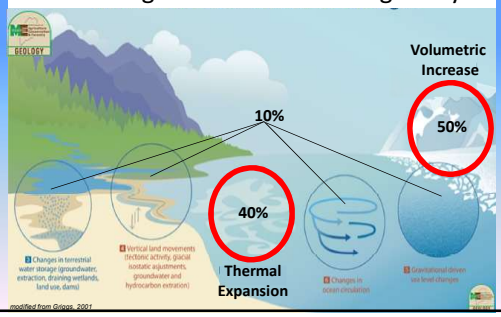

Questions?

74


Sea Level Rise and Coastal Hazards in Maine
Land for Maine's Future
Climate, Carbon, Resilience Workshop
Peter A. Slovinsky, Marine Geologist
Maine Geological Survey
GEOLOGY

75

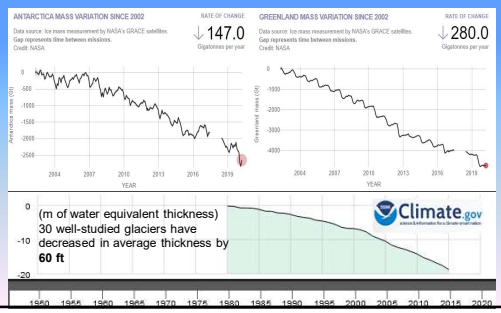
What causes the **global and regional** sea level changes that we are seeing today?



76

Global Sea Level Rise Driving Factors:

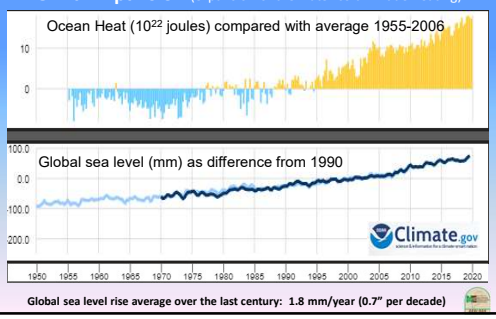
Volumetric Increase (melting of land-based ice sheets and glaciers)



77

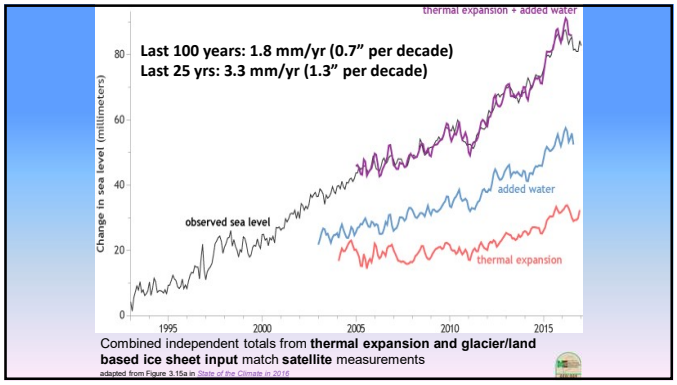
Global Sea Level Rise Driving Factors:

Thermal Expansion (expansion of the water column due heating)

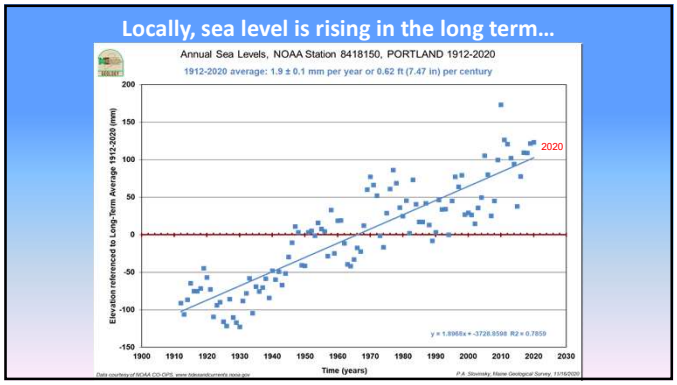


Global sea level rise average over the last century: 1.8 mm/year (0.7" per decade)

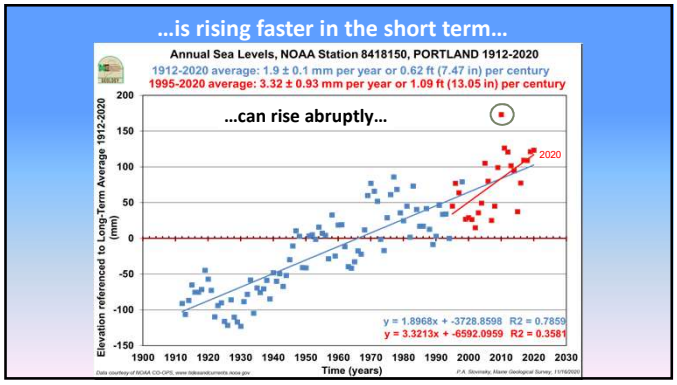
78


thermal expansion + added water
Last 100 years: 1.8 mm/yr (0.7" per decade)
Last 25 yrs: 3.3 mm/yr (1.3" per decade)
Change in sea level (millimeters)
observed sea level
added water
thermal expansion
Combined independent totals from thermal expansion and glacier/land based ice sheet input match satellite measurements
adapted from Figure 3.15a in State of the Climate in 2016

79

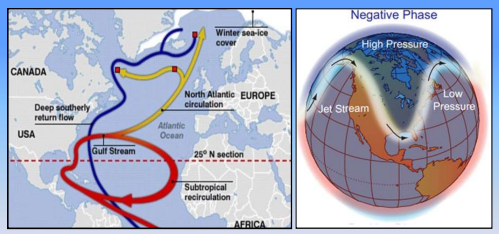

Locally, sea level is rising in the long term…
Annual Sea Levels, NOAA Station 8418150, PORTLAND 1912-2020
1912-2020 average: 1.9 ± 0.1 mm per year or 0.62 ft (7.47 in) per century
Elevation referenced to Long-Term Average 1912-2020 (mm)
2020
Time (years)

80


…is rising faster in the short term…
Annual Sea Levels, NOAA Station 8418150, PORTLAND 1912-2020
1912-2020 average: 1.9 ± 0.1 mm per year or 0.62 ft (7.47 in) per century
1995-2020 average: 3.32 ± 0.93 mm per year or 1.09 ft (13.05 in) per century
…can rise abruptly…
Elevation referenced to Long-Term Average 1912-2020 (mm)
2020
y = 1.8968x + -3728.8598 R2 = 0.7859
y = 3.3213x + -6592.0959 R2 = 0.3581
Time (years)

81

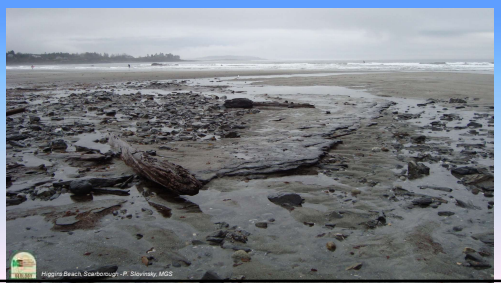
Sea level can change abruptly due to changes in the Gulf Stream and North Atlantic Oscillation



Maine tide gauges saw an **average of approximately 5" higher than normal tides, especially in winter of 2010**. This was the **highest *along the whole east coast***.

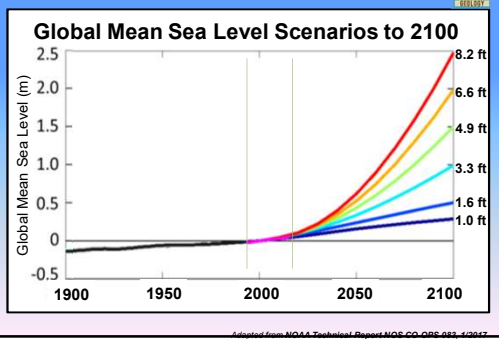
82

In 2010, **higher than normal sea levels combined with storms** led **to high levels of beach and bluff erosion.**



83

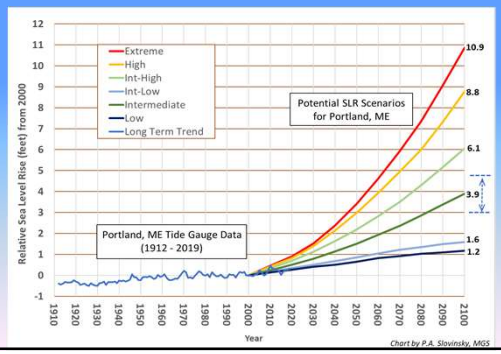
Sea level is expected to *continue to rise...*



Adapted from NOAA Technical Report NOS CO-OPS 083, 1/2017

84

…and in Maine, could potentially rise *higher than* global averages.



85

Central Estimates for *low to extreme* sea level rise scenarios for Maine

Year	Scenario (Central Estimate, 50% probability of being met or exceeded)					
	Low	Int-Low	Interm	Int-High	High	Extreme
2030	0.4	0.5	0.8	1.1	1.4	1.5
2050	0.7	0.9	1.5	2.2	3.0	3.4
2070	0.9	1.2	2.4	3.5	5.0	6.0
2100	1.2	1.6	3.9	6.1	8.8	10.9

From the year 2000. Includes vertical land motion of -0.16 mm/yr at Portland, ME per NOAA Tech Rpt 065

From STS (2020) Figure 5, p. 81.

