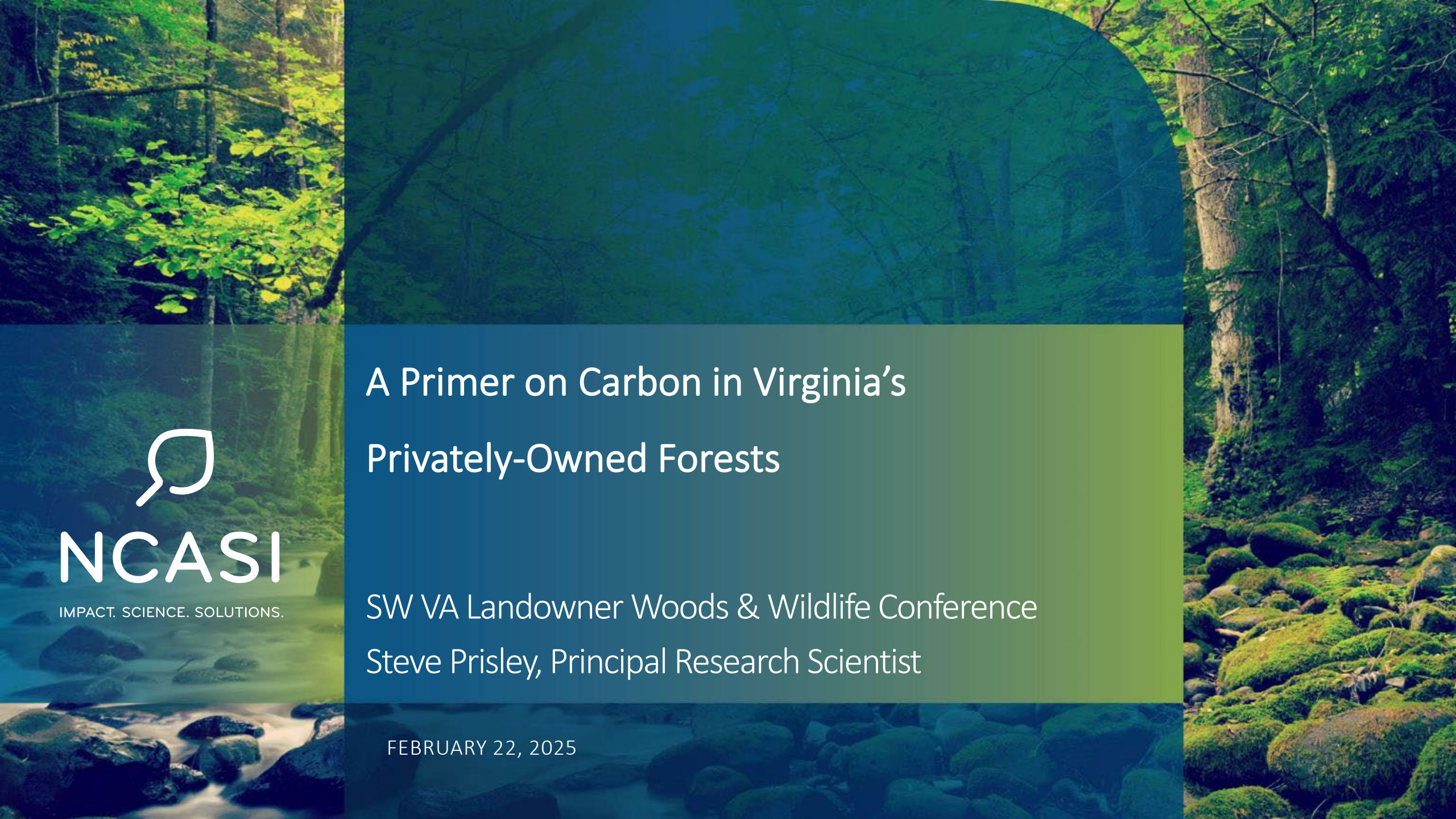

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A Primer on Carbon in Virginia's Privately-Owned Forests

SW VA Landowner Woods & Wildlife Conference

Steve Prisley, Principal Research Scientist

FEBRUARY 22, 2025

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The Planet-Saving Role of Private Managed Forests

SW VA Landowner Woods & Wildlife Conference

Steve Prisley, Principal Research Scientist

FEBRUARY 22, 2025

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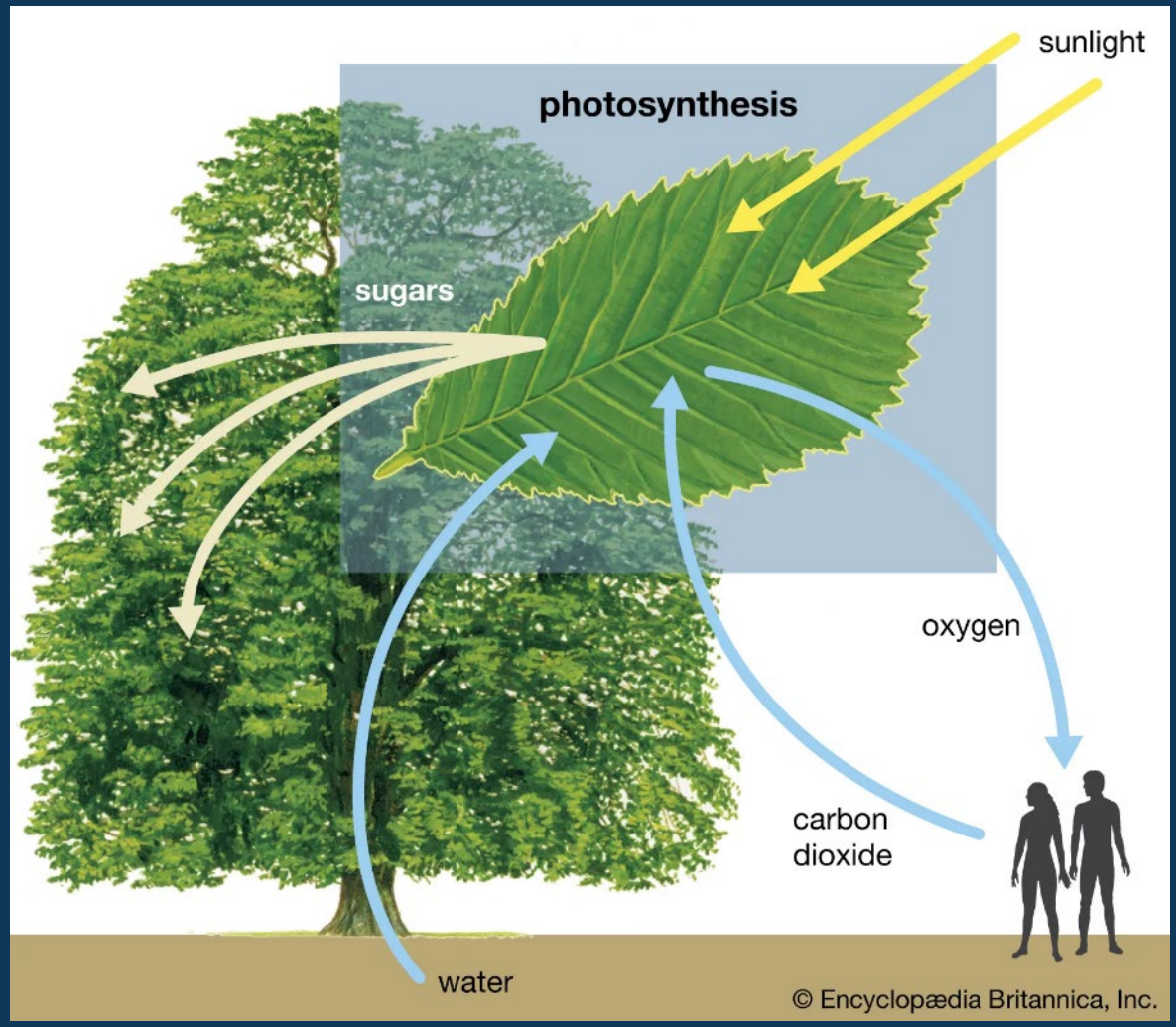
OVERVIEW

- A primer: carbon in Virginia's forests
  - Carbon in a tree
  - Carbon in a forest
- Carbon and age discrimination
- When forest carbon has left the forest
- When bad things happen to good forests
- Resources for forest landowners

The Basics

$$H_2O + CO_2$$

$$O_2 + C_xH_yO_z$$



Terminology:

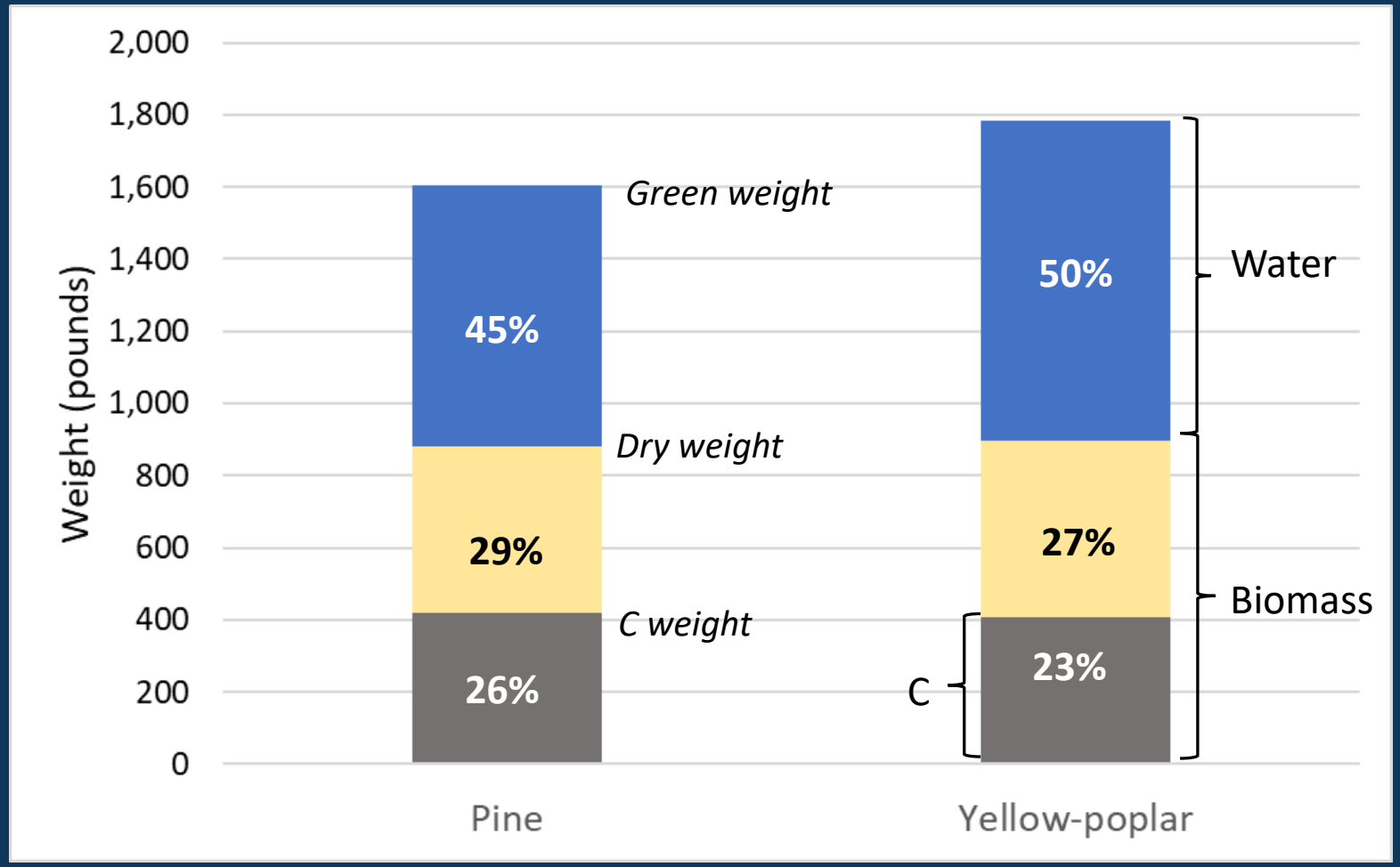
Emissions are transfers of GHG into the atmosphere

