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Department of Forestry & Environmental Resources

Forest Carbon Markets

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Agenda

- Carbon offset markets and key terms
- Carbon stored in forests and wood products
- Examples of carbon markets
- Forest carbon offset projects
- Evolution of carbon offset markets

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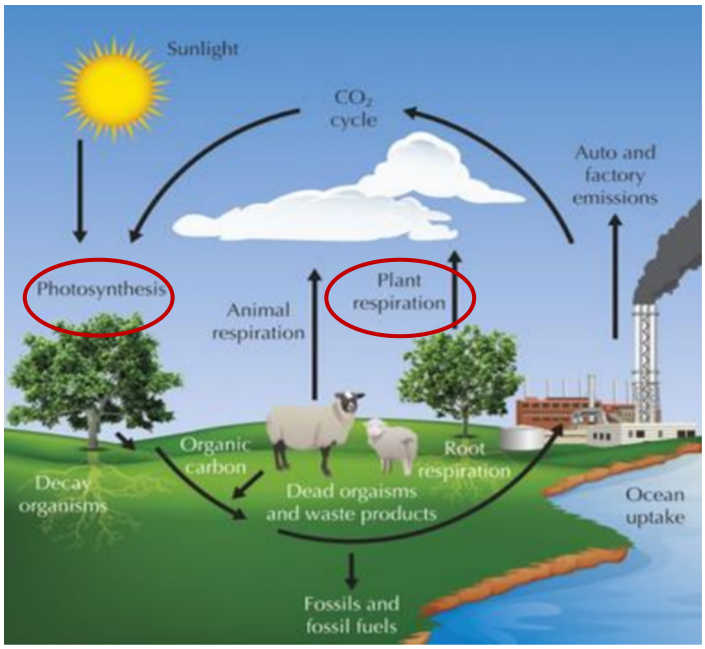
Carbon Offset Markets are based on the reduction of greenhouse gas emissions through capture, prevention, and sequestration.

Key to Carbon Neutrality



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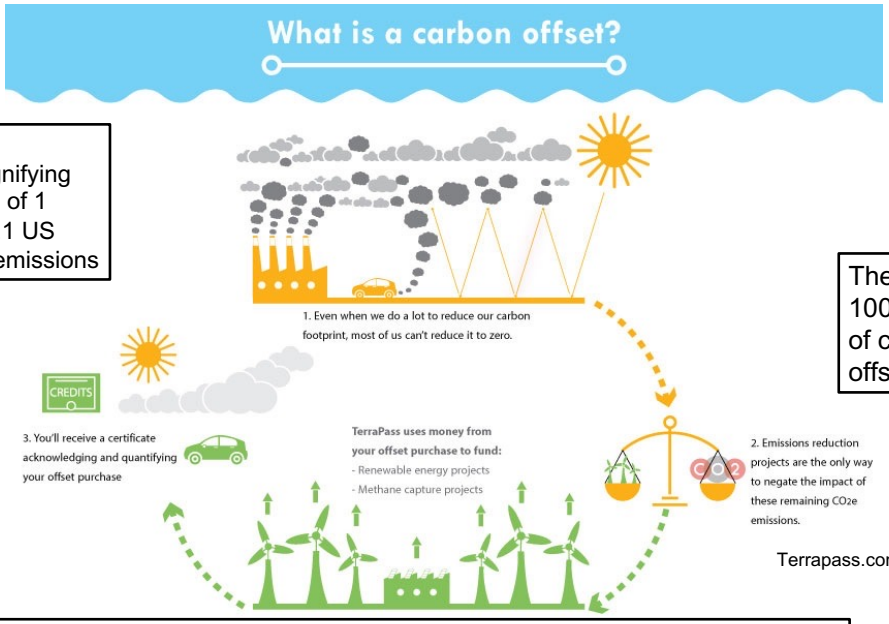

Definition: a certificate signifying the reduction of 1 metric ton (1.1 US ton) of CO_2 emissions

