Forest Carbon & Climate Information

Photo:
Christopher Smith

Learning Goals

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

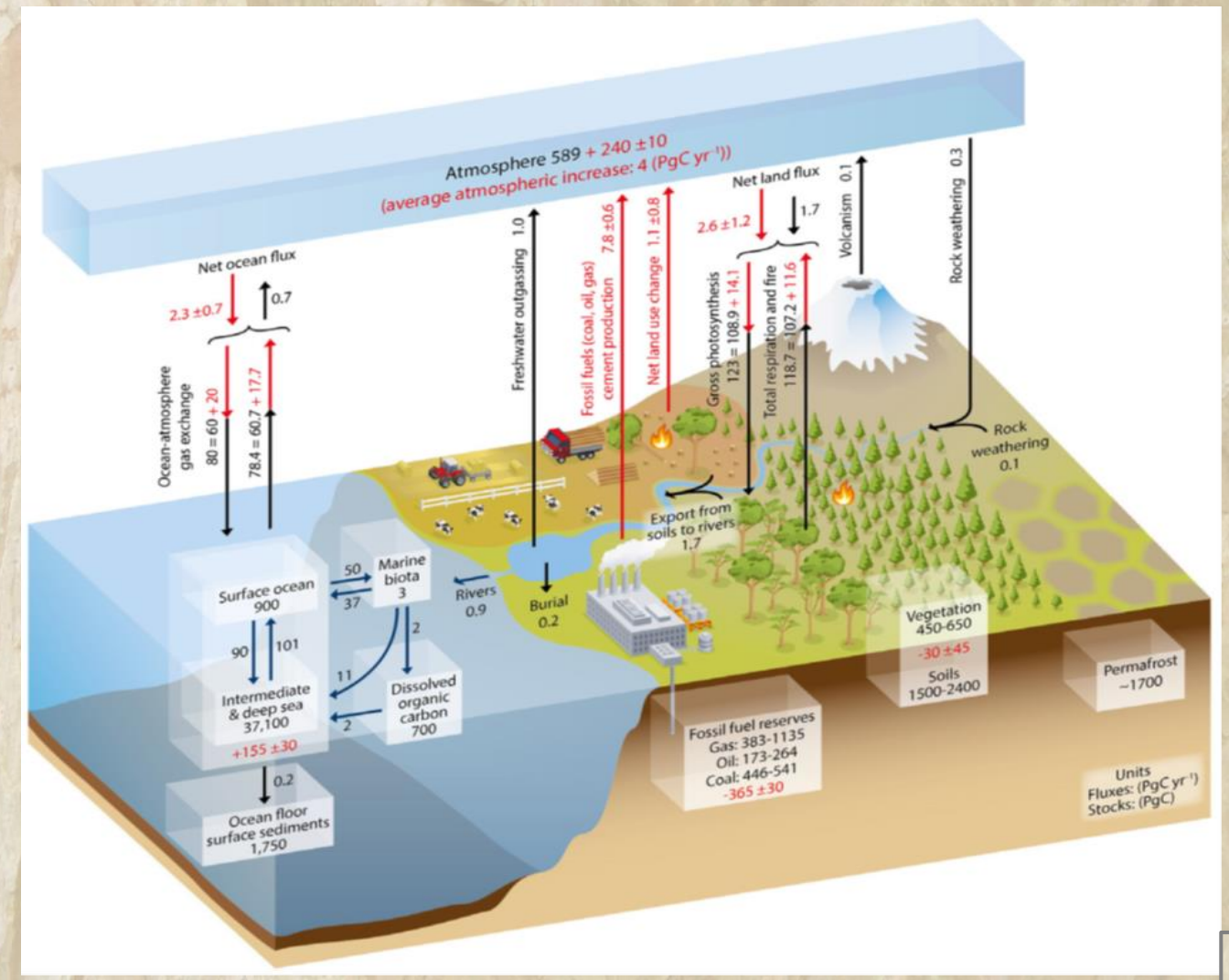
Key Concepts

- Flux vs. Pool
- Baseline & Additionality
- Leakage

Flux vs. Pool

Existing Frameworks

'sequestration' vs. 'storage'



SOCCR2 2018

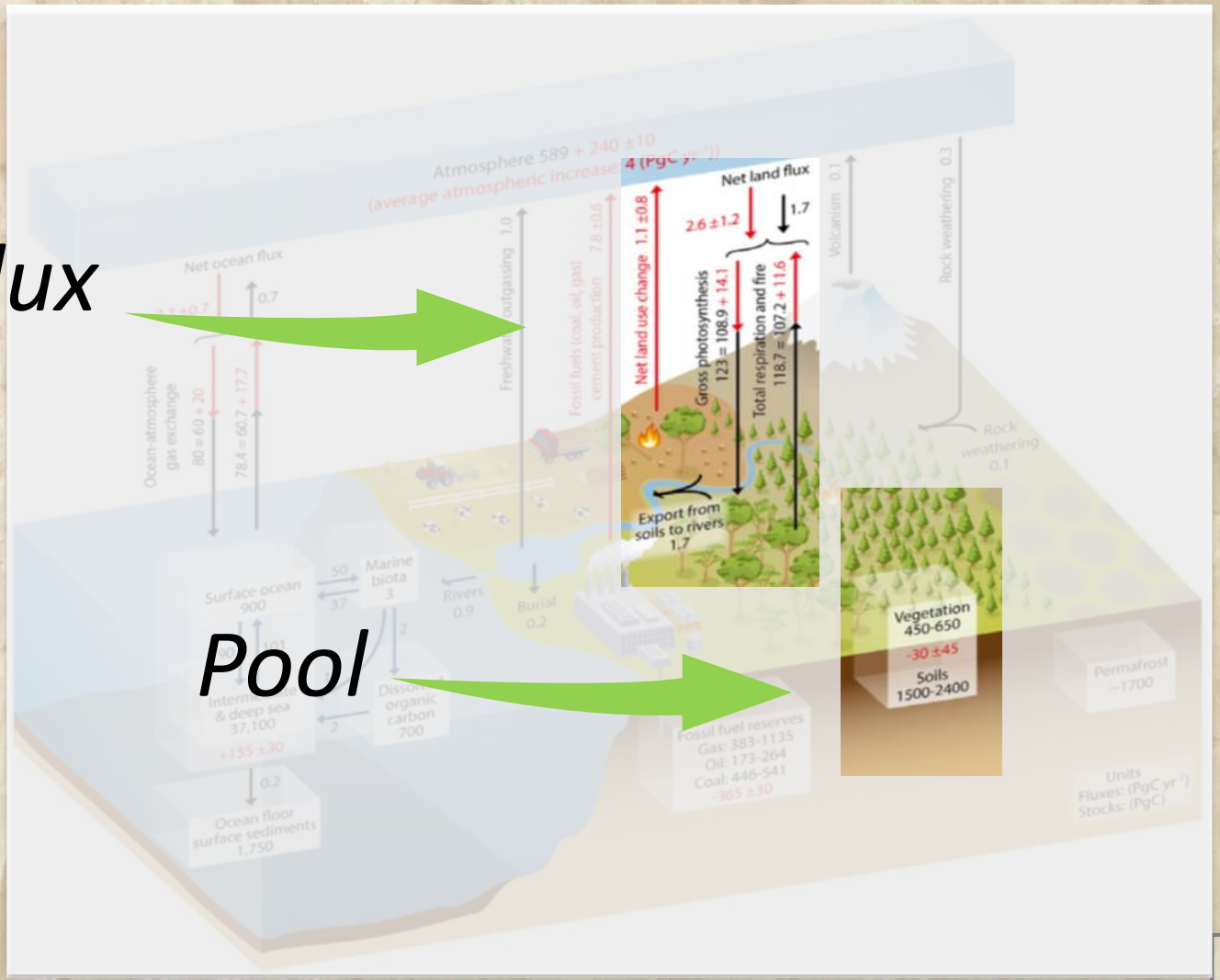
Flux vs. Pool

Existing Frameworks

'sequestration' vs. 'storage'

