Securing Northeast Forest Carbon Program: Primer on Forest Carbon & Forest Carbon Markets

RI Land Trusts webinar, September 21, 2023



Charles Levesque, Executive Director North East *State* Foresters Association www.northeastforestcarbon.org

## Securing Northeast Forest Carbon Program



Goal is to provide forestry professionals and landowners the latest info on forest carbon and forest carbon markets so landowners can make informed forest carbon decisions about their land – including whether to sell forest carbon – FUNDED BY USDA FOREST SERVICE GRANT

## State leads for



- Connecticut Andrea Urbano, Service Forester, CT Dept. of Energy and Environmental Protection – <u>Andrea.Urbano@ct.gov</u>
- Maine Donald Mansius, Director of Forest Policy and Management Division, Maine Forest Service – <u>Donald.J.Mansius@maine.gov</u>
- Massachusetts Sean Mahoney, MA DCR Markets and Utilization Forestry Program Director – <u>sean.mahoney@mass.gov</u>
- New Hampshire Matt Kelley, Forestry Field Specialist, UNH Cooperative Extension <u>Matt.Kelly@unh.edu</u>
- New York Molly Hassett, Climate Forestry and Carbon Section Leader, NY DEC, Division
  of Lands and Forests molly.hassett@dec.ny.gov
- Rhode Island Nancy Stairs, Cooperative Forestry Program Supervisor, RI Dept of Environmental Management, Div. of Forest Environment – <u>Nancy.Stairs@dem.ri.gov</u>
- Vermont <u>Alexandra Kosiba</u>, Climate Forester, VT Dept. of Forests, Parks and Recreation – <u>Alexandra.Kosiba@vermont.gov</u>

Forest Carbon Markets ~



Securing Northeast **Forest Carbon Program** 



**Forest Carbon Science** 

Forest Carbon Management ~

Tools ~ Additional Resources ~

# Securing Northeast Forest Carbon Program

Securing Northeast Forest Carbon Program is a project of the North East State Foresters Association funded through a grant rom the USDA Forest Service



## About this project

The Securing Northeast Forest Carbon Program is a cooperative effort among the State forestry offices in Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island and Vermont to secure as much of the private forest carbon in the northeast region as possible in a 3-year period (2021-2024). The focus is on working forestland carbon. Each State Forester's office has a forest carbon lead staffer and others will be trained as well in how to encourage private forest owners in the region to secure their forest carbon through carbon sales in the voluntary and compliance

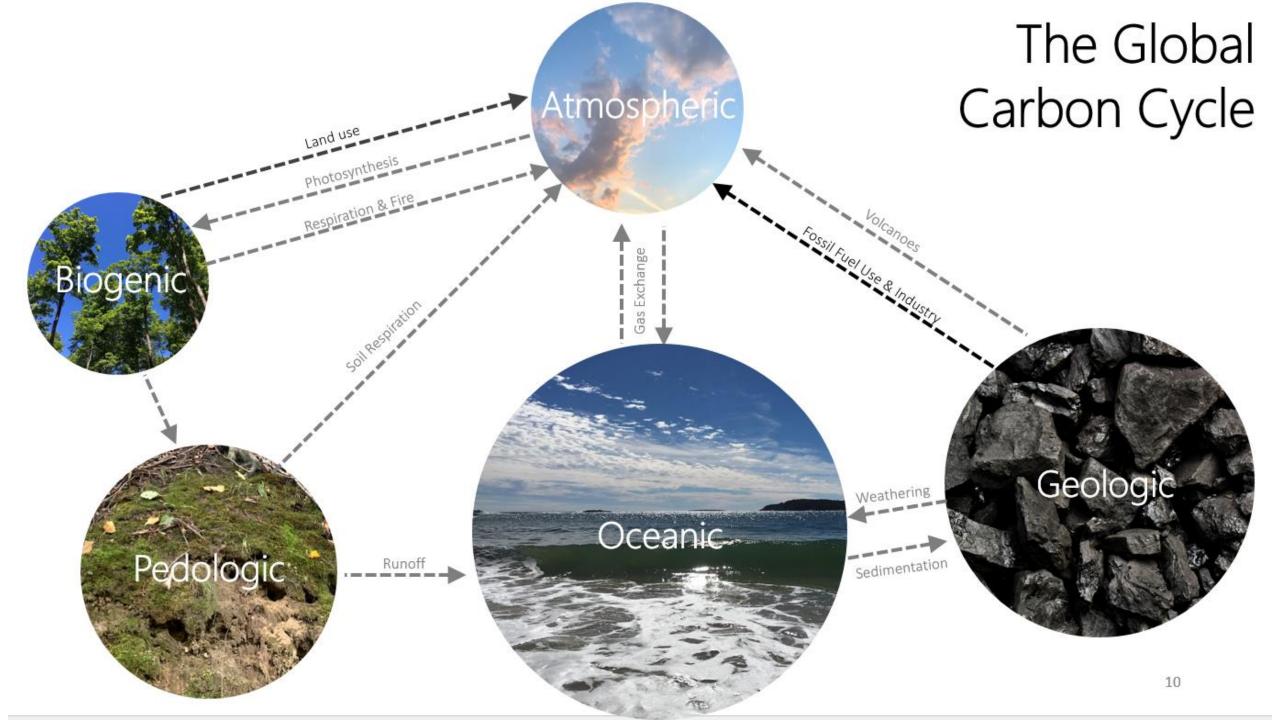
## www.northeastforestcarbon.org

# Today's AGENDA

- -Key Science Concepts on Forest Carbon
- -Key Science Concepts of Carbon-
- Friendly and Climate Adaptation Forest
- Management
- -Forest Carbon Markets Overview