There are 100s of types of carbon offset projects

An American produces 3k lbs of CO_2 emissions per month on average

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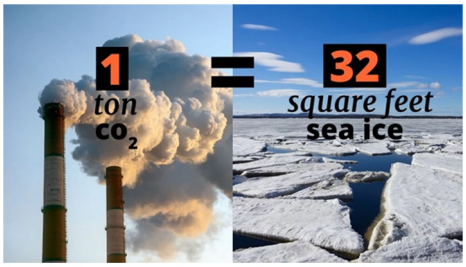
To put that into perspective,

- 10,000 miles driven per year on average in the US at 25 mpg ≈ **4 tCO2**
- 1 burger ≈ 200 miles driven -> 50 burgers ≈ 4 tC02e



https://grist.org/briefly/for-every-ton-of-co2-pumped-into-the-atmosphere-we-lose-32-square-feet-of-arctic-sea-ice/

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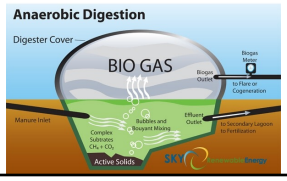
Examples of Carbon Reduction Projects

- Emission Capture: Agriculture
  - Methane capture through anaerobic digester
- Renewable Energy
  - Improved cook stoves that reduce indoor air pollution
  - Fuel switch (non-renewable to renewable source)
- Carbon Sequestration: Forest Management
  - Prolonging timber rotations (extend the harvest time)

https://www.terrapass.com/climate-change/carbon-offsets-explained



Epa.gov

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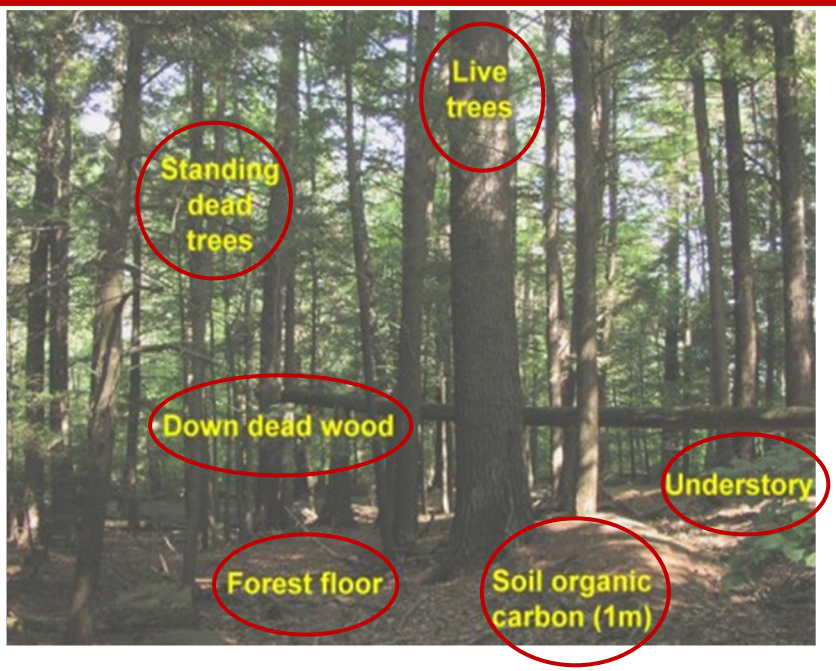
Forests as Natural Climate Solutions



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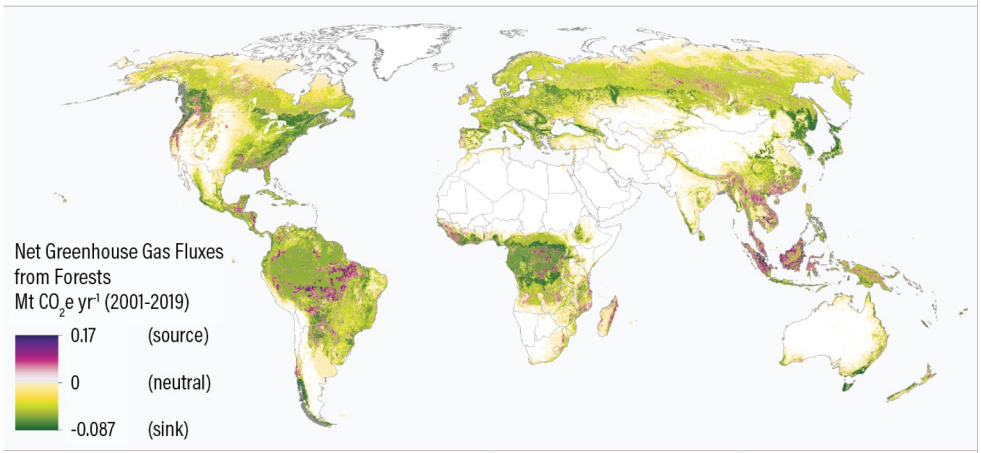
Forests: Carbon Sinks or Carbon Sources?