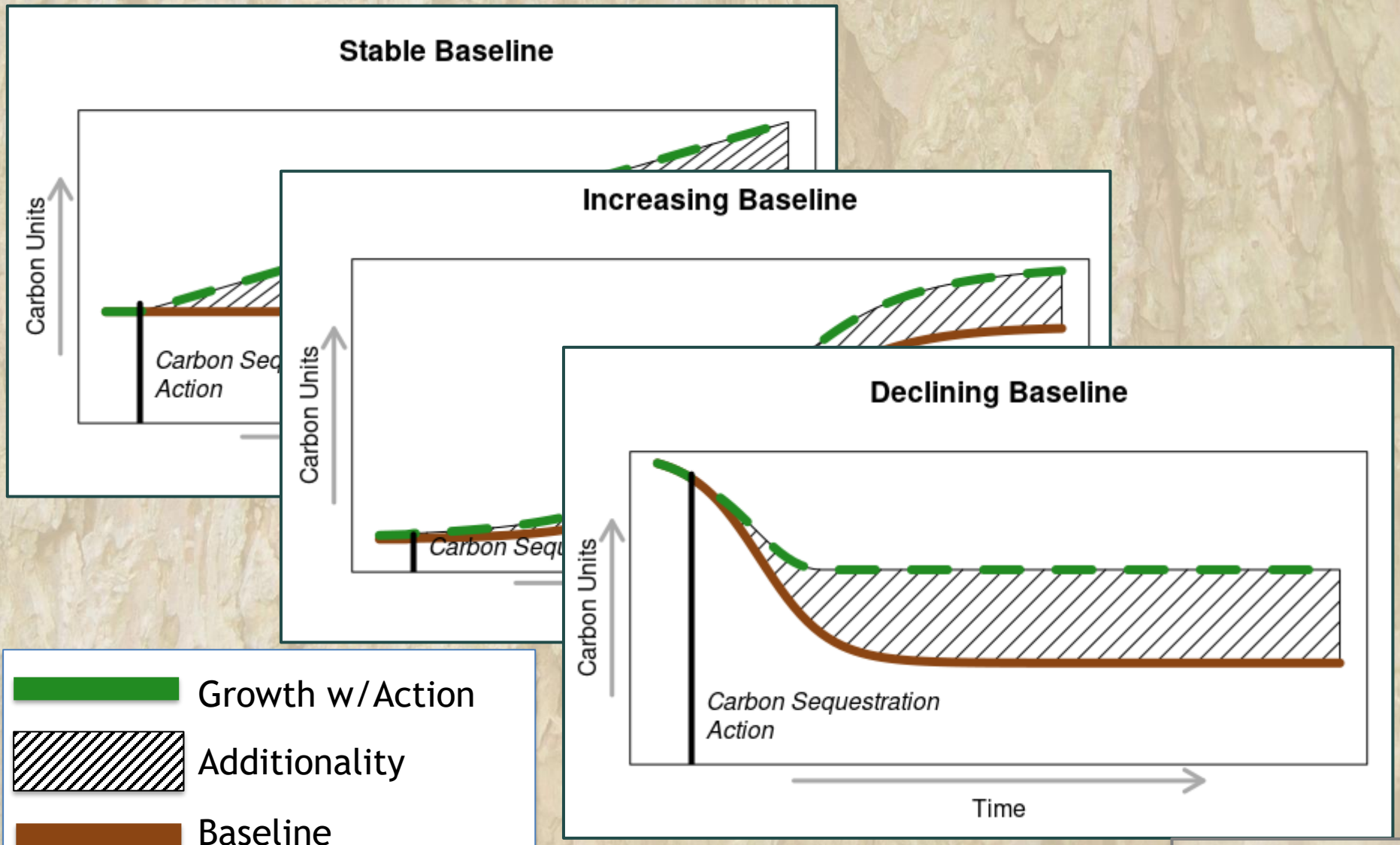
Flux

Pool



Baseline & Additionality

Existing Frameworks

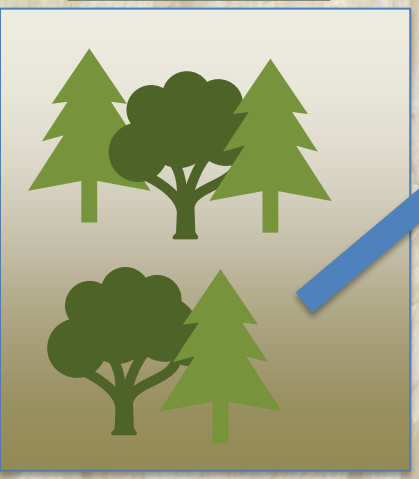


Figures: B. Isaacson

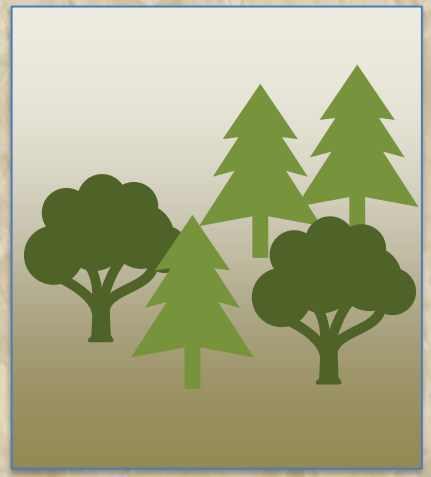
Leakage

Existing Frameworks

Forest A



Forest B

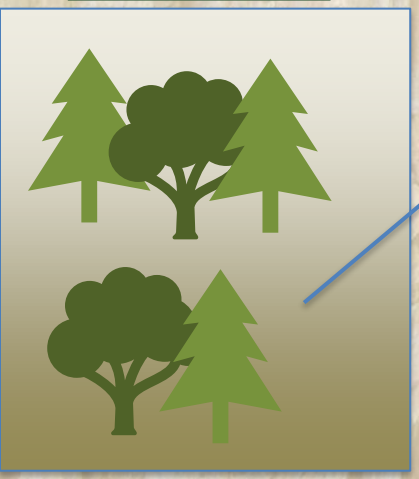


https://www.bobvila.com/articles/lumber-sizes/

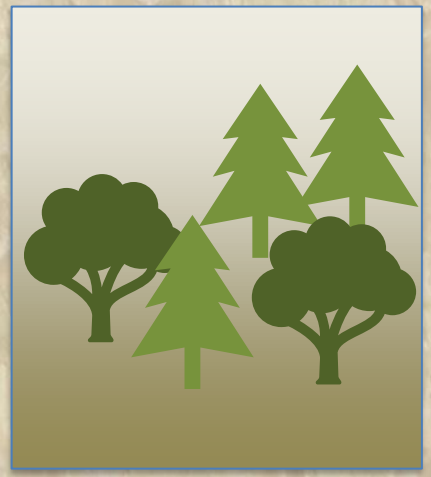
Leakage

Existing Frameworks

Forest A



Forest B



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

Leakage

Existing Frameworks

@ an unnamed Grocery Store in NJ

@ an unnamed business in NJ

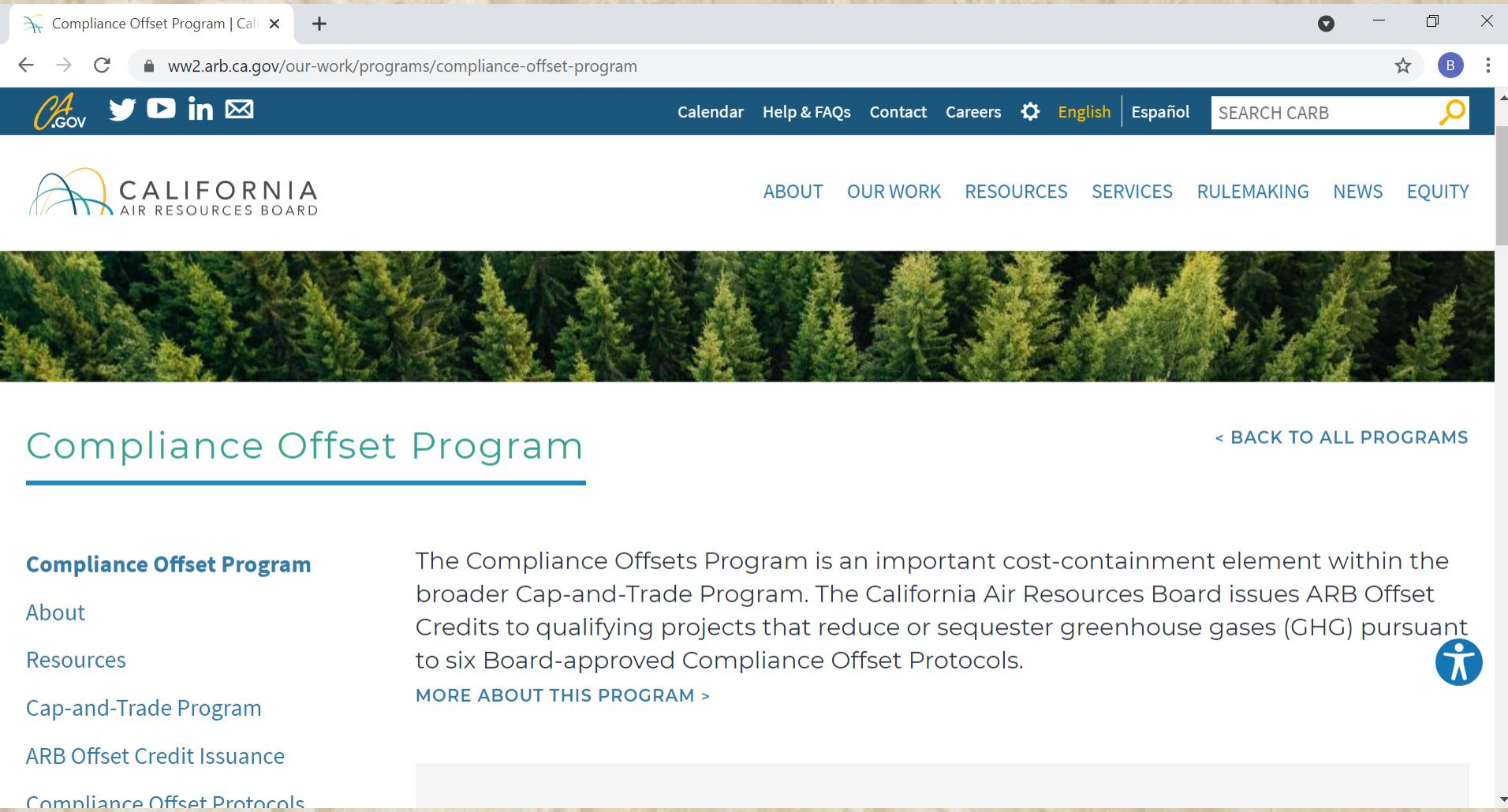
B. Isaacson

Leakage

Existing Frameworks

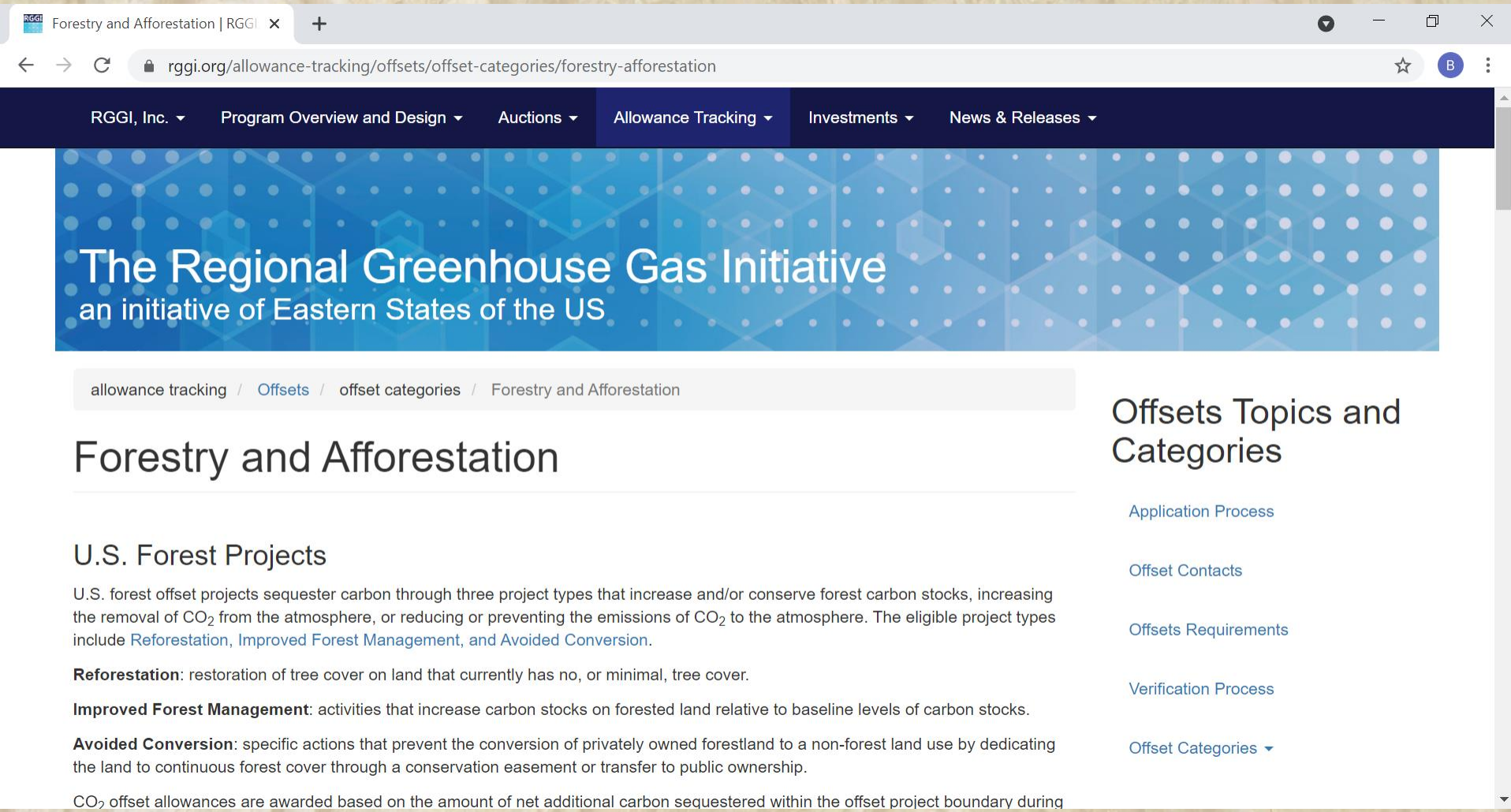
Markets - Compliance

Existing Frameworks



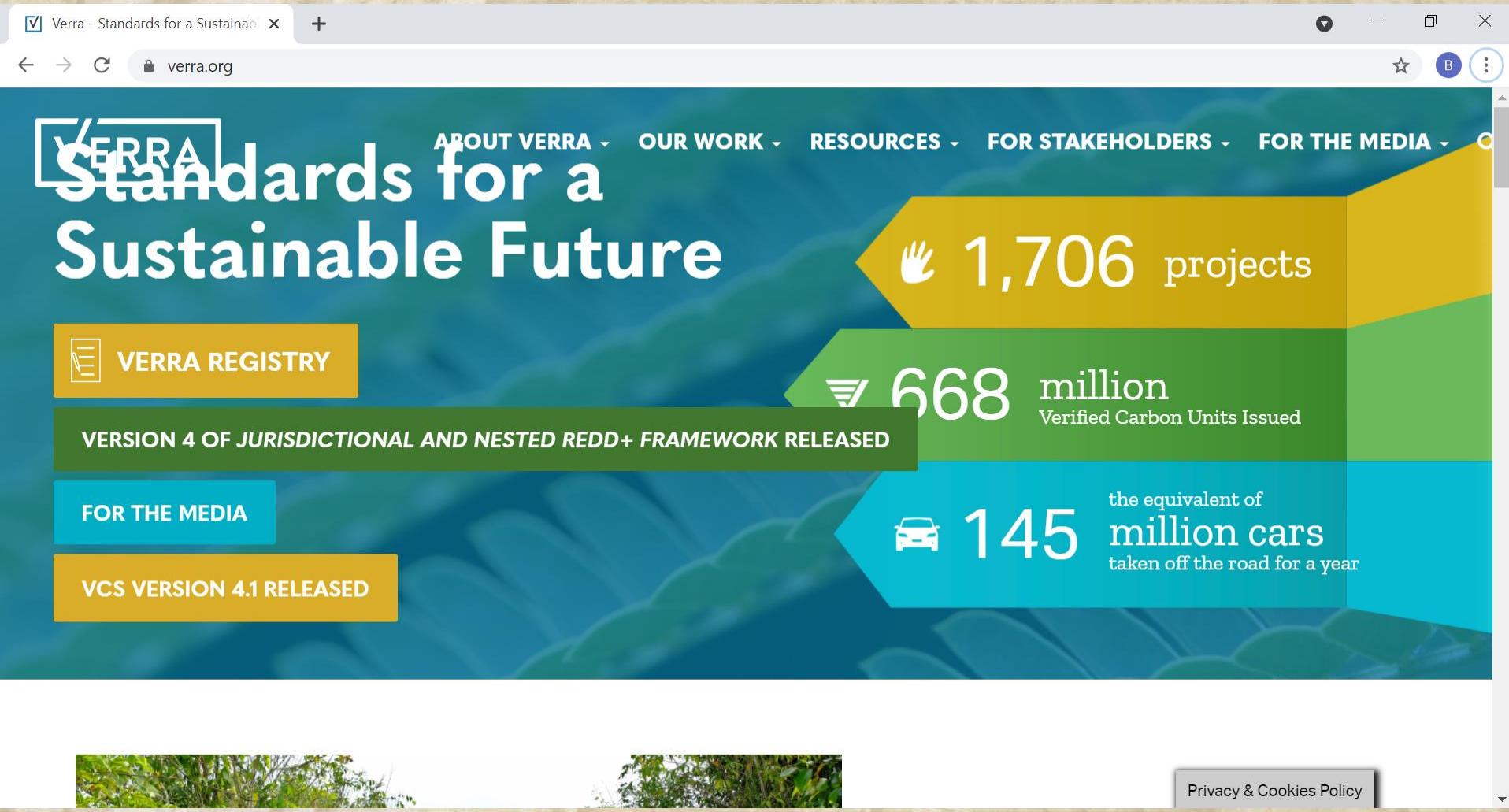
Markets - Compliance

Existing Frameworks



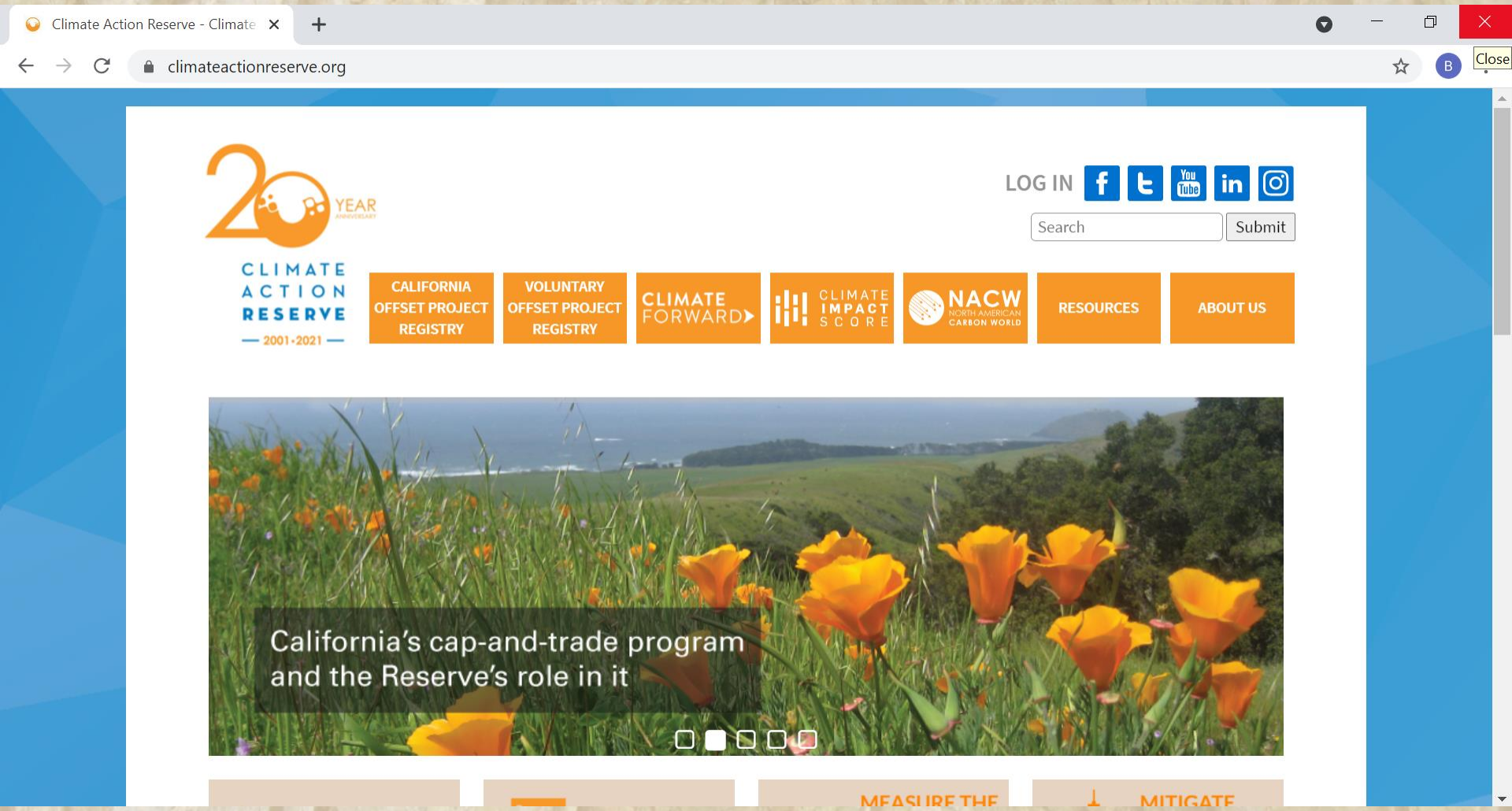
Markets - Voluntary

Existing Frameworks



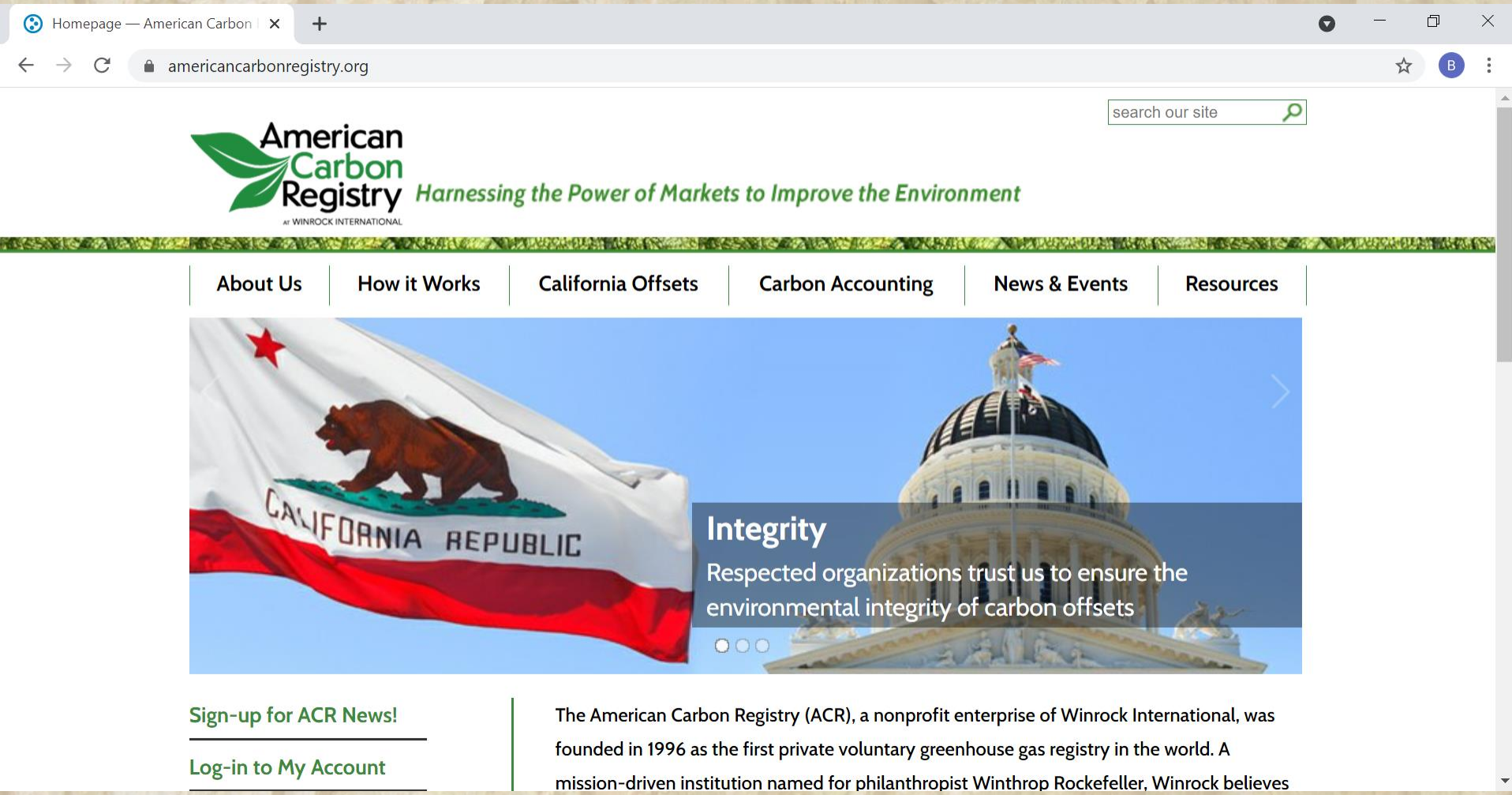
Markets - Voluntary

Existing Frameworks



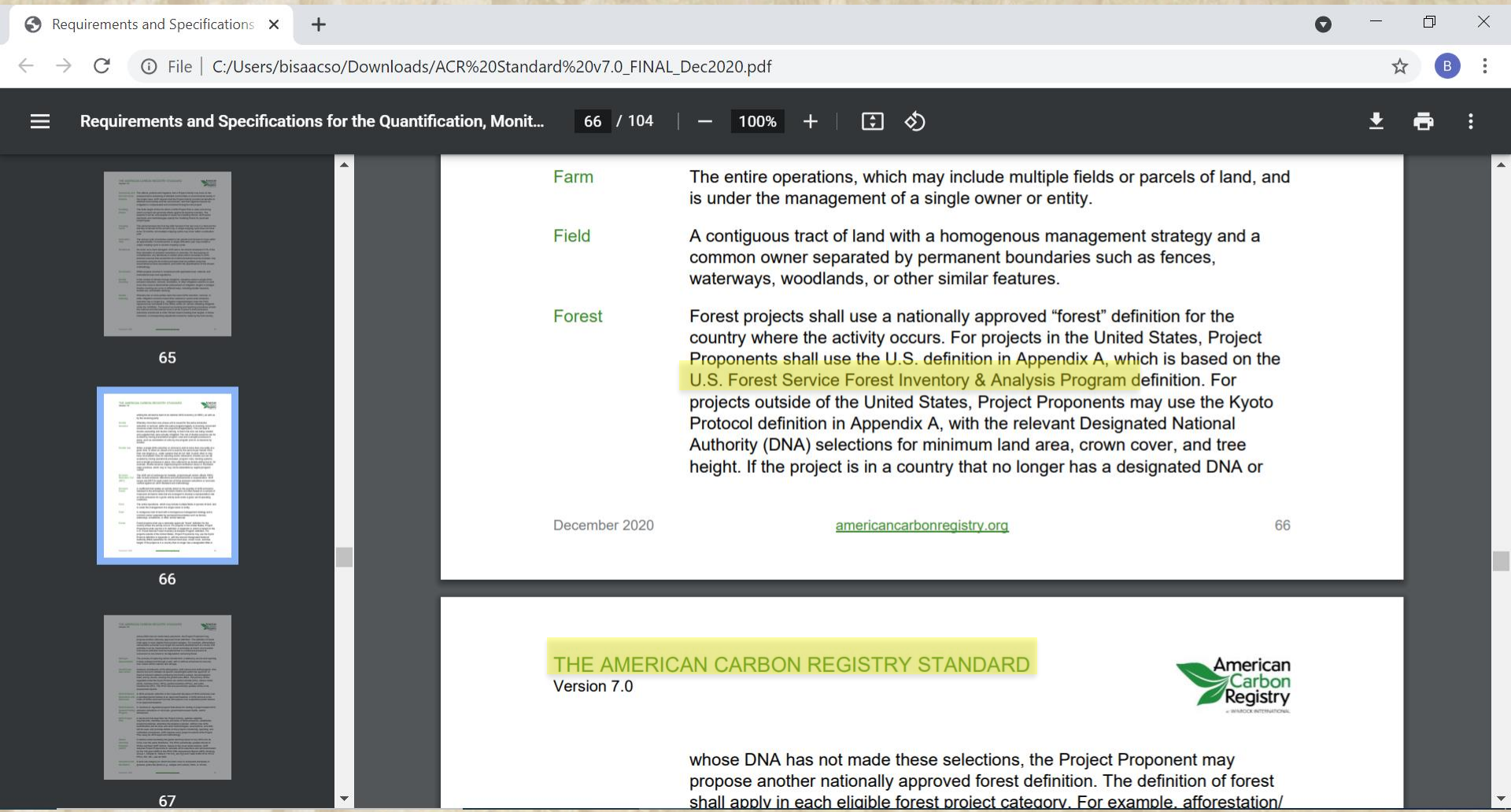
Markets - Voluntary

Existing Frameworks



Standards - Data

Existing Frameworks



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

Standards - Data

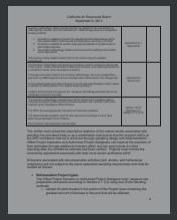
Existing Frameworks

ARB Compliance Offset Program

ww2.arb.ca.gov/sites/default/files/classic//cc/capandtrade/protocols/usforest/verifying-forest-carbon-invent.pdf

ARB Compliance Offset Program U.S. Forest Projects Complian... 5 / 12 100%


3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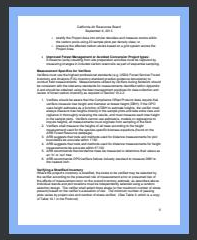

5

the carbon pools using 20 sample plots per density class; or

- measure the affected carbon stocks based on a grid system across the Project Area.

- **Improved Forest Management or Avoided Conversion Project types:** Emissions (soils) resulting from site preparation activities must be captured by measuring changes in included carbon reservoirs as part of sequential sampling.