**Science of Forest Carbon** 





## The Greenhouse Effect

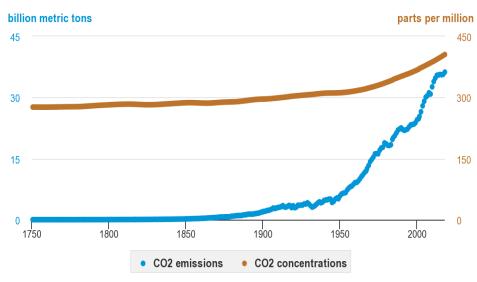
Atmosphere

Some solar radiation is reflected by the atmosphere and Earth

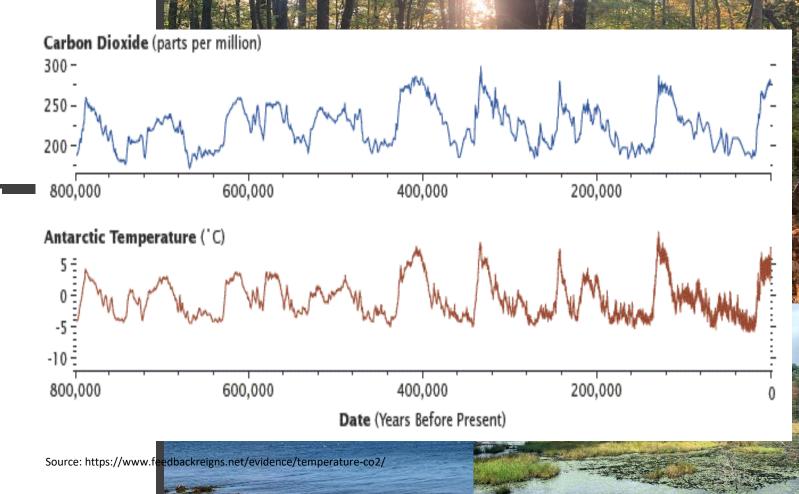
Some of the infrared radiation passes through the atmosphere. Some is absorbed by greenhouse gases and then re-emitted in all directions. The effect is to warm Earth's surface and lower atmosphere.

Some solar radiation is absorbed by Earth's surface, which warms it Infrared radiation is emitted by Earth's surface Carbon released to the atmosphere has an affinity to form carbon dioxide (CO<sub>2</sub>) which is a powerful greenhouse gas, trapping the Earth's energy

World carbon dioxide (CO2) emissions from fossil fuel combustion and global atmospheric concentrations CO2 (1751-2018)



Atmospheric CO<sub>2</sub> concentrations are directly tied to global temperatures



Source: Oak Ridge National Laboratory, Carbon Dioxide Information Analysis Center, Scripps Institute of Oceanography CO2 program, and the U.S. Energy Information Administration, International Energy Statistics

## **Quick Carbon Terminology Primer**

### Carbon storage

total amount of carbon in an entity (tree, acre of forest, cord of wood)

Synonyms: stock, density

## Carbon sequestration

the process of taking CO<sub>2</sub> from the atmosphere and storing it

Synonyms: absorbed, took in, storage rate, change in storage

### Carbon emissions

the opposite of sequestration  $(CO_2 \text{ release back to} atmosphere)$ 

Cellular respiration (metabolism,  $CO_2$ ) Decomposition ( $CO_2$ ,  $CH_4$ ) Combustion ( $CO_2$ ,  $CH_4$ )

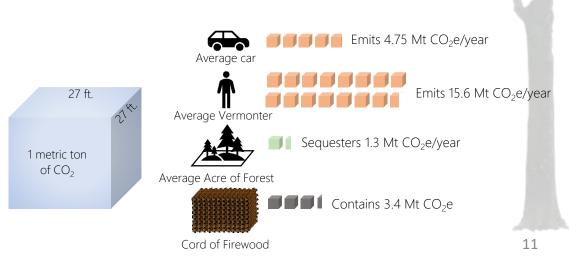
### Carbon sequestration + carbon emissions = carbon flux

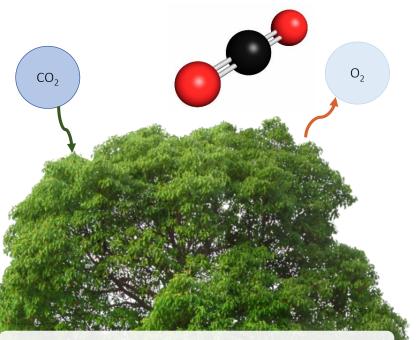
the change in carbon storage Negative flux = net sequestration = carbon sink

Positive flux = net emissions = **carbon source** 

For easier comparisons, we convert carbon and other greenhouse gases to the same units = carbon dioxide equivalent (CO<sub>2</sub>e)

 $\frac{\text{Helpful conversions}}{1 \text{ metric ton (Mt)} = 1 \text{ Mg} = 1000 \text{ Kg} = 2,205 \text{ lbs}}$   $1 \text{ Mt C} = 3.67 \text{ Mt carbon dioxide equivalent (CO_2e)}$   $1 \text{ Mt C per ha} = 1.49 \text{ Mt CO}_2 \text{ per acre}$   $Wood \text{ is } \sim 50\% \text{ carbon by dry weight}$ 





 $CO_2$  + water + sunlight = sugar + water +  $O_2$ 

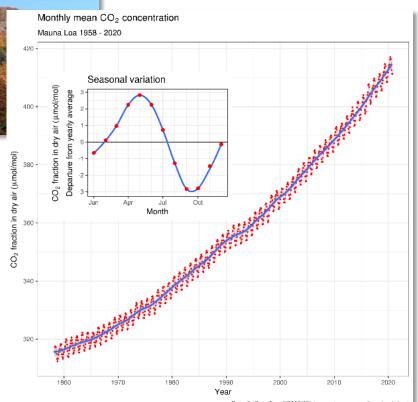
Trees can help mitigate climate change by sequestering  $CO_2$  from the atmosphere and storing the carbon in wood and soil



Carbon taken in by trees gets cycled around the forest and used by other organisms or converted to different forms

HALF

of the dry weight of wood is carbon that was removed from the atmosphere by the growing tree



Date : Dr. Pieter Tans, NOAA/ESBL /www.esrl.noes.gov/gmd/ccco/trends/) an Dr. Relph Keeling, Sprippe Institution of Oceanography (scrippsco2.uced.edu/t. Acce

Source: healthjade.com

Glucose

# Forests of the Northeast store the equivalent of ~54 years of the region's current annual GHG emissions

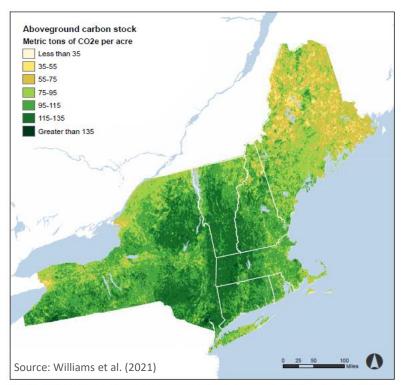
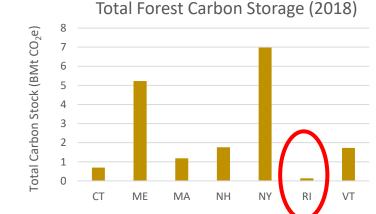


FIGURE 3. Above ground carbon stocks, expressed in metric tons of CO:e per acre, smoothed from the original dataset with focal statistics that average over a 1 km x 1 km block. The highest value in the original, 30 m resolution map is 210 metric tons of CO:e per acre.



