<table>
<thead>
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<th>Learning Goals</th>
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<tr>
<td><strong>1. Existing Frameworks</strong></td>
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<td>build upon the works of others assessing forest carbon</td>
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<td><strong>2. Profiles in Carbon</strong></td>
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<td><strong>4. Sustaining Solutions</strong></td>
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<td>long-term problems require long-term solutions</td>
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Key Concepts

• Flux vs. Pool
• Baseline & Additionality
• Leakage
Flux vs. Pool

‘sequestration’ vs. ‘storage’
Flux vs. Pool

‘sequestration’ vs. ‘storage’

Existing Frameworks

SOCCR2 2018
Baseline & Additionality

Existing Frameworks

Stable Baseline

Increasing Baseline

Declining Baseline

- Growth w/Action
- Additionality
- Baseline

Figures: B. Isaacson
Leakage

Existing Frameworks

Forest A

Forest B

https://www.bobvila.com/articles/lumber-sizes/
Leakage

Existing Frameworks

Forest A

Forest B

https://www.bobvila.com/articles/lumber-sizes/
Leakage

@ an unnamed Grocery Store in NJ

Existing Frameworks

@ an unnamed business in NJ
Leakage

Existing Frameworks
Markets - Compliance

Existing Frameworks

Compliance Offset Program

The Compliance Offsets Program is an important cost-containment element within the broader Cap-and-Trade Program. The California Air Resources Board issues ARB Offset Credits to qualifying projects that reduce or sequester greenhouse gases (GHG) pursuant to six Board-approved Compliance Offset Protocols.

MORE ABOUT THIS PROGRAM >
Forestry and Afforestation

U.S. Forest Projects

U.S. forest offset projects sequester carbon through three project types that increase and/or conserve forest carbon stocks, increasing the removal of CO₂ from the atmosphere, or reducing or preventing the emissions of CO₂ to the atmosphere. The eligible project types include Reforestation, Improved Forest Management, and Avoided Conversion.

Reforestation: restoration of tree cover on land that currently has no, or minimal, tree cover.

Improved Forest Management: activities that increase carbon stocks on forested land relative to baseline levels of carbon stocks.

Avoided Conversion: specific actions that prevent the conversion of privately owned forestland to a non-forest land use by dedicating the land to continuous forest cover through a conservation easement or transfer to public ownership.

CO₂ offset allowances are awarded based on the amount of net additional carbon sequestered within the offset project boundary during
Existing Frameworks

Markets - Voluntary

Standards for a Sustainable Future

Verra Registry
Version 4 of Jurisdictional and Nested REDD+ Framework Released
For the Media
VCS Version 4.1 Released

1,706 projects
668 million Verified Carbon Units Issued
145 million cars taken off the road for a year
Markets - Voluntary

California’s cap-and-trade program and the Reserve’s role in it
Markets - Voluntary

Existing Frameworks
Standards - Data

Requirements and Specifications for the Quantification, Monitoring, and Verification of Greenhouse Gas Emissions from Land Use Change, Forestry, Agriculture, and Other Land Use Activities

Farm
The entire operations, which may include multiple fields or parcels of land, and is under the management of a single owner or entity.

Field
A contiguous tract of land with a homogenous management strategy and a common owner separated by permanent boundaries such as fences, waterways, woodlands, or other similar features.

Forest
Forest projects shall use a nationally approved “forest” definition for the country where the activity occurs. For projects in the United States, Project Proponents shall use the U.S. definition in Appendix A, which is based on the U.S. Forest Service Forest Inventory & Analysis Program definition. For projects outside of the United States, Project Proponents may use the Kyoto Protocol definition in Appendix A, with the relevant Designated National Authority (DNA) selections for minimum land area, crown cover, and tree height. If the project is in a country that no longer has a designated DNA or

December 2020

https://americancarbonregistry.org/carbon-accounting/standards-methodologies
Standards - Data

- [Existing Frameworks](#)

https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program
6.1.1.2 Determining Common Practice and the Initial Baseline

Common Practice refers to the average stocks of aboveground standing live and standing dead carbon associated with the Assessment Area(s) covered by the Project Area. This value represents the result of the suite of management activities taking place within the Assessment Area(s) and is used to approximate a Performance Standard for Improved Forest Management Projects. The overall intent of this protocol is for projects to contribute to long-term increases in average carbon stocking in the Assessment Area(s) where they are located. Projects with initial stocking below Common Practice will increase their stocking over time. Projects with initial stocking above Common Practice will also likely increase their stocking over time, but, as or more importantly, will prevent activities that otherwise would have decreased the stocking on the project site to or below Common Practice stocking. In the absence of a forest project, there is no guarantee that a site with stocking above Common Practice will maintain their stocking levels, especially over the 100-year period committed to by projects.

The Common Practice statistic applicable to a project can be found by consulting the Assessment Area Data File on the Reserve’s FP webpage. If the Project Area covers multiple Assessment Areas, Common Practice must be calculated as the average of the values for each Assessment Area, weighted by the percentage of the Project Area that falls within each Assessment Area.