Measurement Specifics for Verifiers

Verifiers must use the highest professional standards (e.g. USDA Forest Service Forest Inventory and Analysis (FIA) inventory standard practice guidance documents) to conduct field measurements. Measurements utilized by verifiers during fieldwork should be consistent with the tolerance standards for measurements identified within Appendix A and should be obtained using the best management practices for data collection and review of forest carbon inventory as required in Section 10.2.2:

1. Verifiers should be aware that the Compliance Offset Protocol does require that verifiers measure tree height and diameter at breast height (DBH). If the OPO uses height estimates as a function of DBH to estimate heights, the verifier must always measure tree heights directly in the sample plots and take extra care and vigilance in thoroughly reviewing the results, and must measure each tree height in the sample plots. Verifiers cannot use estimators, models or regressions to impute heights, all measurements must originate from sampling in the field.
2. Verifiers shall measure the heights of all trees according to the height measurement used for the species-specific biomass equations (found on the ARB Forest Resource webpage).
3. ARB suggests that tools and methods used for distance measurements for plot boundaries be accurate within 1"/30'.
4. ARB suggests that tools and methods used for distance measurements for height measurements be accurate within 6"/100'

https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program

Standards - Data

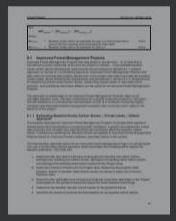
Existing Frameworks

Forest_Protocol_V5.0_Package_04

climateactionreserve.org/wp-content/uploads/2021/04/Forest_Protocol_V5.0_Package_040921.pdf

Forest_Protocol_V5.0_Package_040921.pdf 52 / 155 105%


50


51


52

(i.e., the *preliminary unadjusted baseline* at time zero).

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

