# FOREST CARBON DATA AND TOOLS:

## Elevating Land Protection as a Climate Solution

November 14, 2024

The Nature Conservancy
Protecting nature. Preserving life.

Land Trust Alliance
Together, conserving the places you love

American Forests™

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FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

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TRUST FOR PUBLIC LAND

# Program

Welcome

*Open Space Institute*

Forest Carbon Data

*Clark University*

New Tools

*The Nature Conservancy*

Data Access, Use Cases & Support

*Trust for Public Land & Land Trust Alliance*

Panel Discussion

*All*

Closing

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US Nature 4Climate

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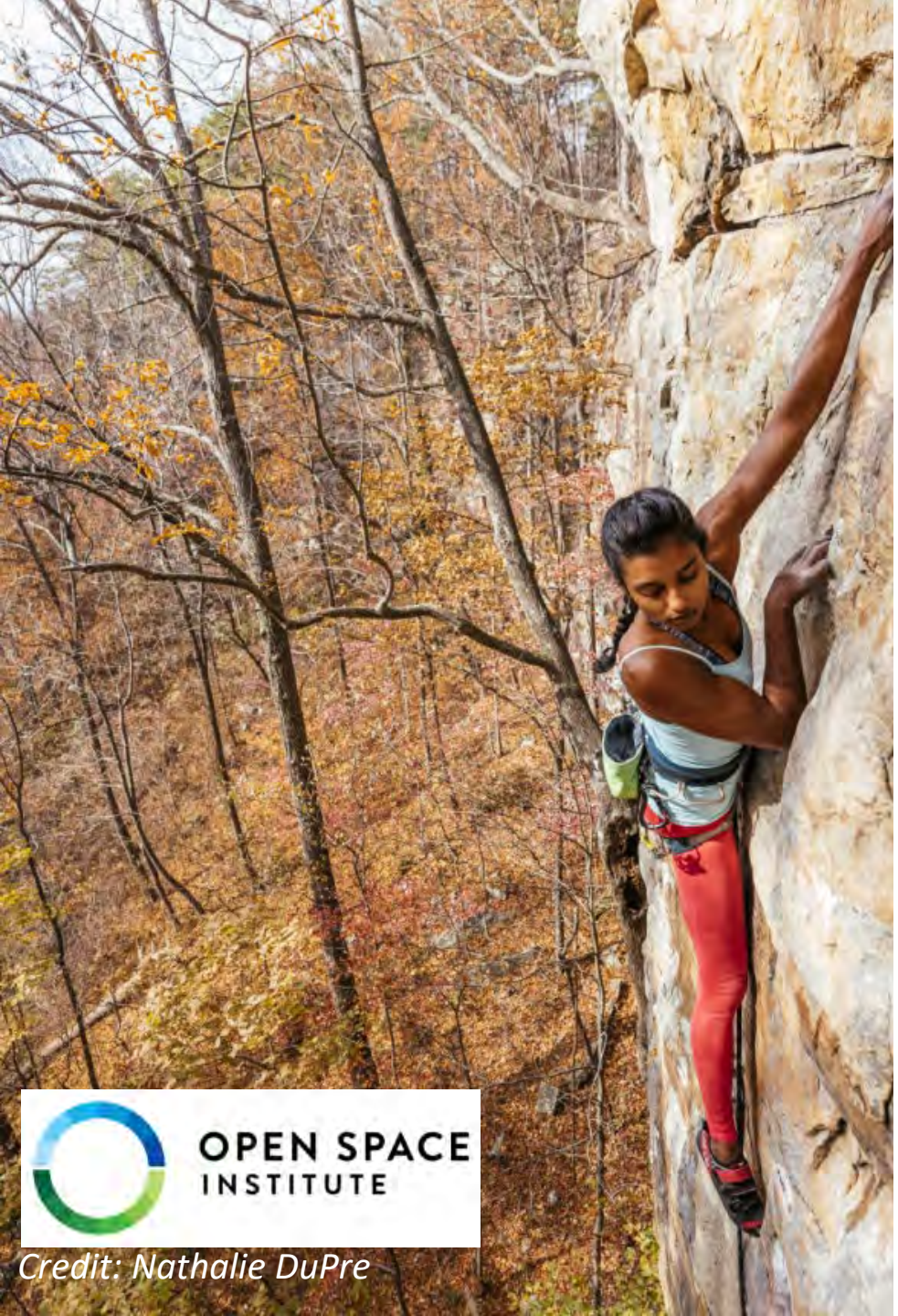
| Natural Climate Solutions Actions<br>(% Extremely or Very Important; * indicates solutions tested) | Overall | GOP | IND | DEM |
|---|---|---|---|---|
| *Protecting natural lands that provide habitat for fish and wildlife | 84% | 80% | 80% | 92% |
| Planting more trees in forests to improve water quality and prevent mudslides | 83% | 79% | 83% | 86% |
| *Replanting forests impacted by wildfire, disease, and other challenges, which also helps prevent mudslides and protect water quality | 83% | 77% | 83% | 88% |
| Planting trees in cities to provide shade, reduce heat, and lower energy costs | 82% | 79% | 80% | 86% |
| *Implementing management practices in forests, like thinning and controlled burns, that reduce the risk of catastrophic wildfires | 82% | 80% | 84% | 83% |
| Protecting and restoring grasslands that also support wildlife and improve water quality | 82% | 78% | 76% | 89% |
| Restoring coastal wetlands that help protect coastal communities from hurricanes | 80% | 73% | 78% | 88% |
| Incentivizing forest owners to adopt climate-smart forestry practices, including sustainable wood harvesting, removing invasive plants, and planting trees adapted to thrive in a changing climate, that also improve water quality and wildlife habitat | 77% | 69% | 75% | 85% |
| *Incentivizing farmers to adopt cover crops that also reduce erosion and increase water efficiency | 76% | 69% | 76% | 82% |
| Encouraging farmers to plant trees in farmland and pastureland, which can help improve soil health, water quality and provide new sources of income for farmers | 75% | 69% | 71% | 83% |
| *Encouraging farmers to adopt climate-smart farming techniques that also reduce erosion and increase water efficiency | 72% | 62% | 65% | 86% |

Based on a survey of 1,000 registered voters to gauge support for Natural Climate Solutions with an oversample of rural voters



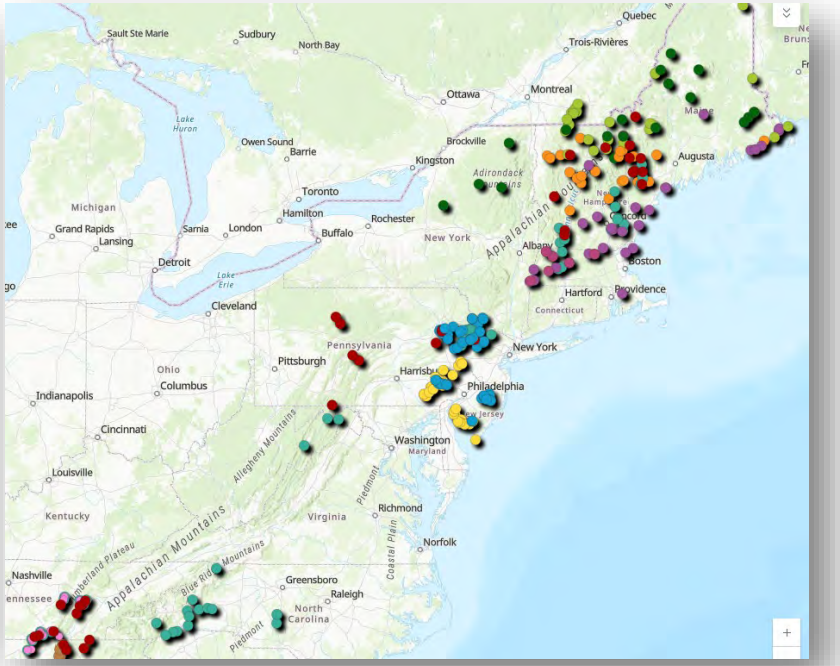

*Credit: Nathalie DuPre*

LAND & WATER CONSERVATION FUND

LWCF

COALITION

*Credit: 12 Rivers Conservation Initiative*

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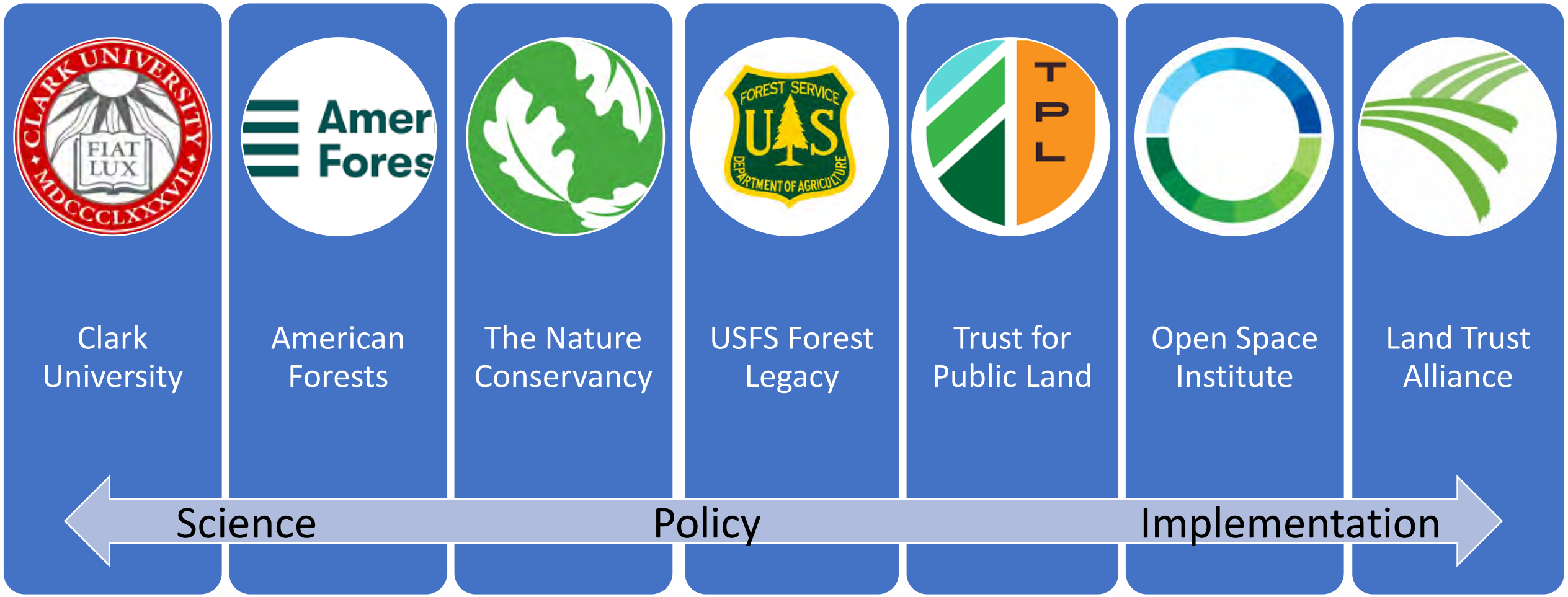
# Mobilizing Conservation Partners to Move Climate Science into Conservation Practice



# Context (and magnitude) are important

Carbon stock change (MMT C eq. $yr^{-1}$)

Carbon stocks (MMT C)

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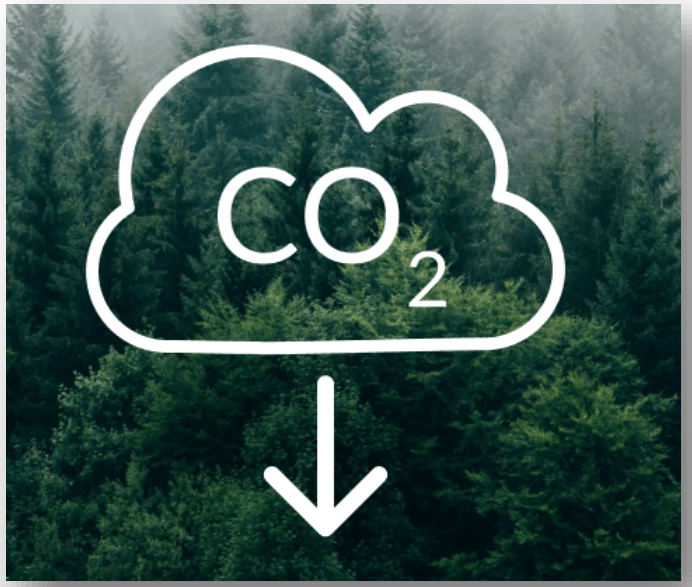
Scaled image thanks to Grant Domke, Forest Inventory Analysis, USFS 2023