As of 2020, the NE forests <u>stored</u> **17.5 billion Mt CO<sub>2</sub>e** 

Average Total Forest Carbon Storage per Acre (2018)

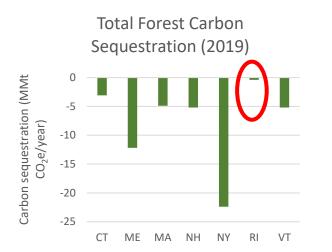


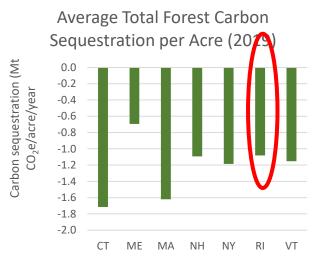
Or an average of **368 Mt CO<sub>2</sub>e/acre** 

## Collectively, NE/NY Forests are a <u>Carbon Sink</u>

## In 2019, NE forests <u>sequestered</u> -53 MMt CO<sub>2</sub>e

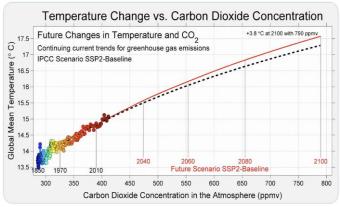
Or an average of -1.2 Mt CO<sub>2</sub>e per acre In doing so, they offset ~**14%** of the region's annual GHG emissions





**Total Forest Carbon** Sequestration as a Proportion of Ratio of total annual sequestration to State-level GHGs state-lelvel annual emissions 80% 70% 60% 50% 40% 30% 20% 10% 0% CT ME MA NH RI NY VT

Climate change itself poses a risk to the ability of forests to sequester and store carbon, and to keep it stored for long periods of time



- Source: Berkeley Earth
- Forest Insects and Climate Change Widespread Increase of Tree Mortality Rates in the Western United States Current Forestry Reports 4, 35–50 (2018) Cite this article Science • 23 Jan 2009 • Vol 523, Issue 5913 • pp. 521-524 • DOI: 10.1126/science.1165000 14k Accesses 83 Citations 72 Altmetric Metric changing climate PRIMARY RESEARCH ARTICLE Climate variability drives recent tree mortality in Euro Forest disturbances under climate change https://doi.org/10.1111/gcb.13724 Climatic stress increases forest fire severity across the western Unraveling the drivers of intensifying forest disturbance regimes United States onathan C. B. Nesmith, MaryBeth Keifer, Eric E. Knapp, Alan Flint, Lorriane Flir MART-JAN SCHELHAAS, MANFRED J. LEXER July 2013 | https://doi.org/10.1111/ele.12151 | Citations: 12 ied: 26 April 2011 | https://doi.org/10.1111/j.1365-2486.2011.02452.x | Citations: 301

- Increased mortality?
- More stressors?
- Altered growth rates?
- More disturbances?
- More insects and diseases?
- Faster decomposition rates?
- Regeneration failure?

A global overview of drought and heatinduced tree mortality reveals emerging climate change risks for forests

Sraig D. Allen <sup>4</sup>7, <sup>18</sup>7, Alison K. Macalady<sup>1</sup>, Haroun Chenchouni<sup>1</sup>, Dominique Bachelet<sup>4</sup>, Nate NcDowell Y. Michel Vennetier<sup>7</sup>, Tiomas Kitzberger Andreas Riging<sup>1</sup>, Dowid D. Breizhans<sup>1</sup>, E.H. Fold Magy, Fastrico Konzale<sup>1</sup>, Red Famman<sup>1</sup>, Zhan Zhang<sup>2</sup>, Jopen Castro<sup>1</sup>, Natalia Demidova<sup>4</sup>, ong-Hwan Lim<sup>9</sup>, Gillian Allard<sup>4</sup>, Steven W. Running<sup>1</sup>... Nel Cobb<sup>1</sup>

 Tree mortality from drought, insects, and their interactions in a changing climate

> ideregg 🕵 Jeffrey A. Hicke. Rosie A. Fisher, Craig D. Allen, Juliann Aukema, Barbara Bentz, Fremy W. Lichstein, Alison K. Macalady, Nate McDowell. Yude Pan ... See all authors 🐱 109 june 2015 | https://doi.org/10.1111/nph.13477 | Citations: 312

Hemlock Declines Rapidly with Hemlock Woolly Adelgid Infestation: Impacts on the Carbon Cycle of Southern Appalachian Forests Aref L. Nachin, Max Westware, Chelor, B. Ford<sup>CH</sup>, Bondid L. Hendick, James M. Voze & Brien D Climate-resilient forests are the best path to ensure a long-term climate mitigation effect

"Resilience" means the capacity of forests to withstand and recover from climatic events, trends, and disruptions.

"Adaptation" means reducing the vulnerability and advancing resilience through enhancements to, or avoiding degradation of, forests.

# Whether a forest is a sink or source of carbon depends on the balance between uptake and release

## Carbon Sequestration

(photosynthesis, storage in forest pools)

## Carbon Emissions

(respiration, decomposition, combustion)

### tion CLIMATE FACTORS • Moisture

- Temperature
- Length of growing season

### SITE FACTORS

- Nutrients, light, water
- Soil type, depth, pH, microbial community
- Tree density
- Disturbance, harvests
- Elevation, aspect