https://www.climateactionreserve.org/how/program/program-manual/

Standards - Data

Existing Frameworks

Quantification_Guidance.pdf

rggi.org/sites/default/files/Uploads/Offsets/Forestry/Quantification_Guidance.pdf

Quantification_Guidance.pdf 14 / 16 100%

14

15

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
- FPS: 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

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

Standards - Data

Existing Frameworks

Smallest scale – County Level
Largest Scale – National

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)** (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).

Select state or circle retrieval

- (•) State(s) retrieval
- ( ) Circle retrieval

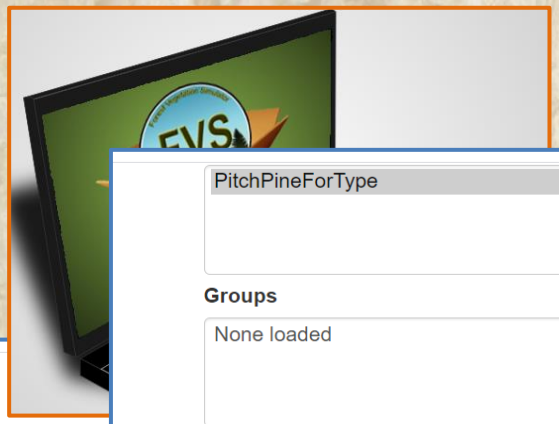
If "Circle retrieval" is selected then specify latitude, longitude and radius of the circle.

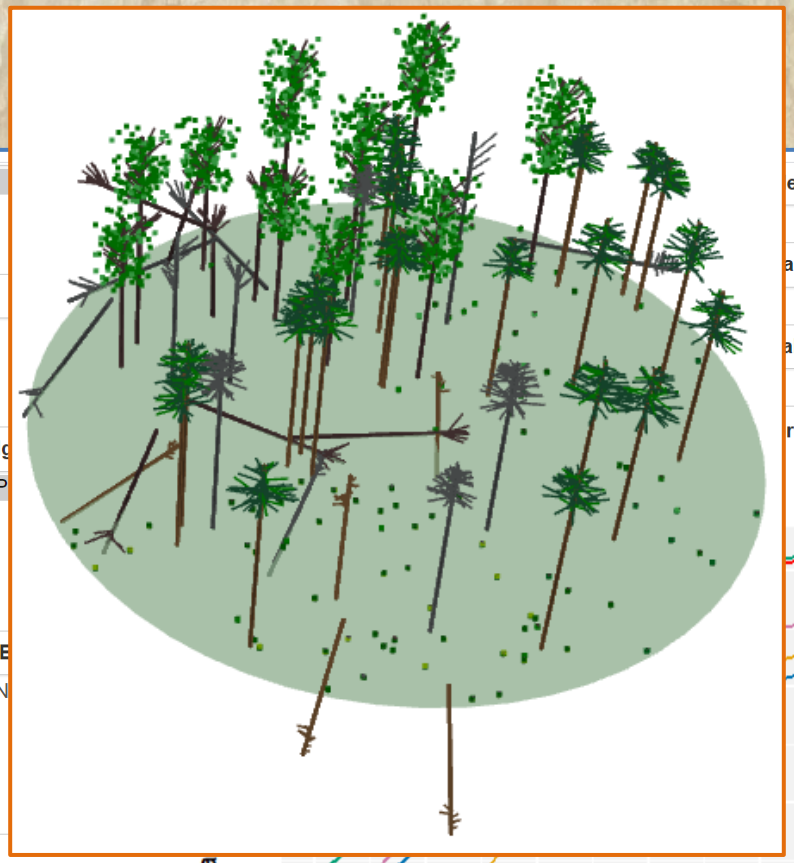
[ ] Latitude(in decimal degrees)

https://apps.fs.usda.gov/Evalidator/evalidator.jsp

Standards - Data

Existing Frameworks





PitchPineForType

Groups

None loaded

Stands

00342019080101029004290
00342019080101029009640
00342019080101029012080
00342019080101029031230
00342019080101029039030
00342019080101029074830

Years

2091
2096
2101
2106
2111
2116

Species

None loaded

Select variables

MgmtID StandID Year
Aboveground_Total_Live
Aboveground_Merch_Live Belowground_Live
Belowground_Dead Standing_Dead
Forest_Down_Dead_Wood Forest_Floor

re controls Hide Show

StandID

00342019080101029004290
00342019080101029009640
00342019080101029012080
00342019080101029031230
00342019080101029039030

Tota

40

Years

2019
2020
2021
2026
2031

Species

None loaded

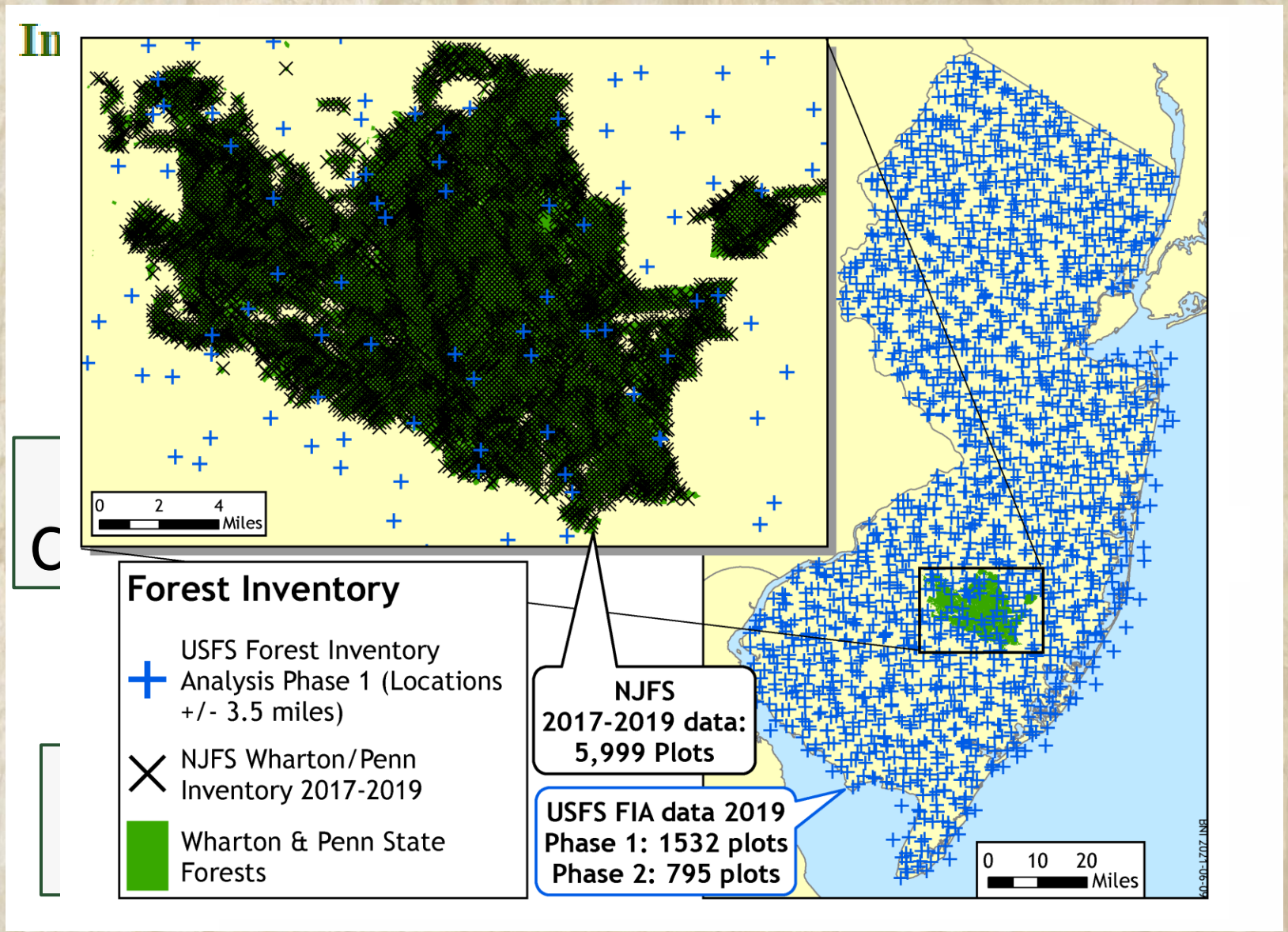
DBHClasses

None loaded

12	2021	16.534	3.623	0.124	0.542	3.908
13	2021	24.944	5.235	0.623	1.269	4.073
14	2021	20.158	4.802	0.266	1.498	4.032
15	2021	4.387	1.118	0.07	0.101	3.838
16	2021	20.359	4.615	0.001	0.006	3.892
17	2021	11.815	3.239	0.02	0.051	4.356