Forestland protection…

Avoids emissions from potential forest conversion

Maintains the ongoing carbon sink




Improves ongoing sequestration through conservation management

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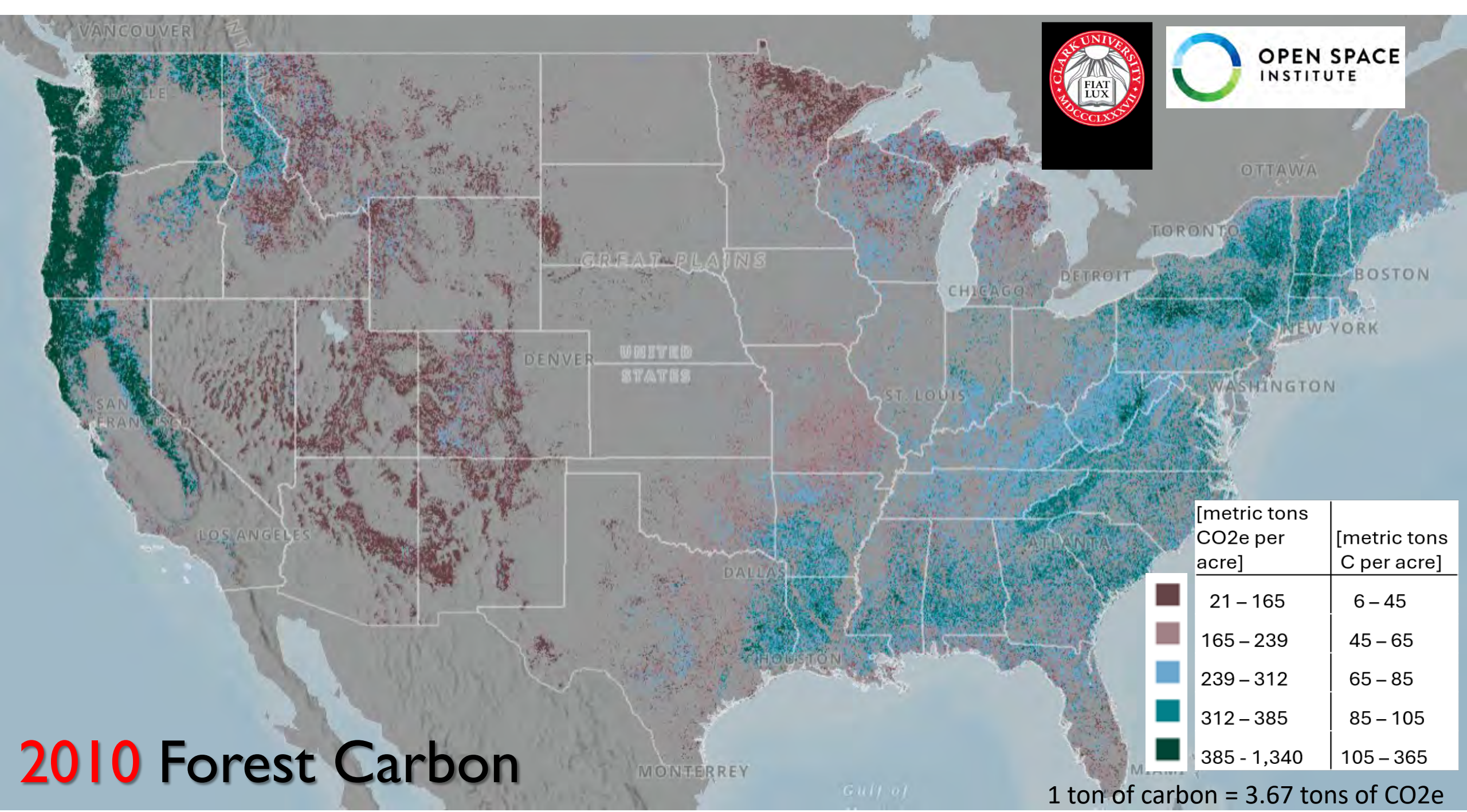
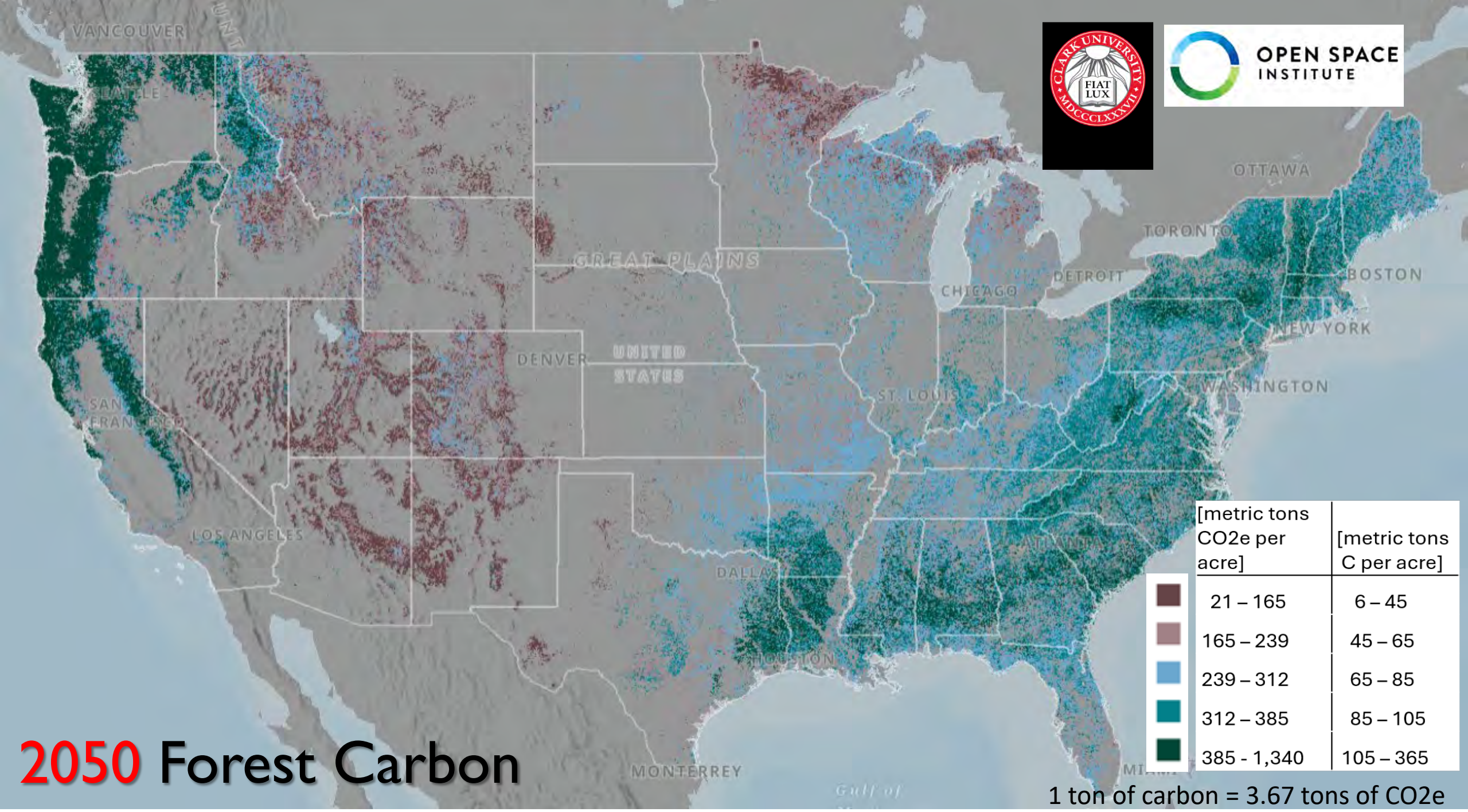



# 2010 Forest Carbon

1 ton of carbon = 3.67 tons of CO2e

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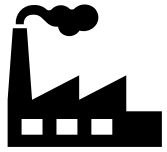
| [metric tons CO2e per acre] | [metric tons C per acre] |
|---|---|
| 21 – 165 | 6 – 45 |
| 165 – 239 | 45 – 65 |
| 239 – 312 | 65 – 85 |
| 312 – 385 | 85 – 105 |
| 385 - 1,340 | 105 – 365 |

# 2050 Forest Carbon

1 ton of carbon = 3.67 tons of CO2e

# USFS Forest Legacy Program

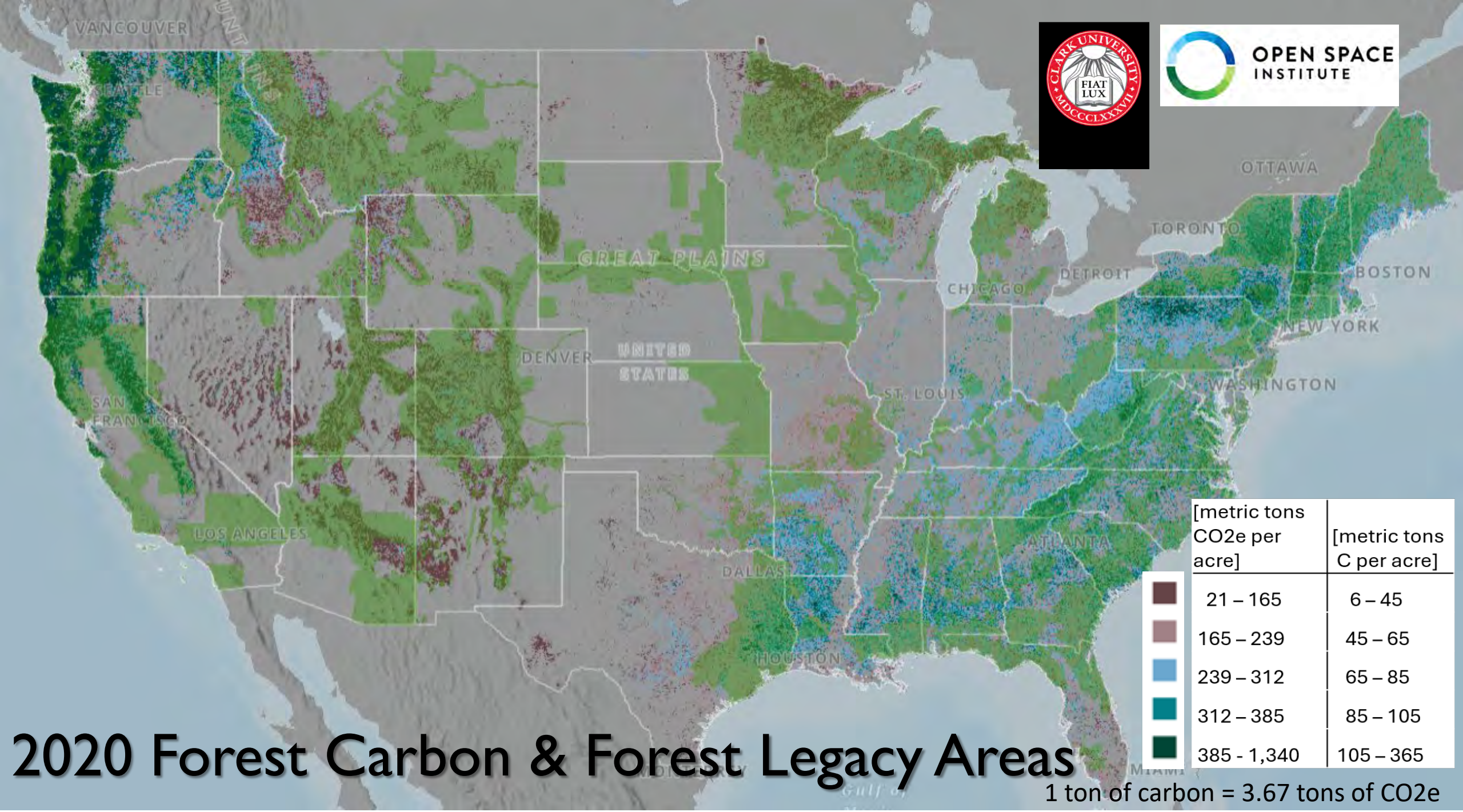
2.9 million acres of USFS Forest Legacy store 775 million metric tons of CO2e and sequester 3.2 million metric tons of CO2.



These Forest Legacy projects store the equivalent of 12% of US annual emissions and sequester 0.05% of emissions annually.

This is the equivalent of 101 million US homes off the grid for one year. (As of 2022, there were approximately 127 million homes in the United States.)

And capturing the carbon equivalent of 419,000 US homes off the grid in one year. (As of 2022, there were approximately 301,000 housing units in Boston.)




# 2020 Forest Carbon & Forest Legacy Areas

1 ton of carbon = 3.67 tons of CO2e

Providing the data and tools to NGOs, state and federal partners so everyone can pick up an oar to pull towards critical climate goals

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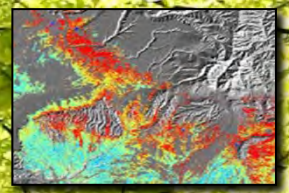

# Update to the NFCMS
## Data and Tools for Applications


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Forest Carbon Data Group Webinar

Graduate School of Geography, Clark University
November 2024

# 1. Why is it important to have an up-to-date forest carbon dataset to meet climate goals?

Essential for characterizing the role of forests as part of emissions reduction and carbon removal strategies, and in guiding conservation to places where it can most effectively support climate goals.

State Carbon Accounting Policy, Planning, and Action

Project Evaluation of Current and Future Carbon Storage

Communicating Carbon Value of Forest Protection

Conservation Planning with Climate Mitigation as a Goal

# 3. What's new with this Update?

## Forest Carbon Updates to 2020

- Remove areas of forest conversion to non-forest
- Decrease biomass in areas recently cut over
- Add areas of recent forest gains
- Grow standing carbon to near-present
- Update expected sequestration to 2050 and 2070 (if grow-only)

# 3. Clarifying Carbon Stocks versus Carbon Sequestration

**Carbon stocks** refers to the **amount of carbon in a forest ecosystem at a moment in time** and held in different reservoirs such as live woody biomass, soil carbon, or coarse woody debris.

**Carbon sequestration** refers to **a positive increment (a gain or growth) in forest carbon stocks**, from forest productivity exceeding respiration and other losses.