Removals are transfers of GHG from the atmosphere into trees, for example

The Basics

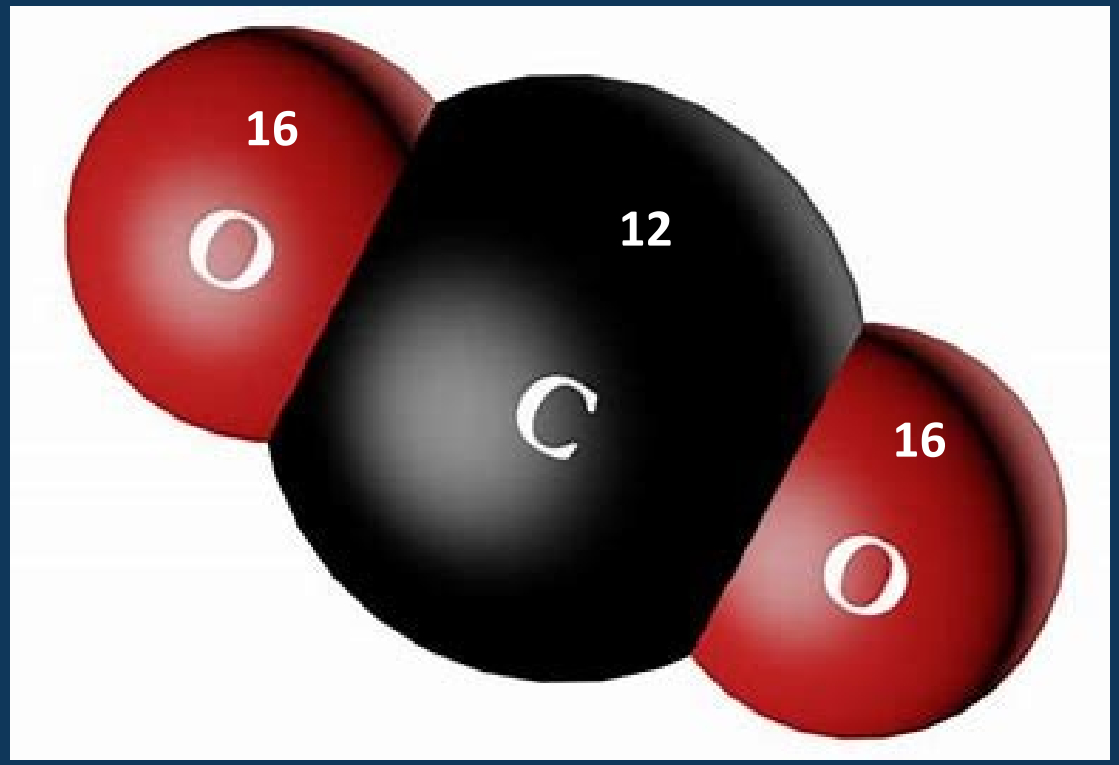
How much carbon is in that tree?

Weight of an ‘average’ 12” DBH tree



The Basics

Are we talking C or CO_2?



Molecular weight CO_2: 44
Molecular weight C: 12

Ratio of CO_2 to C: 44/12 = 3.6667

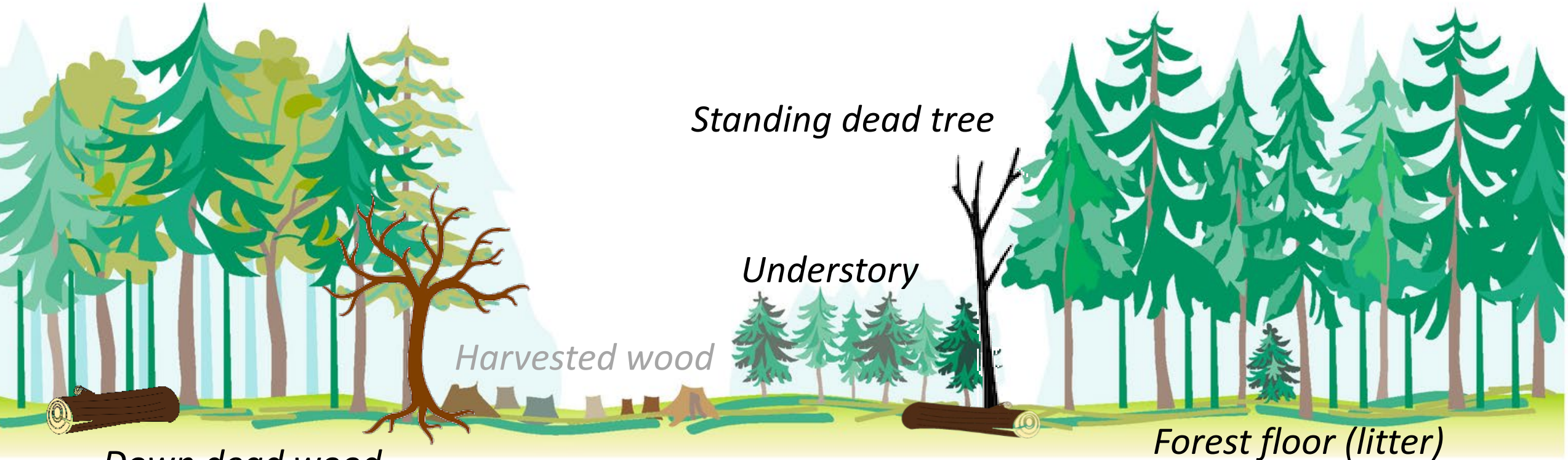
5 tons C ~ 18 tons CO_2

The Basics

1 ton C emitted is equivalent to:	5 tons:
9 months of emissions from an average passenger car	45 months
8,500 miles driven by an average passenger car	42,500 miles
375 gallons of gasoline consumed	1,875 gallons

https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

The Basics


Aboveground live tree
Standing dead tree
Understory
Harvested wood
Down dead wood
Forest floor (litter)
Soil organic carbon
Belowground live tree

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The Basics

Carbon in Virginia's Forests

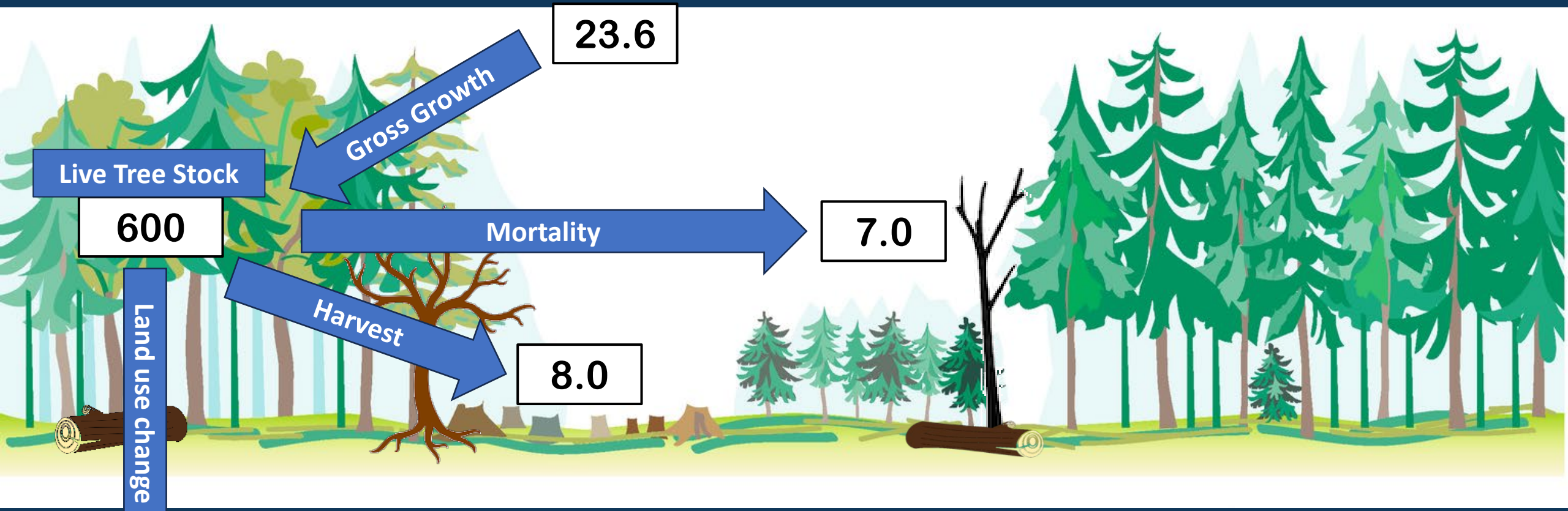
Pool	Million Tons C	Tons C/ac	Percent of Total
Aboveground live trees	599.8	37.6	36.9%
Belowground live trees	108.5	6.8	6.7%
Standing dead trees	24.1	1.5	1.5%
Down dead wood	103.7	6.5	6.4%
Understory	19.4	1.2	1.2%
Forest floor	72.0	4.5	4.4%
Soil	697.8	43.7	42.9%
TOTAL	**1,625.3**	**101.8**	