Standards - State Data

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/

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Northern Research Station
One Gifford Pinchot Drive
Madison, WI 53726
(608) 231-9318
(608) 231-9544 TTY/TDD

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 forest 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 Treesearch**
  https://www.fs.usda.gov/treesearch/

- **National Climate Assessment**
  https://nca2014.globalchange.gov/

An official website of the United States government Here's how you know

Climate Change Atlas

List of Trees | List of Birds

Search Entire Atlas

Northern Research Station

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Northern Institute of Applied Climate Science

The Northern Institute of Applied Climate Science

About NIACS

USDA U.S. FOREST SERVICE
Caring for the land and serving people
United States Department of Agriculture

Treesearch

You are currently viewing the Third National Climate Assessment. To view the most recent assessment please visit https://nca2018.globalchange.gov.

National Climate Assessment

GlobalChange.gov

Highlights

Explore highlights of the National Climate Assessment including an Overview, the report's 12 overarching findings, and a summary of impacts by region.

EXPLORE HIGHLIGHTS

Full Report

Explore the entire report covering our changing climate, regions, cross sector topics, and response strategies in full detail.

EXPLORE THE REPORT

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/

Forest Service
U.S. DEPARTMENT OF AGRICULTURE

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U.S. FOREST SERVICE
Caring for the land and serving people

CLIMATE CHANGE RESOURCE CENTER

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This work is/was supported by the USDA National Institute of Food and Agriculture McIntire-Stennis

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Forest Service

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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?

Northern Forest Futures Project

- Home
- What is the NFFP?
- Current Conditions
- Issues and Influences
- Future Conditions
- Publications

Future Criteria & Indicators

- Biodiversity
- Forest Productivity
- Ecosystem Health
- Soil and Water Conservation
- Global Carbon Cycles
- Socio-Economic Benefits
- Policy and Planning

NJ Forest Carbon Pools

NJ Forest Carbon

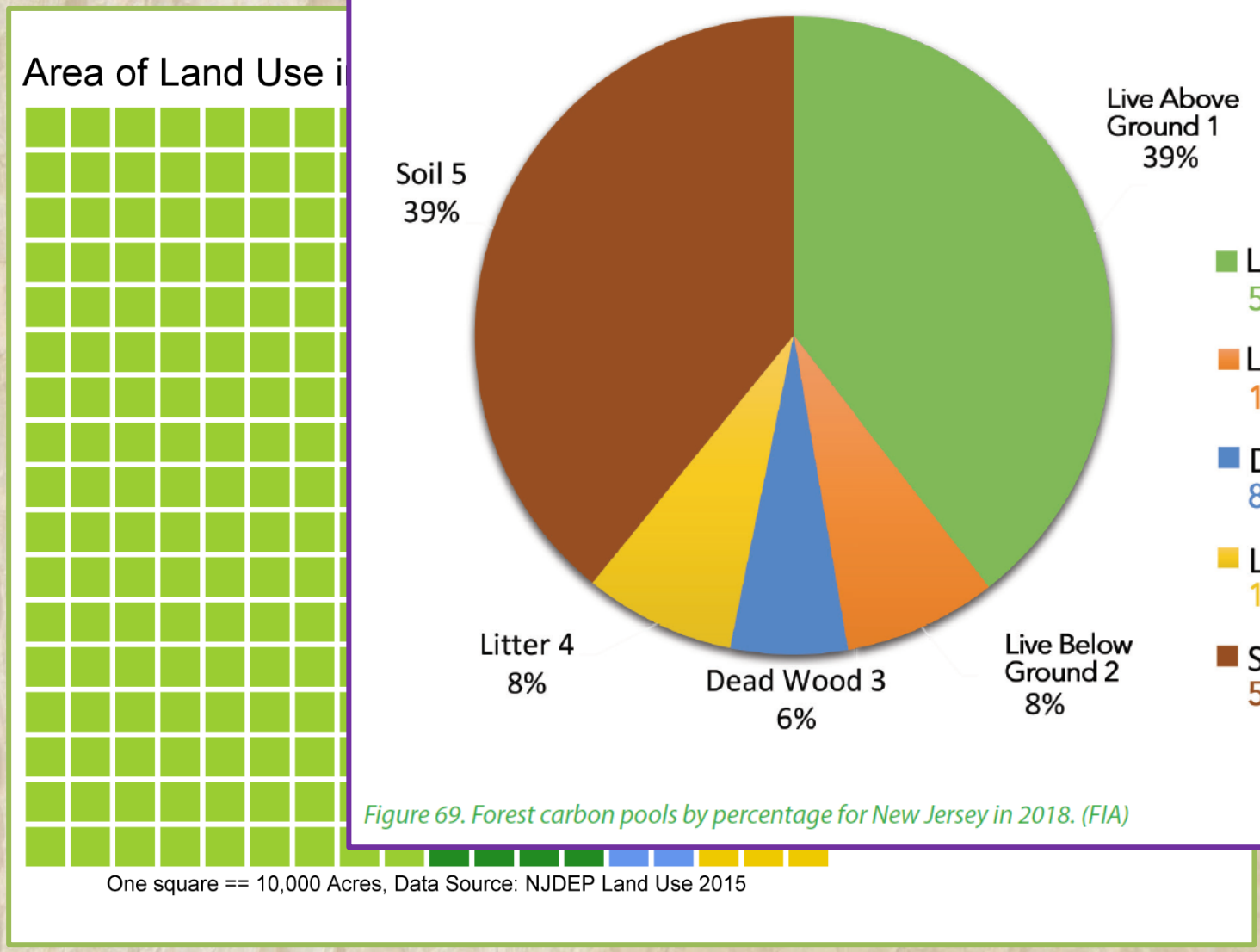
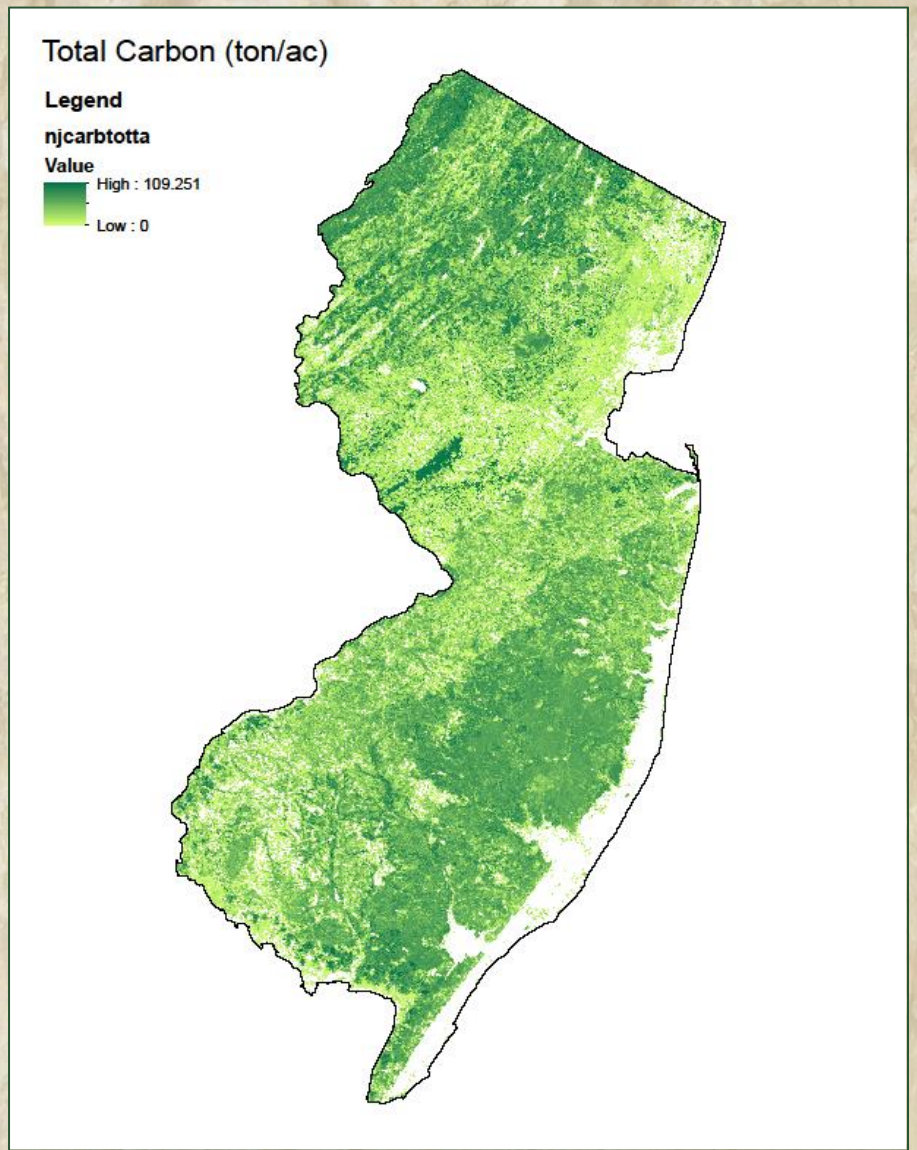
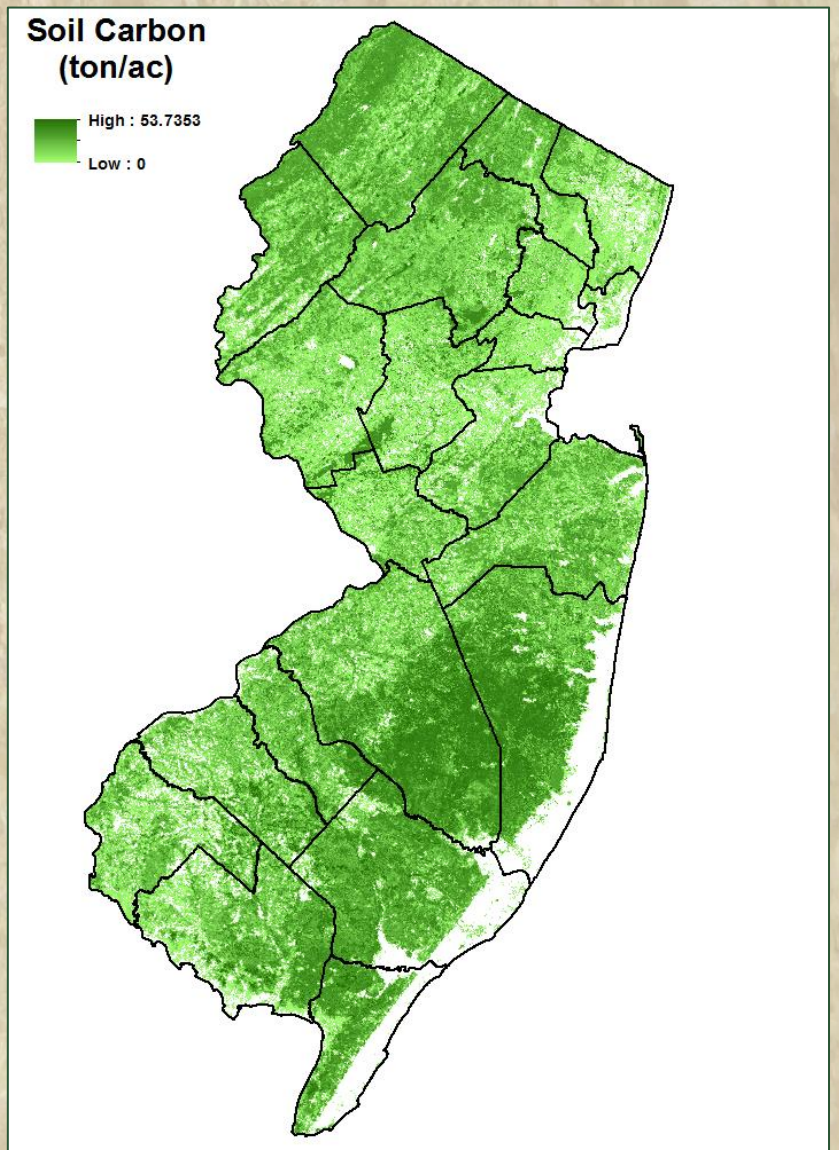