# 3. Clarifying Carbon Stocks versus Carbon Sequestration

**Forest carbon stock**

[metric tons of $CO_2e$ per acre]

40 to >1,000

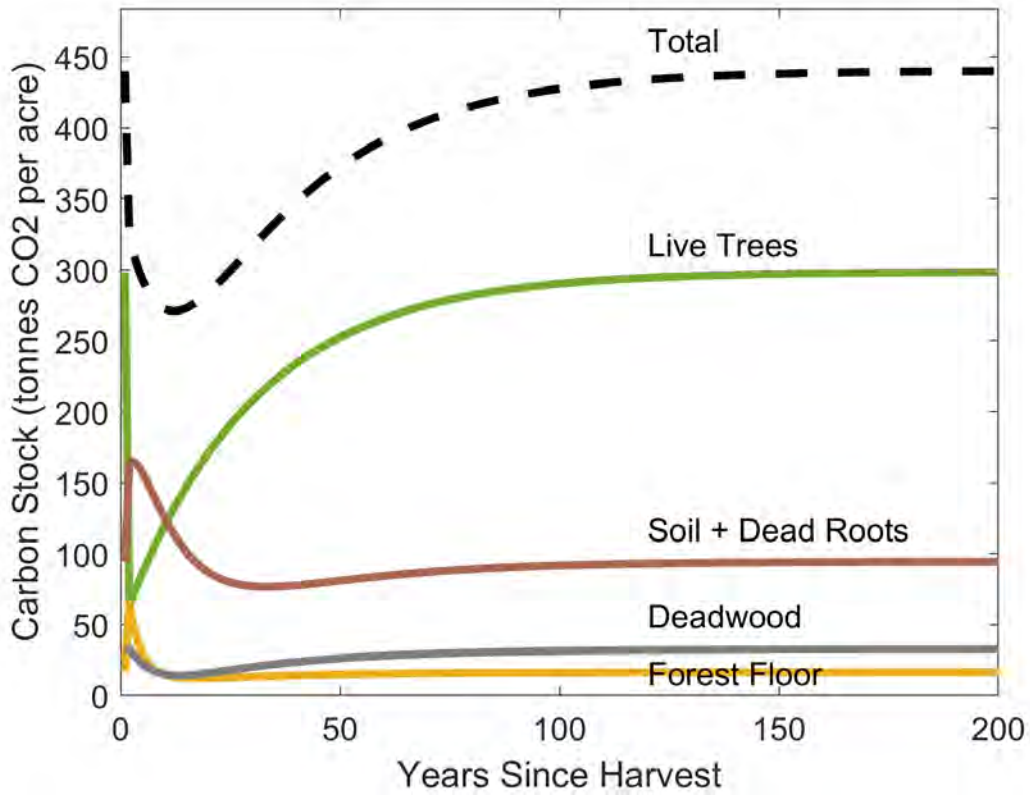
**Forest carbon sequestration**

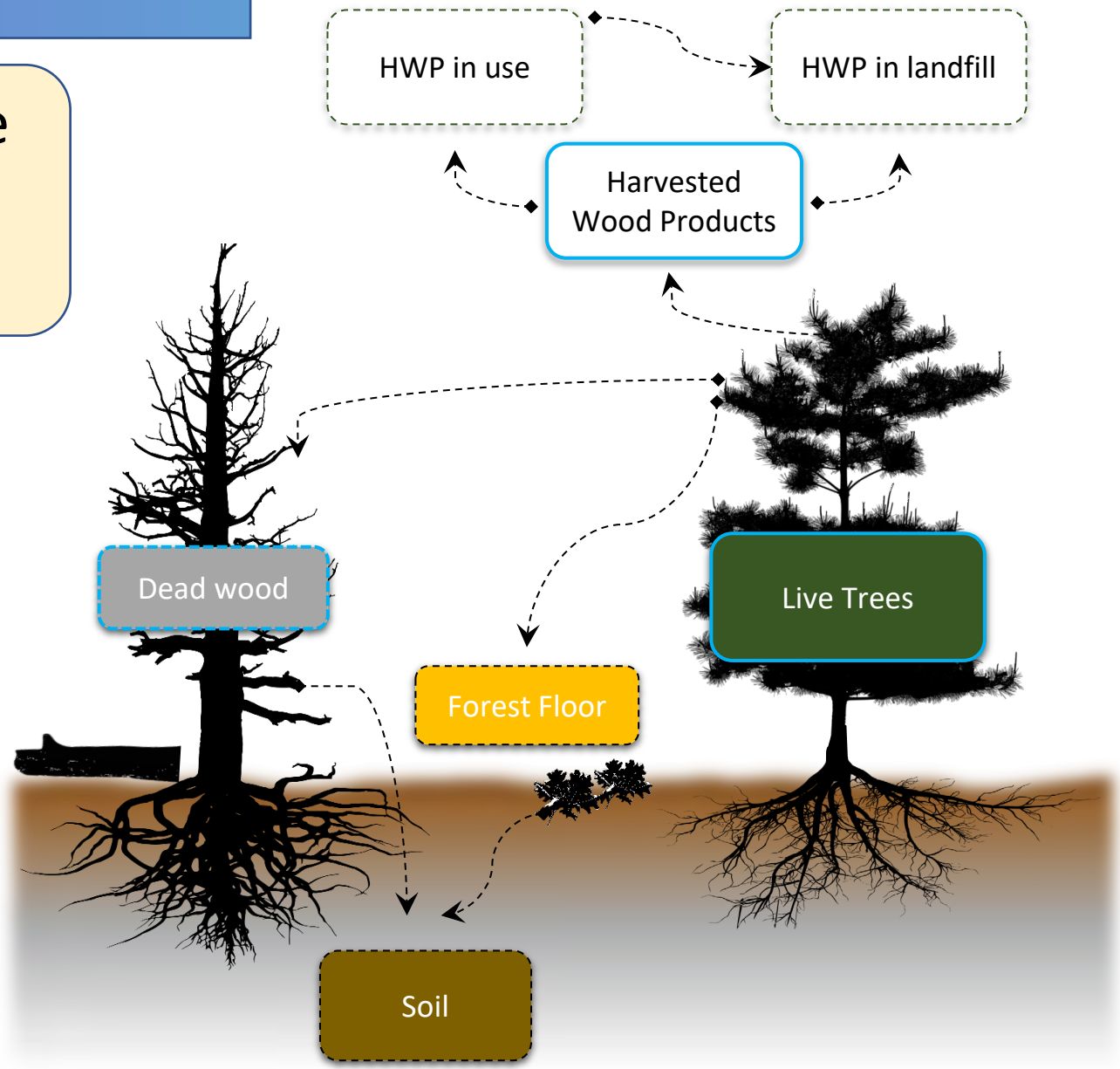
[metric tons $CO_2e$ per acre per year]

0 to 7

# 4. What carbon stocks are represented?

NFCMS tracks forest carbon in a suite of live and dead pools, above and below ground.



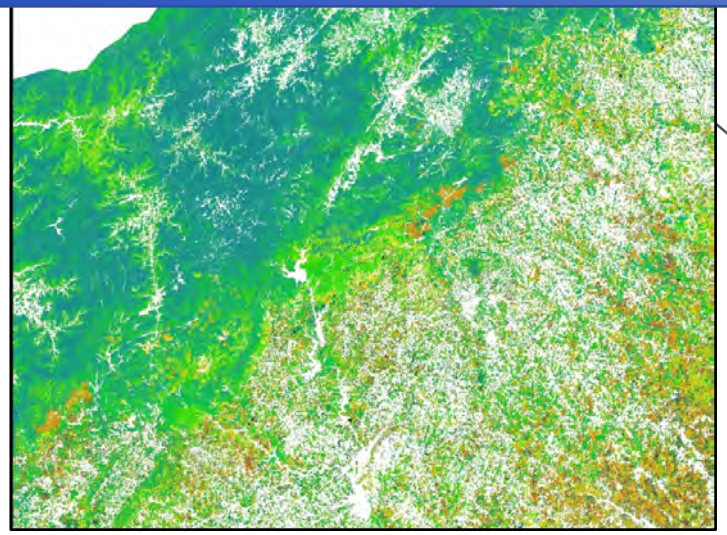



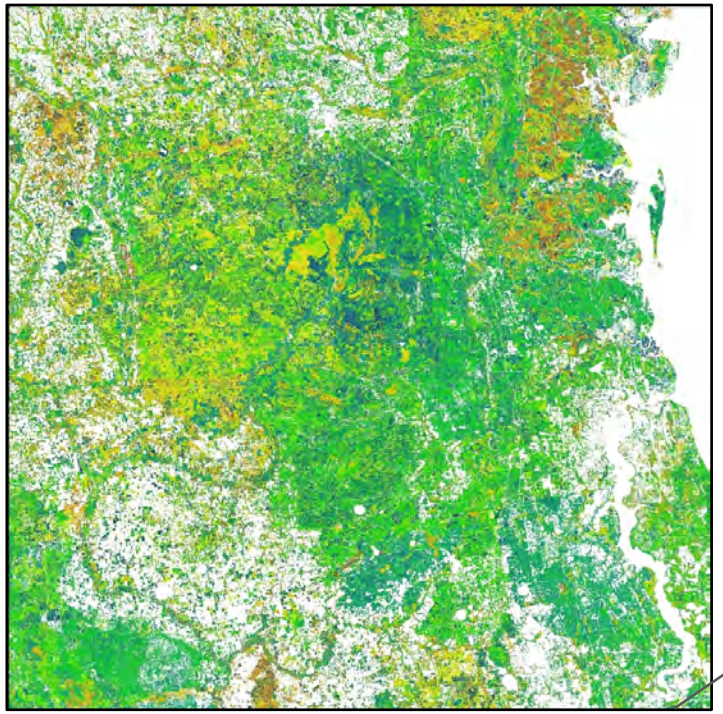

Graphic borrowed from Dr. Ali Kosiba

# 5. What causes variation in forest carbon from place to place?

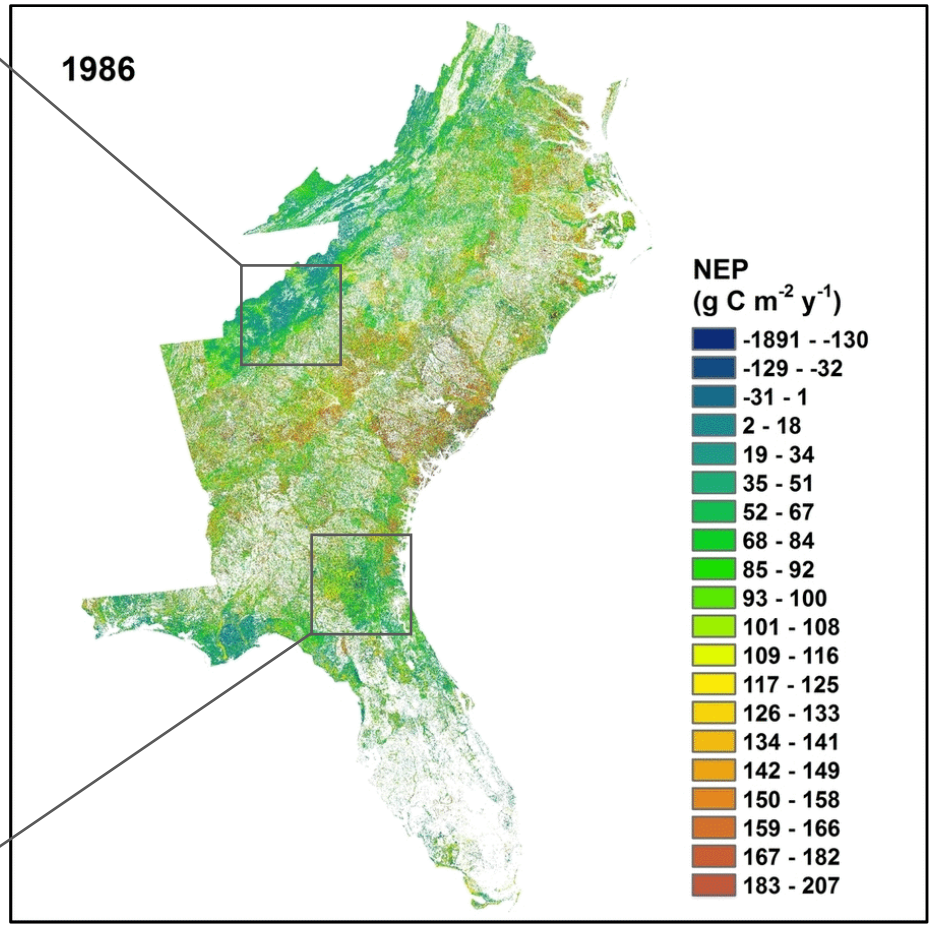
**Many factors**

- **disturbances** reduce biomass
- **climate, topography, and soils** influence forest productivity
- **forest type** influences biomass at maturity





## Carbon Sequestration
1986 to 2010 in the Southeast



# 6. Data accuracy and assumptions

Comparisons to **state and regional USFS reports of forest carbon stocks and fluxes**

Comparison to **other forest biomass carbon maps** of similar resolution

Both find very good agreement across datasets at a scale of 1km or greater.

Independent **plot-scale evaluations** have been favorable.

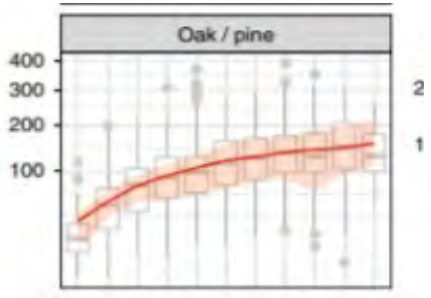
- 6% error rate on aboveground biomass for 12 forest carbon projects in the mid-Atlantic, with a lower error rate than NCX (formerly SilviaTerra) data.
- 2% error rate for carbon projects in the central Appalachians

**Additional testing would be useful** to assess accuracy of the 2020 update at pixel to parcel levels.

# 6. Data accuracy and assumptions

- Inherits **biomass map errors**
- Assumes **disturbed forests recover as same forest type**, except when converted to cropland or development
- **Future carbon stocks rely on a grow-only scenario** from an average for a given forest type group and site class within a broad region
- **Spatial discontinuities at regional boundaries** indicate larger errors in estimates
- **Management effects on growth only partially captured** from regional inventory curves, and are not specific to local site history
- Growth potential is likely **overestimated in areas limited to an only partial forest cover** (i.e., residential lot or a park with open space)
- Relies on **rough approximation of forest type group and productivity class**

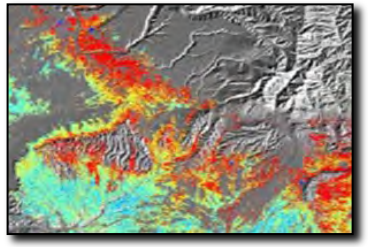
# 7. Where might we go from here? Operationalize monitoring, test management scenarios, other?




**Operationalized for monitoring and reporting**, enabling planners and decision makers to assess the **dynamic baseline**, and to **track progress** as we **evaluate efficacy** of policies and actions.

**Modified to test management scenarios enabling users to select from a range of typical treatments** and compare outcomes to each other and **baseline**

**Future disturbance risks** could be taken into account with maps estimating the **probability of biomass loss** from harvesting, wildfires, and other disturbances.



The NFCMS dataset could be **embedded in other tools and platforms reporting forest carbon and climate resilience**.