86

Recommended SLR Scenario Central Estimates for Planning in Maine

Planning Scenario	"Commit to Manage"	"Prepare to Manage"
Year	Intermediate Scenario	High Scenario
2030	0.8	1.4
2050	1.5	3.0
2070	2.4	5.0
2100	3.9	8.8

Relative Sea Level Rise (feet) from 2000

STS (2020) Table 7b, p. 83.

87

Probability of Exceedance of Central Estimates for the SLR Scenarios in relation to Representative Concentration Pathways (RCPs)

Sea Level Rise Scenario	RCP 4.5	RCP 8.5
Low	98%	100%
Int-Low	73%	96%
Intermediate	**3%**	**17%**
Int-High	0.5%	1.3%
High	**0.1%**	**0.3%**
Extreme	0.05%	0.1%

From Kopp et al. (2014)

88

"Nuisance" flooding along Maine's coast **is increasing. Only 1 foot of sea level rise** will increase current nuisance flooding **by 15-fold in Portland.**

89

Sea Level Rise will also **increase the impacts of storms** in terms of **magnitude and annual probability of occurrence**

Recurrence Interval	% Annual Chance	Storm Tide (ft, MLLW)
1	100%	11.7
5	20%	12.6
10	10%	12.9
25	4%	13.4
50	2%	13.7
100	1%	14.1

~1 foot difference

90

Sea level rise will **increase static and dynamic flood hazards at our working waterfront infrastructure.**

91

Currently, **less than 20 miles of** private and public roads **are at-risk to monthly tidal flooding**

With 3.9 feet of SLR, over <u>150 miles of roads</u> could be at-risk during higher tides

92

About 43% of the dry beach width of Maine's beaches could be lost with 1.6 feet of SLR and 75% with 3.9 feet of SLR*.

* STS Table 15, p. 98

93

With 1.6 feet of SLR, about 60% of Maine's undeveloped dunes would be inundated. With 3.9 feet, it would be over 90%*.

94

About 48% of the Maine coast is made up of erodible coastal bluffs. One-third are currently eroding and are being *armored at high rates*. **Sea level rise will impact these features along with the habitats they support.**

95

Sea level rise will likely result in **more frequent marsh inundation**, **loss of marsh** (conversion to open water), **conversion of dominant marsh types**, and **increased stress** to threatened species

96

Sea Level Rise Summary

- **About half** of the last century's observed sea level rise **occurred since the early 1990s.**
- **Abrupt short-term sea level** changes do occur**.**
- **A 1 foot rise in sea level** will lead to a **15-fold increase in nuisance flooding** for low-lying areas in Maine.
- A **1 foot rise in sea level** will lead to a 10-year storm having the impact of a 100-year event, or a 100-year event having a 10-year recurrence interval.

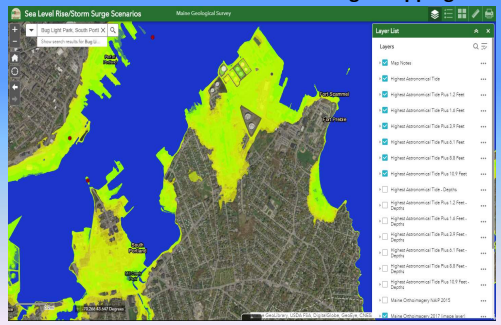
97

Sea Level Rise Summary

- Consider **committing to manage** for a **higher probability, lower risk scenario**. Consider **preparing to manage** for a lower probability, higher risk scenario and based on **criticality of infrastructure.**
  - **Intermediate scenario = 1.5 feet (2050) and 3.9 feet (2100).**
  - **High scenario = 3.0 feet (2050) and 8.8 feet (2100**)
- Consider **revisiting sea level rise planning scenarios based on the best-available science on a regular basis.**
- **Sea level will *continue to rise beyond 2100.***

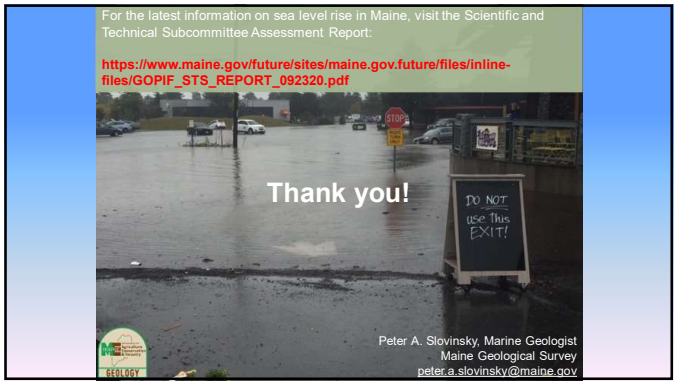
98

MGS Sea Level Rise and Storm Surge Mapping

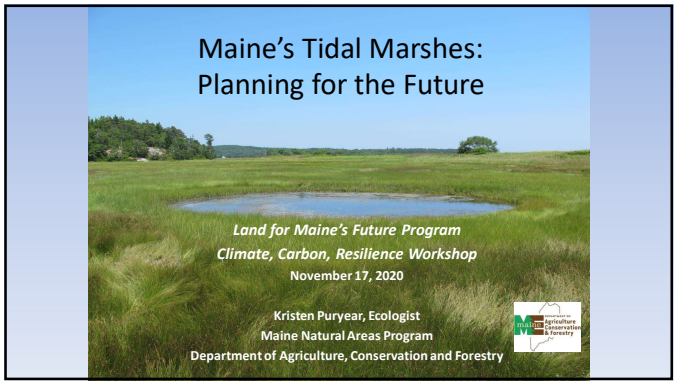


http://www.maine.gov/dacf/mgs/hazards/slr_ss/index.shtml

99


For the latest information on sea level rise in Maine, visit the Scientific and Technical Subcommittee Assessment Report:
https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/GOPIF_STS_REPORT_092320.pdf
Thank you!
DO NOT Use This EXIT!
Peter A. Slovinsky, Marine Geologist
Maine Geological Survey
peter.a.slovinsky@maine.gov

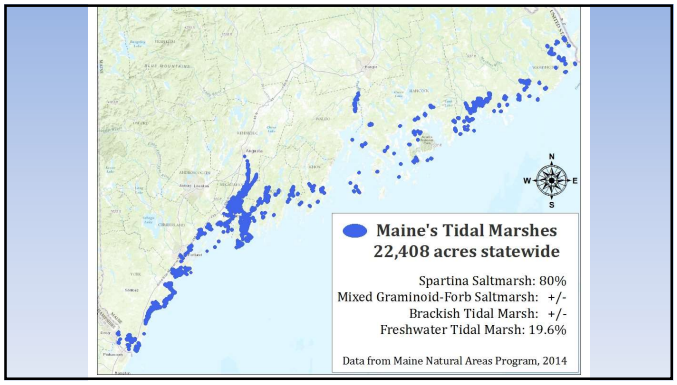
100


Maine's Tidal Marshes:
Planning for the Future
Land for Maine's Future Program
Climate, Carbon, Resilience Workshop
November 17, 2020
Kristen Puryear, Ecologist
Maine Natural Areas Program
Department of Agriculture, Conservation and Forestry

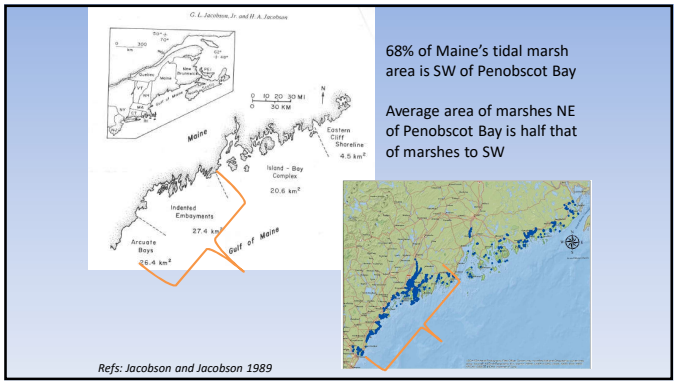
101


To be covered:
• Tidal Marshes Present
• Tidal Marshes Future
• Tidal Marshes in Planning…

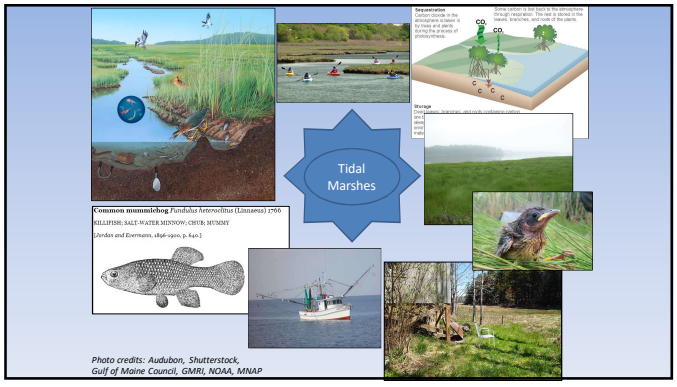
102


Maine's Tidal Marshes
22,408 acres statewide
Spartina Saltmarsh: 80%
Mixed Graminoid-Forb Saltmarsh: +/-
Brackish Tidal Marsh: +/-
Freshwater Tidal Marsh: 19.6%
Data from Maine Natural Areas Program, 2014