Source: Harris et al. 2021

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GLOBAL FOREST WATCH

WORLD RESOURCES INSTITUTE

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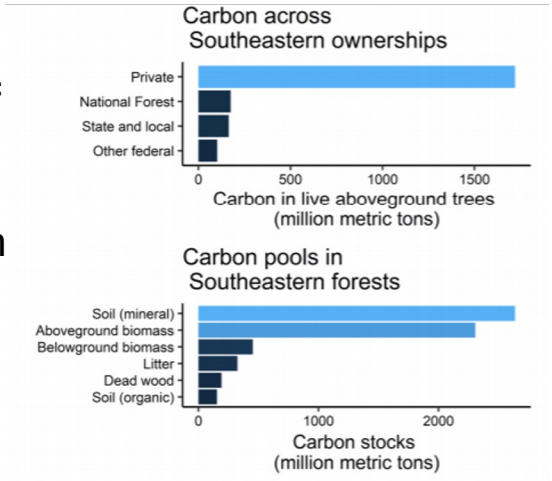
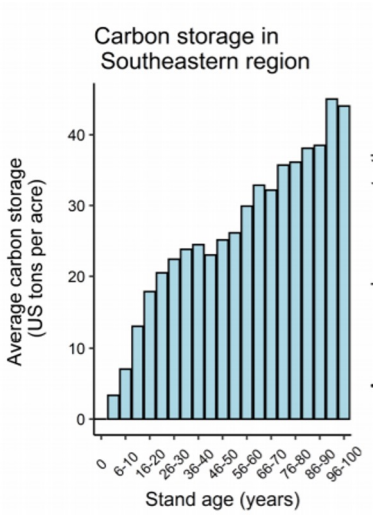
Forest Carbon in the US Southeast

Storage = amount of carbon retained in a forest carbon pool





https://www.forestresources.org/pdf/Southeastern.pdf

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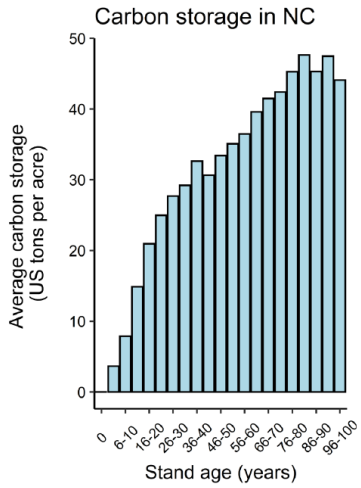
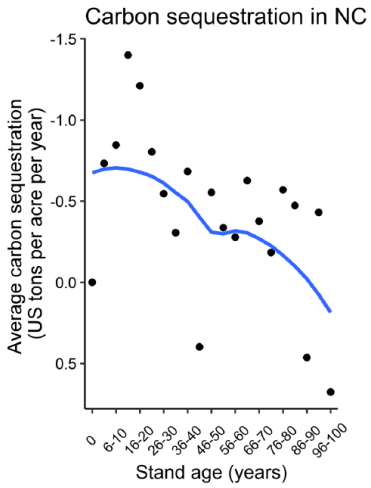
Carbon sequestration vs storage