# 8. How does NFCMS compare to other national datasets?

**Higher Resolution, Better Spatial Detail, Relevant for Parcels**

- 30 m resolution is 1,000 times greater than 1 km x 1km
- 30 m resolution is 11 times greater than 1 ha

**Includes Ongoing Sequestration and All Carbon Stocks**

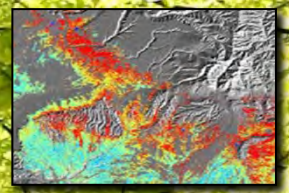
- Not just current, also future carbon stocks with a low disturbance scenario
- Beyond biomass, also includes woody debris, litter and soil carbon

**Freely Available and Served in Web-Mapping Tools**

- Fly through the data, or point and click to get an analysis
- Upload parcel boundaries and get a report
- Request national or regional domains (large)







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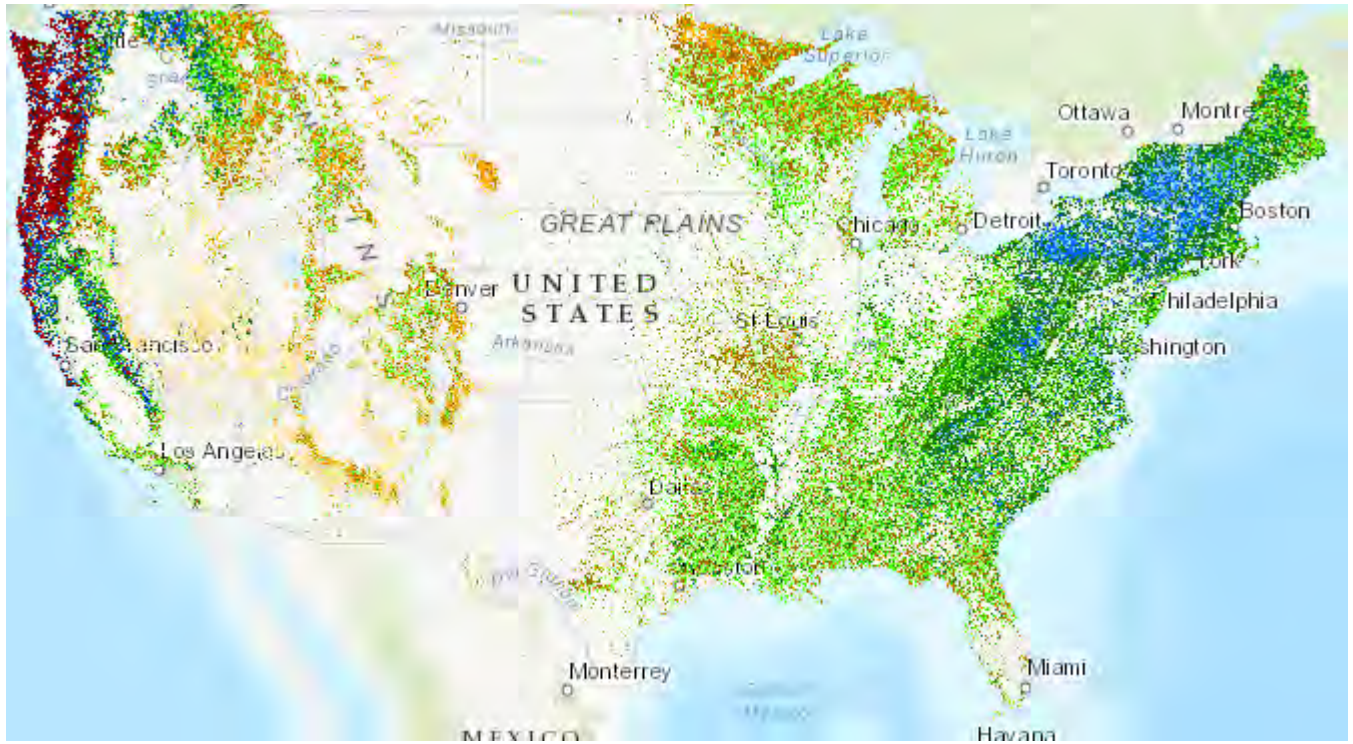
# 2. Outputs & Methods of the NFCMS

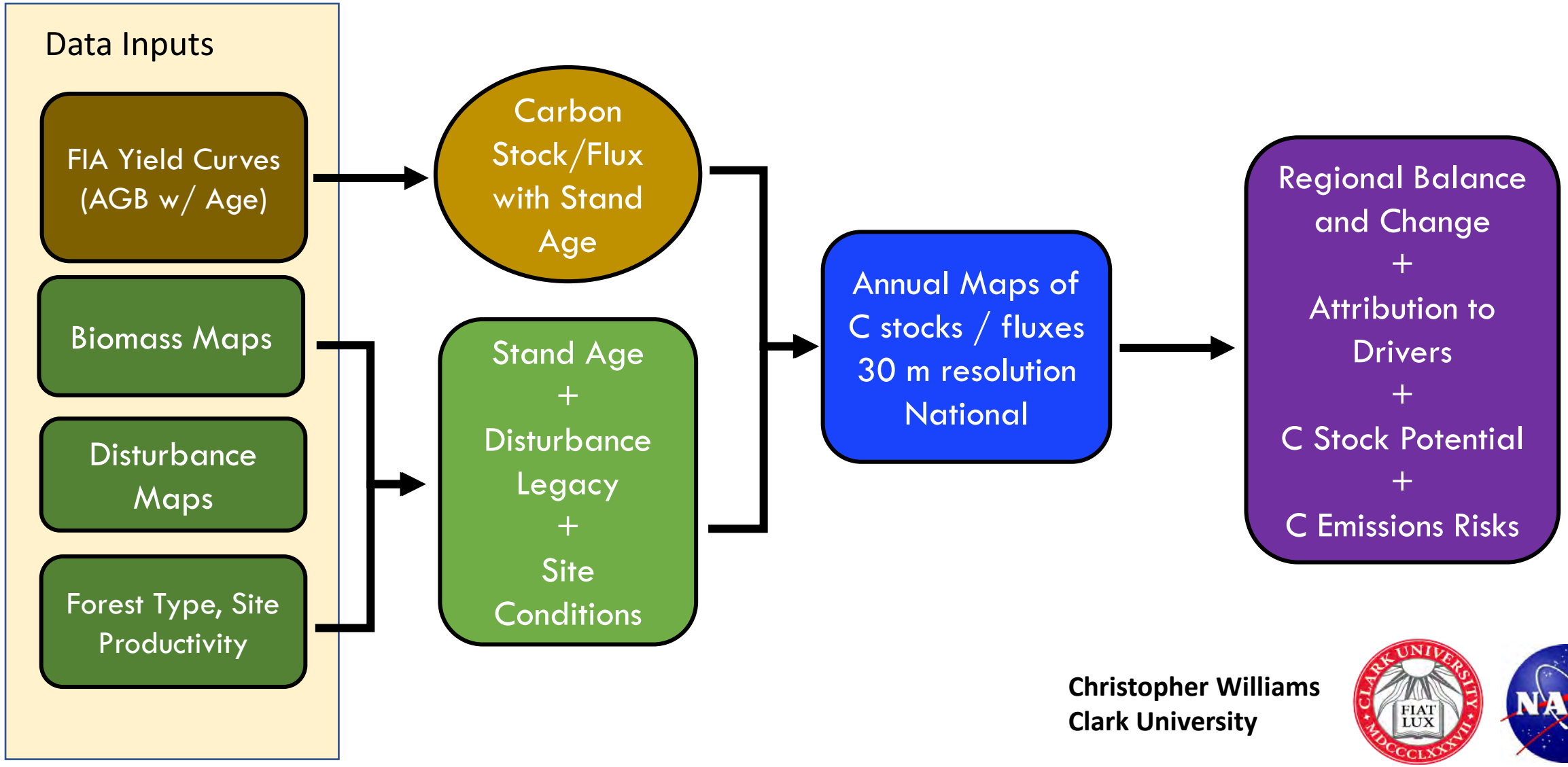
Baseline Biomass and Carbon Stocks

National Coverage (lower 48 states)

Forest Ecosystem Carbon in 2020



# National Forest Carbon Monitoring and Reporting System

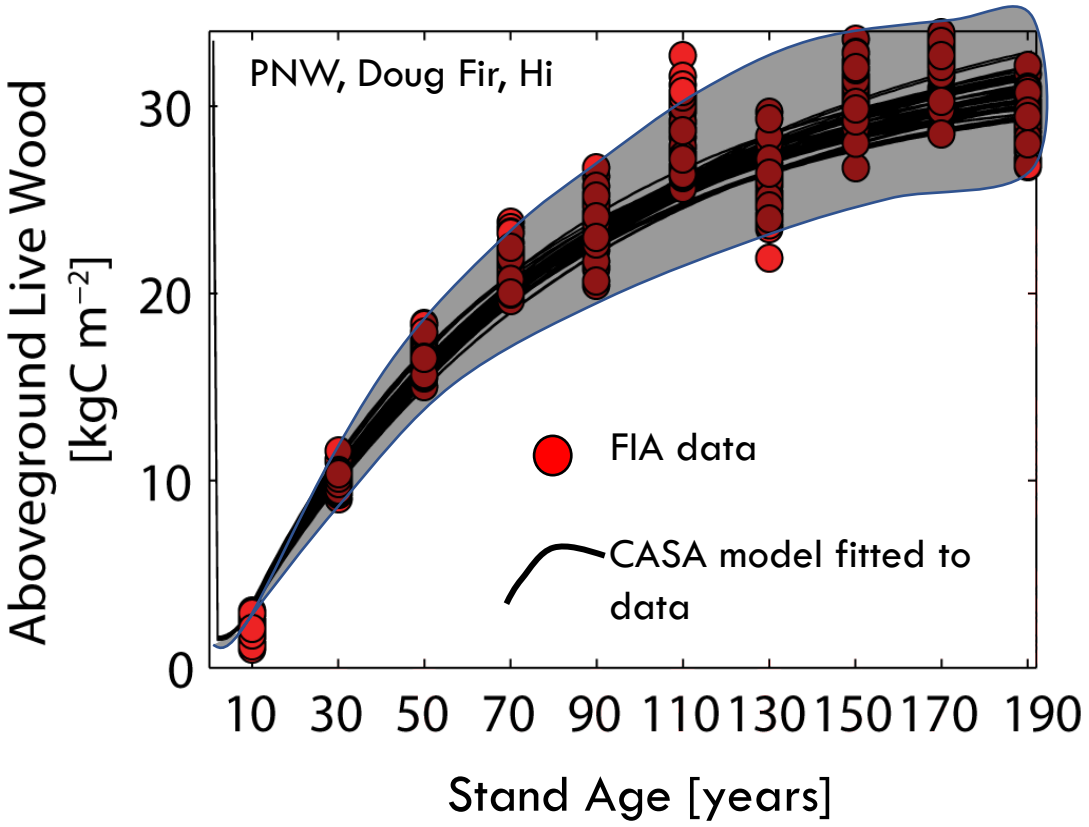


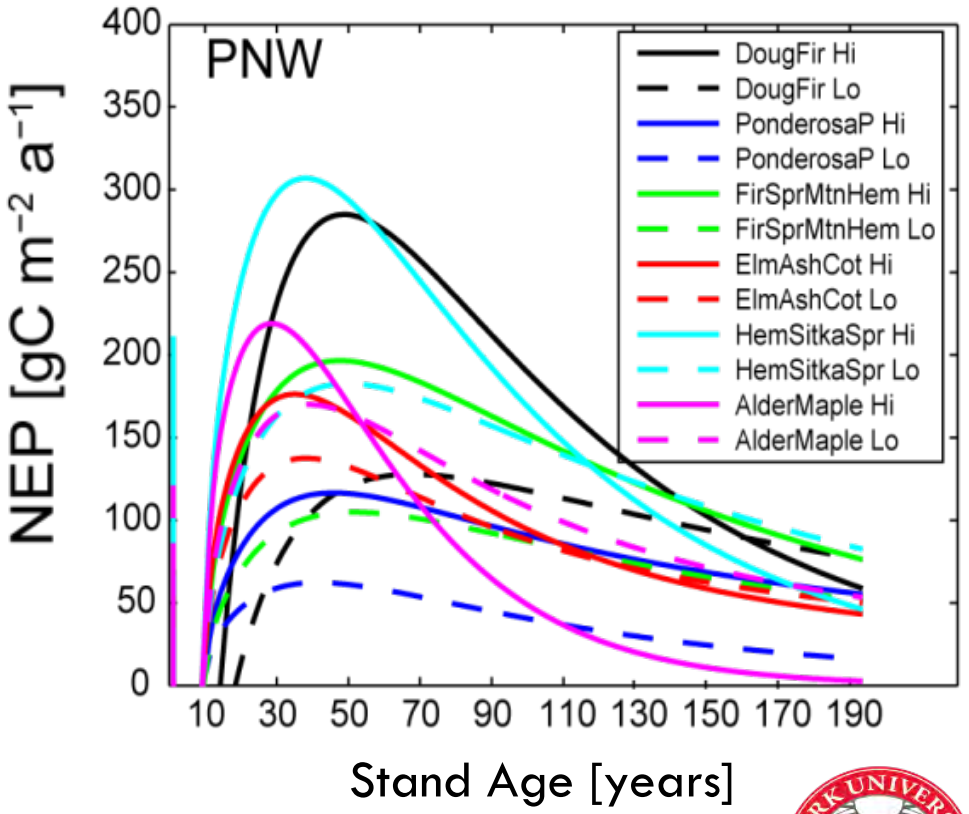

**Christopher Williams**
**Clark University**

# Carbon Storage from FIA Yield Curves + Process Modelling

Accounts for Forest Type, Climate Setting, Site Fertility, Disturbance and Regrowth

Based on **FIA Yield Curves** to Constrain **C-Cycle Modeling**




Williams et al. (2012, 2014)