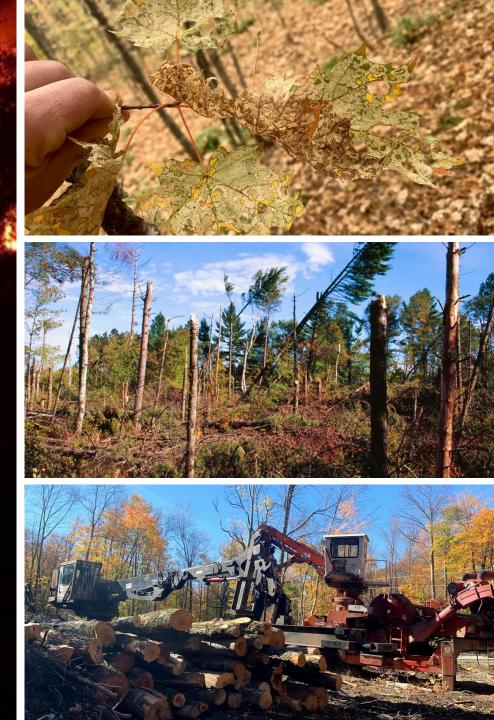
### TREE FACTORS

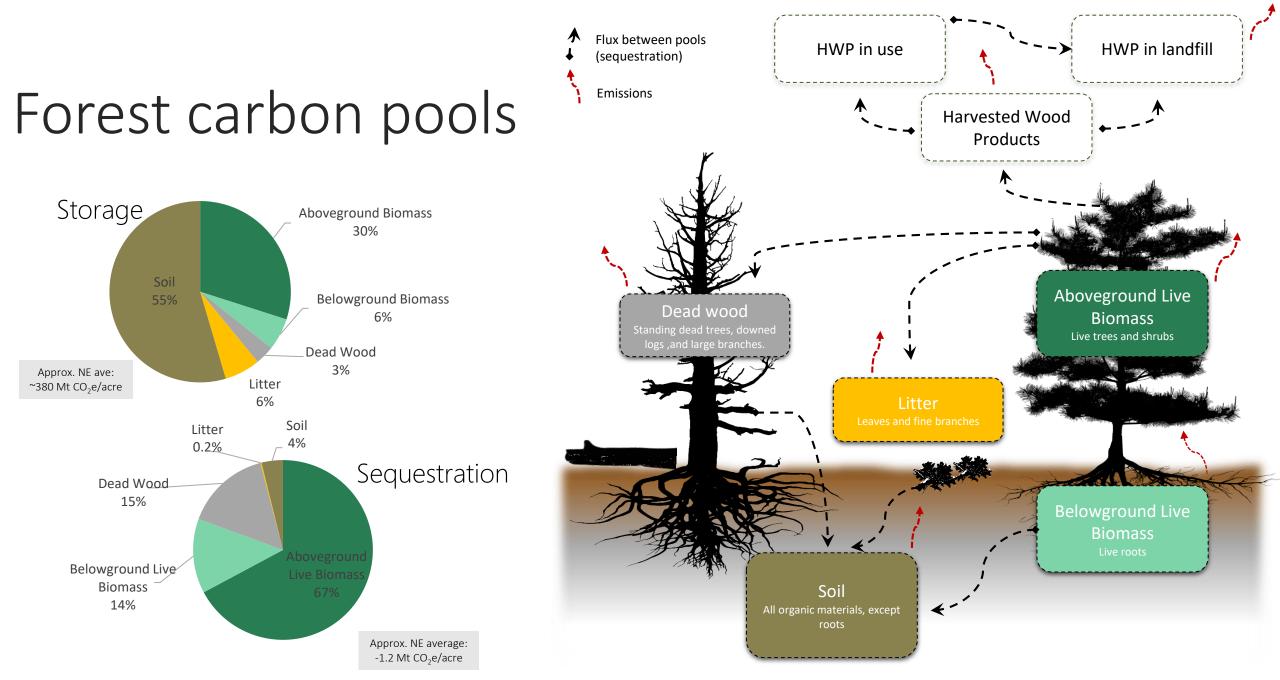
- Species, genetics
- Age, size
- Vigor, condition

Not all forest stands are carbon sinks

## <u>Carbon sink</u> Sequestration > Emissions

<u>Carbon source</u> Sequestration < Emissions

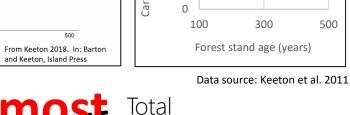


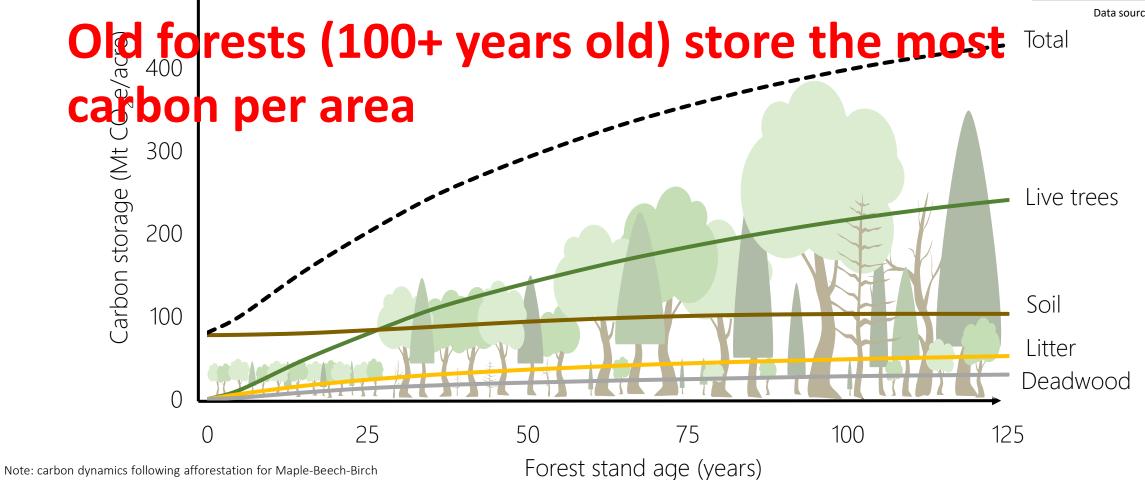


Carbon storage varies over forest stand development

500

Live tree carbon storage Carbon Data from Old Forests in the 200 Northeast Carbon storage (Mt CO<sub>2</sub>e/acre) 0 0 0 0 (E) Partial disturbance Partial / Aboveground Live Biomass (Mg/ha) 100 Years From Keeton 2018. In: Barton and Keeton, Island Press

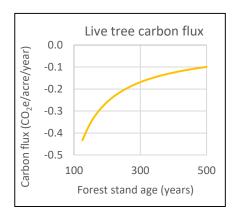


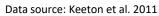


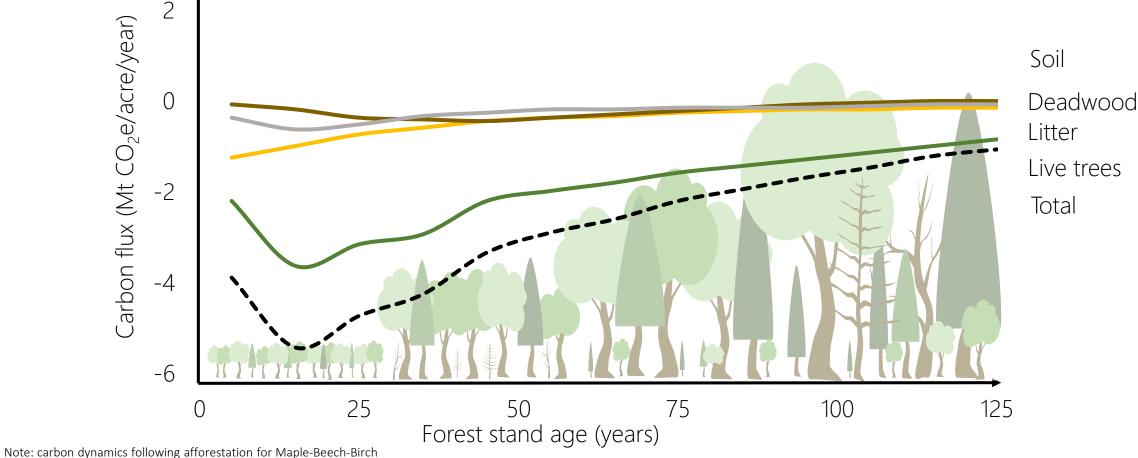
forest, does not include management. Data source: Smith et al. 2006.