80% on Private Lands

Data: USFS Forest Inventory and Analysis data from 2023

The Basics

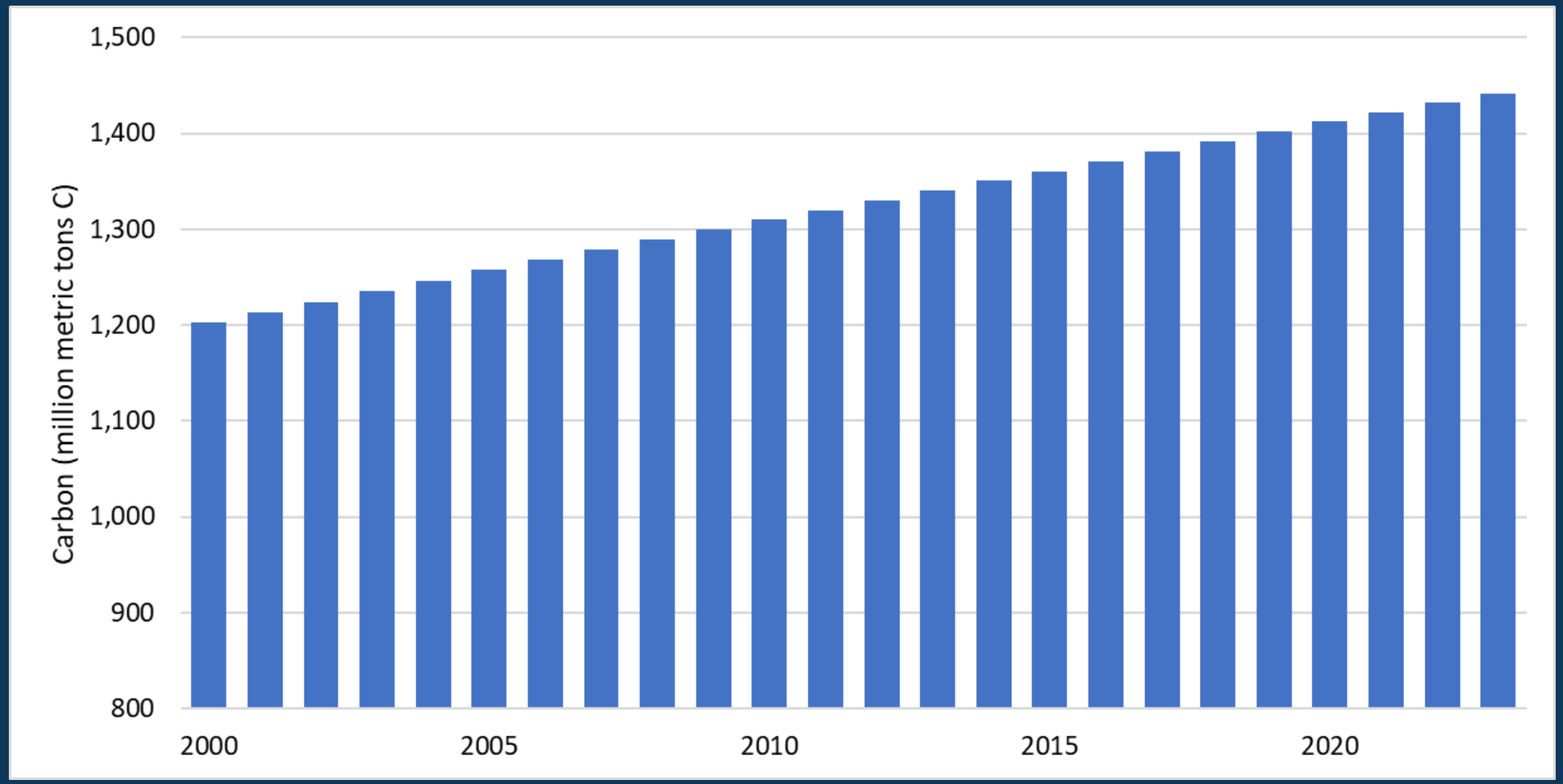
VA Annual Carbon Flux: Million tons C/yr



Terminology: **Stock** is a *quantity* of stored carbon;
Flux is the *rate* of change from one pool to another.

The Basics

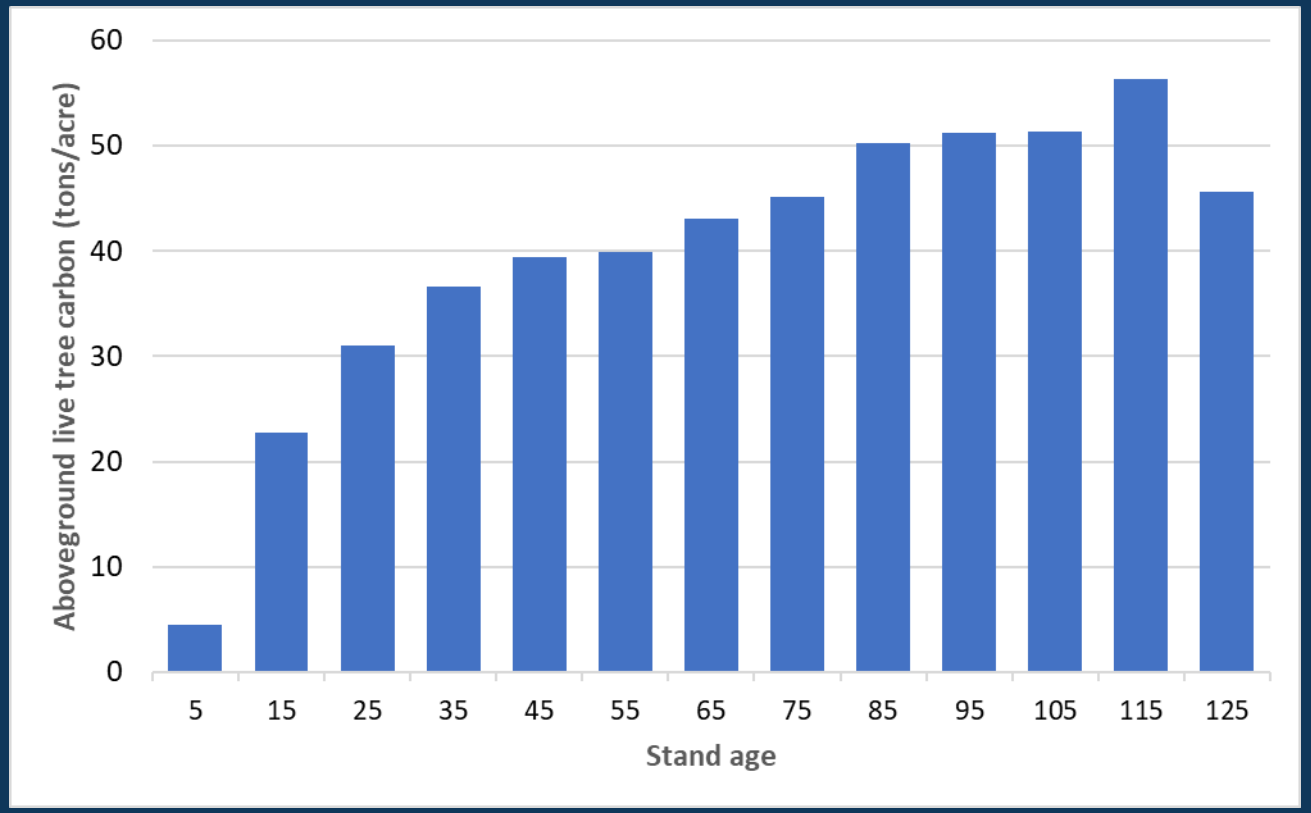
VA Forest Carbon Stock, 2000 - 2023



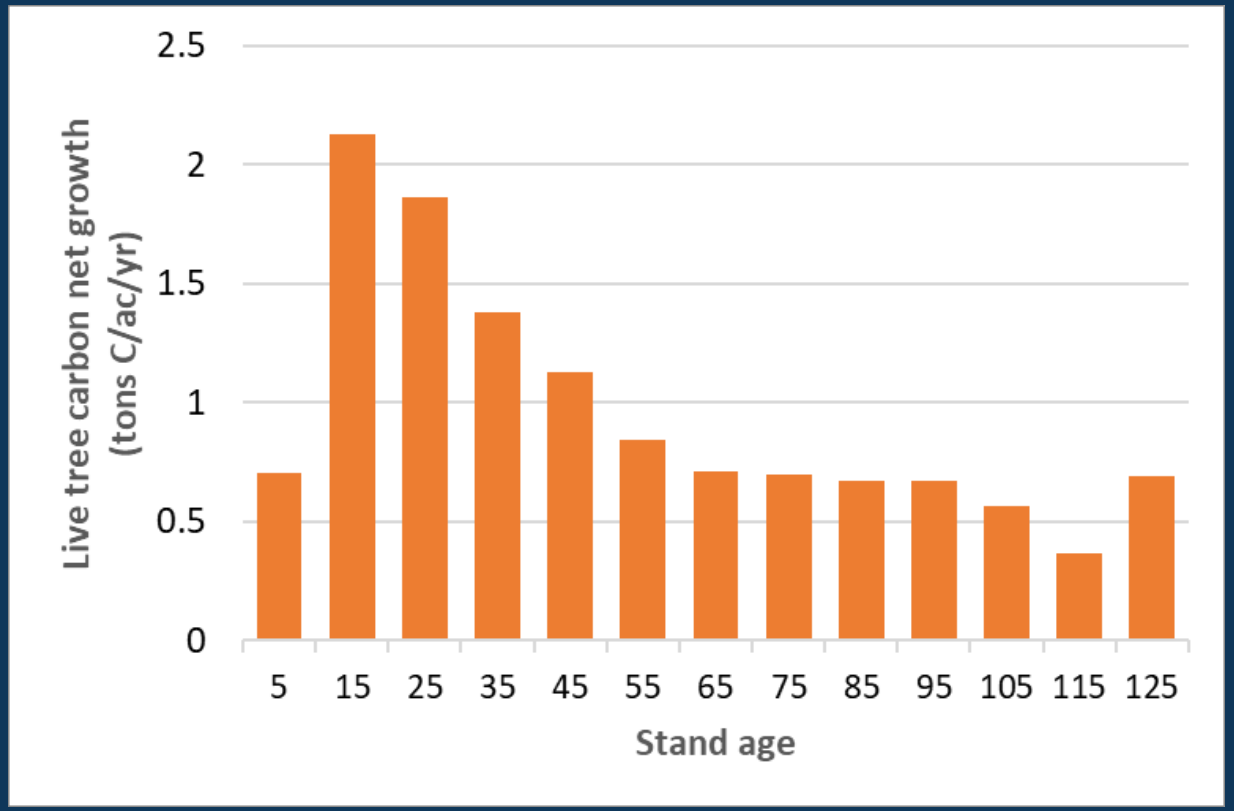
Source: Domke, et al. 2023. Resource Update FS-382, Appendix 1