# Avoided Deforestation App

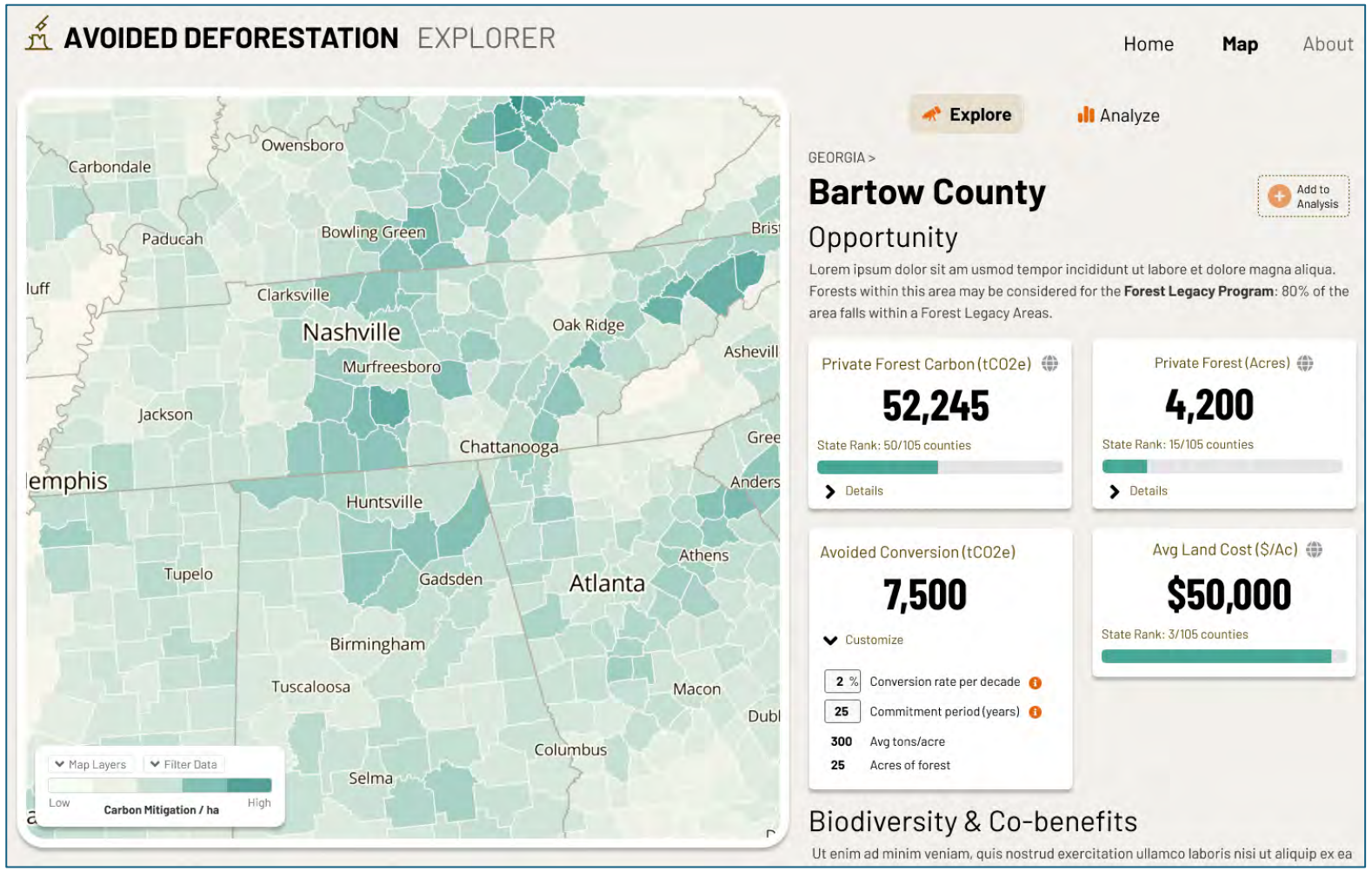
11/14/2024

# App goals

Help users understand and make good decisions about avoided deforestation projects across multiple dimensions:

- **Opportunity –** carbon benefit, unprotected forests, land cost, and programmatic opportunities
- **Co-benefits** like critical habitat, resilience, and water provisioning
- **Conversion risk** based on past trends and future projections

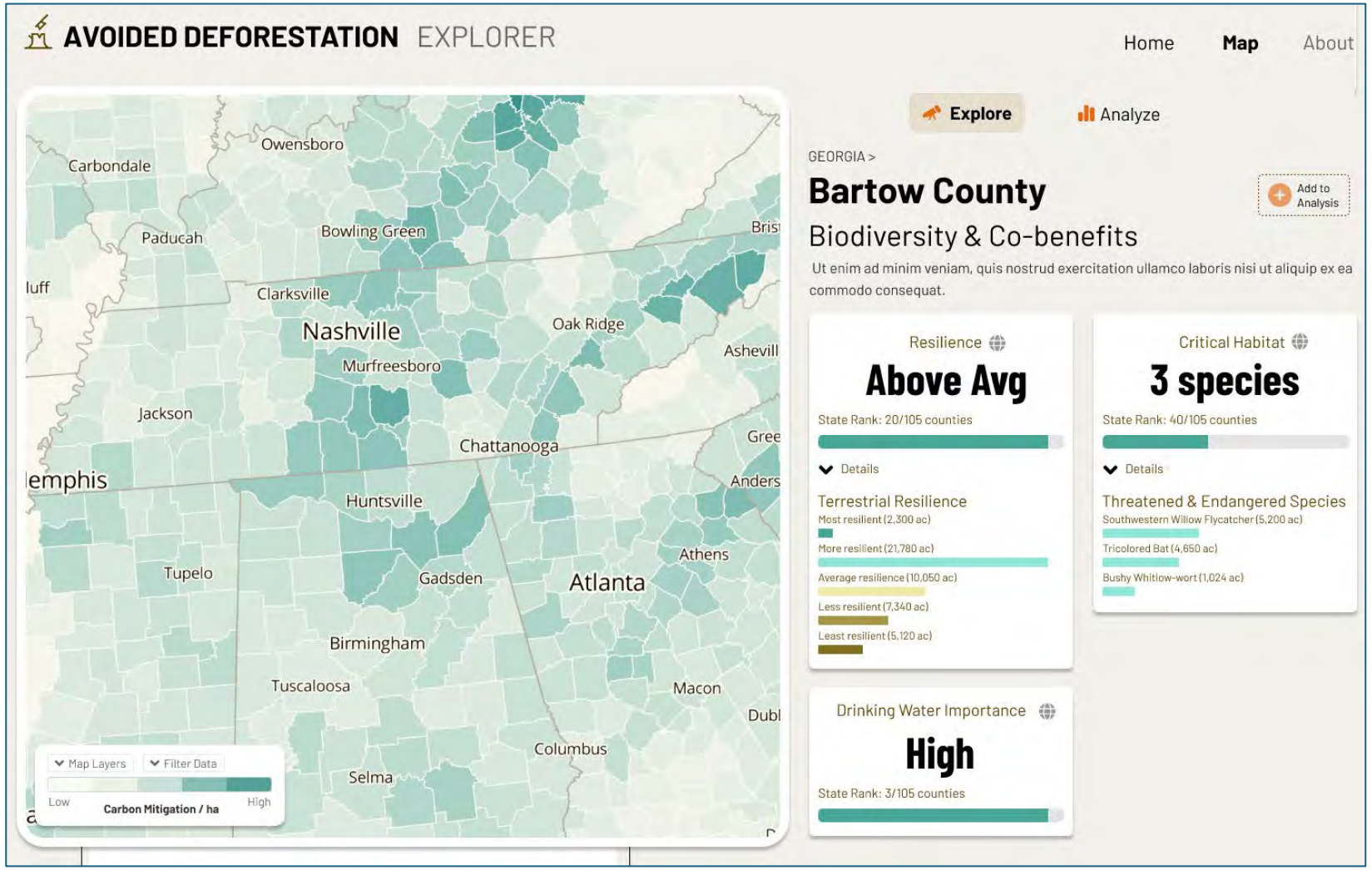
# Instant summaries




Summaries by county and HUC-12 watersheds for 20+ data layers

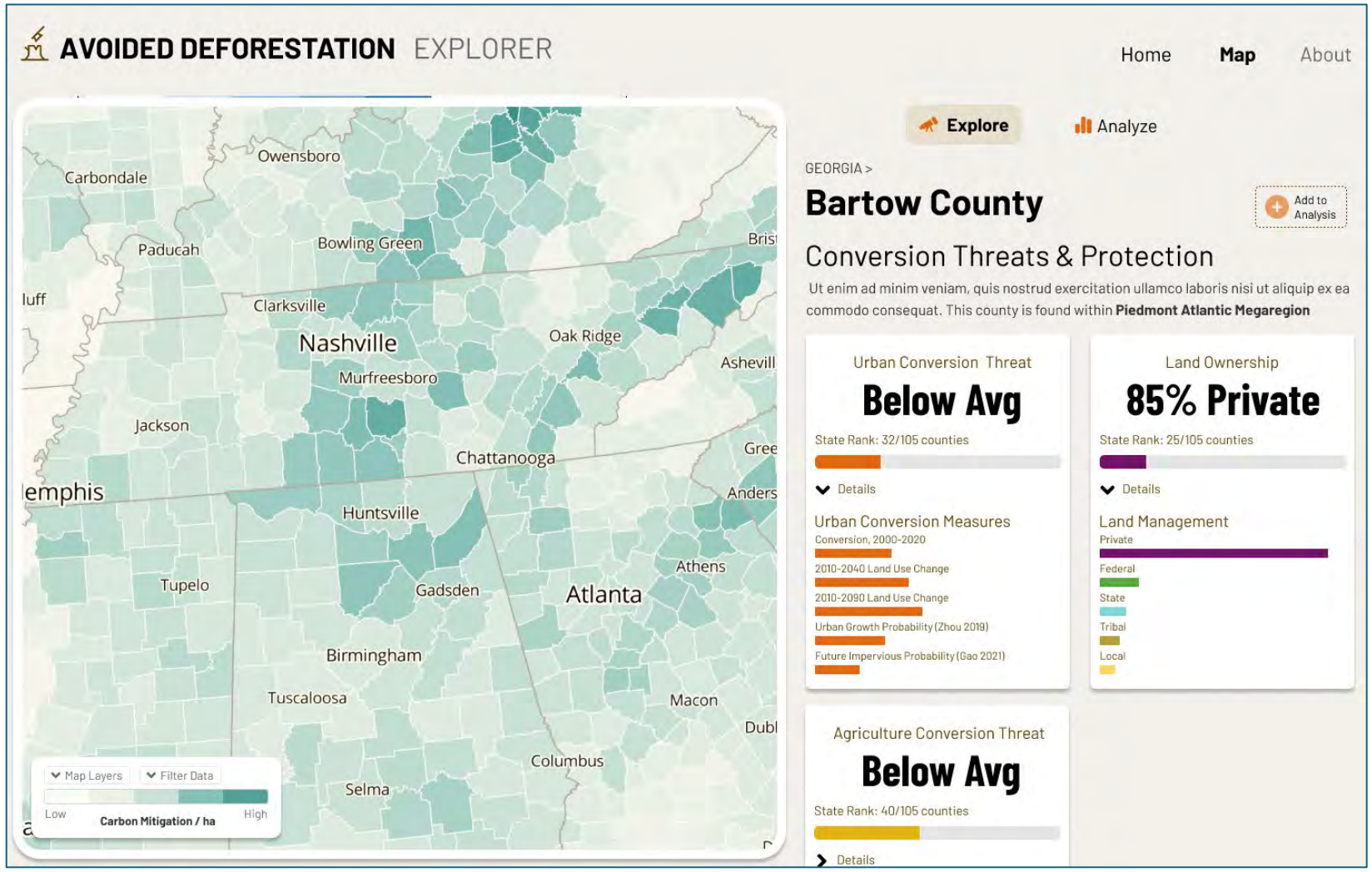
Data broadly useful for prioritizing forest protection efforts such as Forest Legacy

# Co-benefits




- Resilient and connected lands
- Critical habitat
- F2F water provisioning

# Threats



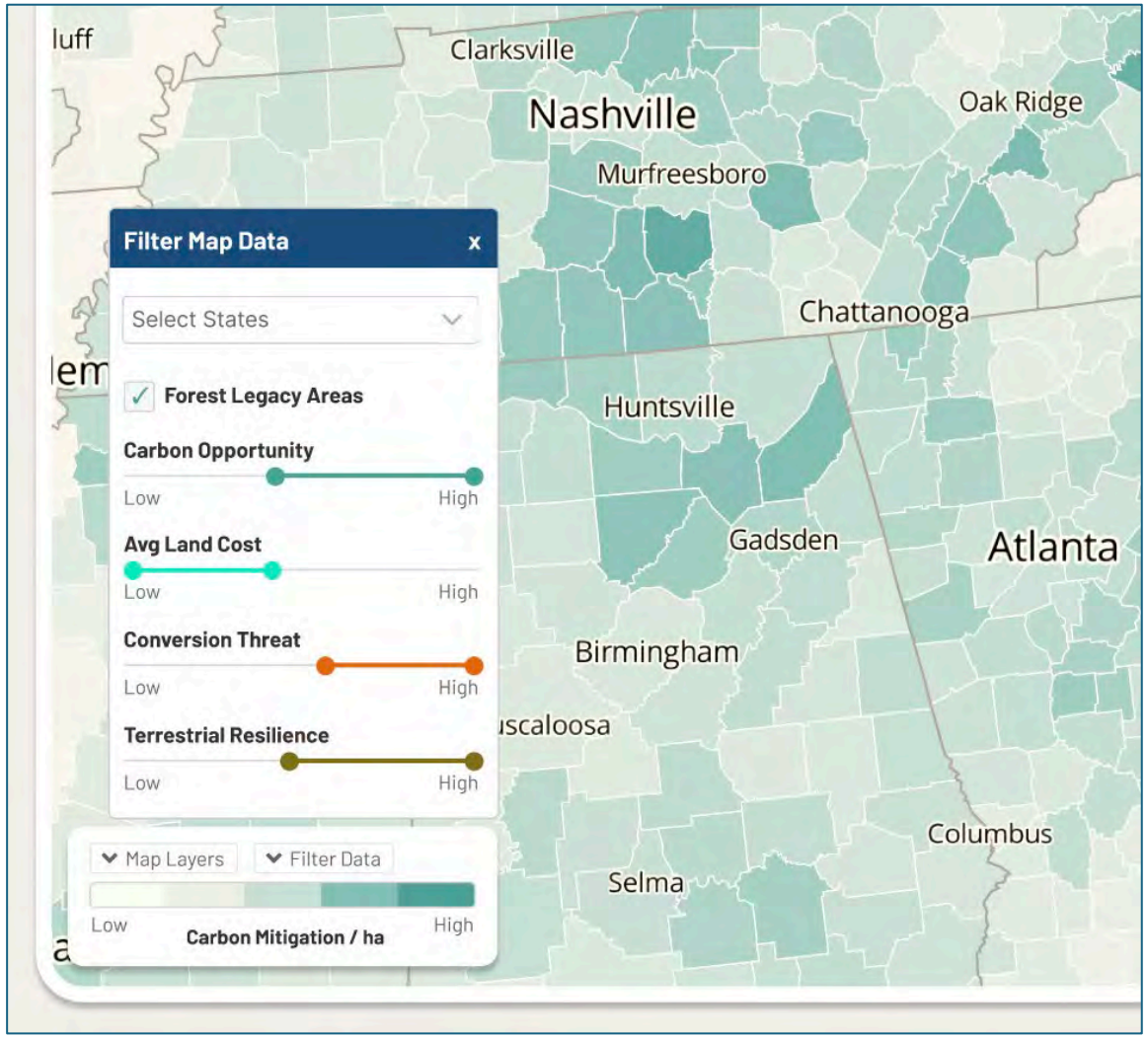

- Historic forest conversion, 1990-2021
- Future urban land change (ICLUS + 2 others)
- Future ag suitability
- Ownership