Common Practice statistics are calculated from United States Forest Service Forest Inventory and Analysis (USFS FIA) program. The Reserve will update the Common Practice statistics in the Assessment Area Data File periodically. The frequency of updating Common Practice statistics will be subject to the availability of new USFS FIA data but will be no more frequent than once every five years. The Reserve will announce any forthcoming updates to the Common Practice statistics before they are released, and any updates will not be retroactive.

The performance standard criteria establish minimum aboveground standing live and standing
Standards - Data

Existing Frameworks

Quantification Guidance for RGGI U.S. Forest Offset Projects

2015

models, may project information regarding tree growth, harvesting, and mortality over time – values that should ultimately be converted into carbon in an additional step. Other models may combine steps and estimate tree growth and mortality, as well as changes in other carbon pools and conversions to carbon, to create estimated projections of carbon stocks over time.

Models are also used to assist in updating inventory plots so that the plots can represent a reporting year subsequent to their actual sample date. The model simulates the diameter and height increment of sampled trees for the length of time between their sampled date and the reporting year. Plot data can be projected for the length of time the projection method is expected to accurately reflect actual forest growth. Inaccurate updating of plot data can lead to the inability of a project to be verified. Verifiers are directed to randomly select plots or stands for verification. If the Project Sponsor’s estimates deviate from the verifier’s measurements, the verification will fail. Hence, it is recommended to update plots at least every 12 years.

The following growth models have been approved:

- CACTOS: California Conifer Timber Output Simulator
- CRYPTOS: Cooperative Redwood Yield and Timber Output Simulator
- FVS: Forest Vegetation Simulator
- SPS: Stand Projection System
- FVS: Forest Projection System
- FREIGHTS: Forest Resource Inventory, Growth, and Harvest Tracking System
- CRYPTOS Emulator
- FORESEE

A Project Sponsor may update inventory plot data for estimating diameter and height growth by incorporating data obtained from sample plots, as in a stand table projection. An example of an appropriate method of making a stand table projection is as follows:

https://www.rggi.org/allowance-tracking/offsets/offset-categories/forestry-afforestation
**Standards - Data**

**EVALIDator Version 1.8.0.01**

Revision date: October 31, 2019

**Step 1 of 4 (choosing retrieval type and estimate type group)**

**User Alerts**

**Retrieval Type**

The "State(s) retrieval" type is the default. You should only select the "Circle retrieval" type when the area of interest is a circular area around some point. If you choose the circle option you must also enter the latitude and longitude of point center in decimal degrees (the latitude and longitude of Duluth, for example, is latitude = 46.78 and longitude = -92.12) and enter the circle radius in miles. A location's latitude and longitude can be obtained using [Google Maps (opens in new window)](https://www.google.com/maps) (1. locate the point of interest using Google Maps, 2. right click on the location, 3. select "What's here?", 4. click on the green arrow to get the coordinates).

- State(s) retrieval
- Circle retrieval

If "Circle retrieval" is selected then specify latitude, longitude and radius of the circle.

- Latitude (in decimal degrees)
Standards - State Data

Forest Inventory
- USFS Forest Inventory Analysis Phase 1 (Locations +/- 3.5 miles)
- NJFS Wharton/Penn Inventory 2017-2019
- Wharton & Penn State Forests

NJFS 2017-2019 data: 5,999 Plots

USFS FIA data 2019
- Phase 1: 1532 plots
- Phase 2: 795 plots

Existing Frameworks
Forest Carbon Data Sources

- Forest Inventory & Analysis Program (FIA)
  https://www.fia.fs.fed.us/forestcarbon/index.php

- Michigan State University Forest Carbon & Climate Program
  https://www.canr.msu.edu/fccp/

- State of the Carbon Cycle Report (SOCCR, SOCCR2)
  https://www.carboncyclescience.us/state-carbon-cycle-report-soccr

- USFS Northern Research Station: Tools for Carbon Inventory, Management, & Reporting
  https://www.nrs.fs.fed.us/carbon/tools/
Carbon

Tools for carbon inventory, management, and reporting

Accurate estimates of carbon in forests are crucial for forest carbon management, carbon credit trading, national reporting of greenhouse gas inventories to the United Nations Framework Convention for Climate Change, calculating estimates for the Montreal Process criteria and indicators for sustainable forest management, and registering forest-related activities for state and regional greenhouse gas registries and programs.