Sequestration = process of removing carbon from the atmosphere

Expressed as an annual rate

Decreases with age

https://www.forestresources.org/pdf/Southeastern.pdf

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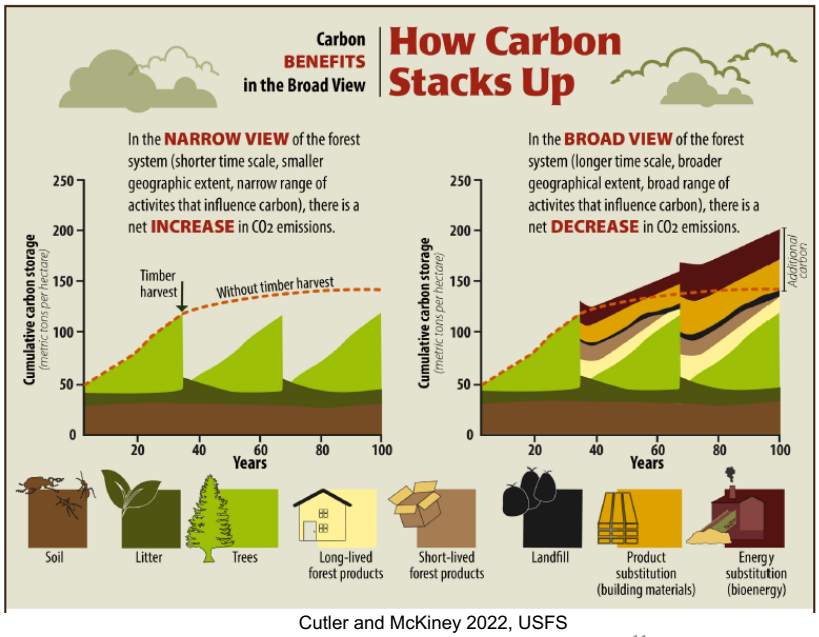
Harvest doesn't reduce carbon storage



Cutler and McKiney 2022, USFS

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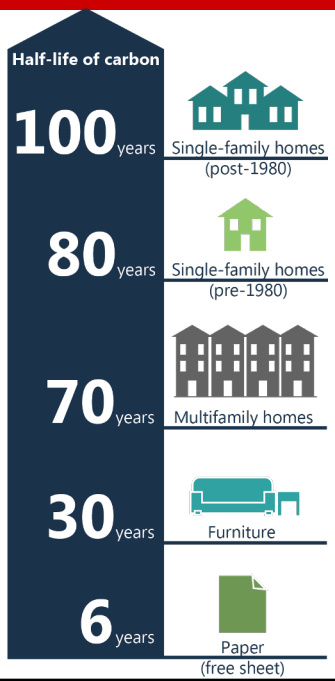
Carbon Stored in Wood Products

https://www.fs.usda.gov/ccrc/topics/carbon-benefits-wood-based-products-and-energy



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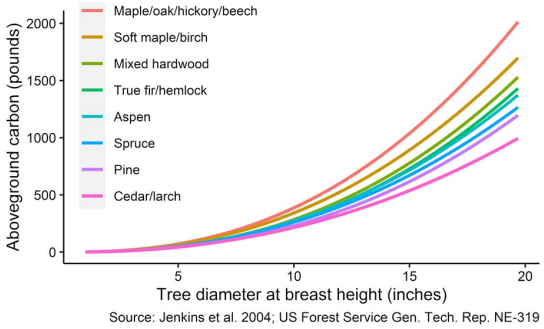
"Inventorying" Carbon in Forests

Estimation depends on:

- DBH of trees
- Tree heights
- Tree Species



Source: Jenkins et al. 2004; US Forest Service Gen. Tech. Rep. NE-319

Protocols developed by independent organizations

- **Verra's Verified Carbon Standard**
- **American Carbon Registry**
- **California Compliance Standard**

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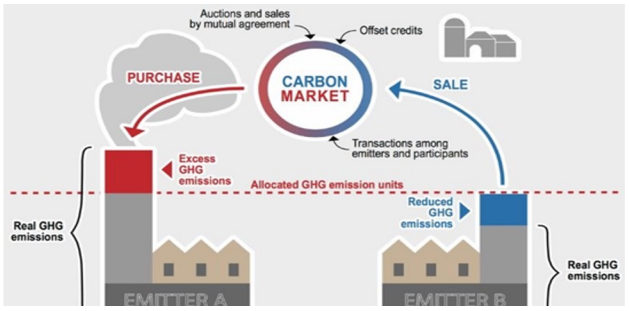
Carbon Offset as a Forest Product