103


68% of Maine's tidal marsh area is SW of Penobscot Bay
Average area of marshes NE of Penobscot Bay is half that of marshes to SW
Maine
Eastern Cliff Shoreline
4.5 km²
Island - Bay Complex
20.6 km²
Indented Embayments
27.4 km
Arcuate Bays
26.4 km²
Gulf of Maine
Refs: Jacobson and Jacobson 1989

104

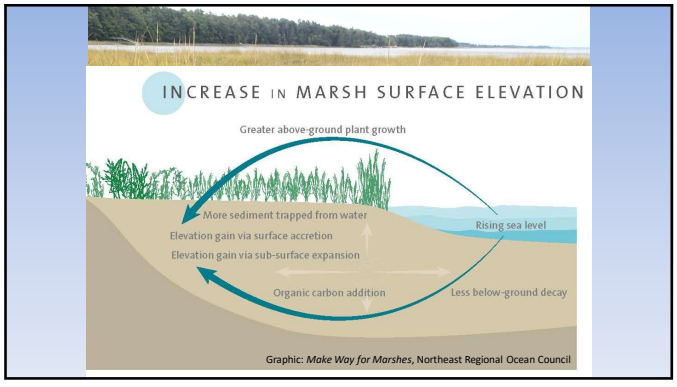

Tidal Marshes
Photo credits: Audubon, Shutterstock, Gulf of Maine Council, GMRI, NOAA, MNAP

105

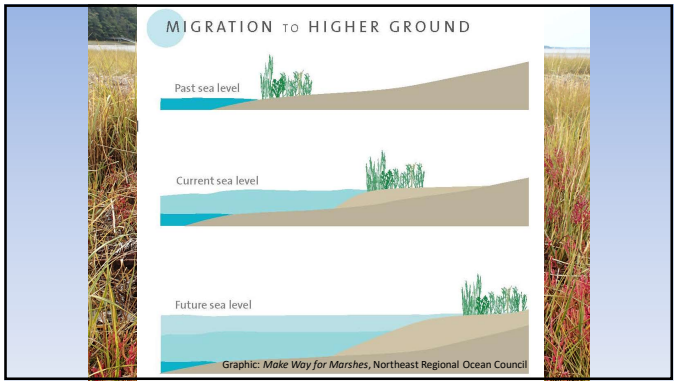
106


Ditching and berms
Development
Tidal restrictions
Tide gates
Invasive species

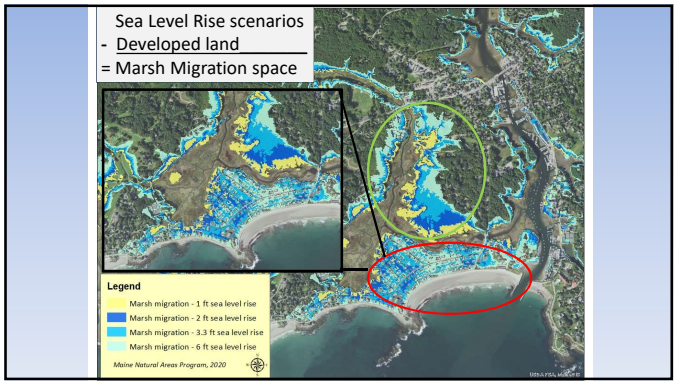
107


INCREASE IN MARSH SURFACE ELEVATION
Greater above-ground plant growth
More sediment trapped from water
Elevation gain via surface accretion
Elevation gain via sub-surface expansion
Rising sea level
Organic carbon addition
Less below-ground decay
Graphic: Make Way for Marshes, Northeast Regional Ocean Council

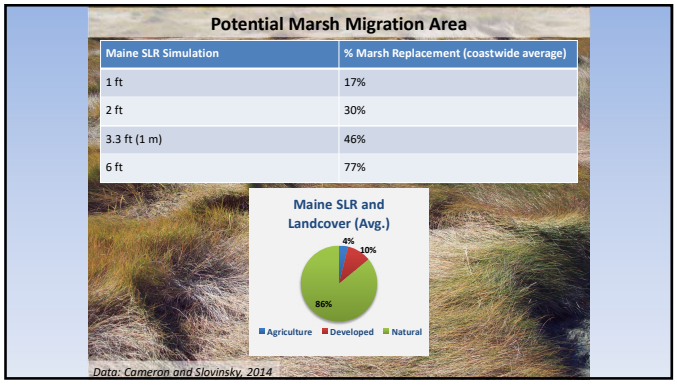
108


MIGRATION TO HIGHER GROUND
Past sea level
Current sea level
Future sea level
Graphic: Make Way for Marshes, Northeast Regional Ocean Council

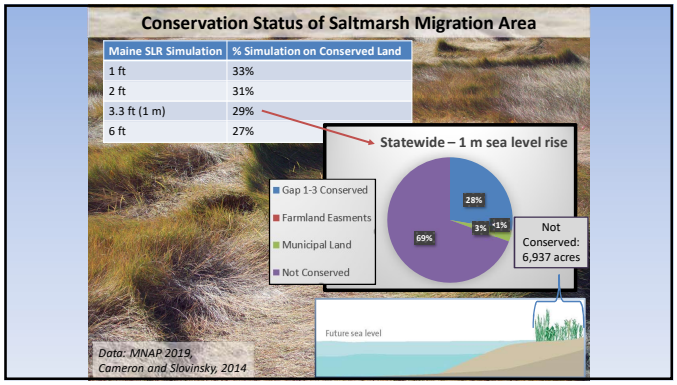
109


Sea Level Rise scenarios
- Developed land
= Marsh Migration space
Legend
Marsh migration - 1 ft sea level rise
Marsh migration - 2 ft sea level rise
Marsh migration - 3.3 ft sea level rise
Marsh migration - 6 ft sea level rise
Maine Natural Areas Program, 2020

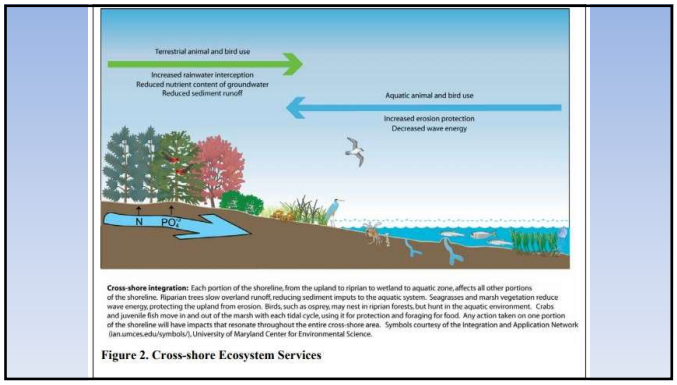
110


Potential Marsh Migration Area
Maine SLR Simulation | % Marsh Replacement (coastwide average)
1 ft | 17%
2 ft | 30%
3.3 ft (1 m) | 46%
6 ft | 77%
Maine SLR and Landcover (Avg.)
4%
10%
86%
Agriculture
Developed
Natural
Data: Cameron and Slovinsky, 2014

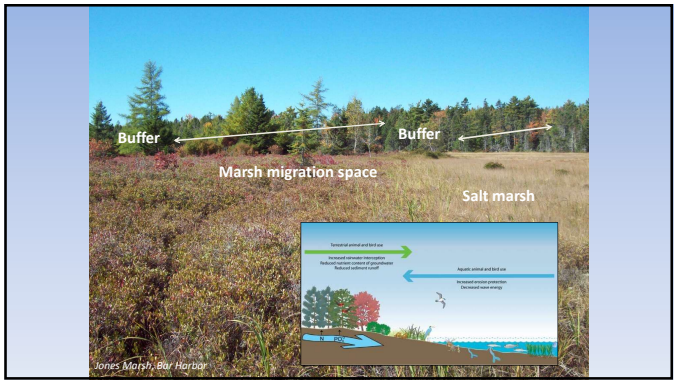
111


Conservation Status of Saltmarsh Migration Area
Maine SLR Simulation | % Simulation on Conserved Land
1 ft | 33%
2 ft | 31%
3.3 ft (1 m) | 29%
6 ft | 27%
Statewide – 1 m sea level rise
Gap 1-3 Conserved
Farmland Easments
Municipal Land
Not Conserved
28%
3%
<1%
69%
Not Conserved: 6,937 acres
Future sea level
Data: MNAP 2019, Cameron and Slovinsky, 2014