Carbon sequestration varies over forest stand development

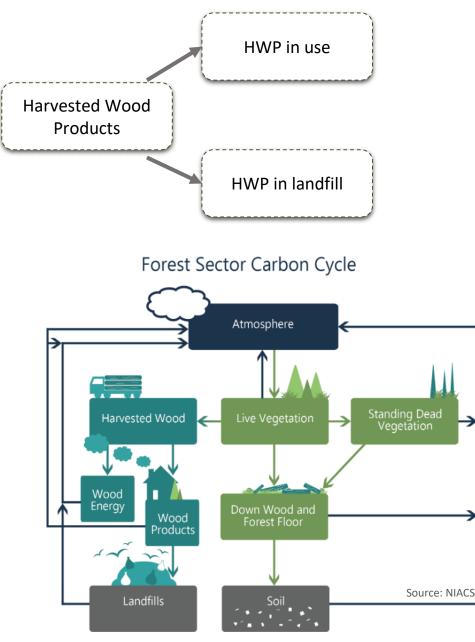
# Forests 25-70 years old sequester the most carbon per area







forest, does not include management. Data source: Smith et al. 2006.



*Figure: The forest sector carbon cycle includes forest carbon pools and carbon transfer between pools. Modified from Heath et al. (2) and United States Department of Agriculture (3).* 

### Wood Products

**Carbon storage** for as long as product is in use, and when it is no longer in use and is in a landfill slowly decomposing.

Can provide additional  $CO_2$  reduction benefits by acting as a **substitute** for high GHG products (steel, concrete, plastics, fossil fuels)

When considering the carbon impacts of HWP we must consider <u>LEAKAGE</u>



21

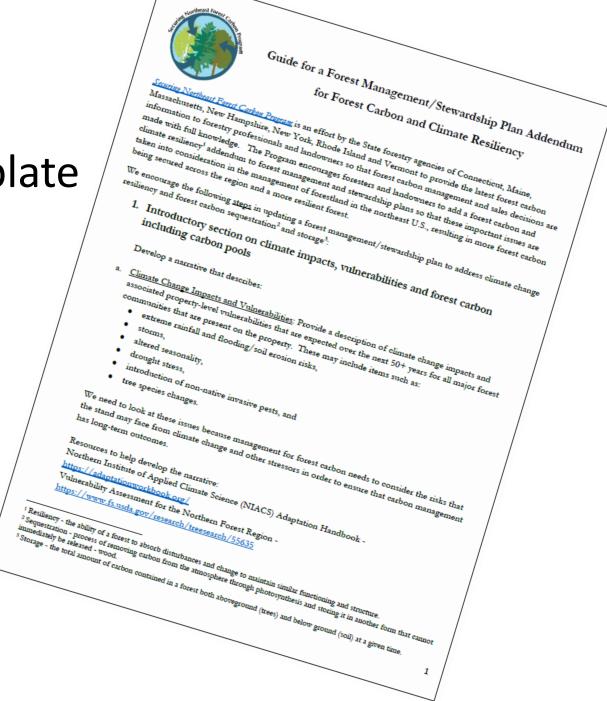
Science of Carbon-Friendly and Climate Adaptation Forest Management Some key forest management methods to increase carbon sequestration and storage:

- Avoid forest loss
- Establish reserves permanent or temporary
- Extend forest rotations: from regeneration to harvest. Partial harvest best.
- Careful forest thinning to increase growth rates
- Increase areas with younger forests (but not by clearing really old forests)
- Retain some big trees

Some key forest management methods to increase carbon sequestration and storage (cont.):

- Increase stocking in forest areas that are not dense or reforest areas with no trees
- Increase tree species diversity so there is a tree to fill all niches
- Make sure you limit damage to remaining trees when harvesting
- Protect soil during harvesting
- Get as much timber harvested into durable wood products boards and timbers
- Reduce emissions from the forest products harvesting supply chain – the machines that get the timber from the woods to the mill

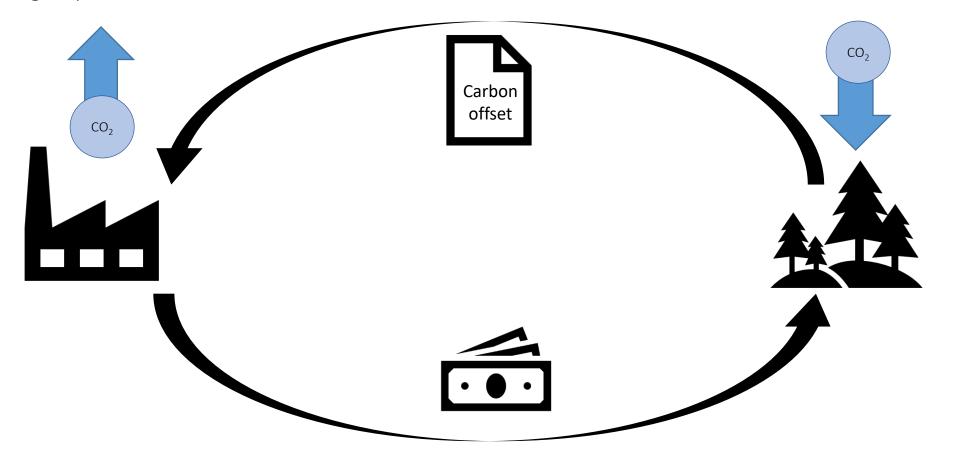
## Forest Management Plan addendum template