Landowners (producers) are compensated to maintain a minimum stocking level of carbon

Buyers (consumers) purchase offsets to contain the costs associated with carbon emissions

- May also sell offset credits in Cap and Trade



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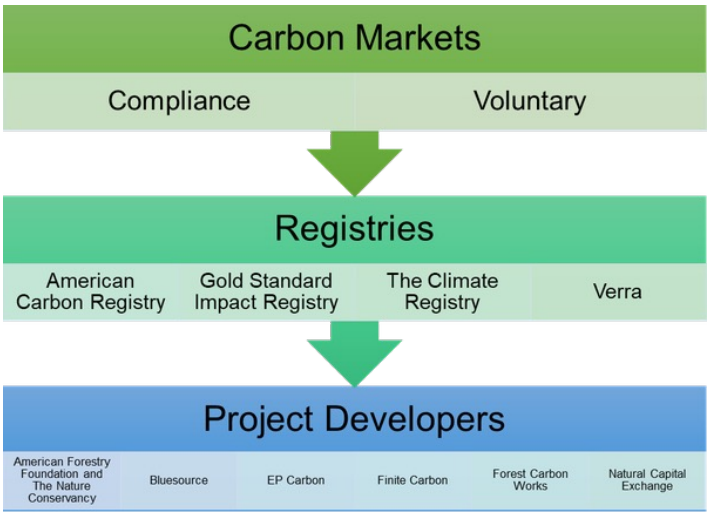
Forest Carbon Markets in Brief

Compliance Markets
- Regulated
- Required for specific industries (varies by market)

Voluntary Markets
- Not required by law
- Projects largely located outside the US
- Becoming more feasible in the U.S.



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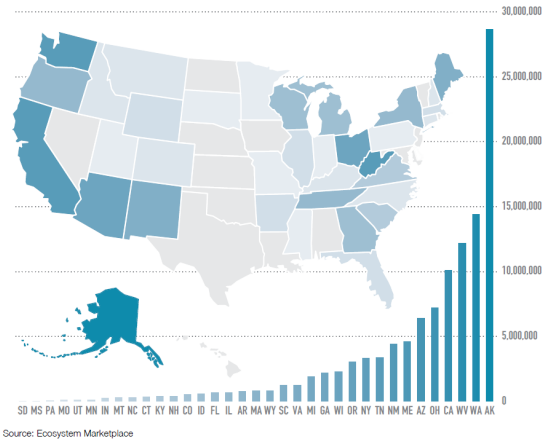
California Compliance Market

- Started in 2013, recently extended to 2030
- Regulated entities
  - Oil and gas companies
  - Manufacturers
  - Utilities
- 2017 law: "50% of offsets used for compliance in the 2021-2025 period demonstrate direct environmental benefits to California"



Ecosystem MarketPlace. State of Forest Carbon Finance 2021

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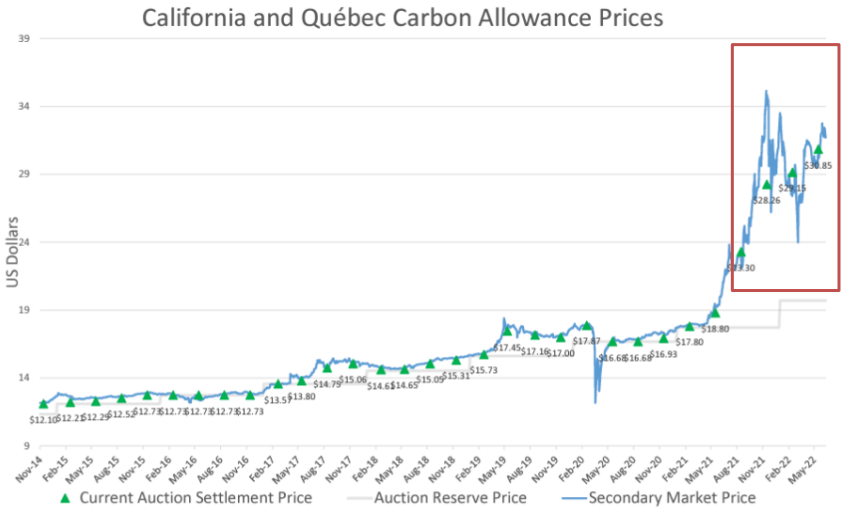
California Carbon Price Trends



https://ww2.arb.ca.gov/sites/default/files/classic/cc/capandtrade/carbonallowanceprices.pdf