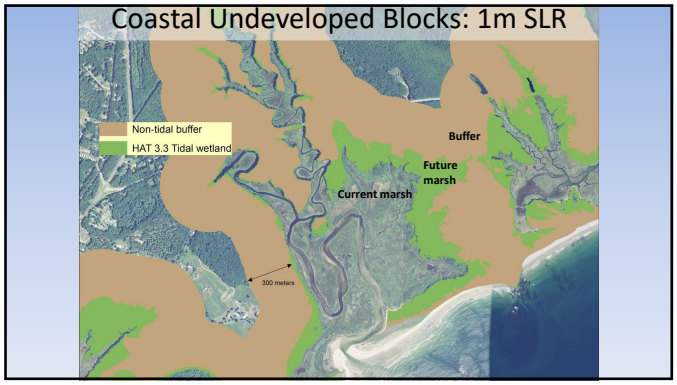
112


Terrestrial animal and bird use
Increased rainwater interception
Reduced nutrient content of groundwater
Reduced sediment runoff
Aquatic animal and bird use
Increased erosion protection
Decreased wave energy
N
PO4
Cross-shore integration: Each portion of the shoreline, from the upland to riprian to wetland to aquatic zone, affects all other portions of the shoreline. Riparian trees slow overland runoff, reducing sediment imputs to the aquatic system. Seagrasses and marsh vegetation reduce wave energy, protecting the upland from erosion. Birds, such as osprey, may nest in riprian forests, but hunt in the aquatic environment. Crabs and juvenile fish move in and out of the marsh with each tidal cycle, using it for protection and foraging for food. Any action taken on one portion of the shoreline will have impacts that resonate throughout the entire cross-shore area. Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols/), University of Maryland Center for Environmental Science.
Figure 2. Cross-shore Ecosystem Services

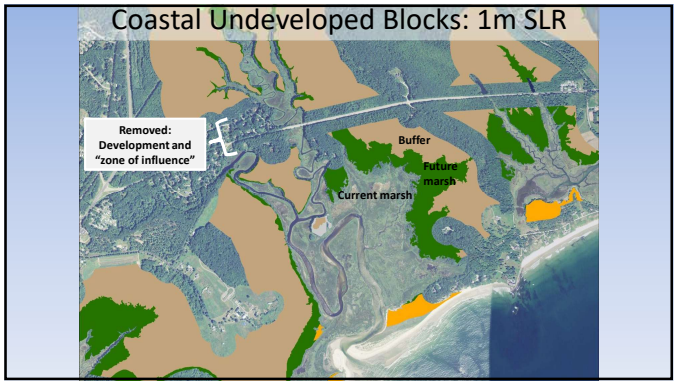
113


Buffer
Buffer
Marsh migration space
Salt marsh
Jones Marsh, Bar Harbor

114



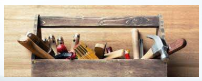
115



116

Marshes in Planning – Maine Data

Applications and Data Access



Dataset	Access	Application
Maine Marsh Migration Scenarios (1ft – 6ft SLR)	MNAP Viewer, Maine-TNC Web Viewers	-Scale: *Parcel to Local* -Conservation, Mgmt. & Restoration Planning
Maine Coastal Undeveloped Blocks	MNAP Viewer (& download)	-Scale: *Parcel to Regional* -Cons, Mgmt, & Rest. Planning -Strategic planning, buffers
Maine Highly Resilient Coastal Areas	MNAP, MCHT	-Scale: *Regional to Statewide* -Strategic planning, connectivity
Resilient Coastal Sites (TNC)	The Nature Conservancy, coastalresilience.org	-Scale: *Statewide to Northeast* -Strategic planning, connectivity

117

Summary:

- Maine's 22,000 acres of tidal marsh are unique, diverse and valuable
- Sea level rise is increasing marsh vulnerability
- Marshes must keep up (accrete sediment) or migrate inland
- State models identify potential marsh migration areas for conservation within intact landscapes
- Conserving marsh buffers & integrated coastal-inland areas is vital (current and future)
- Further marsh research needed to detect changes and inform strategies

118

Thank you!

Special thanks to:
The Coastal Resiliency Opportunities Work Group
Justin Schlawin, Don Cameron (MNAP)
Pete Slovinsky, Steve Dickson (MGS)

Financial support from: USEPA, Maine Outdoor Heritage Fund

Kristen.Puryear@maine.gov

Maine Sea Level Rise and Undeveloped Block data available at:
http://www.maine.gov/dacf/mnap/

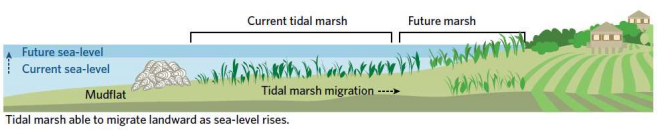
119

120

121

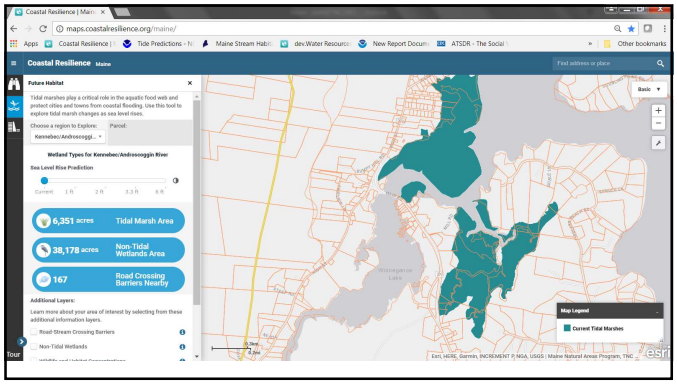
Marsh Migration Tool

122

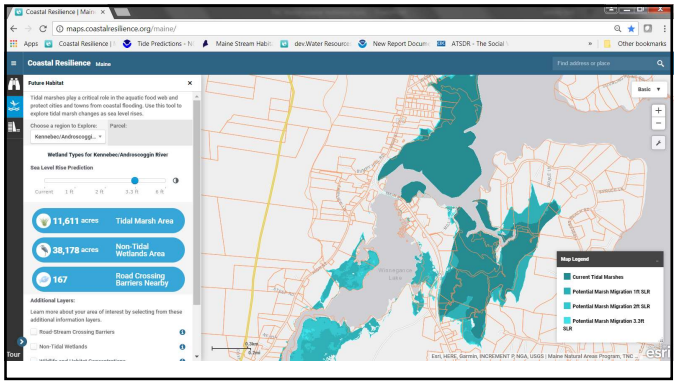


Tidal marsh able to migrate landward as sea-level rises.

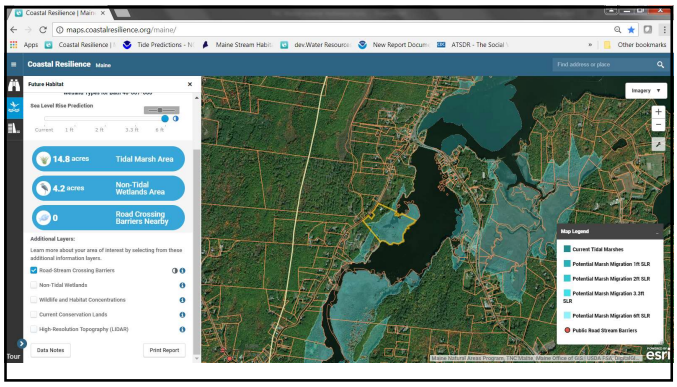
123


maps.coastalresilience.org/maine/
Coastal Resilience | Maine
Future Habitat
Wetland Types for Kennebec/Androscoggin River
Sea Level Rise Prediction
6,351 acres
Tidal Marsh Area
38,178 acres
Non-Tidal Wetlands Area
167
Road Crossing Barriers Nearby
Additional Layers:
Map Legend
Current Tidal Marshes

124


maps.coastalresilience.org/maine/
Coastal Resilience | Maine
Future Habitat
Wetland Types for Kennebec/Androscoggin River
Sea Level Rise Prediction
11,611 acres
Tidal Marsh Area
38,178 acres
Non-Tidal Wetlands Area
167
Road Crossing Barriers Nearby
Additional Layers:
Map Legend
Current Tidal Marshes
Potential Marsh Migration 1ft SLR
Potential Marsh Migration 2ft SLR
Potential Marsh Migration 3.3ft SLR

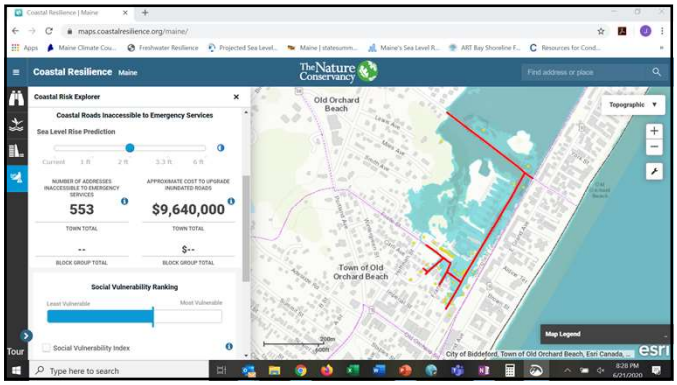
125


maps.coastalresilience.org/maine/
Coastal Resilience | Maine
Future Habitat
Sea Level Rise Prediction
14.8 acres
Tidal Marsh Area
4.2 acres
Non-Tidal Wetlands Area
0
Road Crossing Barriers Nearby
Additional Layers:
Road-Stream Crossing Barriers
Non-Tidal Wetlands
Wildlife and Habitat Concentrations
Current Conservation Lands
High-Resolution Topography (LiDAR)
Data Notes
Print Report
Imagery
Map Legend
Current Tidal Marshes
Potential Marsh Migration 1ft SLR
Potential Marsh Migration 2ft SLR
Potential Marsh Migration 3.3ft SLR
Potential Marsh Migration 6ft SLR
Public Road Stream Barriers