Age Discrimination

VA Private Forest Aboveground live tree carbon



VA Aboveground live tree carbon net growth



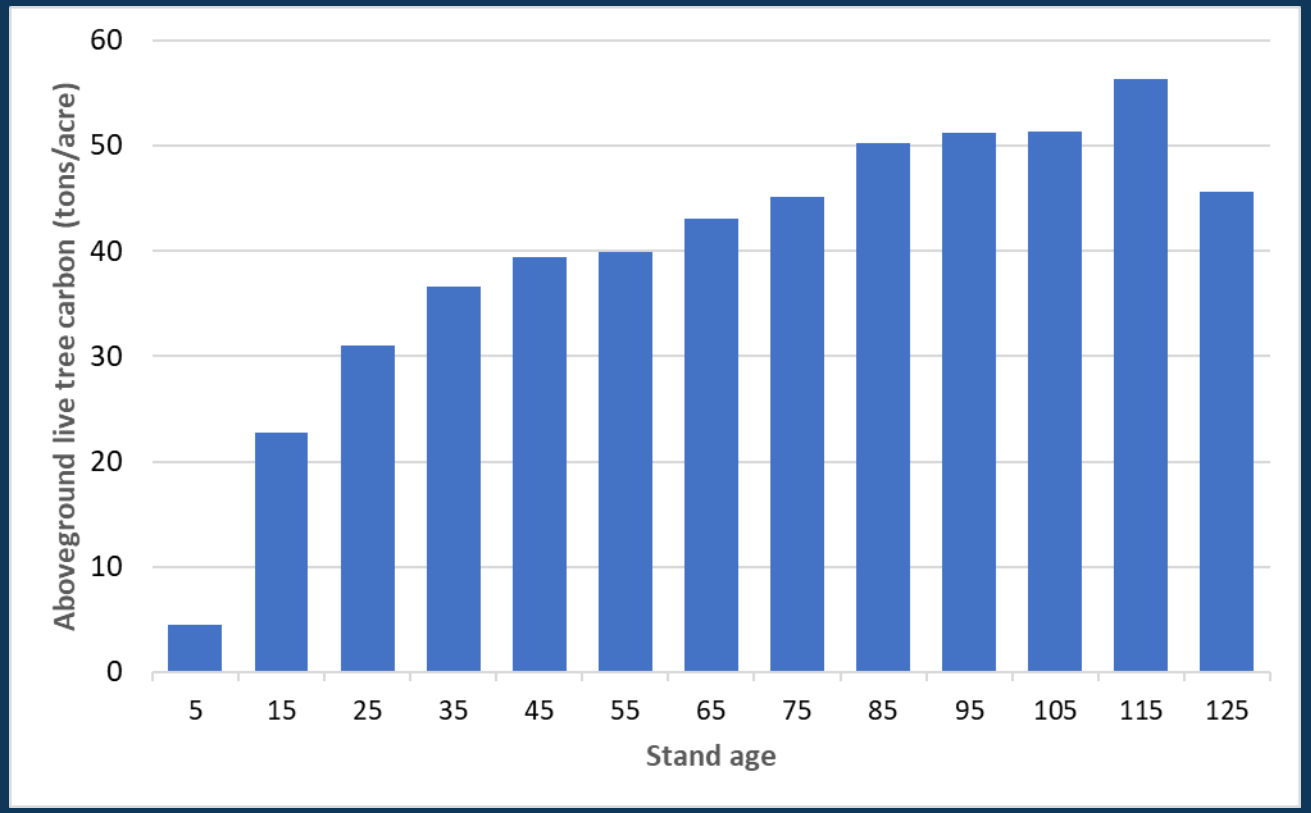
STORAGE / STOCK

SEQUESTRATION / FLUX

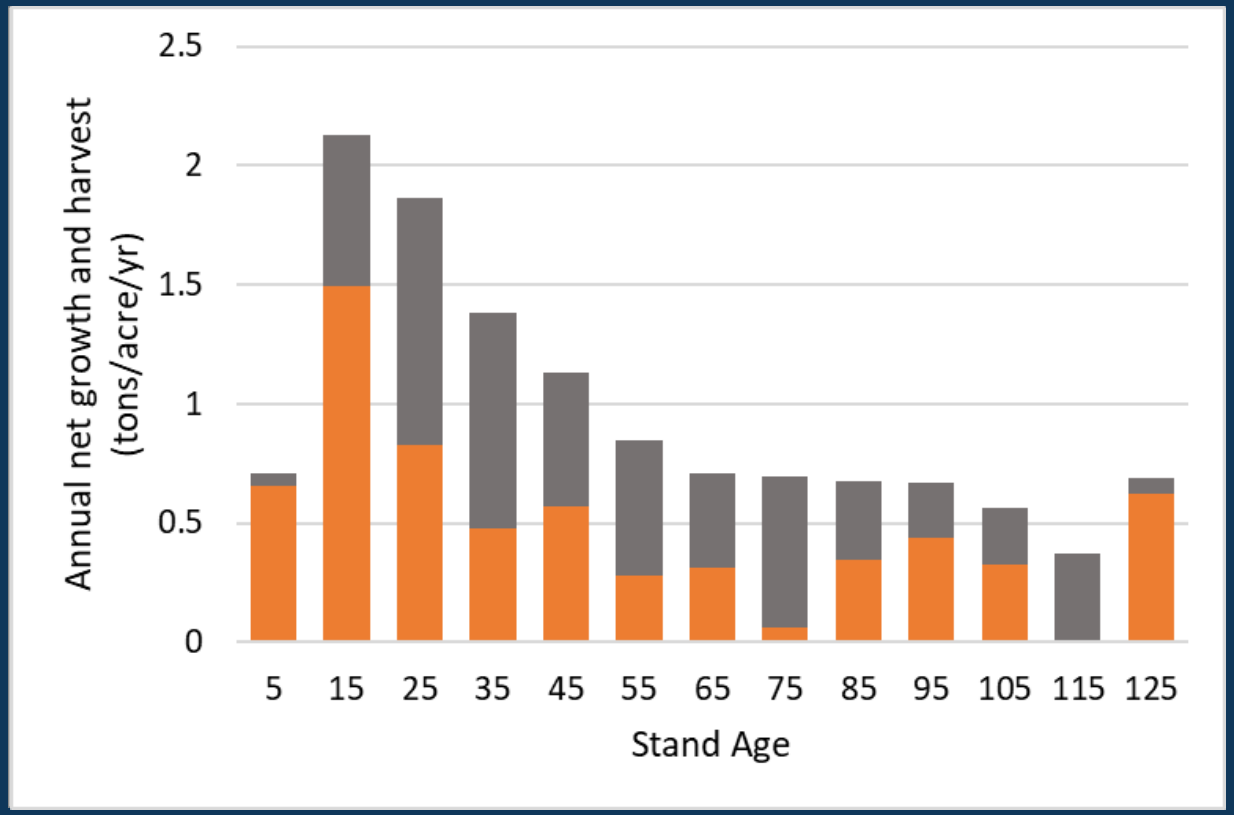
Proforestation: protecting existing natural forests for continuous growth, carbon accumulation, and structural complexity

Age Discrimination

VA Private Forest Aboveground live tree carbon



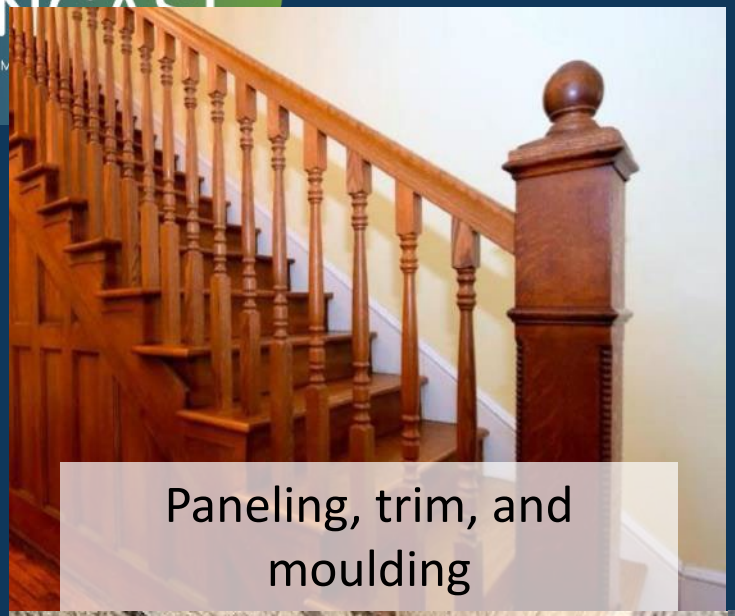
VA Aboveground live tree carbon net growth