## **Forest Carbon Markets Overview**

## What is the purpose of forest carbon offsets?

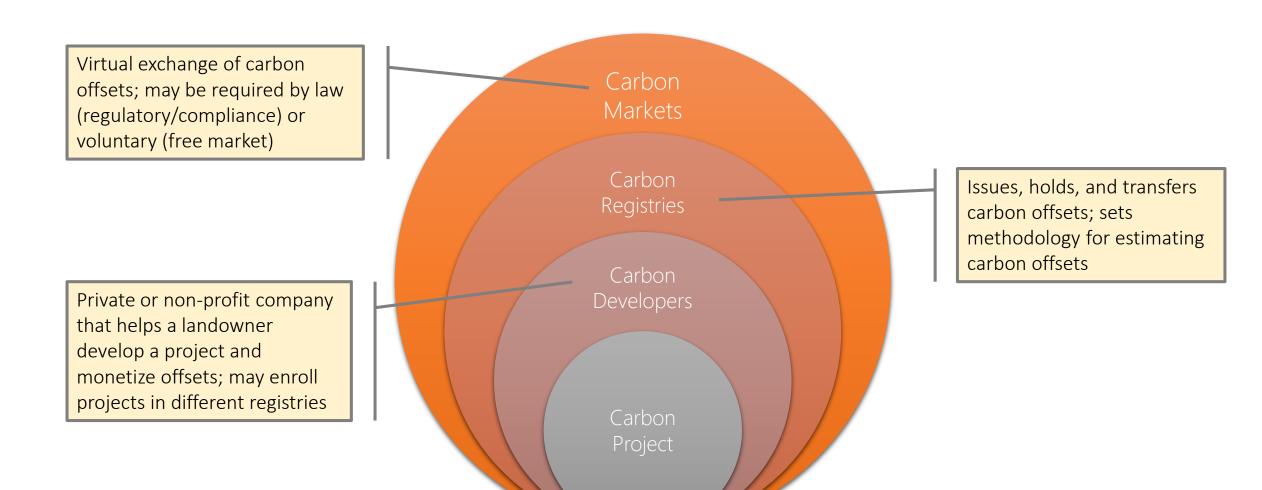
Allows entities to reduce emissions more quickly than they could otherwise by purchasing offsets where carbon is actively being sequestered or emissions avoided Helps to finance forest management, restoration, conservation, tree planting, and other activities



## Currently, there are three categories of actions for forest carbon offsets

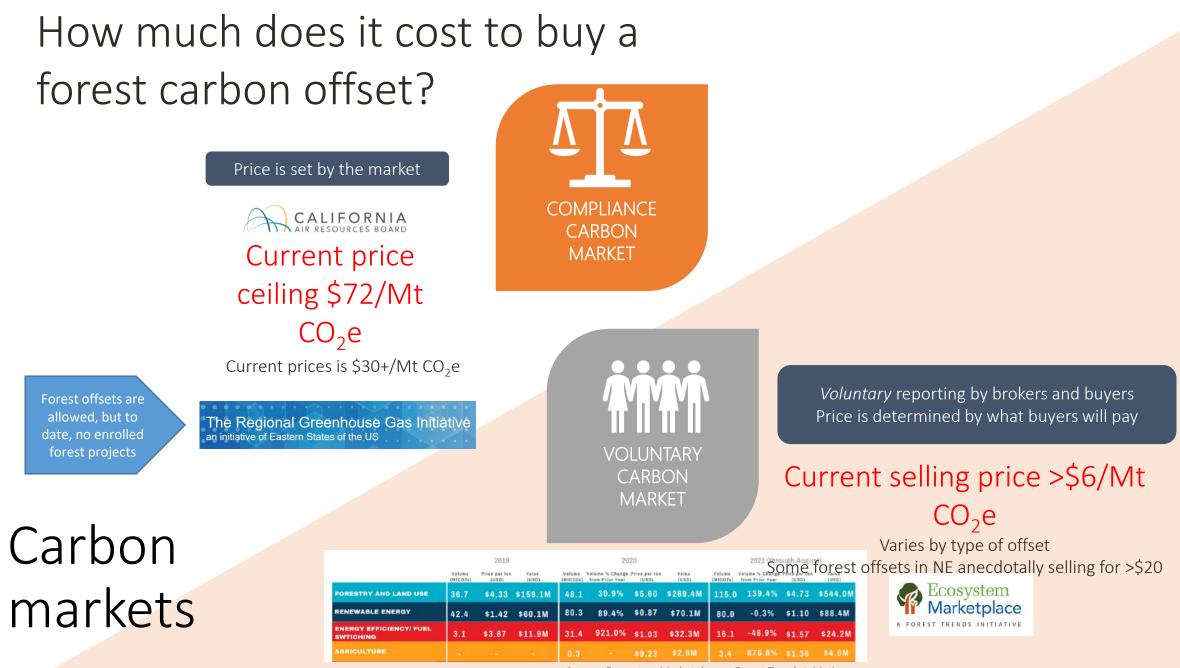


## Carbon market terminology



## Two Types of Carbon Markets

Required by law in some states Regulated transaction of offsets Centralized market, registry, and standard Set offset price  $\geq$ Emitters are required to reduce their emissions but can either buy allowances from other regulated emitters or 100 years +carbon offsets COMPLIANCE > Allowances decline over time for gradual reductions in commitment CARBON emissions MARKET Forest offsets are allowed, but to The Regional Greenhouse Gas Initiative date, no enrolled an initiative of Eastern States of the US forest projects Not required by law Not regulated DEPARTMENT OF No centralized market or registry ECOLOGY No requirement for the use of a registry or standard VOLUNTARY State of Washington No set offset price, depends on what buyers will pay CARBON Open to everyone: individuals, companies Carbon MARKET No requirement for buyers to reduce emissions over time 40 years +/markets commitment



Source: Ecosystem Marketplace, a Forest Trends Initiative.



## CA Air Resources Board compliance carbon offset market – estimated 2022 value = \$3.7 billion

Voluntary carbon offset market – estimated 2022 value = \$2.5 billion

2020 voluntary market – \$520 million 2021 voluntary market – nearly \$2 billion

## Carbon Registries

- > Carbon projects are registered and tracked through carbon registries that monitor offset trading and retirement
- > Registries have specific protocols for developing, verifying, and selling carbon offsets that must be adhered to
- Registries are not required in the voluntary market, but help buyers trust the integrity of the offset



## Carbon Developers

> private or non-profit company that helps a landowner develop a project and sell offsets

### Larger forestlands



GreenAssets

For larger forestlands, projects may be able to enroll under California ARB market/registry or in voluntary market registries (e.g., ACR)

> \*not exhaustive; there may be newer developers or developers for specific types of projects there are not included here



Approved under California's ARB market/registry



Independent market, registry, and developer In process of approval with VCS registry

### Smaller forestlands



Approved under ACR registry



In process of approval with VCS registry

### **Urban Forests**



For more information and links to these developers, see www.northeastforestcarbon.org

## Current Offset Programs for Smaller Landowners



#### Forest Carbon Works

- 40+ acres
- 100-year commitment (CA compliance market)
- Similar to large project, but reduces costs with inventory approach



NCX

### CORE Carbon (Finite Carbon)

- 40-5,000 acres
- 40-year commitment
- Use FIA plots and sub-sampling to reduce costs

??