126

Coastal Risk Explorer

127

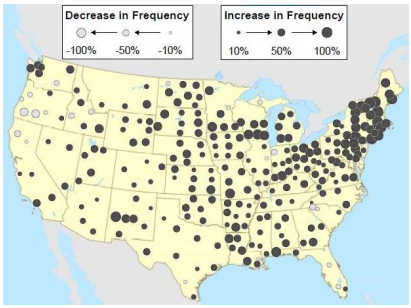


128

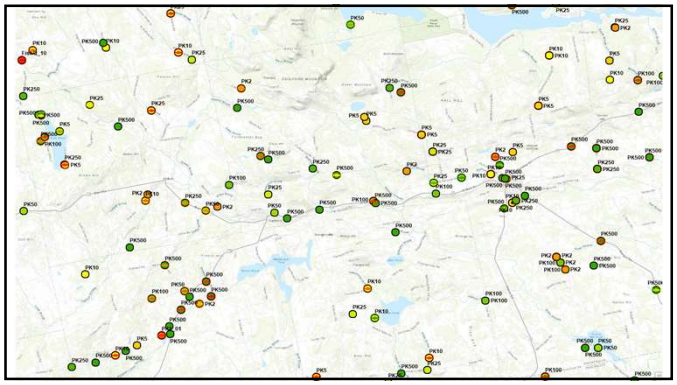
Inland Flood Risk Explorer

129

Extreme storms are happening more frequently across much of the United States.



130



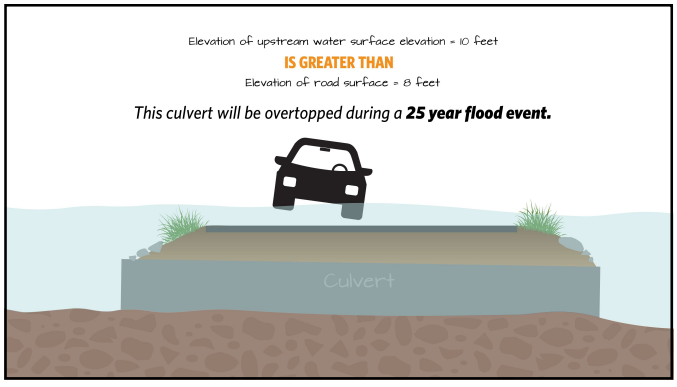
131

Elevation of upstream water surface elevation = 10 feet

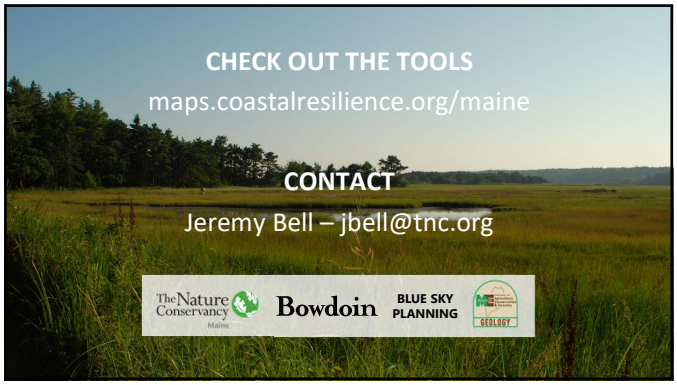
IS GREATER THAN

Elevation of road surface = 8 feet

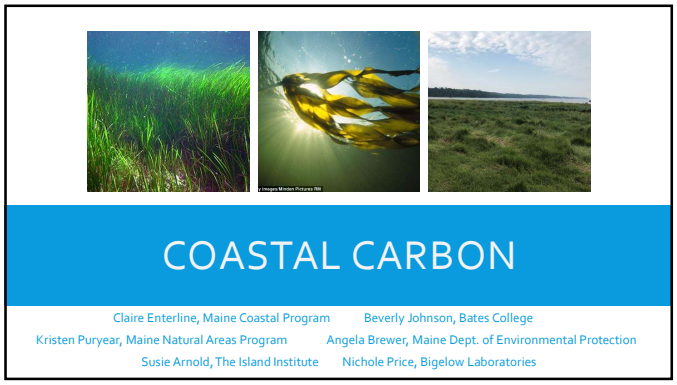
*This culvert will be overtopped during a **25 year flood event.***



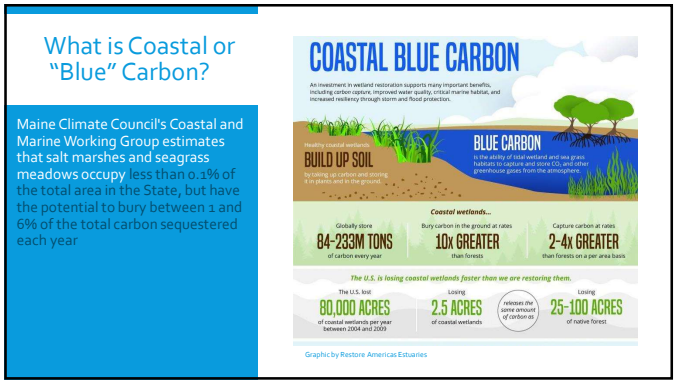
132


CHECK OUT THE TOOLS
maps.coastalresilience.org/maine
CONTACT
Jeremy Bell – jbell@tnc.org
The Nature Conservancy Maine
Bowdoin
BLUE SKY PLANNING
GEOLOGY

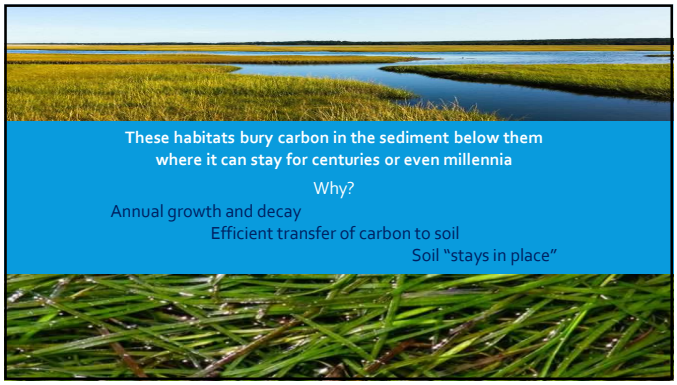
133


COASTAL CARBON
Claire Enterline, Maine Coastal Program
Beverly Johnson, Bates College
Kristen Puryear, Maine Natural Areas Program
Angela Brewer, Maine Dept. of Environmental Protection
Susie Arnold, The Island Institute
Nichole Price, Bigelow Laboratories

134


What is Coastal or "Blue" Carbon?
Maine Climate Council's Coastal and Marine Working Group estimates that salt marshes and seagrass meadows occupy less than 0.1% of the total area in the State, but have the potential to bury between 1 and 6% of the total carbon sequestered each year
COASTAL BLUE CARBON
BLUE CARBON
BUILD UP SOIL
Coastal wetlands...
84-233M TONS
10x GREATER
2-4x GREATER
The U.S. is losing coastal wetlands faster than we are restoring them.
80,000 ACRES
2.5 ACRES
25-100 ACRES
Graphic by Restore Americas Estuaries

135



These habitats bury carbon in the sediment below them where it can stay for centuries or even millennia

Why?

Annual growth and decay

Efficient transfer of carbon to soil

Soil "stays in place"

136

What Is Maine's Blue Carbon Potential?

Salt Marshes:

38.9 Gg CO_2equiv/yr *

(Uncertainty of +- 30%. Long term C burial rates from Ouyang et al., 2014; area from Maine Natural Areas Program, 2016)

*Restoration of tidal flow at many marshes could increase this potential

Eelgrass:

50.6 Gg CO_2equiv/yr

(Uncertainty of +- 30%. Long term C burial rates from McLeod et al., 2011; area from DMR 2010 GIS Layer, 2001-2009 survey years)

Seaweeds:

Intertidal: 11.0 Gg CO_2equiv/yr

Subtidal: 0.3 Gg CO_2equiv/yr

Farmed: 0.03 Gg CO_2equiv/yr

(STS Phase 1, Topinka, J., Tucker, L. and Korjeff, W., 1981., Island Institute)

137

What Are Some Factors That Influence Blue Carbon Potential?