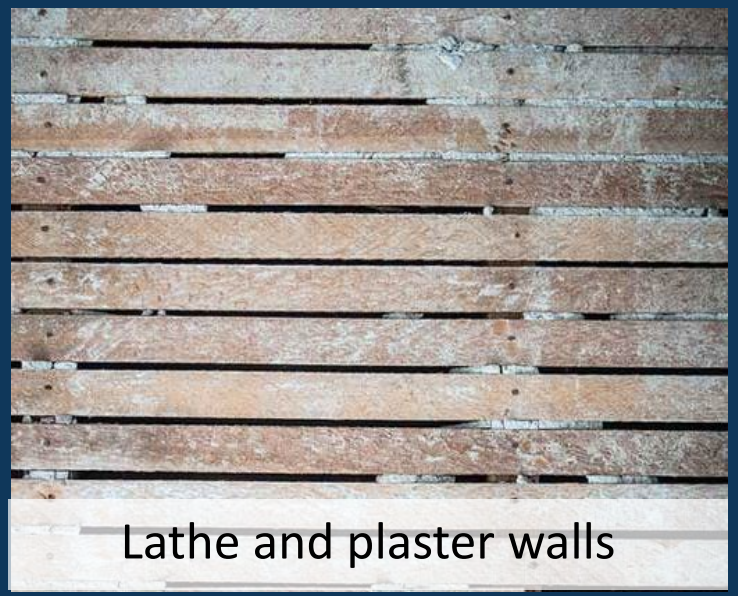
STORAGE / STOCK

SEQUESTRATION / FLUX

When carbon has left the forest



Paneling, trim, and moulding



Lathe and plaster walls

Joists and subflooring

Waste to landfill

Oak flooring

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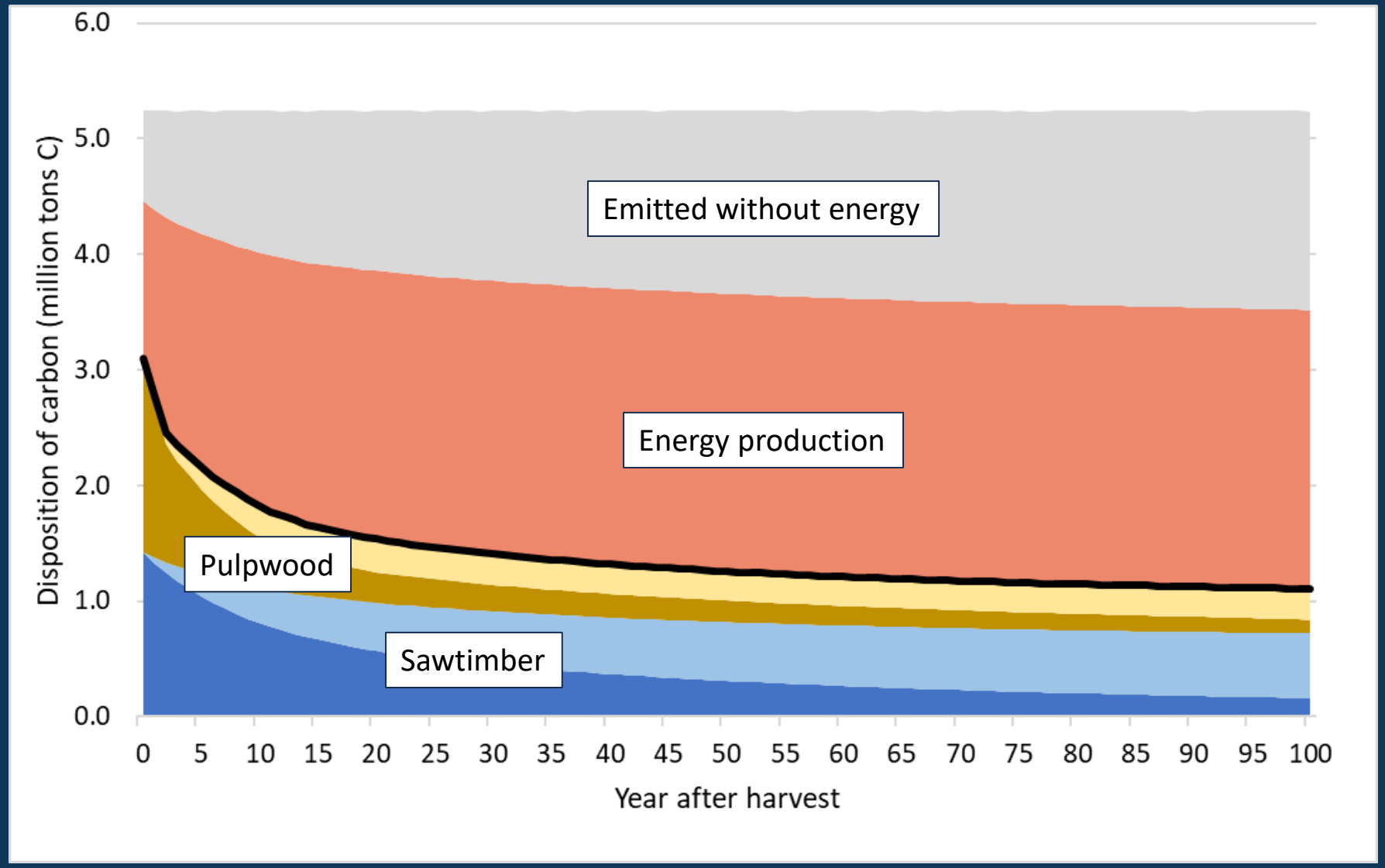
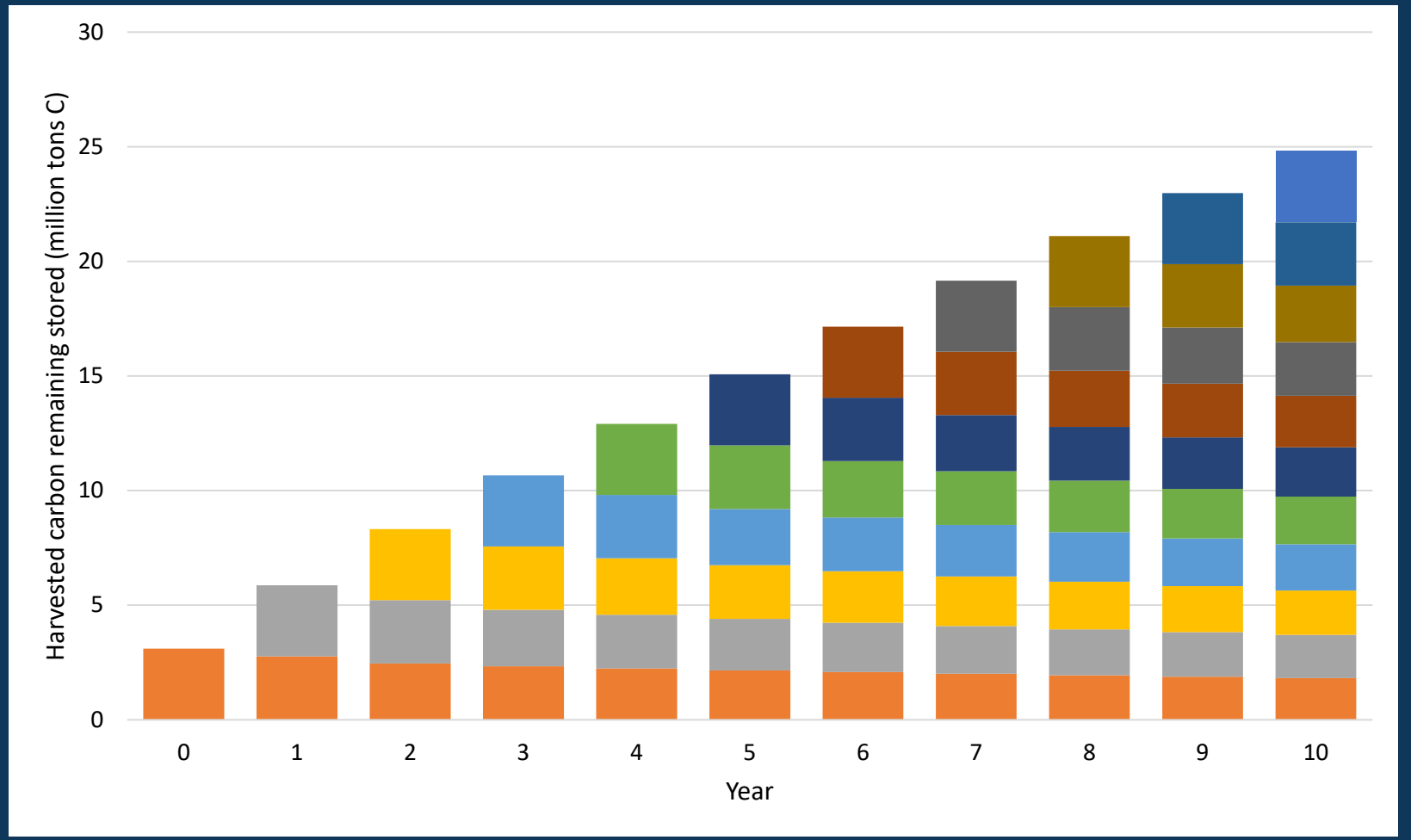
When carbon has left the forest

Disposition of carbon in Virginia's annual timber harvest



When carbon has left the forest

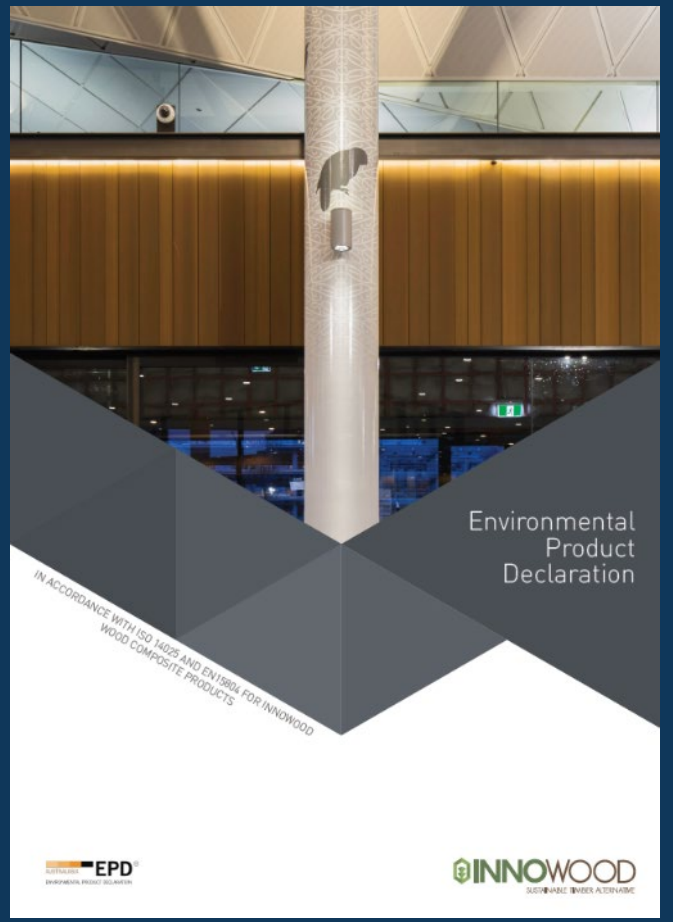
Cumulative effect of Virginia's annual timber harvest