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Voluntary Carbon Markets

- Companies and organizations participate individually or as industry-wide scheme
  - Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)
- Corporate Social Responsibility (CSR) and Environment, Social, Governance (ESG) of organizations

Voluntary Carbon Allowances Prices

Transaction Year	Volume (MtCO2e)	Average Price ($/tCO2e)	Median Price ($/tCO2e)
2017	16.9	$3.85	$9.75
2018	51.1	$3.39	$9.33
2019	36.7	$4.33	$9.00

Ecosystem Marketplace. State of Forest Carbon Finance 2021

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Forests and Carbon Markets

3 types of carbon offset projects for forests

- **Avoided Conversion**
  - Preventing conversion of forested land to non-forested land
- **Improved Forest Management**
  - Projects with land management activities that increase or maintain carbon stocking
- **Afforestation/reforestation**
  - Restoring tree cover to previously non-forested or forested land

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Forest Carbon Offset Projects

Requirements:

- **Real/Actual**
  - Actual carbon dioxide emissions reduction
- **Permanence**
  - GHG removal enhancements - maintained for **100 years**
  - Periodic third-party verification
- **Additionality**
  - Forest project must sequester more carbon than '*business as usual*'
- **No-leakage**
  - Leakage - GHG reductions in one area results in an unintended increase in GHG emissions in another location.

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Cost-Benefit Analysis of Participation

Costs

- Financial (vary by project)
  - Start-up
  - Maintenance
  - Verification
- Nonfinancial
  - Time
  - Flexibility of property use
  - Uncertainty

Benefits

- Financial
  - New revenue
  - Tax incentives
- Nonfinancial
  - Ecosystem services
  - Wildlife habitat
  - Privacy
  - Aesthetics
  - Recreation
  - Legacy

Previously, landowners with less than **5,000 acres** usually could not participate in carbon offset projects

- High costs (inventory and verification)
- Low price per forest carbon credit

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Criticism of Forest Carbon Offsets

Pachama has found that 69% of certified forest carbon projects have at least one of three quality concerns that put sustainability programs at risk*

Not Additional

Emissions would have been reduced or avoided without a carbon project. For example, a new planting would've happened with or without credit funding.

Over Credited

The credit issuance was based on faulty assumptions. For example, calculations assumed an inflated risk of deforestation.

Degrade Over Time

The project does not deliver a lasting climate impact. For example, between crediting issuances the forest experienced major deforestation.

Based on Pachama's evaluation of projects certified by Verra, Gold Standard, Climate Action Reserve, and American Carbon Registry

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https://pachama.com/enterprise/

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The Evolution of Carbon Markets

Addressing Cost Barriers
- Technological innovation

Carbon Price Problem
- Surplus of credits in the voluntary markets
- Policy intervention

On June 23, 2020 Amazon commenced its $2 billion Climate Pledge Fund to further endeavors to become net zero by 2040. In January of 2020 Microsoft committed to invest $1 billion over the next four years as part of their Climate Innovation Fund. And on July 21, 2020 Apple committed to become 100% carbon neutral – across its entire business, supply chain, and product life cycle by 2030.

https://conservationfinancenetwork.org/2021/01/26/higher-price-or-the-highest-price-inside-the-forest-carbon-market

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The Evolution of Carbon Markets: How to make them work?

To reduce the costs of project development:
- **Forest Carbon Works (FCW) —** 40 acre minimum, 125-year contract, harvesting permitted after 6 years

- **Core Carbon—**a digital platform that estimates carbon using geospatial and remotely sensed data. 40 acre minimum, harvesting permitted

CORE CARBON
By FiniteCarbon

Facebook: Forest Carbon Works

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The Evolution of Carbon Markets: How to make them work?