Sea Level Rise +/-

Coastal Development Infrastructure (Existing and Future) Δ

Nutrient Inputs (stormwater, wastewater treatment, septic) Δ

Tidal Flow and Sedimentation +/-

Invasive Species -

Sea temperature change and ocean acidification -

Marine Shared-Space Issues (fishing, boating, harvesting) Δ

Seaweed Farming +

> For all, there is a need for better understanding of these factors, and active management

138

Salt marshes

Key Issues:
- Sea level rise
- **Road crossings restrict tidal flow leading to upstream subsidence and net GHG emissions**
- Nutrient inputs and groundwater changes

Conservation and Restoration Opportunities:
- **Tidal flow restoration using the CoastWise Approach**
- Protection of marsh migration corridors and spaces
- Stormwater solutions, septic management, smart development and retrofits
- **Dune protection and living shorelines**

Note: Text in **bold/underline** indicates opportunity unique to this habitat, not the most important opportunity

Uncertainties:
- Will marshes will keep pace with sea level rise by building their elevation, or be "drowned" by higher water levels or lost by erosion of marsh banks
- How quickly and to what degree will marsh migration occur

Assessment Needs:
- Mapping performed on a regular basis
- Long-term elevation and vegetation monitoring
- Fine-tune carbon sequestration rates

139

Eelgrass

Key Issues:
- Nutrient and freshwater inputs
- Sea level rise, temperature change
- Light availability
- Invasive species (green crab, tunicates)

Conservation and Restoration Opportunities:
- Protection of shallow migration spaces (mudflats)
- **Stormwater solutions, septic management, smart development and retrofits**
- Responsible marine harvesting and aquaculture siting
- **"Conservation" moorings**
- **Active eelgrass bed restoration using proven techniques**

Uncertainties:
- Ability of eelgrass to migrate to shallower areas

Assessment Needs:
- Mapping performed on a regular basis
- Fine-tune carbon sequestration rates
- Long-term health assessments

Note: Text in **bold/underline** indicates opportunity unique to this habitat, not the most important opportunity

140

Seaweeds

Key Issues:
- Sea level rise, temperature change
- Light availability

Conservation and Restoration Opportunities:
- Protection of shallow migration spaces
- **Manage nutrient and freshwater runoff**
- **Responsible aquaculture to reduce localized ocean acidification and increase carbon removal**

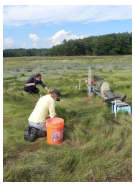
Note: Text in **bold/underline** indicates opportunity unique to this habitat, not the most important opportunity

Uncertainties:
- **Species specific responses to CO_2 increases, sea level rise, and temperature changes**
- Ability of seaweeds to migrate to shallower areas

Assessment Needs:
- Mapping performed on a regular basis
- Fine-tune carbon sequestration rates

141



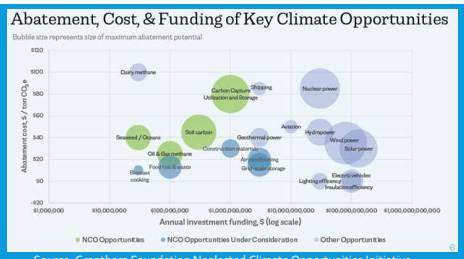


Key Overlaps For Conservation And Understanding

- Conservation and restoration of flows and natural processes
- Protection of migration spaces
- Nutrient and freshwater flow management: Stormwater solutions, septic management, smart development and retrofits
- Active restoration (e.g. living shorelines)
- Responsible marine harvesting and aquaculture siting
- Ongoing mapping to track changes

142

What is the Relative Cost Compared to Other Climate Strategies?



Source: Grantham Foundation Neglected Climate Opportunities Initiative

143

Questions?

Protecting coastal carbon habitats provides climate resilience for our communities and wildlife

Claire Enterline
Research Coordinator, Maine Coastal Program
claire.enterline@maine.gov




144

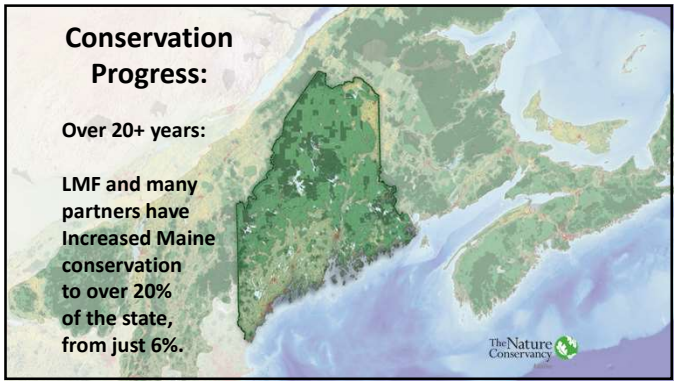

Data & Tools:
Maine Forests and Carbon
Land for Maine's Future Board
Climate Workshop
November 17, 2020
Mark Berry
Forest Program Director
The Nature Conservancy
Maine

145

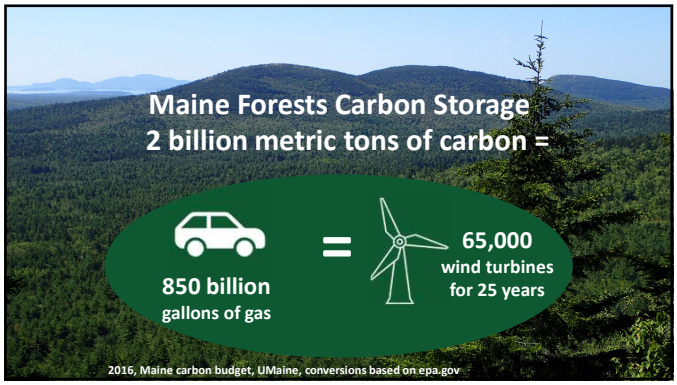
146


Maine's forest & land ownership
~89% forested (USFS)
~93% private (USFS)
10 largest owners and forest managers: ~ 8 million acres (TNC estimate)
86,000 family owners of 10 acres or more (Maine Woodland Owners)
Ownership continues to be in transition

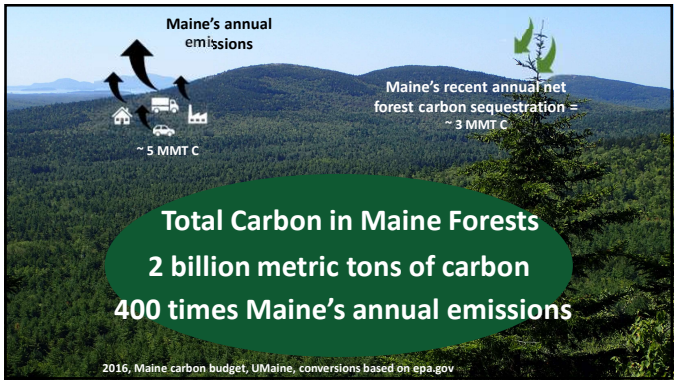
147


Conservation Progress:
Over 20+ years:
LMF and many partners have Increased Maine conservation to over 20% of the state, from just 6%.
The Nature Conservancy

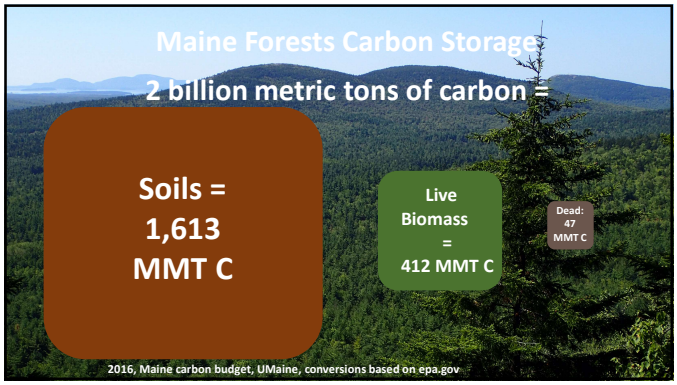
148


Maine Forests Carbon Storage
2 billion metric tons of carbon =
850 billion
gallons of gas
=
65,000
wind turbines
for 25 years
2016, Maine carbon budget, UMaine, conversions based on epa.gov

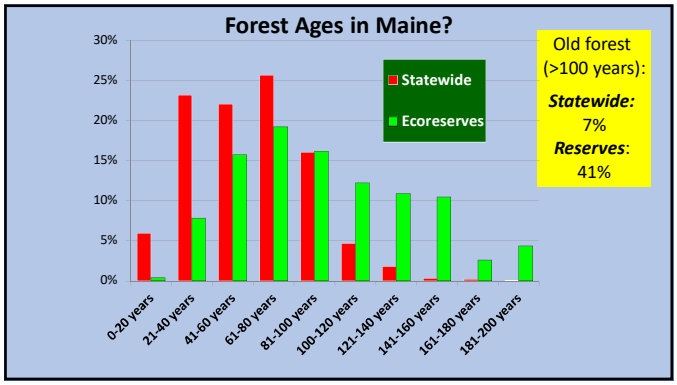
149


Maine's annual emissions
~ 5 MMT C
Maine's recent annual net forest carbon sequestration =
~ 3 MMT C
Total Carbon in Maine Forests
2 billion metric tons of carbon
400 times Maine's annual emissions
2016, Maine carbon budget, UMaine, conversions based on epa.gov

150


Maine Forests Carbon Storage
2 billion metric tons of carbon =
Soils = 1,613 MMT C
Live Biomass = 412 MMT C
Dead: 47 MMT C
2016, Maine carbon budget, UMaine, conversions based on epa.gov