When carbon has left the forest

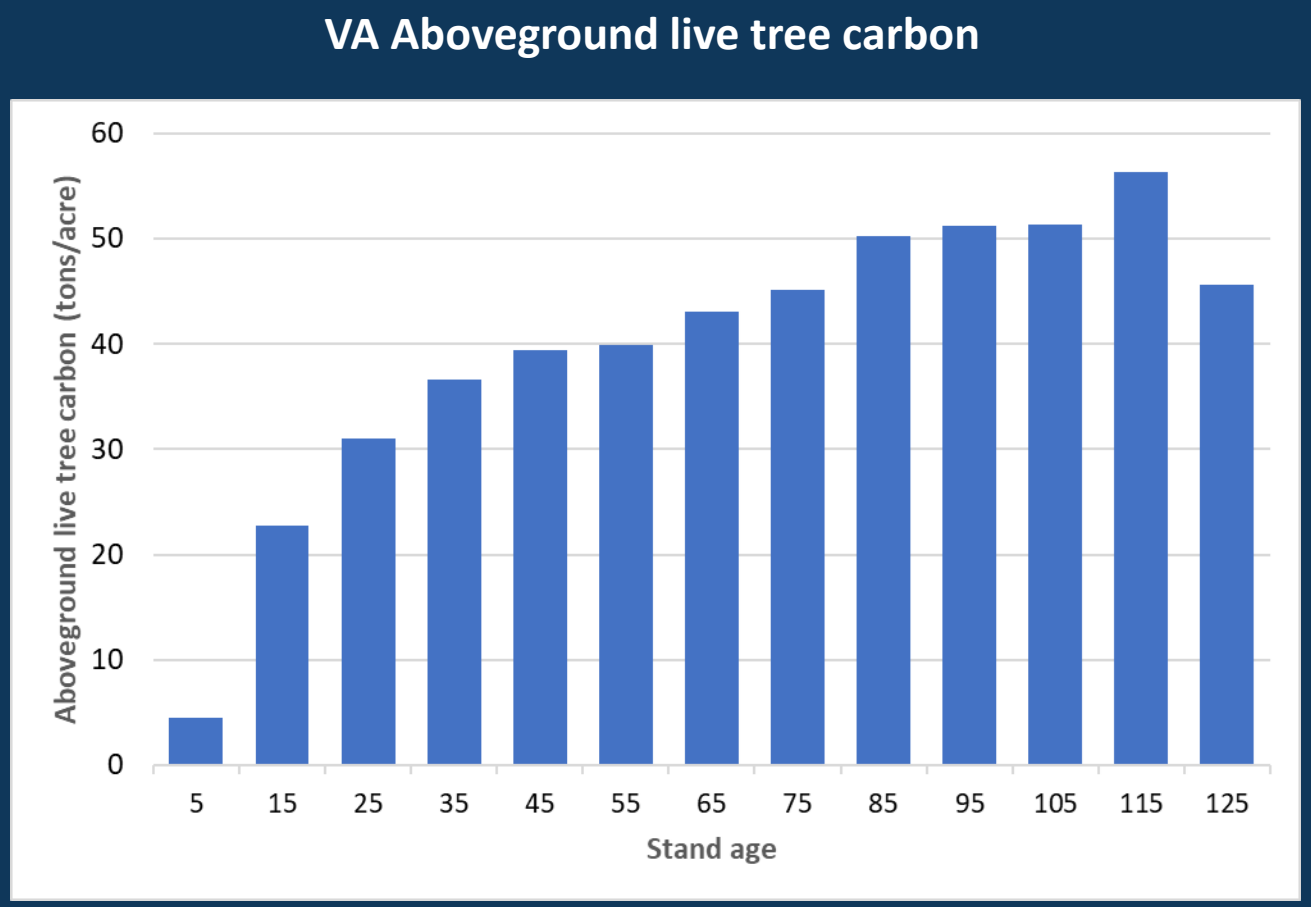
Substitution

Reductions in production of one product leads to increases in other (possibly more emission-intensive) products.



Manufacturing emissions of CO_2e per m^2:	**2.4 kg**	**31.8 kg**

When bad things happen to good forests



STORAGE / STOCK

When bad things happen to good forests

Environmental Pollution 310 (2022) 119888

Contents lists available at ScienceDirect

"In this short communication, we estimate that California's wildfire carbon dioxide equivalent (CO_2e) emissions from 2020 are approximately two times higher than California's total greenhouse gas (GHG) emission reductions since 2003."

Up in smoke: California's greenhouse gas reductions could be wiped out by 2020 wildfires☆

Michael Jerrett [a,*], Amir S. Jina [b], Miriam E. Marlier [a]

[a] Department of Environmental Health Sciences, Fielding School of Public Health, University of California, Los Angeles, 650 Charles E. Young Dr. S., 56-070 CHS Box 951772, Los Angeles, CA, 90095, USA
[b] Harris School of Public Policy, University of Chicago, 1307 East 60th Street, Chicago, IL, 60637, USA

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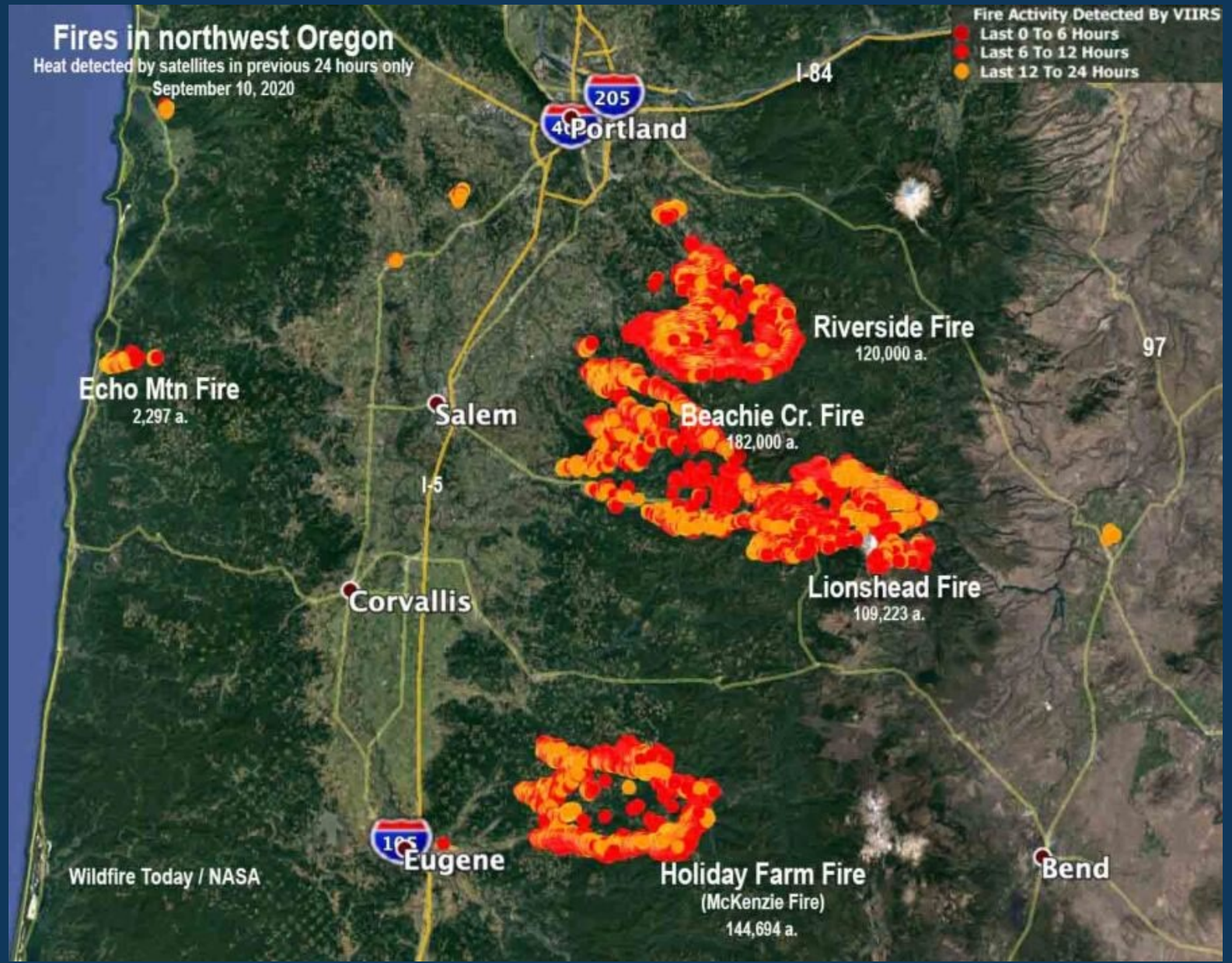
When bad things happen to good forests



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When bad things happen to good forests

Private (corporate) land

National Forest

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When bad things happen to good forests