# Data Filtering and Visualization

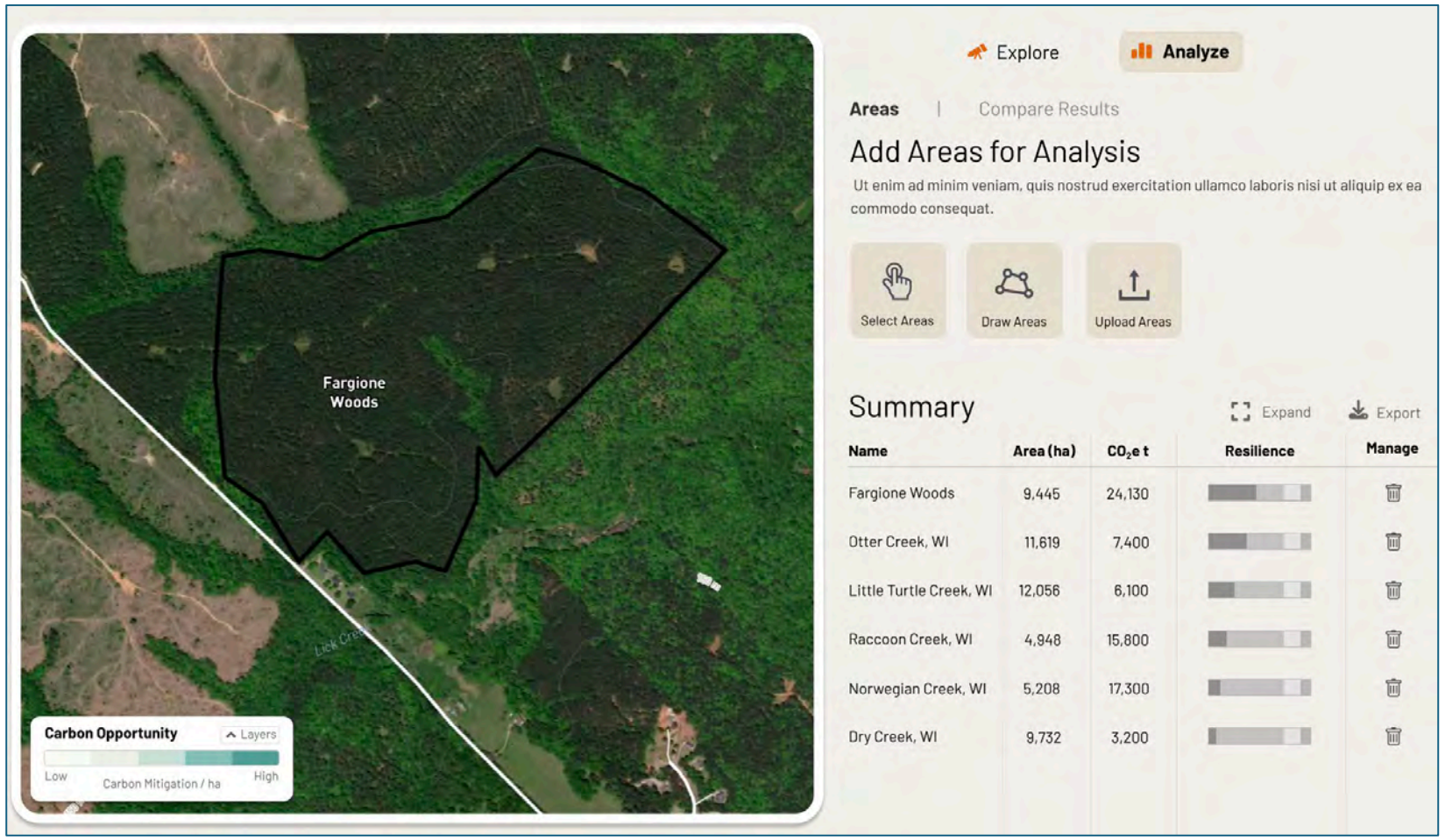
Data filtering allows easy identification of areas which meet *multiple criteria*, such as:

What HUC-12 watersheds in Kentucky and Tennessee:

- Are above the median for **private forest carbon opportunity**
- Have **high terrestrial resilience**
- Have a high likelihood of significant **future conversion**
- Have a **low cost**
- Are within identified **Forest Legacy Areas**



# Analysis-on-demand




Custom analysis provides summary of all 20+ variables for drawn polygons or uploaded shapefiles

Compare multiple user areas

Export tabular results

# Functionality Summary

- **Instant summaries** at county and HUC-12 watersheds for 20+ data layers
- **Data filtering and visualization** to prioritize action based on multiple dimensions
- **Analysis-on-demand** for custom drawn or uploaded areas
- **Content** to help users understand the data and resources for deforestation projects

# Timeline

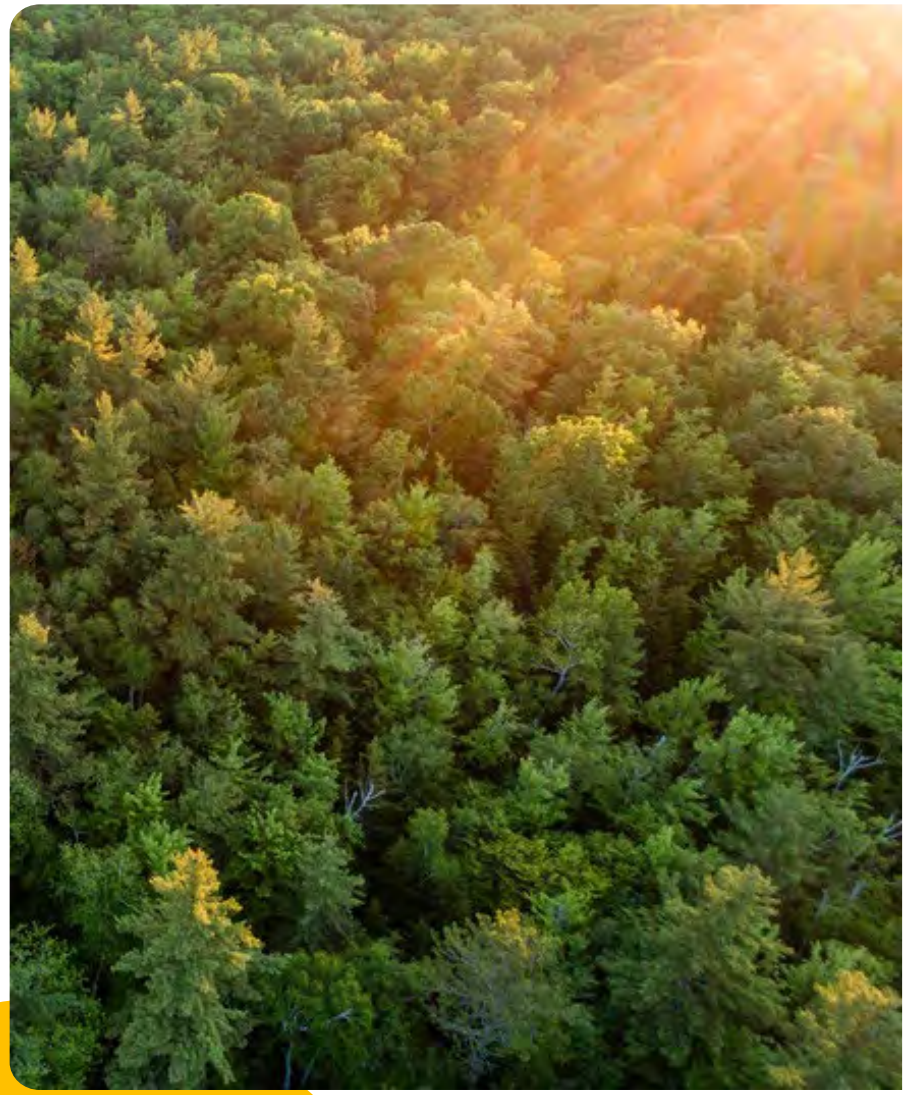
- Beta release in **January 2025**

# Feedback questions

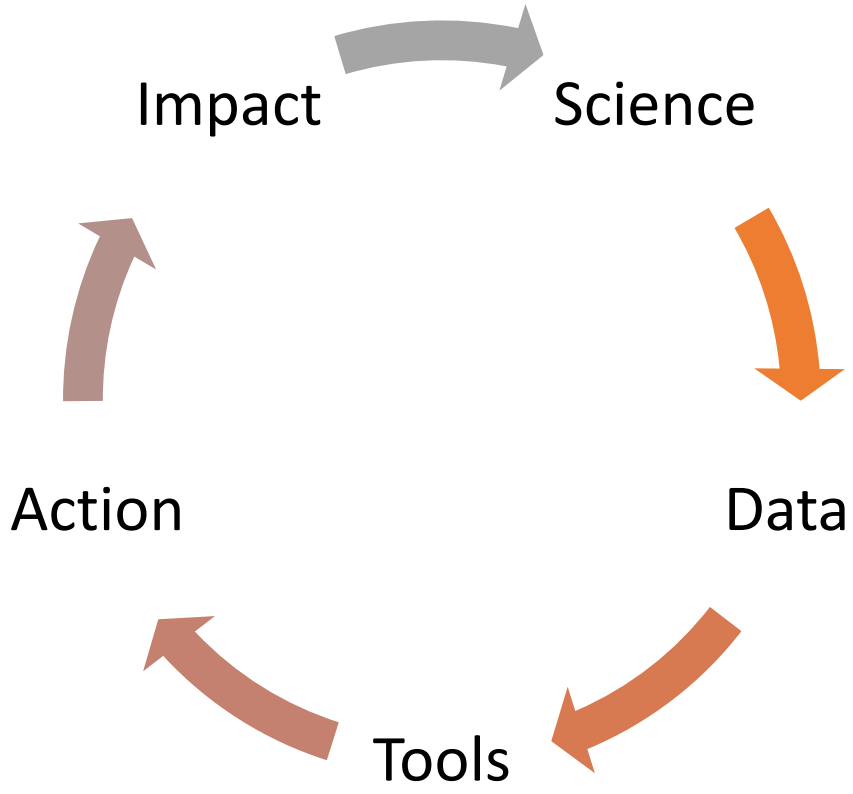
- Would it be useful to roll up data to other aggregates like states, larger watersheds, USFS boundaries, congressional districts, etc.?

- For custom user areas, is summarizing multiple areas simultaneously useful?

- What data are we missing?



# Putting it all together…



# Now

- 2020 forest carbon stock (Co2e) per acre
- 2020-2050 carbon sequestration (CO2e) per acre
- Available through ArcGIS online

# Early 2025

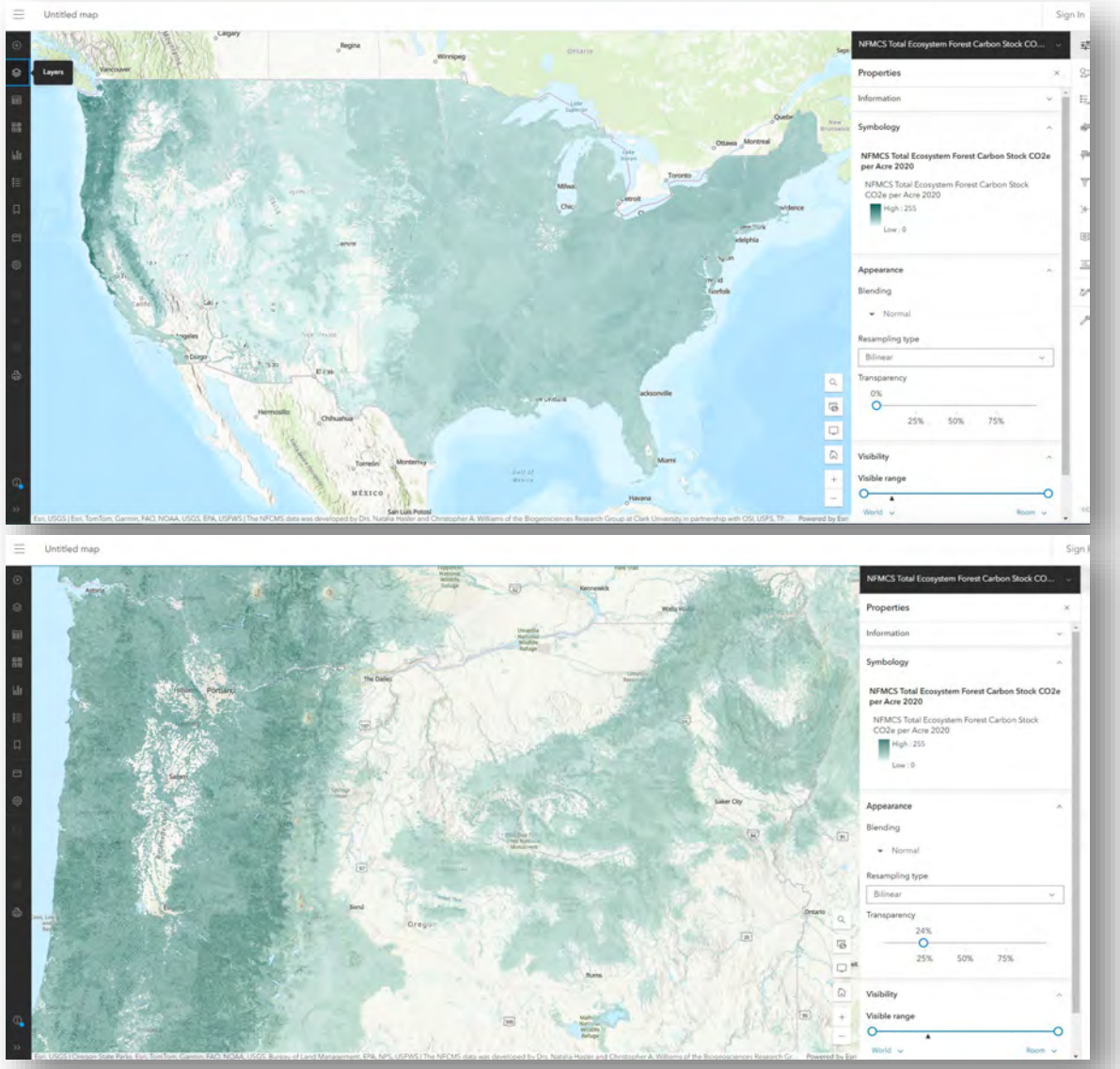
- Updated data in Resilient Lands Mapping Tool
- Data download from National Geospatial Data Asset (NGDA) Land Use and Land Cover Theme (on arcgis.com)
- ***New*** Avoided Conversion Mapping Tool