151

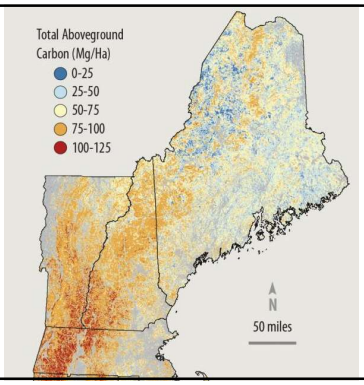

Forest Ages in Maine?
30%
25%
20%
15%
10%
5%
0%
Statewide
Ecoreserves
Old forest (>100 years):
Statewide: 7%
Reserves: 41%
0-20 years
21-40 years
41-60 years
61-80 years
81-100 years
100-120 years
121-140 years
141-160 years
161-180 years
181-200 years

152


EMERGENT LAYER
CANOPY
UNDER STORY
SHRUB LAYER
FOREST FLOOR
Old Forests Accumulate Carbon for Centuries

153

Above Ground Forest Carbon, 2000

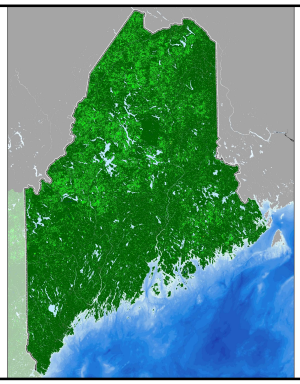


From Wildlands & Woodlands

154

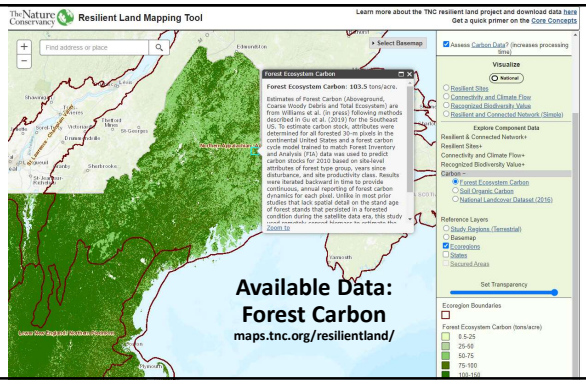
Land Cover Change, 2001-2016

Bright Green = Changes to, from, or among forest types

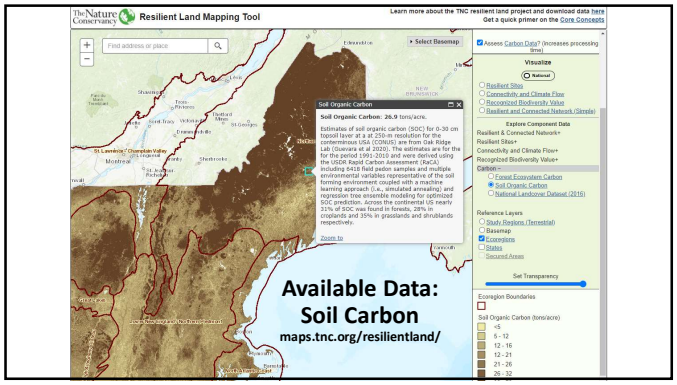


From National Land Cover Dataset (NLCD)

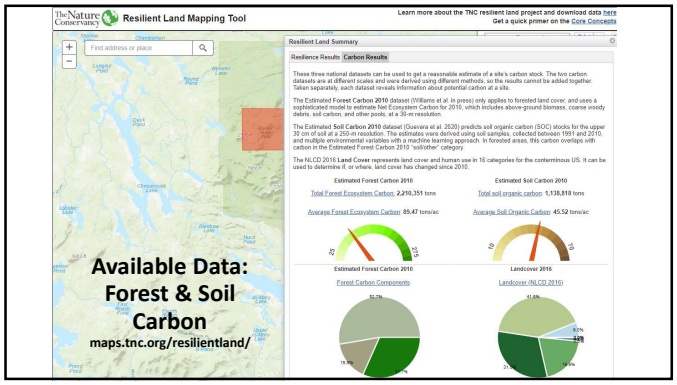
155



156



157

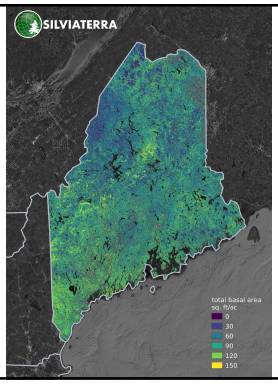


158

Forest Carbon:

Timber stocking (basal area per acre)

Current modeled data from SilviaTerra

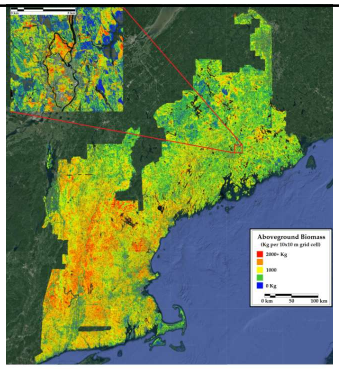


159

Forest Carbon:

Aboveground biomass

Current project of the Wheatland Geospatial lab at Umaine, with NASA and LIDAR from the ISS



160

Carbon role of forest products?

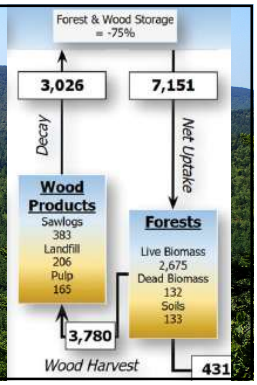
Net carbon positive

Gunn & Buchholz, 2018

Climate advantage for longer-lived products.

2017 Harvest mix by Volume: *MFPC*

- 45% pulpwood
- 34% sawlogs
- 19% biomass for electricity
- 2% firewood or pellets



161

Retain Forest Land

Forest Cover in Maine is Decreasing

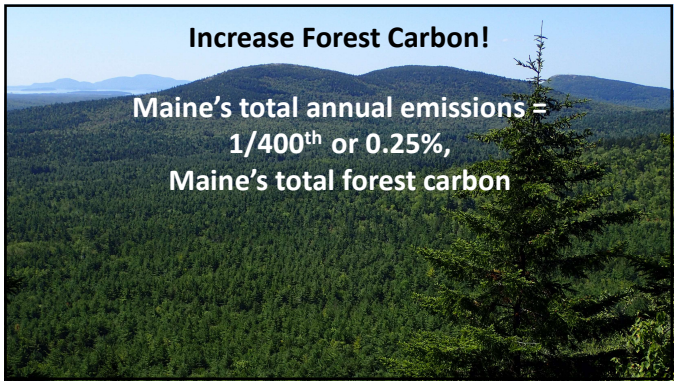
23 acres per day = 8,398 acres per year, 1990-2010

Projected loss: 10,000 acres per year 2020-2030

Forest Carbon on 10,000 acres = 900,000 cars for one year **or** 500,000 homes for one year

Rate of Loss from Catanzaro & D'Amato 2019, Forest carbon from UMaine, Projection from Maine CAP, conversions based on epa.gov

162


Increase Forest Carbon!
Maine's total annual emissions =
1/400th or 0.25%,
Maine's total forest carbon

163


Climate-friendly forest economy
Forest economy contributes to retaining forests
Avoid pushing harvest elsewhere
Encourage management for long-lived products

164


Thank You
The Nature Conservancy
Maine

165

Natural Climate Solutions for Maine's Managed Lands

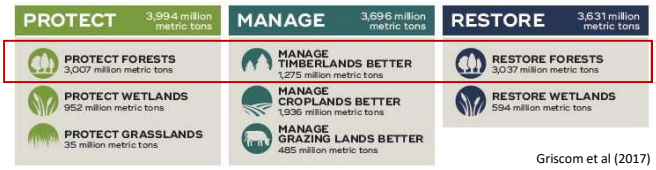
Dr. Adam Daigneault
University of Maine

Land for Maine's Future Climate, Carbon & Resilience workshop
November 17, 2020

166

What are "Natural Climate Solutions"?

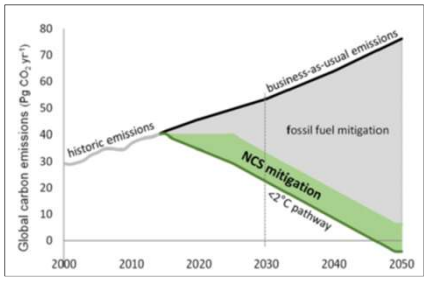
Any action that **conserves**, **restores** or improves the use or **management** of forests, wetlands, grasslands, and agricultural lands, while simultaneously **increasing carbon storage** or **avoiding greenhouse gas emissions**.