Natural Capital Exchange (NCX)

- Landowners are paid to defer timber harvest for one year (tonne year)
- Contiguous US
- Free application and provide GIS shapefiles for project boundaries
- Average auction price of $8-12 per acre

CONTRACT LENGTH: 1 Year

FEES TO PARTICIPATE: $0

ACRE MINIMUM: None

Democratizing access to carbon markets by measuring every value, on every acre, for every landowner, every year.

4.6M	3,823	1.13M
Acres	Landowners and counting	$MTCO_2e$ expected climate impact

For more info: https://www.ncx.com/

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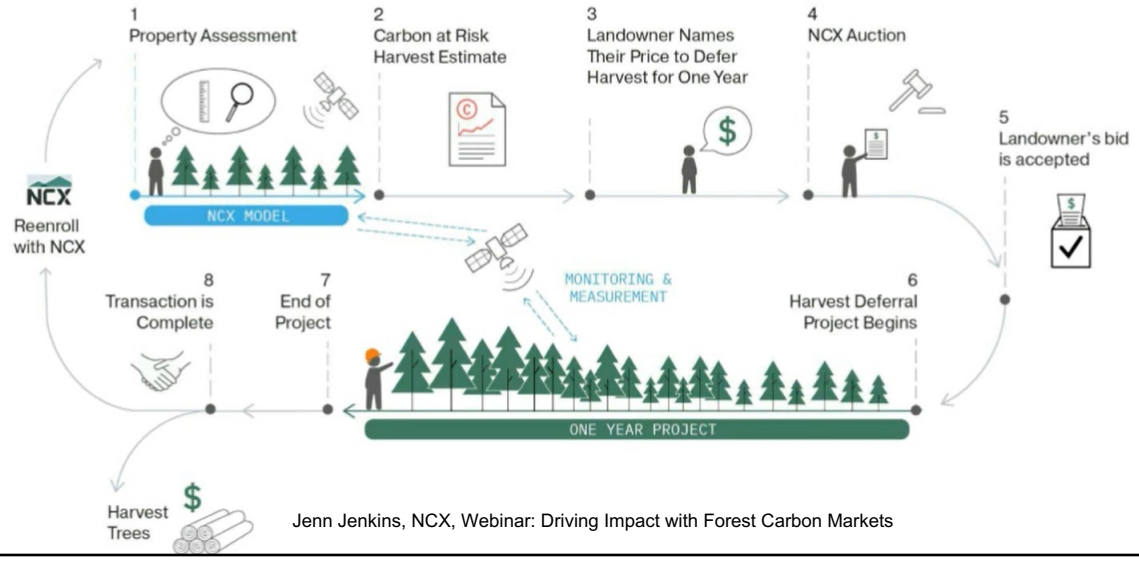
A year in NCX's Carbon Program



Jenn Jenkins, NCX, Webinar: Driving Impact with Forest Carbon Markets

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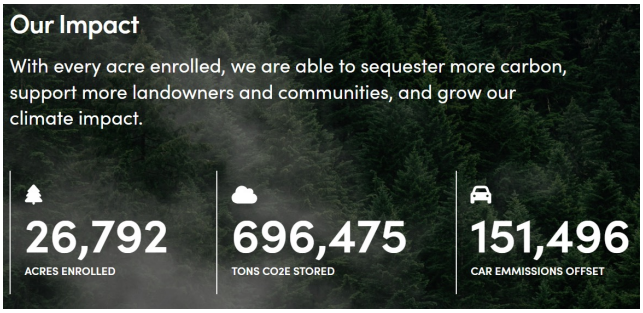
The Evolution of Carbon Markets: How to make them work?