Figure 69. Forest carbon pools by percentage for New Jersey in 2018. (FIA)

NJ Forest Carbon Distribution

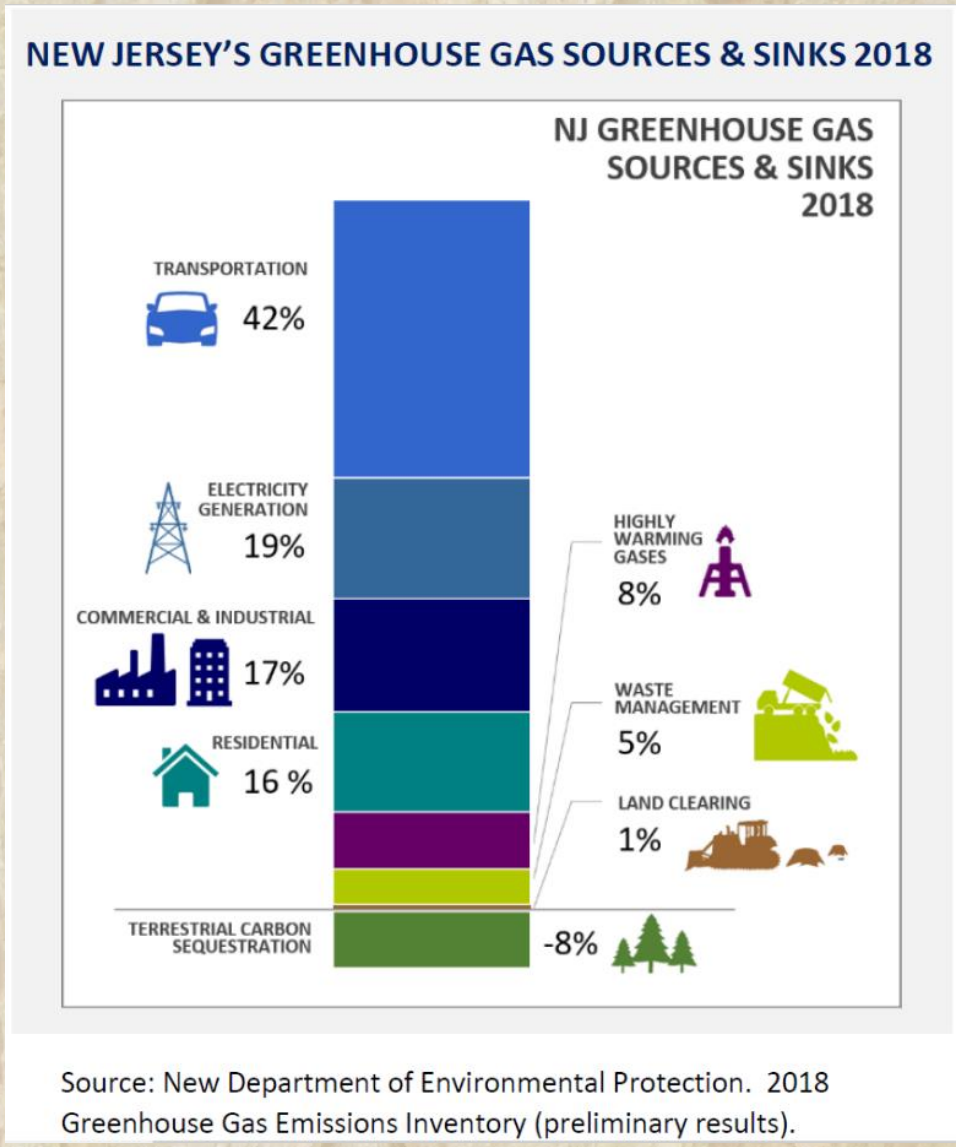
NJ Forest Carbon

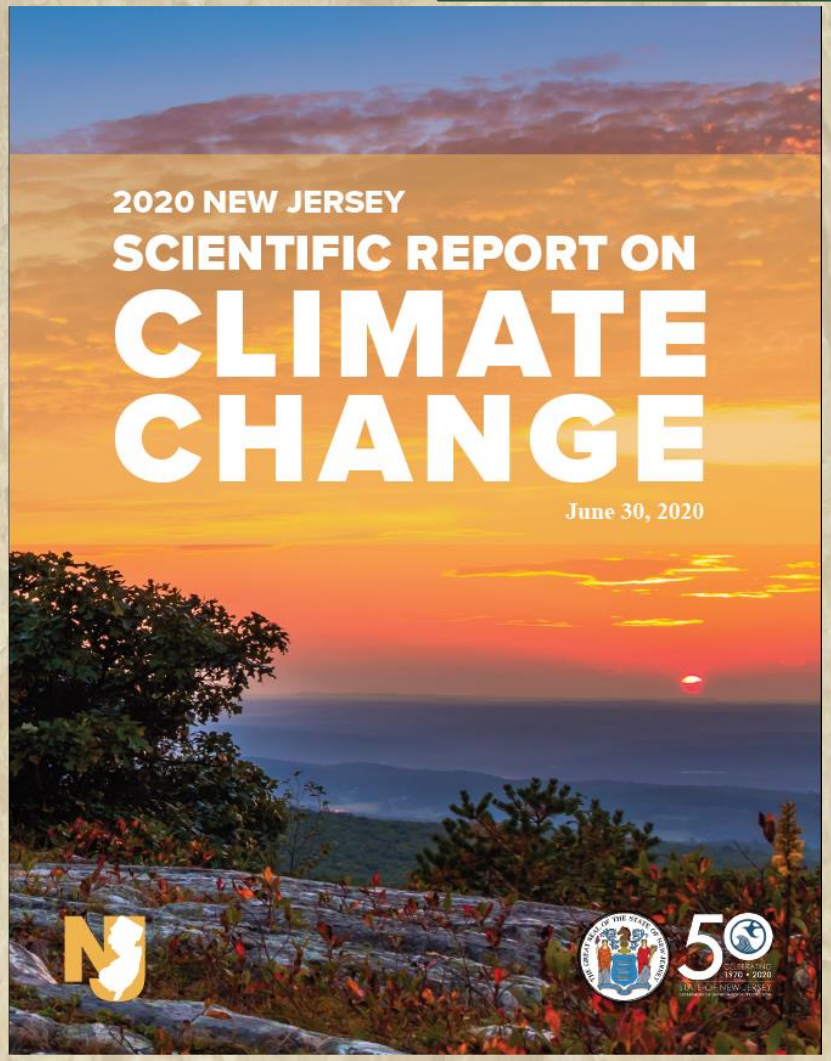




NJ Forest Carbon

NJ Forest Carbon

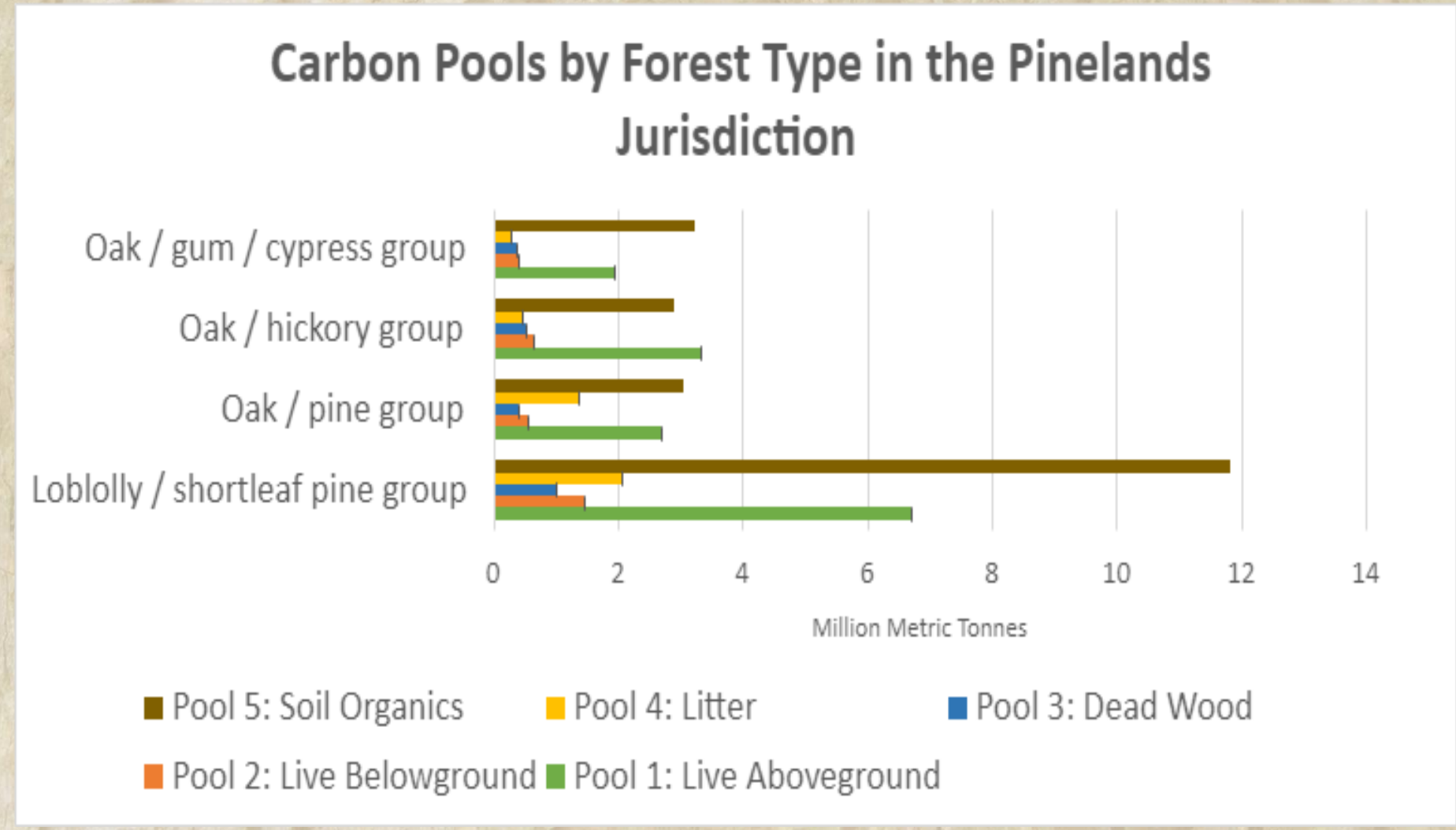




https://www.nj.gov/dep/climatechange/docs/nj-scientific-report-2020.pdf

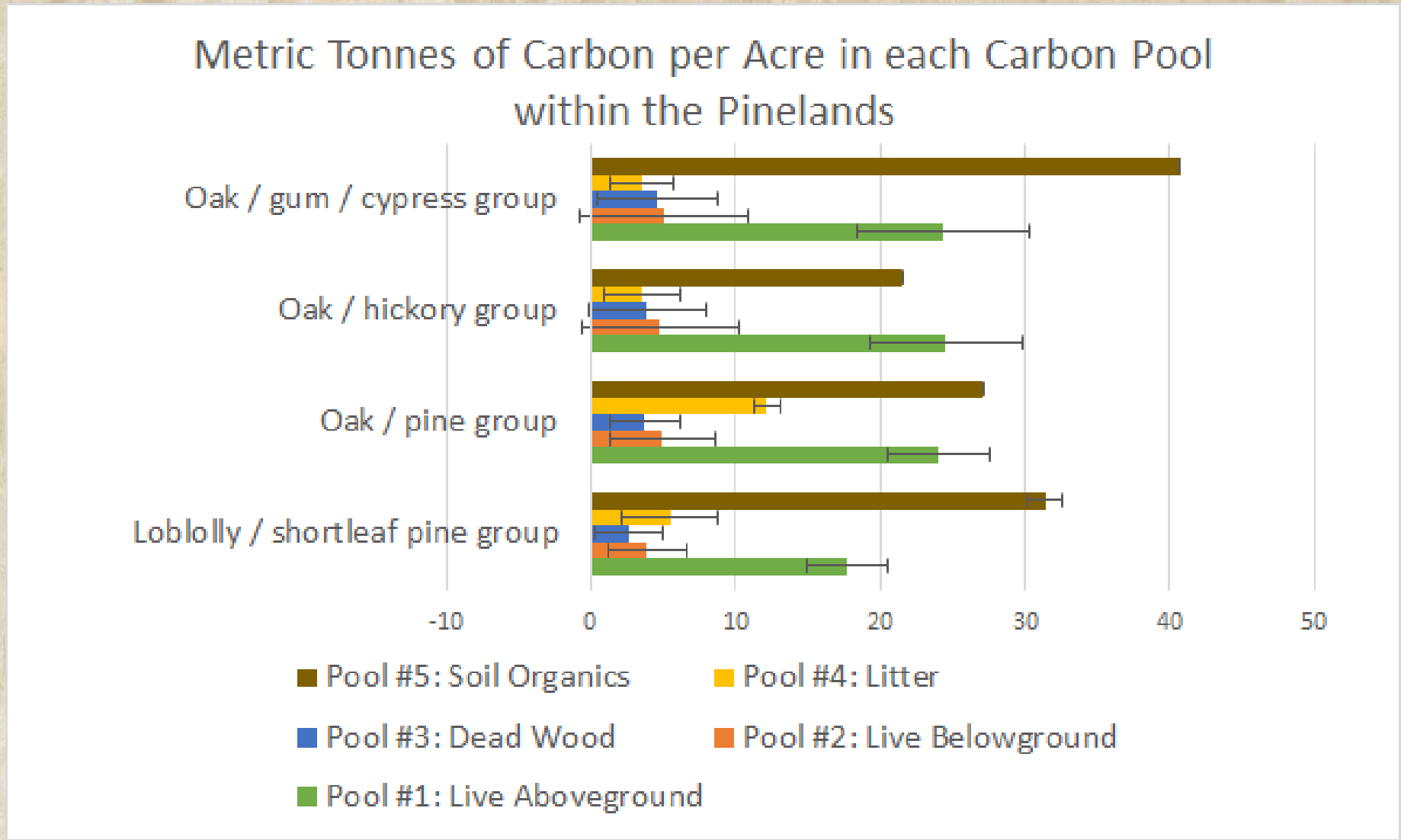
Pinelands Forest Carbon

Pinelands Forest Carbon



Pinelands Forest Carbon

Pinelands Forest Carbon



Land Use Conversion

Changes to the Pool

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

James Denny Ward, USDA Forest Service, Bugwood.org