# 2020 carbon stocks – ArcGIS online

## Key data info:

- Covers total ecosystem carbon of forested landscapes
- Values are in metric tons of CO2e per acre
- 30 meter data resolution
- Available for viewing (via online ArcGIS Map Viewer) and download and custom analysis via ArcGIS Desktop or Pro

Data location: https://tinyurl.com/3krt92cw

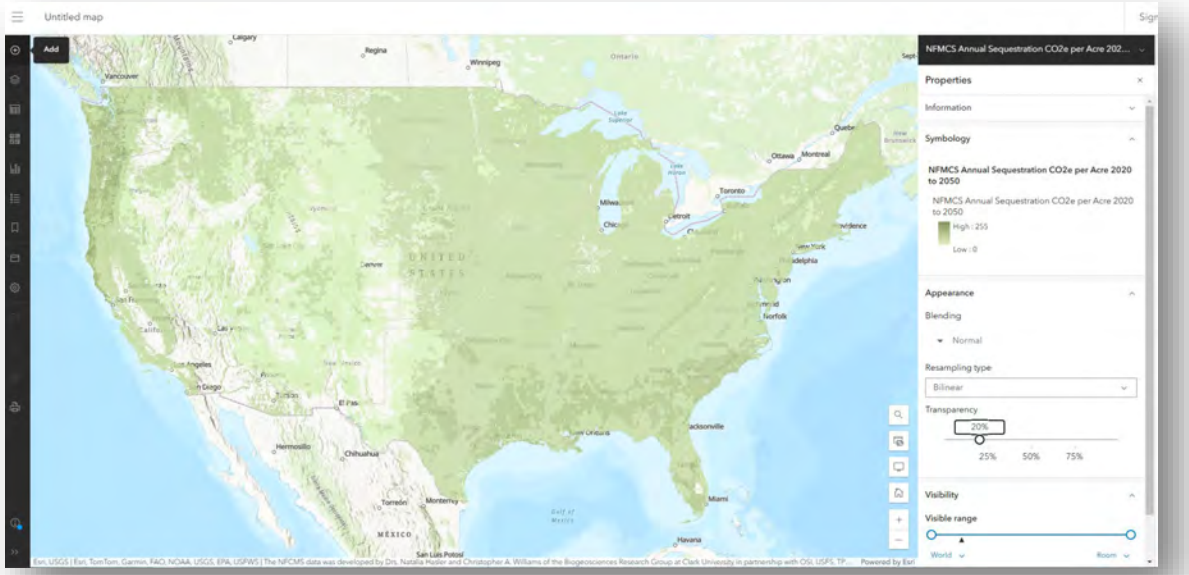


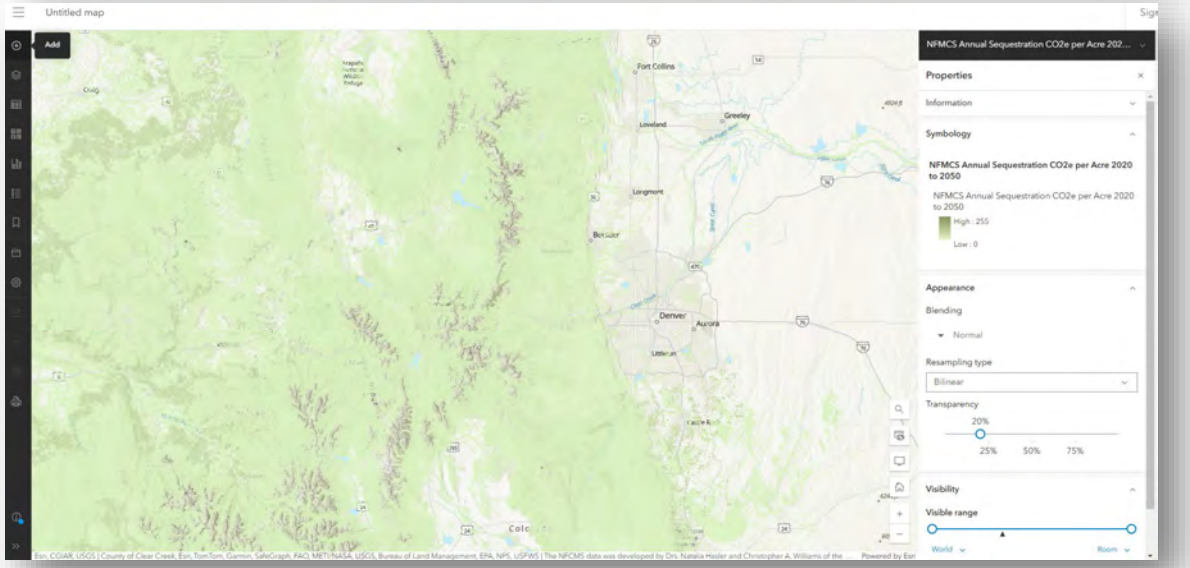
# Forest carbon sequestration – ArcGIS online

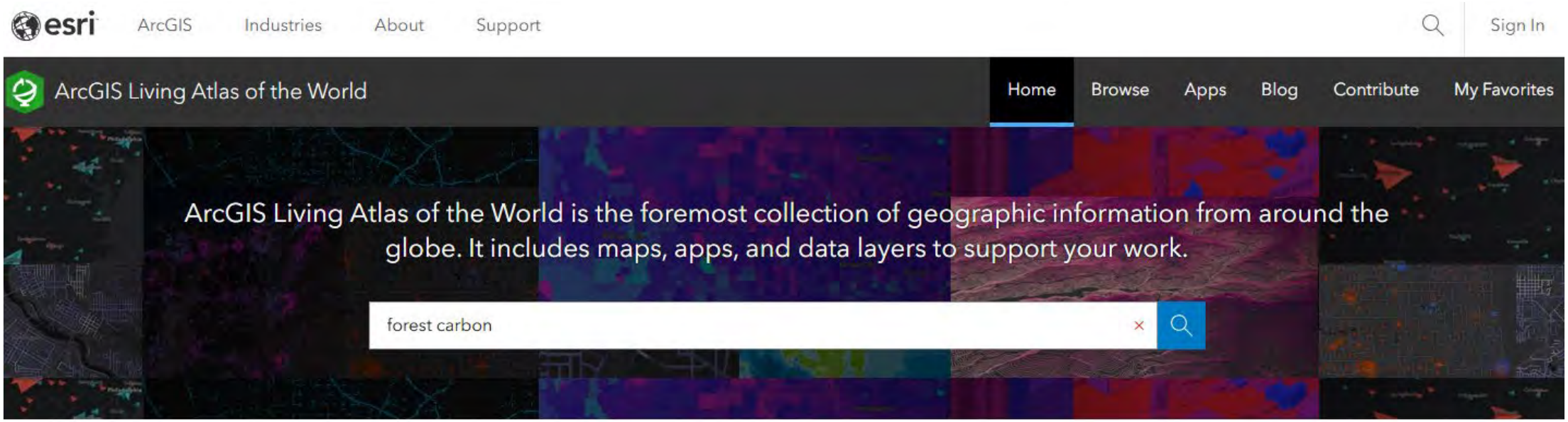
## Key data info:

- Annual carbon sequestration value calculated as avg between 2020 and 2050.
- Values are in metric tons of CO2e per acre annually
- 30 meter data resolution
- Available for viewing (via online ArcGIS Map Viewer) and download and custom analysis via ArcGIS Desktop or Pro

Data location: https://tinyurl.com/fmsw9wab



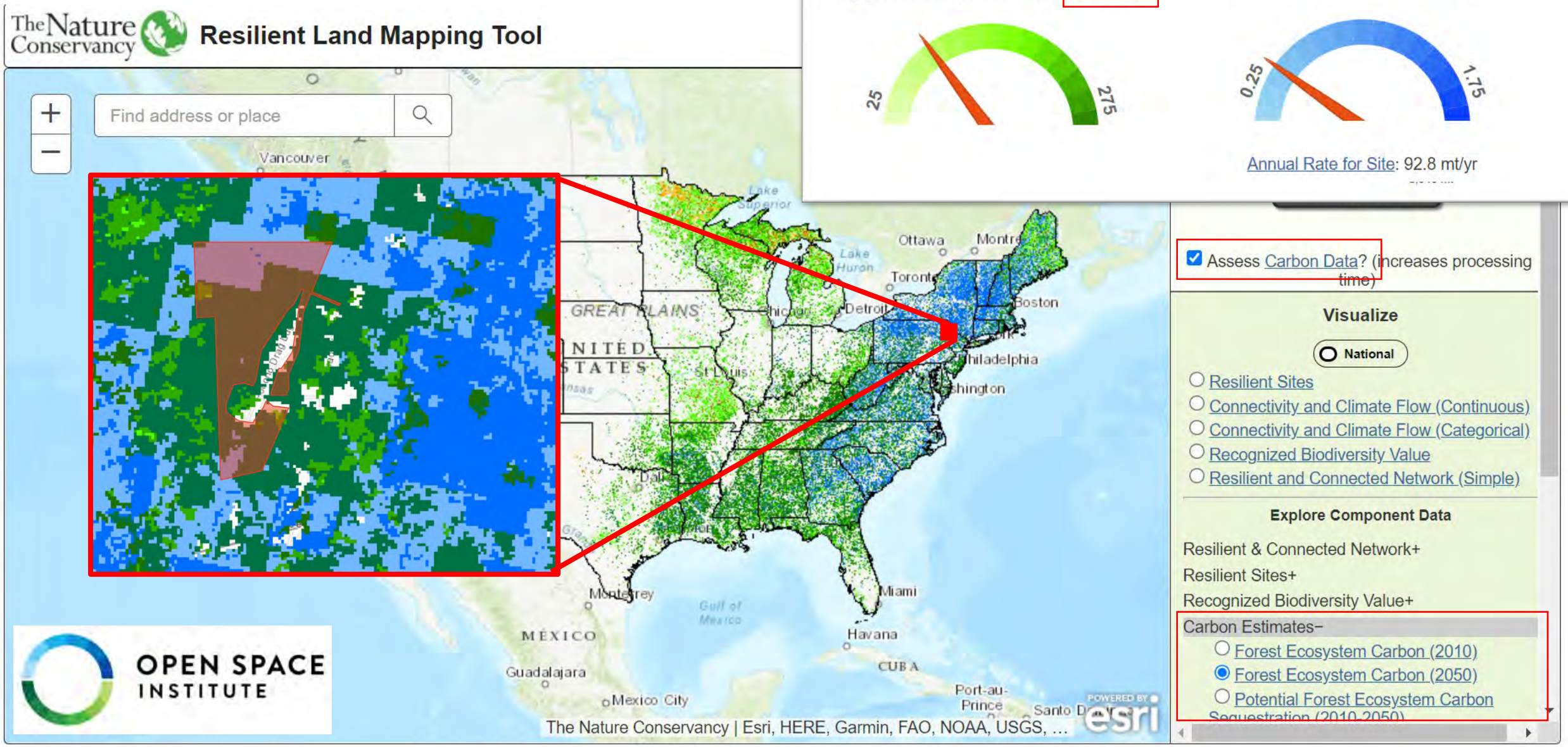






# Making the data available to all

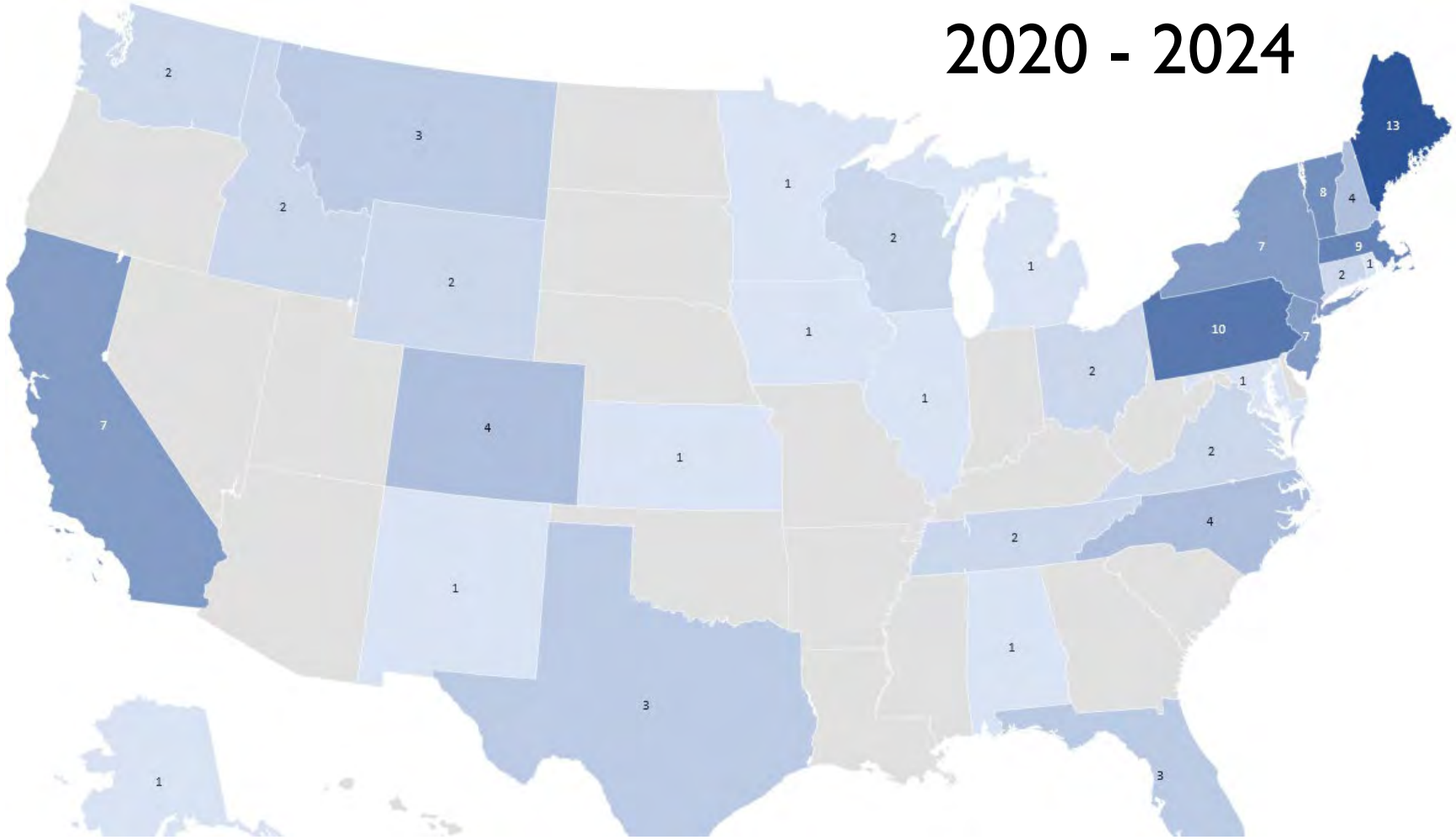
- Data will be featured on Esri's Living Atlas
- High # of users
- High impact