### Family Forest Carbon Program

- Payment for carbon-friendly forest management practices
- 30 2,400 acres
- 20-year commitment
- Monitors practices on each property; carbon on a sub-set, compare to FIA
- Awaiting acceptance in VCS registry
- Plan to launch in some parts of NE region this spring

NCX: Natural Capital Exchange

- 1-year deferred harvest, unique methods
- 'Harvest deferral credits' = cof a traditional offset
- No acreage threshold
- 1-year commitment
- Independent marketplace for buying/selling sredits, awaiting acceptance in VSC registry

### Forest Carbon Developers and Programs Operating in the U.S.

Developer/Program	Website	Registry standard(s) <sup>1</sup>	Landowner Commitment	Min. Parcel Size
American Forest Foundation & The Na Conservancy – Family		rg VCS 10-	20-year minimum	30-2,400 acres
Forest Carbon Progra	m Limited states: PA, WV, MD wit	h some northeast sta	ates to be added in	1 2022
Blue Source	http://www.bluesource.com	ACR, VCS, CAR, ARB	40 or 100 years	3,000+ acres
EP. Carbon	http://www.epcarbon.com	ACR,VCS,CAR,ARB	40 or 100 years	5,000+ acres
Finite Carbon	https://finitecarbon.com	ACR.ARB	40 or 100 years	2,000+ acres
Finite Carbon – Core Carbon Program	https://corecarbon.com	ACR	40 years	40-5,000 acres
Forest Carbon Works	https://forestcarbonworks.org	ARB	100+ years	40+acres
Forest Carbon Partne https://newforests.co	rs om.au/forests-carbon-partners/	ARB	100 years	2,000+ acres
Green Assets	http://www.green-assets.com	ARB	100 years	10,000+ acres
NCX – Natural Capita	Exchange <u>https://www.ncx.com</u>	RISE	1 year	None
Ostrom Cliimate	http://www.ostromclimate.com	BCCR.ACR	40 years	2,000+ acres
SIG Carbon https://www.sigcarbo	on.com/	ACR ARB.CAR.VCS	40 or 100 years	100+/- (aggregator)
The Climate Trust	http://climatetrust.org	ACR, ARB	40 or 100 years	2,000+ acres
Woodlands	ncy & Blue Source – Working	VCS	40 xears	2000+acres

# Key Requirements for Carbon Offsets

# Real

# Additional

## Verifiable

#### Permanent

### Enforceable

Because a carbon offset

 Is not a physical object that is bought and sold
 Is used to offset actual emissions made elsewhere

Measuring, tracking, and evaluating forest carbon must adhere to strict criteria

# Two types of leakage

Activity-shifting leakage: Carbon project results in an increase in harvest on another property owned by the landowner

 In all programs, must enroll or at least declare all other properties owned

#### Market leakage:

Carbon project results in an increase in harvest on another property or location

Varies by program, most require % of offsets for leakage deduction based on reduction in harvest



Period	Baseline wood products summed over 20-yr crediting period (tons CO <sub>2</sub> )	Project wood products summed over 20-yr crediting period (tons CO <sub>2</sub> )	Project decrease in wood products relative to baseline (%)	Applicable leakage factor (%)
2017-2037	340,725	22,603	-93%	40%

Example of market leakage deduction for MA Tri-City Carbon Project

13,536-acre project in cities of Westfield, Holyoke, and West Springfield



## New: The Core Carbon Principles Assessment Framework

Click here to read more about the Assessment Framework.

A high-integrity voluntary carbon market is a key complementary tool to reduce and remove emissions above and beyond what would otherwise be possible and to channel finance towards climate resilient development.

#### Who We Ares

The Integrity Council for the Voluntary Carbon Market (Integrity Council) is an independent governance body for the voluntary carbon market.

#### What We Do5

We will set and enforce a definitive global threshold, drawing on the best science and expertise available, so high-quality carbon credits efficiently mobilize finance towards urgent mitigation and climate resilient development.

# Encourage landowners to engage with developers before entering a program

Example questions a landowner may want to ask before entering a carbon program

What types of management activities are allowed?

How is verification done?

Does the contract stay with the property if I sell?

What happens if I need to exit the contract early?

What happens if there is a natural disturbance on the property?

Is salvage harvesting allowed?

Are harvest wood product carbon stocks included?

What happens if the developer goes bankrupt or ceases to exist?

What is the payment schedule?

What is the expected revenue for my land?

How do you assure the integrity of carbon offsets?

Who buys the offsets?