Pests

Changes to the Pool

Now a Net-Emitter

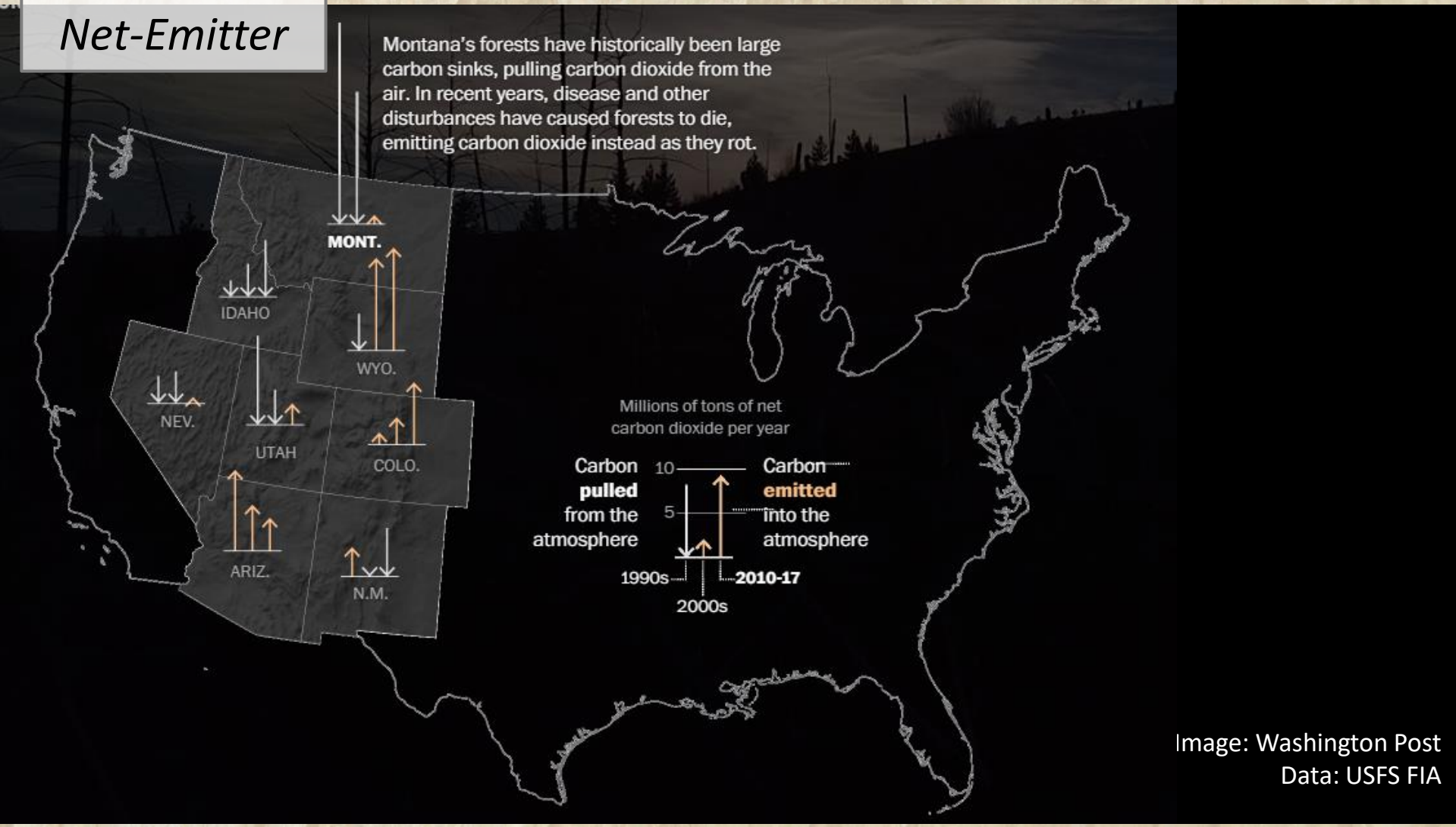
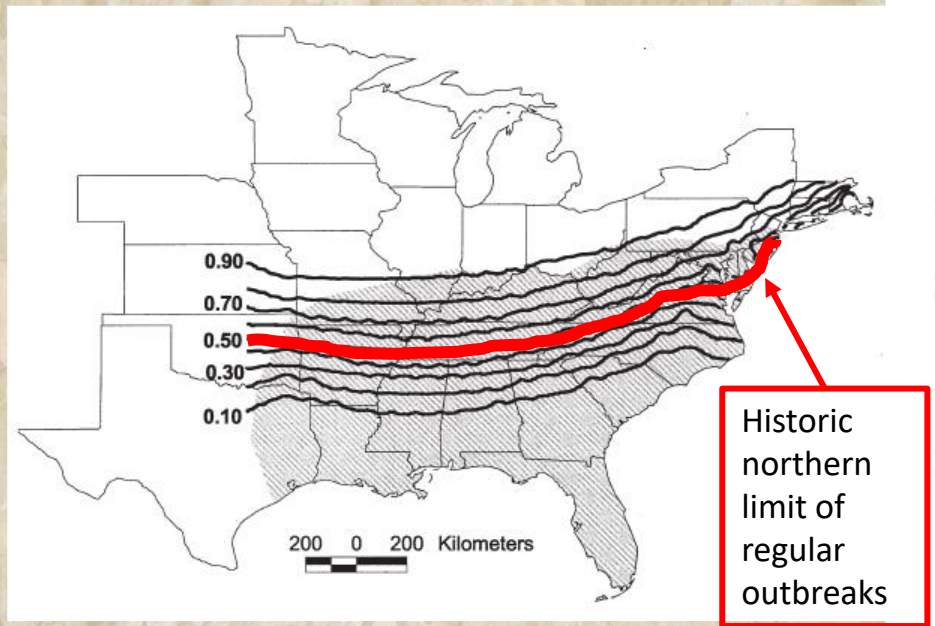


Image: Washington Post
Data: USFS FIA

Pests

Changes to the Pool



Historic northern limit of regular outbreaks

Figure 6 Annual probability of reaching the lower lethal temperature for *D. frontalis* ($PLLT_1$ = -16 °C air temperature). Maximum reported *D. frontalis* distribution shown as shaded area.

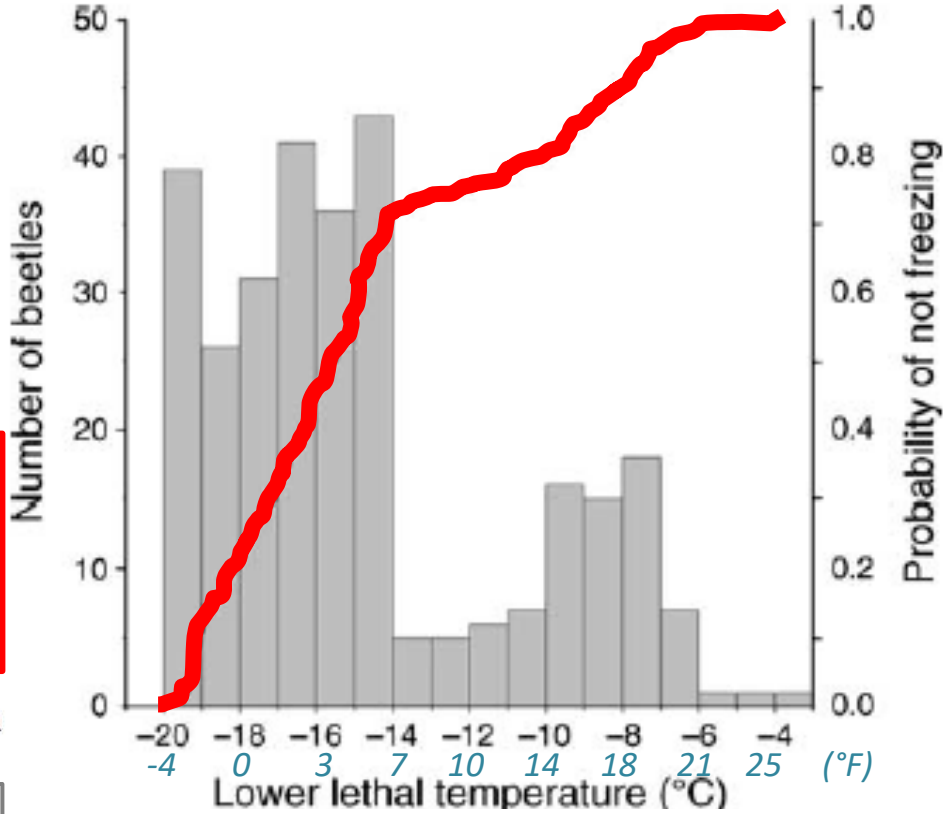


FIG. 5. Frequency distribution of supercooling points of late fourth-instar larvae from New Jersey measured during February 2005. The line indicates the probability of not freezing.