# Project Evaluation



# Land and Climate Planning Grants and Technical Assistance

## 2020 - 2024




- 111 Awards
- More than $1.4 M in support
- 31 states & Puerto Rico

Land Trust Alliance
Together, conserving the places you love

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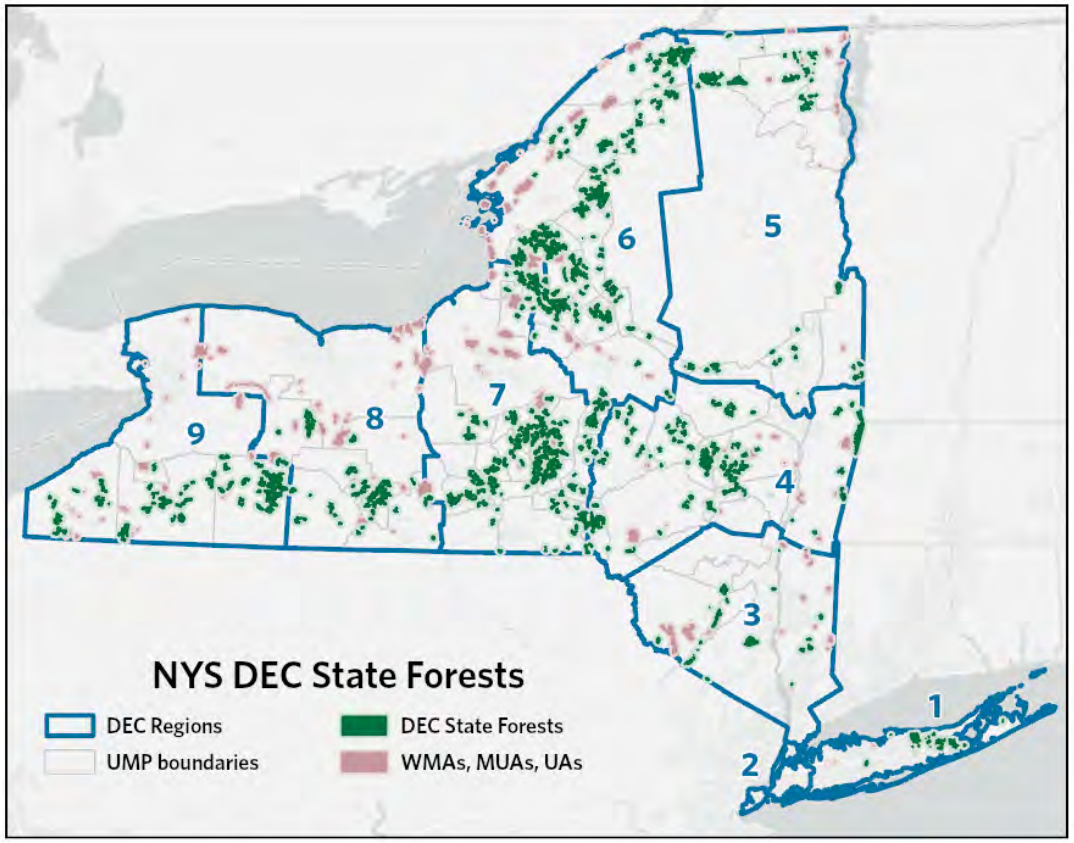
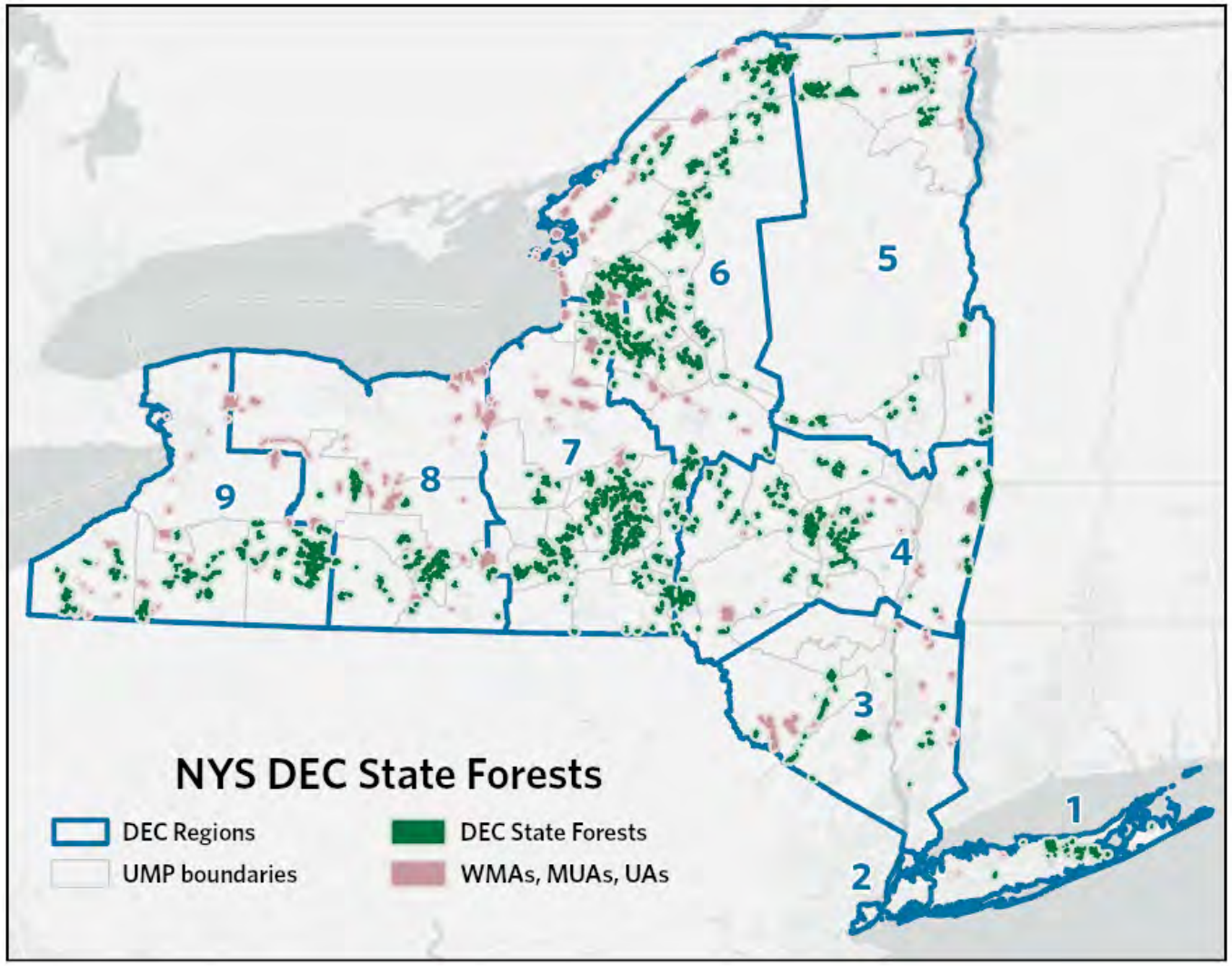
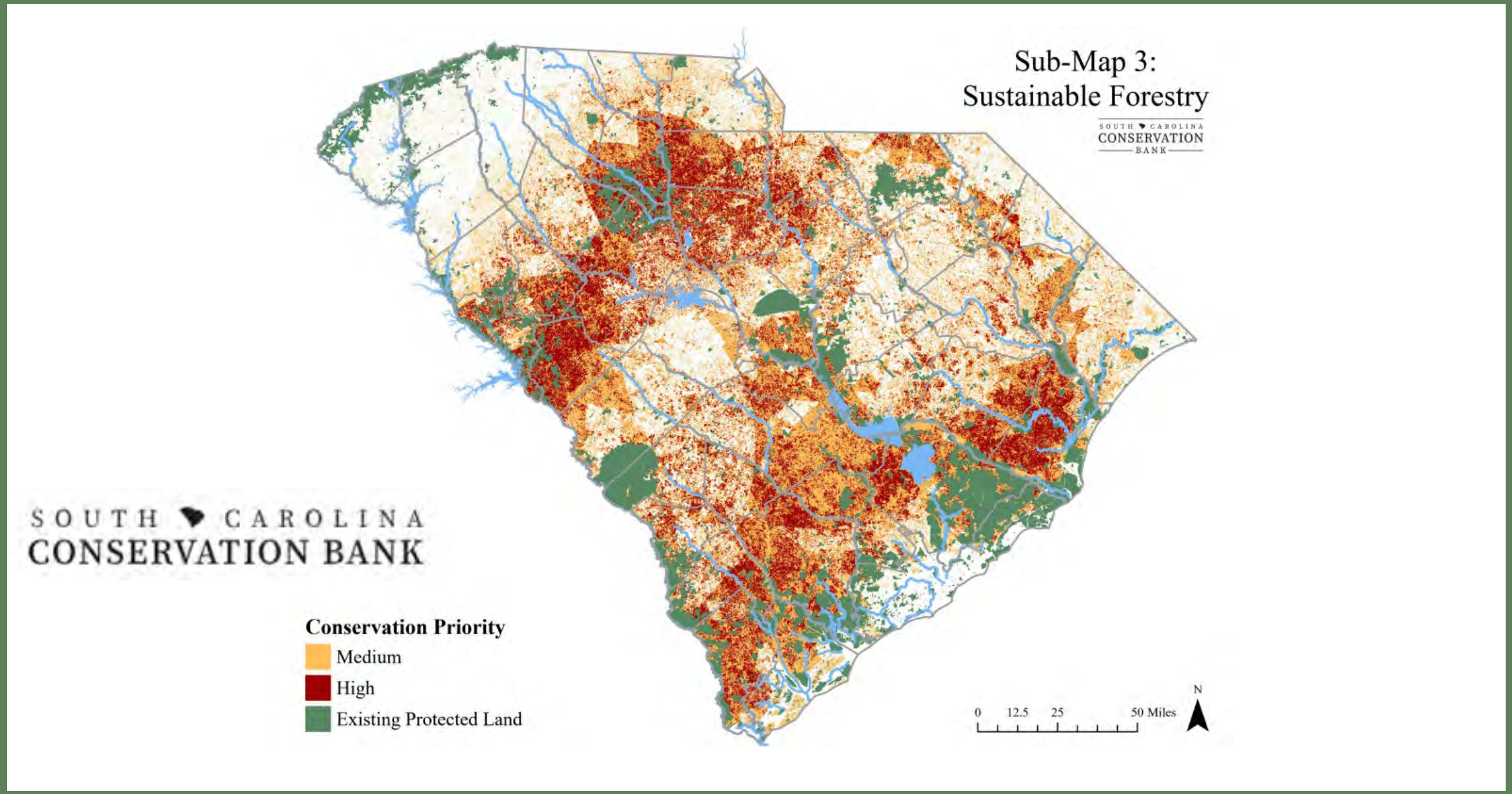
# Changing the way conservation happens on the ground.




# TNC New York - State Forest Land Assessment


Sub-Map 3:
Sustainable Forestry
SOUTH CAROLINA
CONSERVATION
BANK
SOUTH CAROLINA
CONSERVATION BANK
Conservation Priority
Medium
High
Existing Protected Land
0
12.5
25
50 Miles
N


# Land Protection as a Climate Solution

## Available Resources

- Capital grants for climate-driven land protection
- Conservation planning grants
- Online tools
- One-on-one technical assistance

## Potential Resources

- Virtual training series
- Written guidance
- Recorded demos
- Online Hub - a single go-to resource
- Peer cohort
- Mailing list: updates

# Resources

- Guidance on Use and Application of the National Forest Carbon Monitoring System Dataset
- ArcGIS Online Total ecosystem carbon for 2020 and estimated sequestration from 2020 to 2050
- TPL's report and associated USN4C blog post on the Power of Land Conservation to Address the Climate Crisis
- Tools to Quantify the Carbon Value of Forest Protection (2024)
- Recording of the First Forest Carbon Field Briefing – February 2024
- New Polling Reveals Overwhelming Bi-partisan Support For Natural Climate Solutions

# How Can We Support You?

1. How do you plan to use these data and resources? (select top 3) (Multiple choice)

| | |
|---|---|
| Policy/Advocacy | (20/57) 35% |
| Conservation Targeting | (37/57) 65% |
| Communications | (19/57) 33% |
| Outreach and Engagement | (21/57) 37% |
| Case Making for Existing Projects | (19/57) 33% |
| Education | (10/57) 18% |
| Strategic Planning | (27/57) 47% |

You did not answer this question

2. What resources would you find most useful? (select top 3) (Multiple choice)

| | |
|---|---|
| Series of Online Trainings | (28/53) 53% |
| Resource Hub | (37/53) 70% |
| Recorded Video Demos | (23/53) 43% |
| Written Guidance | (23/53) 43% |
| One-on-One Technical Assistance | (14/53) 26% |
| Mailing List | (6/53) 11% |
| Peer Cohort Series | (4/53) 8% |

You did not answer this question

Close