Private (corporate) land

National Forest

When bad things happen to good forests

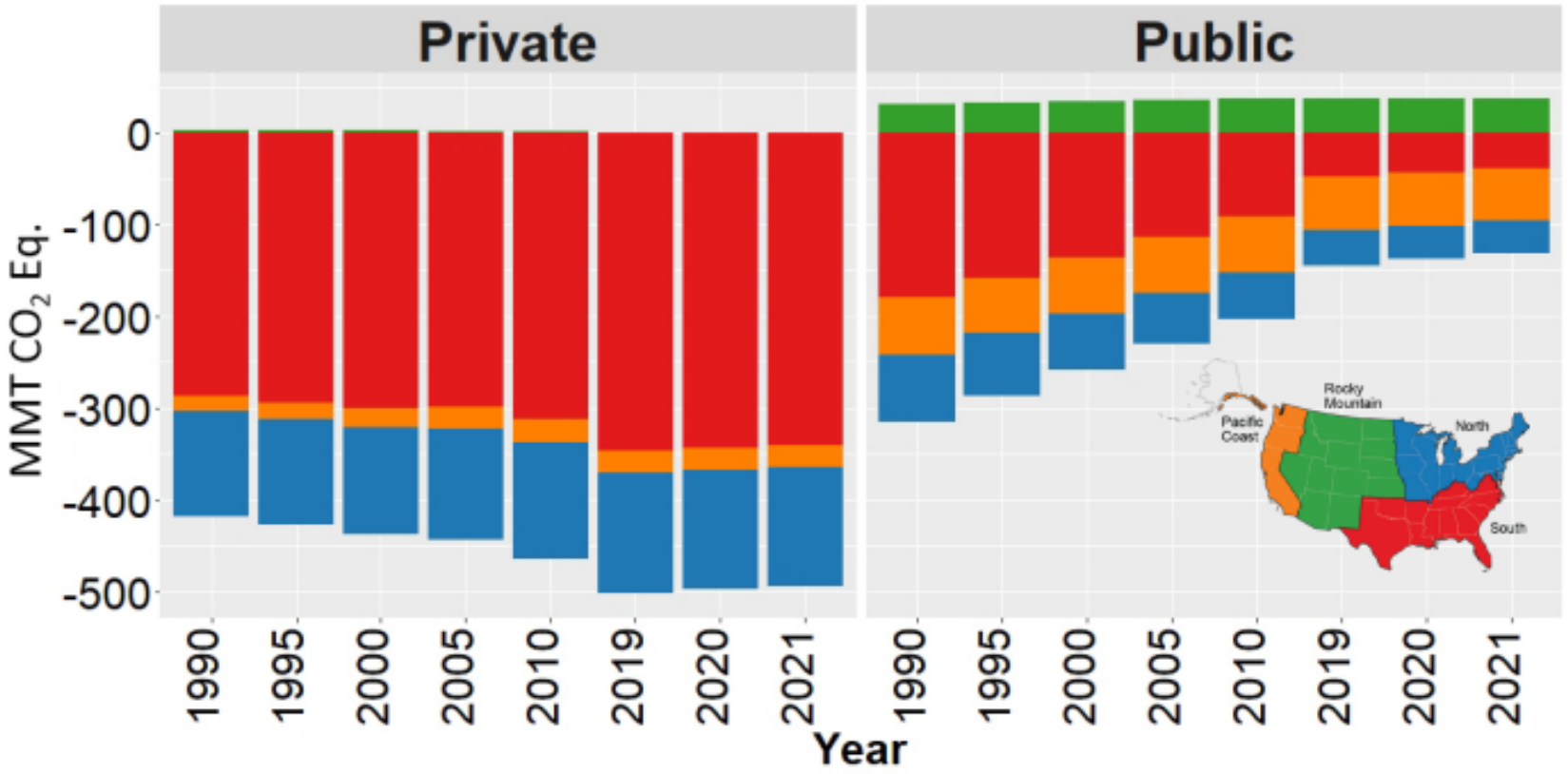

Figure 2.—Carbon stock changes for forest land remaining forest land in private and public ownership for the conterminous 48 States and coastal Alaska (ownership information was not available for forest land in Interior Alaska so those lands were excluded from these estimates) by region and ownership (MMT CO_2 Eq.). Negative estimates indicate net carbon uptake (i.e., a net removal of carbon from the atmosphere or transfer from another carbon pool).

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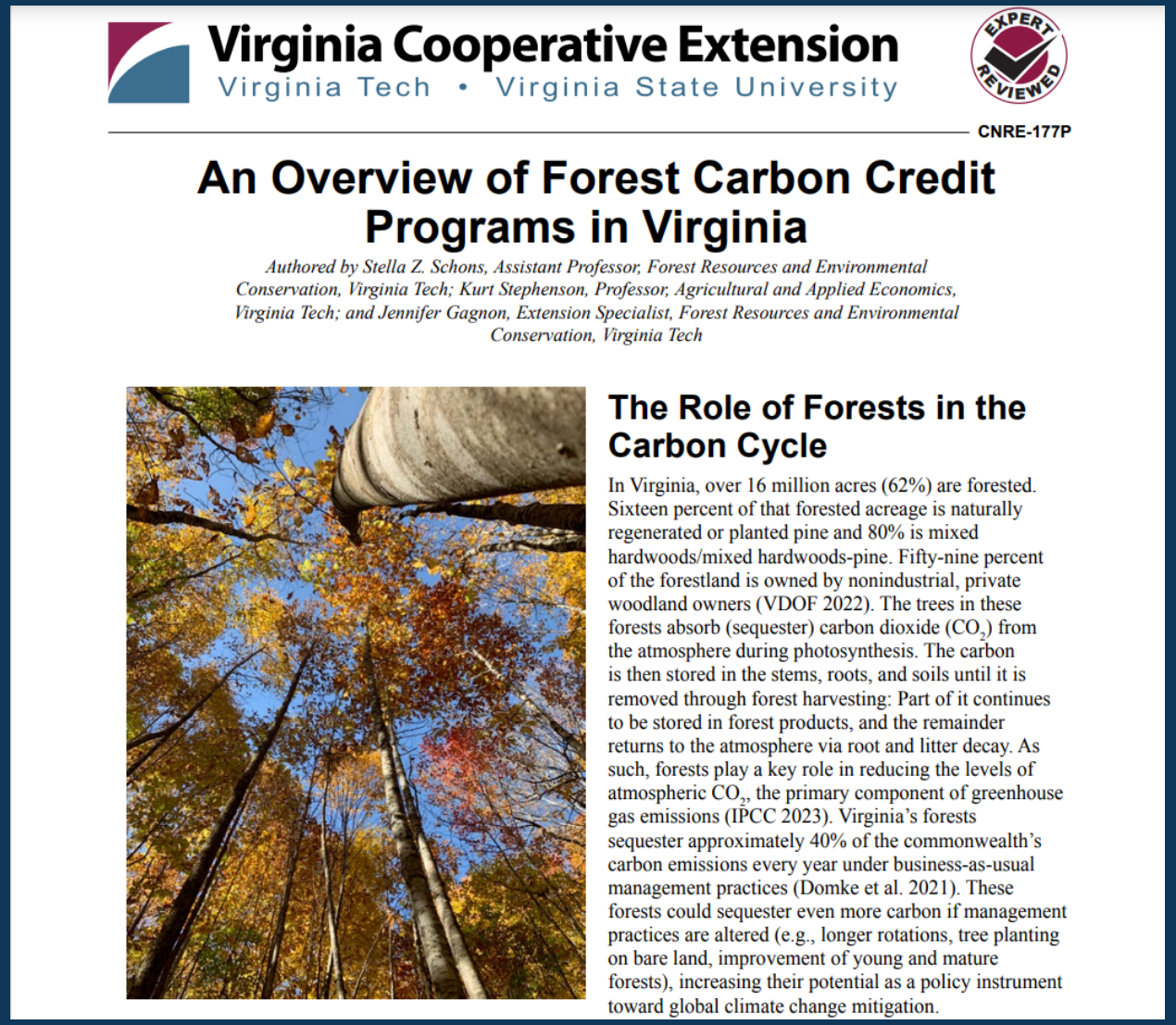
RECAP

- Virginia forests:
  - *Store over 1.6 billion tons of carbon*
  - *Remove about 3X as much carbon from the atmosphere as is harvested annually*
  - *C stocks have increased 20% over last 20 years*
- Old forests store, young forests sequester
- Wood and paper products extend forest carbon storage, substitute for more carbon-intensive products
- Carbon is not protected in protected forests

RESOURCES TO LEARN MORE

Virginia Forest Landowner Education Program website (https://forestupdate.frec.vt.edu/)



Virginia Cooperative Extension
Virginia Tech • Virginia State University

EXPERT REVIEWED

CNRE-177P

An Overview of Forest Carbon Credit Programs in Virginia

Authored by Stella Z. Schons, Assistant Professor, Forest Resources and Environmental Conservation, Virginia Tech; Kurt Stephenson, Professor, Agricultural and Applied Economics, Virginia Tech; and Jennifer Gagnon, Extension Specialist, Forest Resources and Environmental Conservation, Virginia Tech

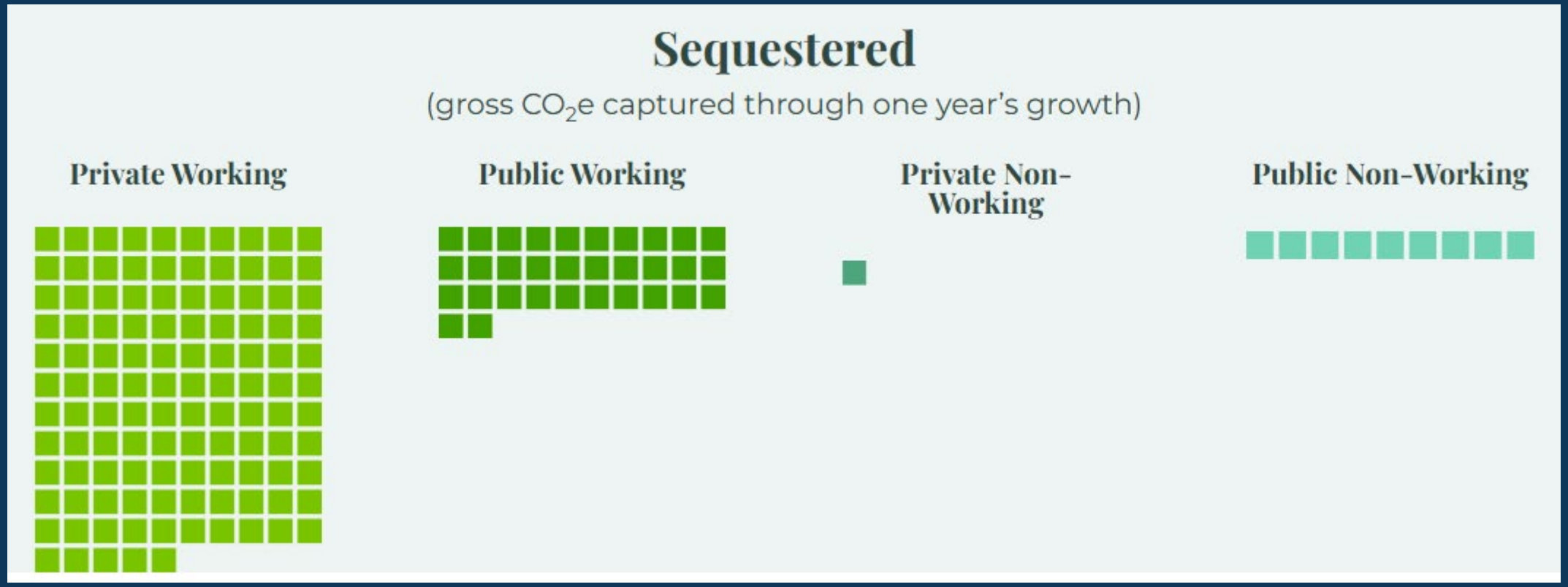
The Role of Forests in the Carbon Cycle

In Virginia, over 16 million acres (62%) are forested. Sixteen percent of that forested acreage is naturally regenerated or planted pine and 80% is mixed hardwoods/mixed hardwoods-pine. Fifty-nine percent of the forestland is owned by nonindustrial, private woodland owners (VDOF 2022). The trees in these forests absorb (sequester) carbon dioxide (CO_2) from the atmosphere during photosynthesis. The carbon is then stored in the stems, roots, and soils until it is removed through forest harvesting: Part of it continues to be stored in forest products, and the remainder returns to the atmosphere via root and litter decay. As such, forests play a key role in reducing the levels of atmospheric CO_2, the primary component of greenhouse gas emissions (IPCC 2023). Virginia's forests sequester approximately 40% of the commonwealth's carbon emissions every year under business-as-usual management practices (Domke et al. 2021). These forests could sequester even more carbon if management practices are altered (e.g., longer rotations, tree planting on bare land, improvement of young and mature forests), increasing their potential as a policy instrument toward global climate change mitigation.