Cold Winter Nights Are Keeping the Lid on Southern Pine Beetle in NJ

Left: Ungerer *et al.* 1999
Right: Tran *et al.* 2007

Pests

Southern States Have Adapted to Southern Pine Beetle

Changes to the Pool

Albert (Bud) Mayfield, USDA Forest Service, Bugwood.org

Wildfire

Changes to the Pool

Wildfire

"BAD" FIRE!

Changes to the Pool

Now an Emitter

Peat Fires

Changes to the Pool

https://phys.org/news/2017-10-years-washington-feds-swamp.html

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

Loss of Ecosystem Function

Changes to the Pool

Pine Barren Gentian

Changes to the Pool

B. Isaacson

Climate Stress

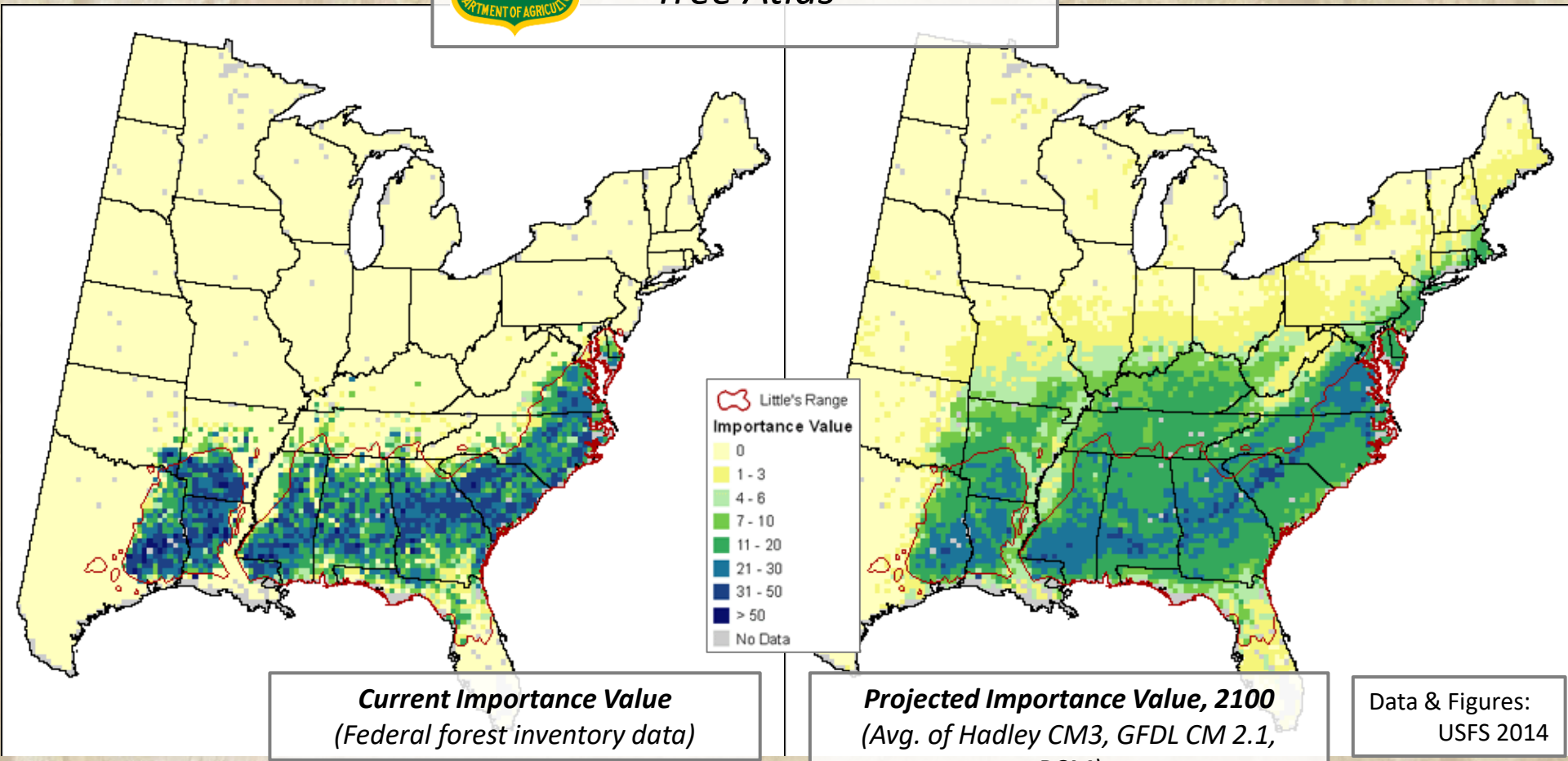
Changes to the Pool

Climate Stress

Changes to the Pool

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

Solutions

Sustaining Solutions

Balance – Maximizing Any One Thing Makes the Maximum Unstable

Forest Carbon Solutions

Sustaining Solutions

Afforestation/Reforestation

Forest Carbon Solutions

Sustaining Solutions

Restoration

Forest Carbon Solutions

Sustaining Solutions

Improved Forest Management

NJFS, 2019

Forest Carbon Solutions

Sustaining Solutions

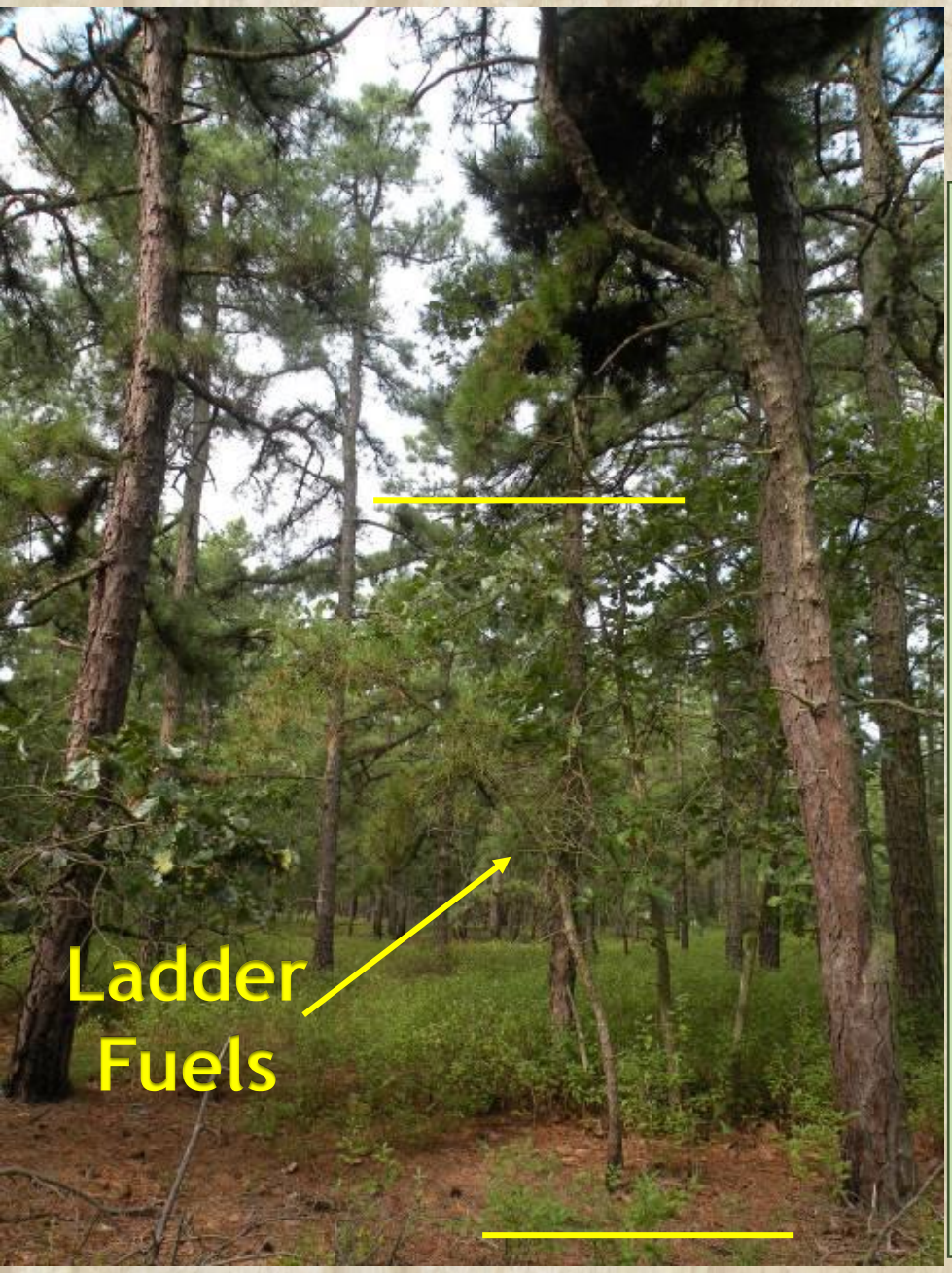
Avoided Forest Conversion & Emissions

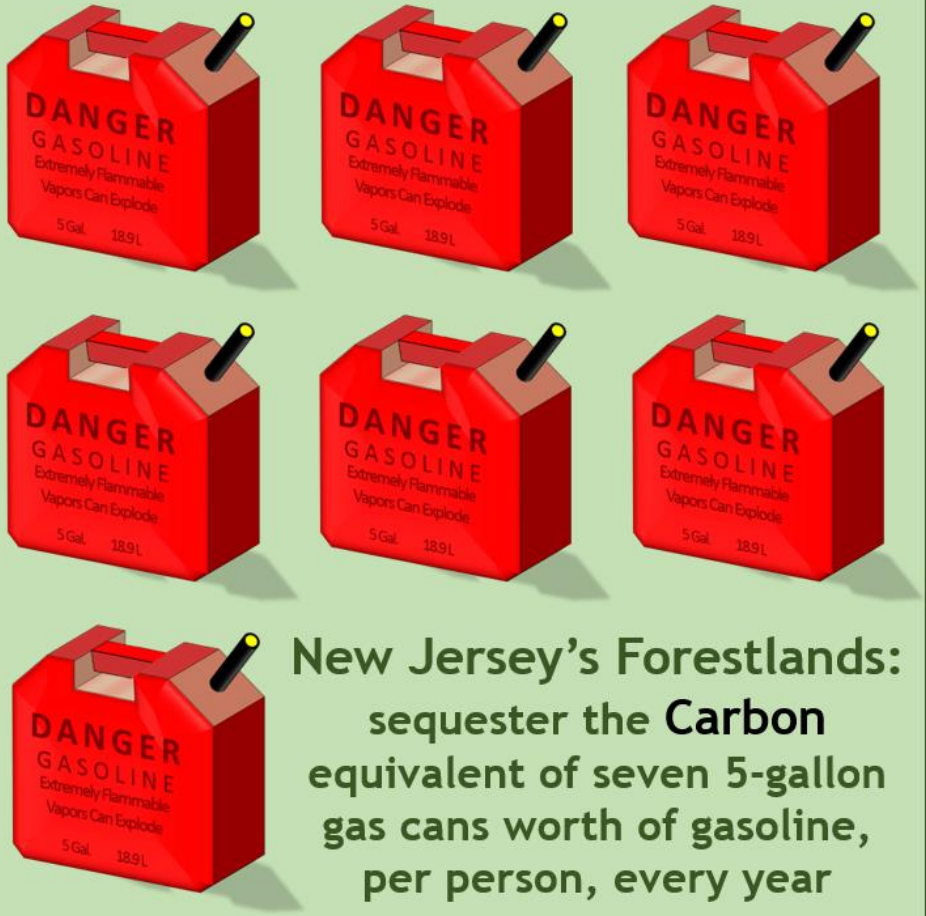
"GOOD" FIRE!

Sustaining Solutions

B. Isaacson

Sustaining Solutions





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


Sustaining
Solutions

*Utilization of **small** diameter products from **fuels treatment** projects.*

United Wood Products, Boulder, Colorado, April 2002,

Sustaining Solutions

Doug Page, USFS / BLM, Bugwood.org


Sustaining
Solutions
B. Isaacson

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?

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Thank You!