Griscom et al (2017)

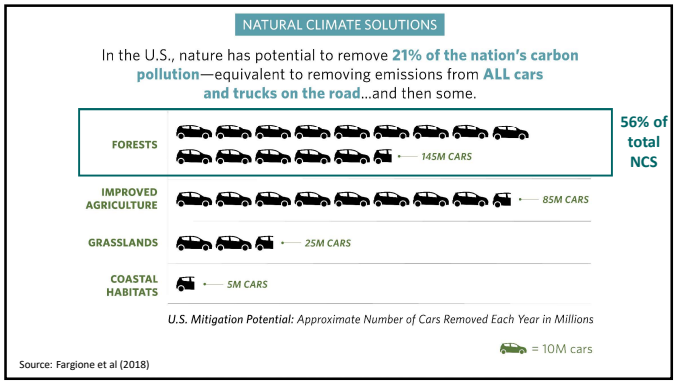
167

Globally, Natural Climate Solutions (NCS) are expected to contribute to at least 20% of the Paris Agreement's aggregate reduction target

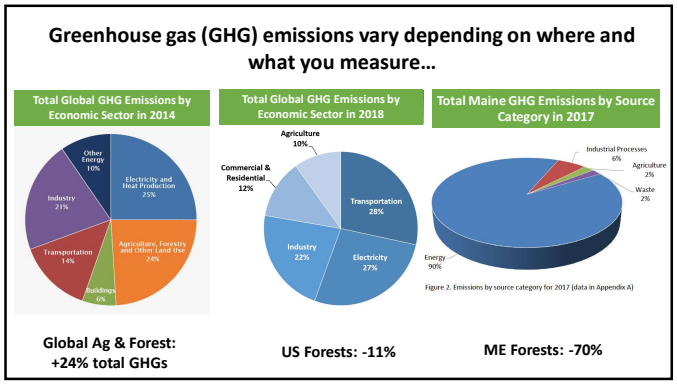


Griscom et al (2017)

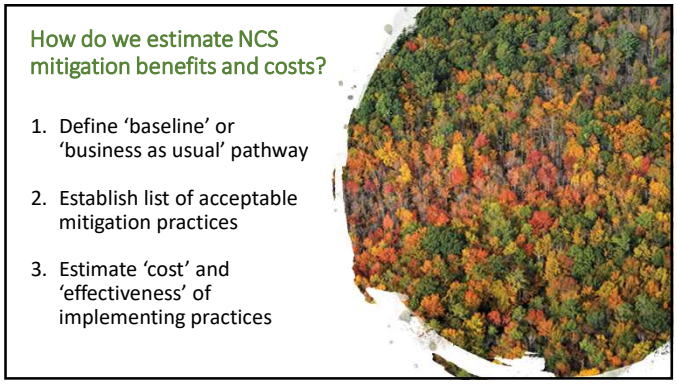
168


NATURAL CLIMATE SOLUTIONS
In the U.S., nature has potential to remove 21% of the nation's carbon pollution—equivalent to removing emissions from ALL cars and trucks on the road...and then some.
FORESTS
145M CARS
56% of total NCS
IMPROVED AGRICULTURE
85M CARS
GRASSLANDS
25M CARS
COASTAL HABITATS
5M CARS
U.S. Mitigation Potential: Approximate Number of Cars Removed Each Year in Millions
= 10M cars
Source: Fargione et al (2018)

169


Greenhouse gas (GHG) emissions vary depending on where and what you measure…
Total Global GHG Emissions by Economic Sector in 2014
Other Energy 10%
Electricity and Heat Production 25%
Industry 21%
Transportation 14%
Agriculture, Forestry and Other Land Use 24%
Buildings 6%
Total Global GHG Emissions by Economic Sector in 2018
Agriculture 10%
Commercial & Residential 12%
Transportation 28%
Industry 22%
Electricity 27%
Total Maine GHG Emissions by Source Category in 2017
Industrial Processes 6%
Agriculture 2%
Waste 2%
Energy 90%
Figure 2. Emissions by source category for 2017 (data in Appendix A)
Global Ag & Forest: +24% total GHGs
US Forests: -11%
ME Forests: -70%

170


How do we estimate NCS mitigation benefits and costs?
1. Define 'baseline' or 'business as usual' pathway
2. Establish list of acceptable mitigation practices
3. Estimate 'cost' and 'effectiveness' of implementing practices

171

Estimating Costs and Benefits

Costs

- Opportunity
  - Yield reductions
  - Harvestable area
- Capital/equipment
- Labor
- Maintenance
- Other environmental costs?

Benefits

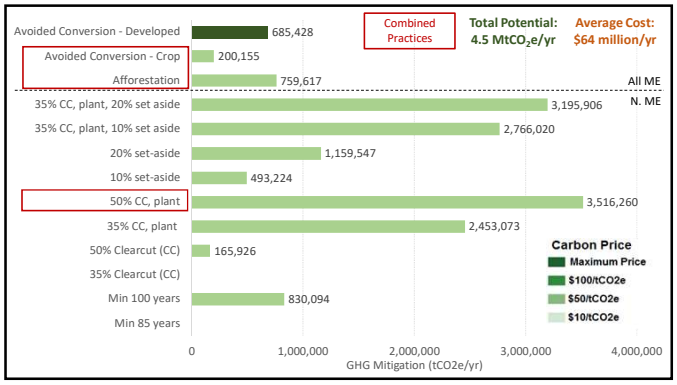
- Increased C sequestration
- Yield improvements
- Diversified income stream
- Cost-savings
- Other environmental co-benefits?

172

Figure shows detailed costs, but does not include mitigation potential

173

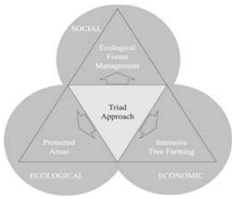
174



175

ME Forest NCS Summary

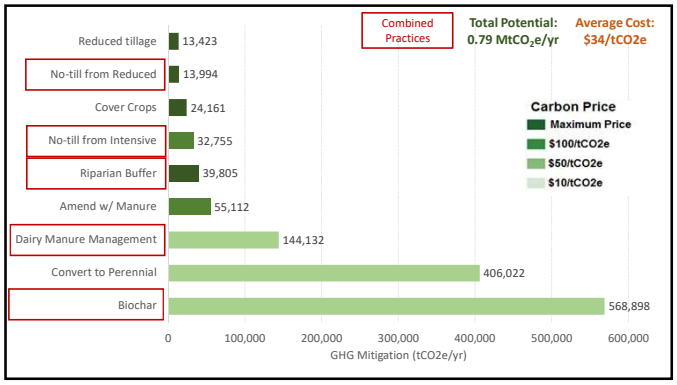
- Top NCS for Maine: Mix of **intensive harvest**, **planting**, and **set-asides**
- Most NCS allow **harvests to continue to follow historical trends**
- Harvests close to BAU → **minimal risk of 'leakage'**
- **Habitat tradeoffs** with increased clearcut & planting v. natural regeneration
- **Costs are relatively cheap** compared to typical carbon prices for other sectors of economy & social cost of carbon estimates (often $40+/tCO2e or more)



176

176

177



178

ME Agriculture NCS Summary

- Top NCS for Maine: Mix of **biochar, manure management**, and **convert to perennials**
- Many NCS **limited by area extent** and/or **low GHG benefits** (e.g,. no-till)
- Typically **more expensive than forestry** practices
- Ag sector could be **carbon neutral** if enough farmers adopt NCS
- **Financial and technical assistance** could accelerate implementation

179

Thanks to all our collaborators and funders…

Dr. Erin Simons-Legaard
Dr. Aaron Weiskittel
Dr. Ivan Fernandez
Dr. Sonja Birthisel
Ms. Jen Carroll

Senator George J. Mitchell Center for Sustainability Solutions

180

Want to know more about Maine's Natural Climate Solutions?

Visit the UMaine Forest Climate Change Initiative's website for full report, fact sheets, and more!

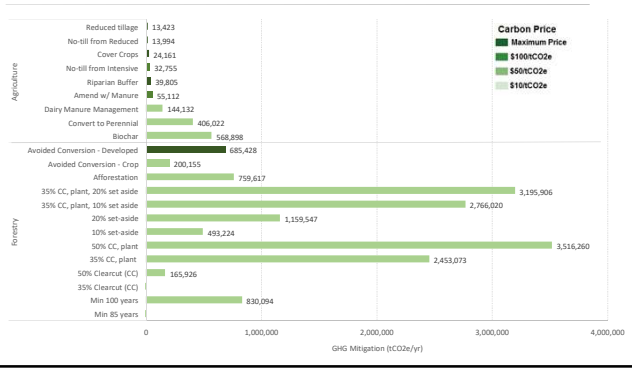
https://crsf.umaine.edu/forest-climate-change-initiative/ncs/

181

Contact Details

Dr. Adam Daigneault
E.L. Giddings Asst Prof of Forest, Conservation, and Recreation Policy
University of Maine
5755 Nutting Hall, Rm 219
adam.daigneault@maine.edu

182



183

Day 2 Agenda

Real World Examples – How partners are incorporating CCR considerations into their conservation planning **and** land management processes.

- Maine Coast Heritage Trust
- 12 Rivers
- Western Foothills/Loon Echo LTs
- Maine Farmland Trust
- AMC
- BPL

Questions
Break

Strategies - Discussion and brainstorm on strategies LMF could adopt to ensure we are a strong partner in the State's goal of promoting and enhancing the resiliency of Maine's natural resources.

- Proposal
- Scoring
- On the ground implementation (easement terms and ongoing stewardship)
- Other ideas?

Next Steps for the LMF Board

- Update on LAPAC review which will incorporate climate change/resiliency/carbon sequestration considerations and recommendations from this meeting for the Board's review.
- Other next steps for the LMF Board to consider?

184