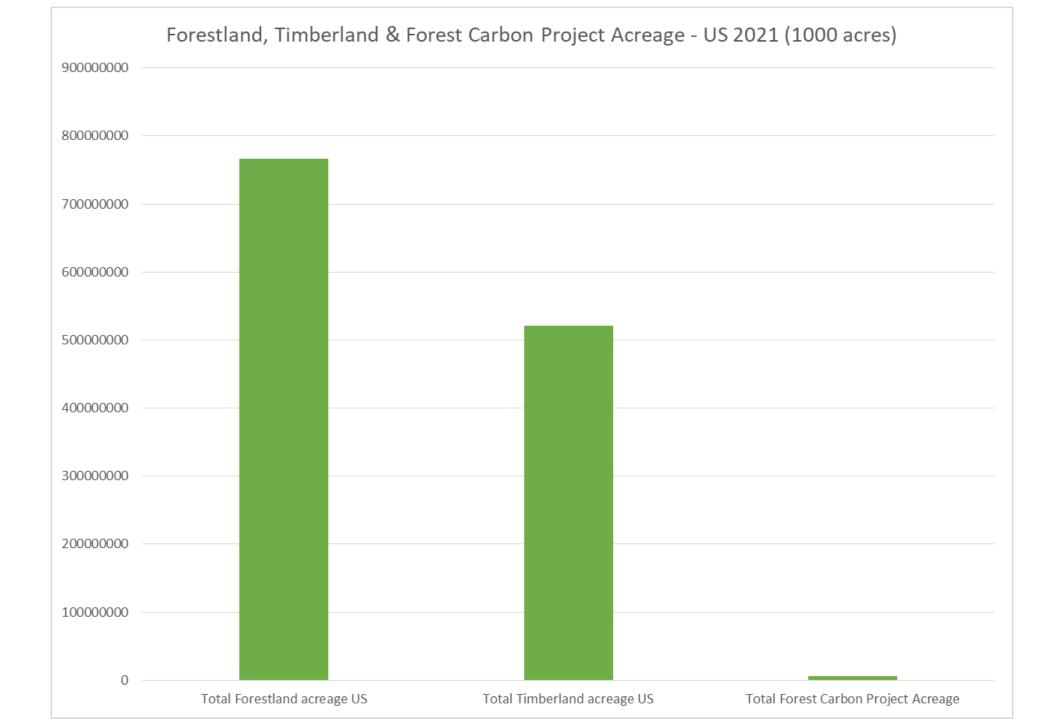


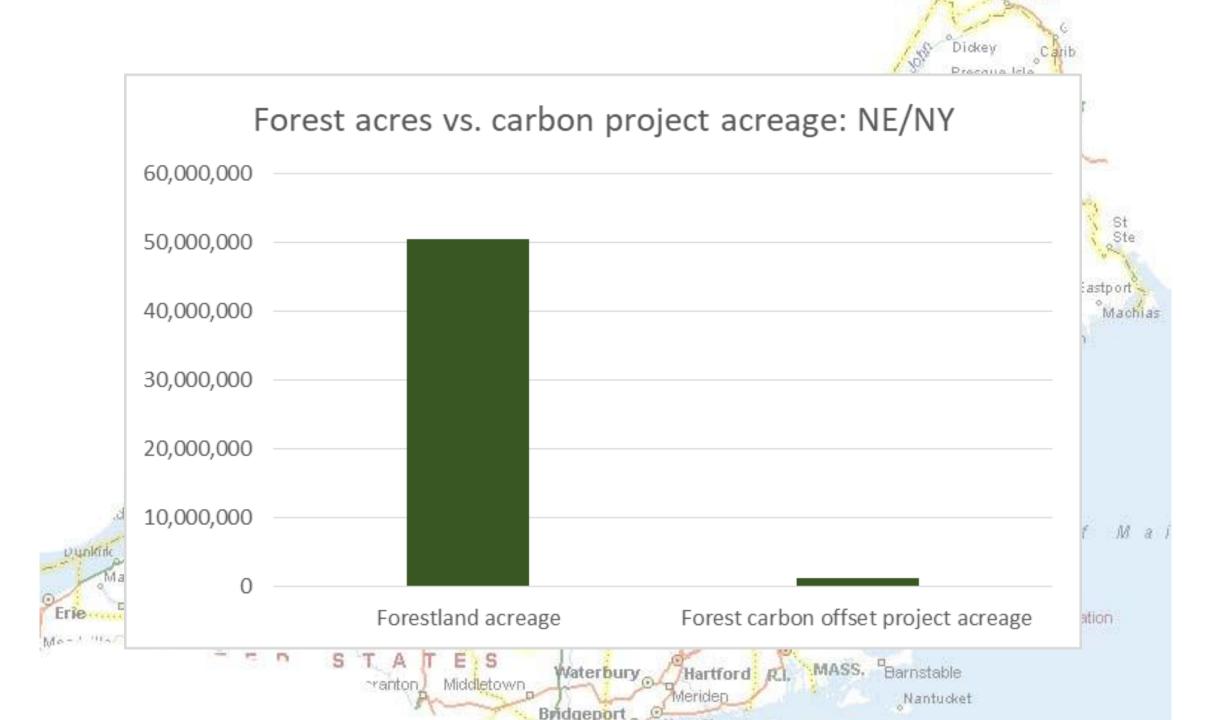
# How much forestland is in forest carbon offset markets so far?

# Forest Carbon Sale Projects 2000

Source: Forest Trends

# Forest Carbon Sale Projects 2020



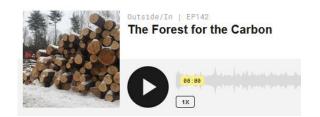


# There is a lot of debate over carbon offsets right now, which likely means that they will continue to evolve...



#### A Nonprofit Promised to Preserve Wildlife. Then It Made Millions Claiming It Could Cut Down Trees.

The Massachusetts Audubon Society has managed its land as wildlife habitat for years. Here's how the carbon credits it sold may have fueled climate change.



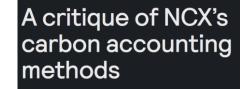
#### Systematic over-crediting in California's forest carbon offsets program

Grayson Badgley.
 Jeremy Freeman,
 Joseph J. Hamman,
 Barbara Haya,
 Anna T. Trugman,
 William R.L. Anderegg,
 Danny Cullenward
 doi: https://doi.org/10.1101/2021.04.28.441870
 Now published in *Global Change Biology* doi: 10.1111/gcb.15943

The U.S. Is About to Go All in on Paying Farmers and Foresters to Trap Carbon

The problem is, it's unclear if "Carbon Offsets" even work

- 1. These Trees Are Not What They Seem: www.bloomberg.com/
- 2. A Nonprofit Promised to Preserve Wildlife. Then It Made Millions Claiming It Could Cut Down Trees: www.propublica.org/
- 3. The U.S. Is About to Go All in on Paying Farmers and Foresters to Trap Carbon: www.rollingstone.com
- 4. Rethinking Forest Carbon Offsets: <u>www.caryinstitute.org/</u>
- 5. Systematic Over-crediting in California's Forest Carbon Offsets Program: <u>www.biorxiv.org/</u>
- 6. A Critique of NCX's Carbon Accounting Methods: <u>www.carbonplan.org/</u>
- 7. A Framework to Ensure that Voluntary Carbon Markets Will Truly Help Combat Climate Change: <u>www.brookings.edu/</u>
- 8. The Forest for the Carbon: <u>http://outsideinradio.org/</u>
- 9. John Oliver: <u>https://www.youtube.com/watch?v=6p8zAbFKpW0</u>





A framework to ensure that voluntary carbon markets will truly help combat climate change

Robert O. Mendelsohn, Robert E. Litan, and John Fleming - Thursday, September 16, 2021



# www.northeastforestcarbon.org

Sign up for new forest carbon enewsletter and links to 4 forest carbon webinars:



In this Issue:

Issue 1, 2022

- . What's this? A new effort all about forest carbon in the Northeast -
- · Who to contact in your state on forest carbon
- The Securing Northeast Forest Carbon Program website
- What's to come?

What's this? A new effort - all about forest carbon in the Northeast - Securing Northeast Forest Carbon Program

# www.northeastforestcarbon.org



Charles Levesque North East *State* Foresters Association levesque@inrsllc.com 603-588-3272