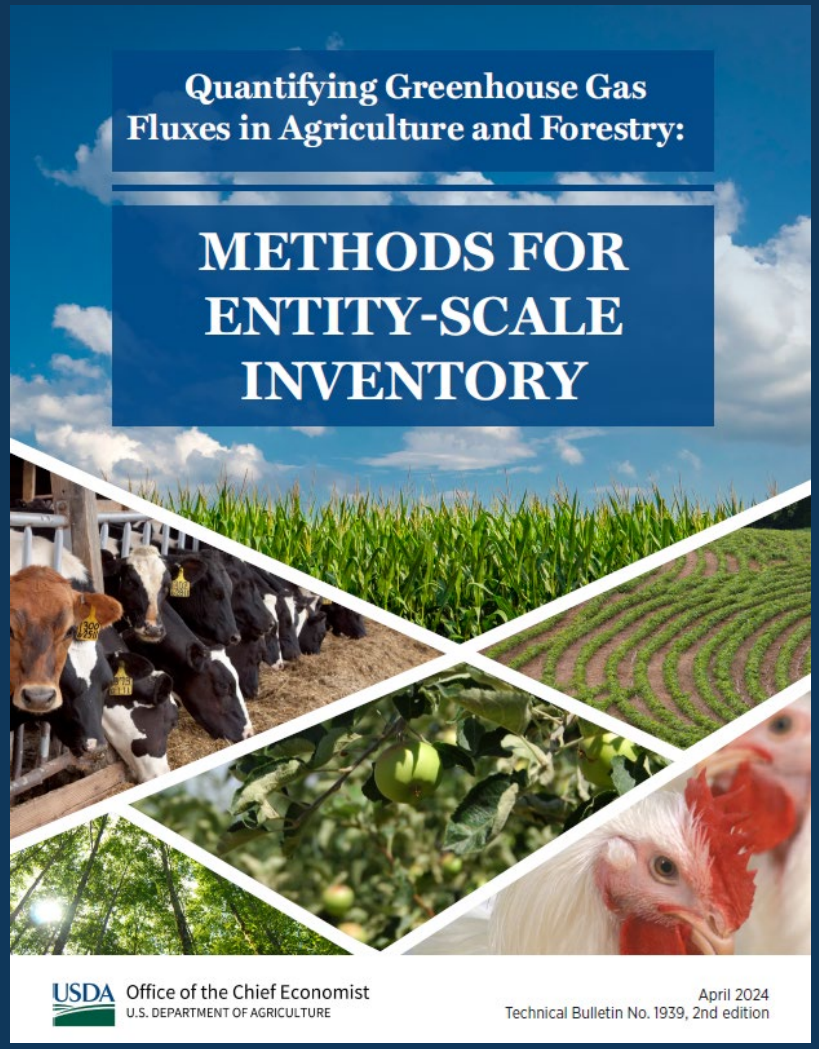
RESOURCES TO LEARN MORE

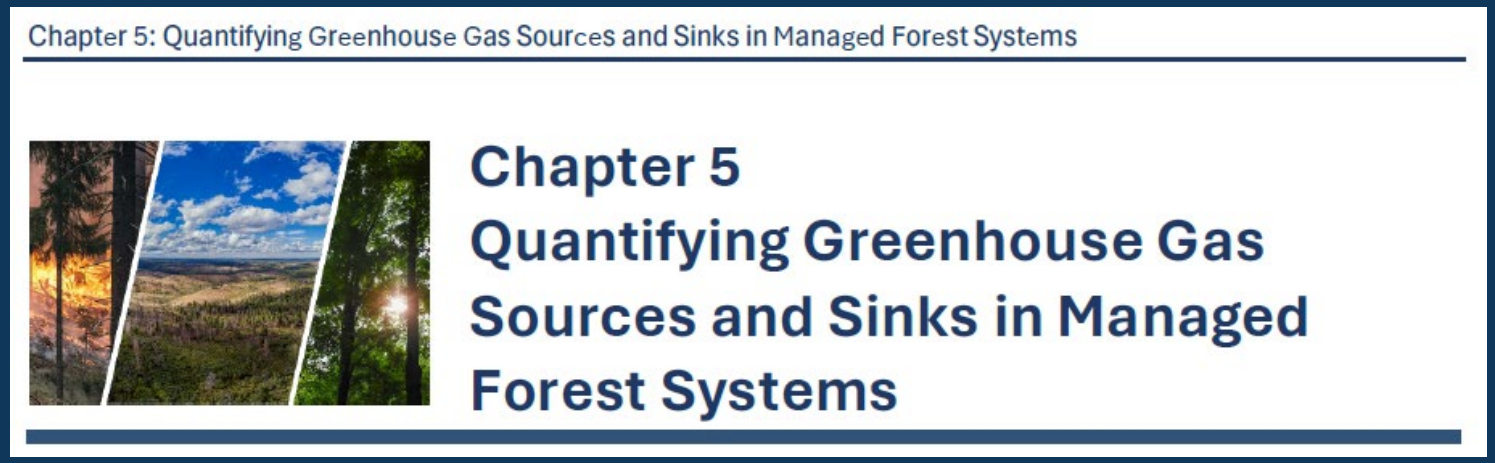
- National Alliance of Forest Owners (https://forestcarbondataviz.org/)

Forest Carbon Data Visualization



RESOURCES TO LEARN MORE





https://www.usda.gov/oce/entity-scale-ghg-methods

RESPONSES		
Basic projection under fm, with harvest	See 'Context & Instructions' tab for a description of dropdown menu options.	
100	Acres	Users may select acres or hectares from the dropdown menu and results will automatically adjust.
Southeast	See 'US Regions' tab for geographic delineations applied.	
Loblolly / shortleaf pine group	The forest type groups are limited to those for which inventory data are available in the selected U.S. region. The more common a forest type is in the selected region, the more precise results are likely to be. Where a forest type is relatively rare, users may want to instead choose a broader grouping (e.g., 'unknown' or "predominantly softwood species, type not known') which will render a more generic regional estimate for carbon stocks and stock change to apply in the calculator.	
Natural	Select whether the forest was planted or of natural origin. Where this is not known, users may select 'unknown' from the dropdown menu options	
0-20 years	Select the current stand age range. Where this is not known or the age of the trees in the stand is mixed (i.e., uneven-aged forest), users may select 'unknown' from the dropdown menu options.	

RESOURCES TO LEARN MORE

Virginia Forest Landowner Education Program website (https://forestupdate.frec.vt.edu/)

National Alliance of Forest Owner- Forest Carbon Data Visualization (https://forestcarbondataviz.org/)

USDA- Methods for Entity-Scale Inventory (https://www.usda.gov/oce/entity-scale-ghg-methods)

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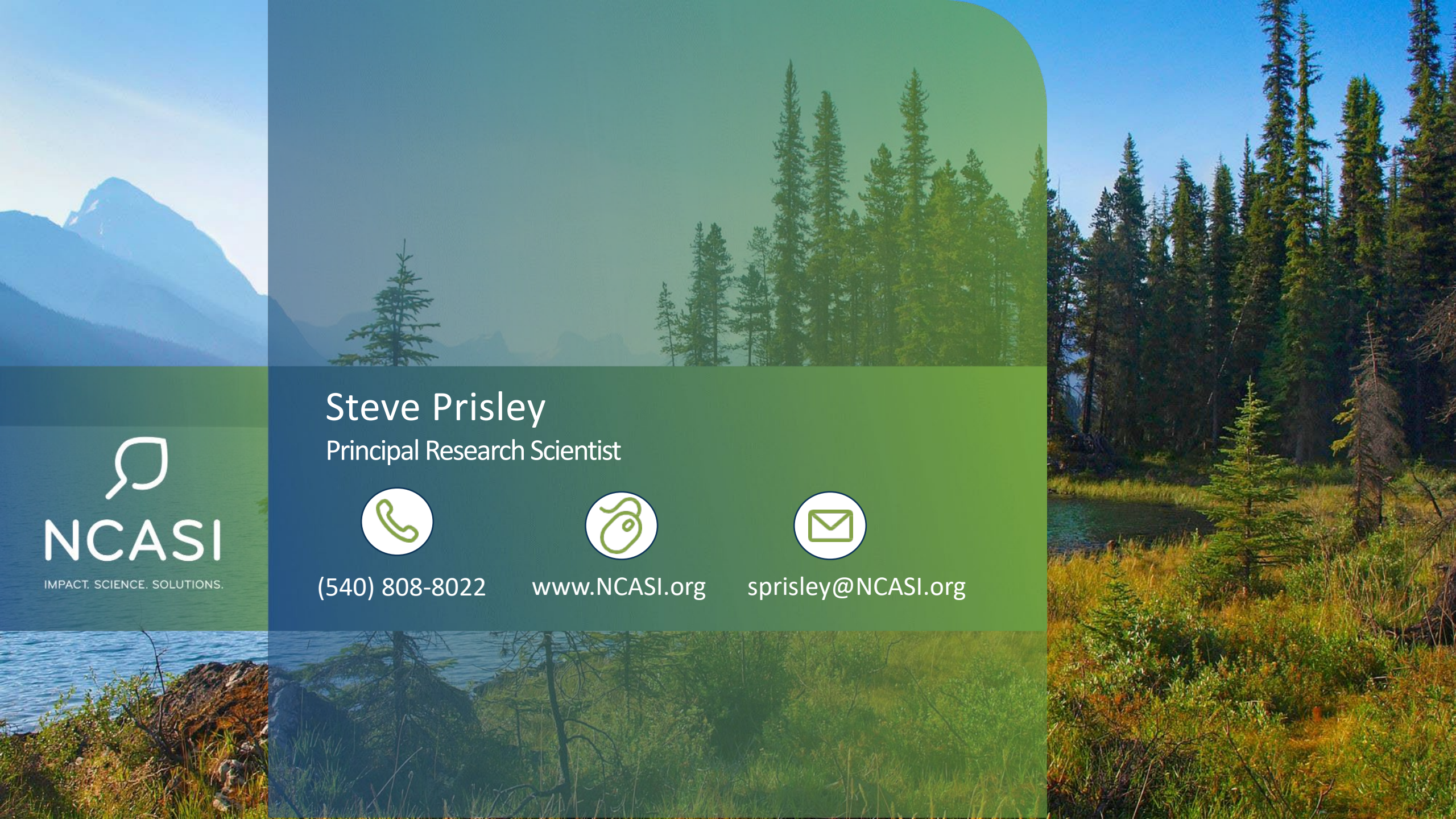
sprisley@ncasi.org spprisley@gmail.com (After March 31)



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