Our scientists have contributed to developing a toolbox full of basic calculation tools to help quantify forest carbon for planning or reporting. The following tools are currently available:

- PRESTO: an online tool to estimate carbon in harvested wood products
- Measurement guidelines for the sequestration of carbon

Carbon

- Carbon Home
- Literature resources for carbon inventories
- Tools for carbon inventory, management, and reporting
- Tools Workshop
- Summaries
- Webcasts
- Carbon Factoids

Carbon Tools

- PRESTO: an online tool to estimate carbon in harvested wood products
Forest & Climate Data Sources

• Climate Change Atlas: Tree Atlas
  https://www.fs.fed.us/nrs/atlas/tree/

• Northern Institute of Applied Climate Science (NIACS)
  https://www.nrs.fs.fed.us/niacs/

• USFS Treeresearch
  https://www.fs.usda.gov/treeresearch/

• National Climate Assessment
  https://nca2014.globalchange.gov/
Forest & Climate Data Sources

• Climate Change Vulnerability Assessments
  https://www.fs.usda.gov/managing-land/sc/vulnerability-assessments

• USFS Climate Change Resource Center
  https://www.fs.usda.gov/ccrc/

• Rutgers Climate Institute – NJ Forest Adapt
  https://njforestadapt.rutgers.edu/#/splash

• Northern Forest Futures & Future Forests of the Northern US
  https://www.nrs.fs.fed.us/futures/
Northern Forest Futures Project

Northern Forest Futures Project
The Northern Forest Futures Project is a window on tomorrow’s forests, revealing how today’s trends and choices can change the future landscape of the Northeast and Midwest. Using the latest inventory data and scientific projections, the Northern Forest Futures Project helps visualize what’s here today and what to expect tomorrow. Ultimately, this project informs decision-making about the sustainable management of public and private forests in the northern United States.

What about Northern Forests

What are they like now?

What is changing?
NJ Forest Carbon Pools

Figure 69. Forest carbon pools by percentage for New Jersey in 2018. (FIA)

Area of Land Use in Acres

Soil 5 39%
Live Above Ground 1 55,768,441 metric tons
Live Below Ground 2 11,028,959 metric tons
Dead Wood 3 8,386,448 metric tons
Litter 4 10,848,325 metric tons
Soil 5 55,288,201 metric tons

One square == 10,000 Acres, Data Source: NJDEP Land Use 2015
NJ Forest Carbon Distribution

Total Carbon (ton/ac)
Legend
njcarbtotta
Value
High : 109.251
Low : 0

Soil Carbon (ton/ac)
Legend
Value
High : 53.7383
Low : 0
NJ Forest Carbon

NEW JERSEY’S GREENHOUSE GAS SOURCES & SINKS 2018


Carbon Pools by Forest Type in the Pinelands Jurisdiction

- Oak / gum / cypress group
- Oak / hickory group
- Oak / pine group
- Loblolly / shortleaf pine group

- Pool 1: Live Aboveground
- Pool 2: Live Belowground
- Pool 3: Dead Wood
- Pool 4: Litter
- Pool 5: Soil Organics

[Graph showing carbon pools in million metric tonnes]
Pinelands Forest Carbon

Metric Tonnes of Carbon per Acre in each Carbon Pool within the Pinelands

- Oak / gum / cypress group
- Oak / hickory group
- Oak / pine group
- Loblolly / shortleaf pine group

- Pool #1: Live Aboveground
- Pool #2: Live Belowground
- Pool #3: Dead Wood
- Pool #4: Litter
- Pool #5: Soil Organics
Land Use Conversion

Changes to the Pool

https://crssa.rutgers.edu/projects/lc/urban_growth.html

James Denny Ward, USDA Forest Service, Bugwood.org
Montana’s forests have historically been large carbon sinks, pulling carbon dioxide from the air. In recent years, disease and other disturbances have caused forests to die, emitting carbon dioxide instead as they rot.

Changes to the Pool

Now a Net-Emitter
Cold Winter Nights Are Keeping the Lid on Southern Pine Beetle in NJ

Historic northern limit of regular outbreaks

Left: Ungerer et al. 1999
Right: Tran et al. 2007
Southern States Have Adapted to Southern Pine Beetle

Pests
Wildfire

“BAD” FIRE!

Now an Emitter

Changes to the Pool

B. Isaacson
Peat Fires


https://doi.org/10.1016/B978-0-444-59510-2.00001-X

Changes to the Pool
Loss of Ecosystem Function

Pine Barren Gentian

Changes to the Pool
Changes to the Pool
Climate Stress

Changes to the Pool
Climate Stress

USFS Climate Change Tree Atlas

Loblolly Pine

Current Importance Value
(Federal forest inventory data)

Projected Importance Value, 2100
(Avg. of Hadley CM3, GFDL CM 2.1, PCM)

Data & Figures: USFS 2014

Changes to the Pool
Balance - Maximizing Any One Thing Makes the Maximum Unstable
Forest Carbon Solutions

Afforestation/Reforestation
Forest Carbon Solutions

Restoration
Forest Carbon Solutions

Improved Forest Management
Forest Carbon Solutions

Avoided Forest Conversion & Emissions
“GOOD” FIRE!

Sustaining Solutions
Ladder Fuels

New Jersey’s Forestlands: sequester the Carbon equivalent of seven 5-gallon gas cans worth of gasoline, per person, every year.

Data Sources:
USDA Forest Service FIA
US Environmental Protection Agency 2018-07-05
Learning Goals Re-Cap

1. Existing Frameworks
   build upon the works of others assessing forest carbon

2. Profiles in Carbon
   what does our forest carbon pool look like?

3. Changes in Store
   need to consider risks to carbon pools

4. Sustaining Solutions
   long-term problems require long-term solutions
Questions?

Thank You!

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