For more information: https://familyforestcarbon.org/

- **Family Forest Carbon Program**
  - American Forestry Foundation and The Nature Conservancy
  - 30-acre minimum
  - 10- or 20-year contracts
  - Harvesting permitted with restrictions
  - Currently in PA, WV, MD, MA, NY, and VT

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Expected Revenue: PA Case Study

"Wilsons"

- 135 acres of land with 130 acres in forest
- Timber, game, and biodiversity management
- Seed tree harvest on 30 acres in 2014 (warbler habitat)
- NCX: $8/acre/yr on 100 acres of mature forest ($800/year): in 20 years, accounting for TMV: $26,452.
- **FFCP: $280/ac on 30 acres, $230/acre on 100 acres, 20-yr contract ($31,400 total)**

https://extension.psu.edu/what-is-selling-forest-carbon-like-three-landowners-experiences

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NCX Case study: NCSU CNR Forests

- June 2021: NCSU's Forest Asset team enrolled 36,200 acres of forestland
- All forests with no planned activities were submitted
- 25 tons of CO_2 = 1 offset credit
- **24,464 harvest deferral credits (~2/3 credit per acre)**

FOREST CARBON

Forest Carbon as an Income Source: A Case Study at North Carolina State University

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The Evolution of Carbon Markets: How to make them work?

Green Trees

- Convert farmland to hardwood forest (Afforestation/Reforestation, ACR)
  - IFM may be allowed, advised to contact
- Income depends on growth rate of trees and market price for the credits
  - 2019: $38 per acre per year on average
- 5+ acres
- 40-yr contract
- Mississippi Alluvial Valley

GREEN TREES
ONE ACRE AT A TIME

For more information: https://www.green-trees.com/

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Green Trees

Landowner Choices and Decisions

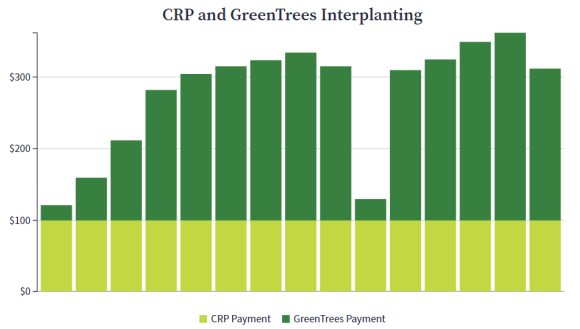
The GreenTrees program is competitive as well as easier on many landowners than agriculture!

Landowners have options when it comes to their payment structure. We want you to pick the options that best suit you and build the future you envision!

Year 1 - 15	Year 16 - 40
Fixed Annual Payments $20 Per Acre: Years 1 - 5 $30 Per Acre: Years 6 - 10 $40 Per Acre: Years 11 - 15	**Timber Income** (No Carbon Income)
OR	OR
50% Carbon Income (Payment of 50% carbon credit value from year 1 to 15.)	**50% Carbon Income** (No hardwood thinning.)

Number of Acres

1



Cotton/hardwood interplanting

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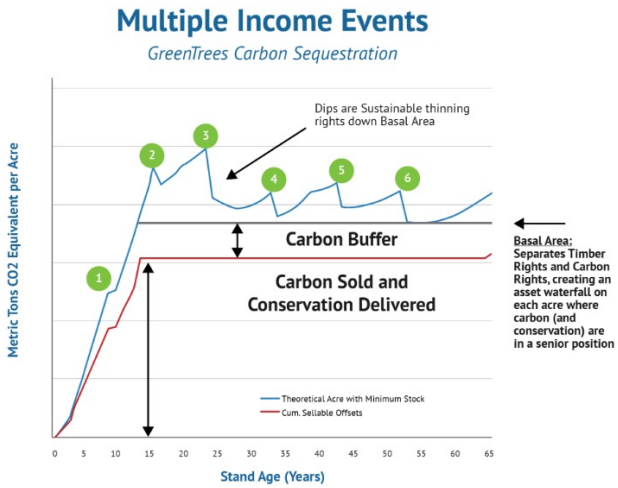
Green Trees



Turning Trees into Income

Landowners receive:

- A faster forest and habitat
- 3 points of Cottonwood harvest income at year 10, 17, and 25
- 3 points of Hardwood harvest income at year 35, 45, and 55
- 50% of the carbon and ecological income sold by GreenTrees

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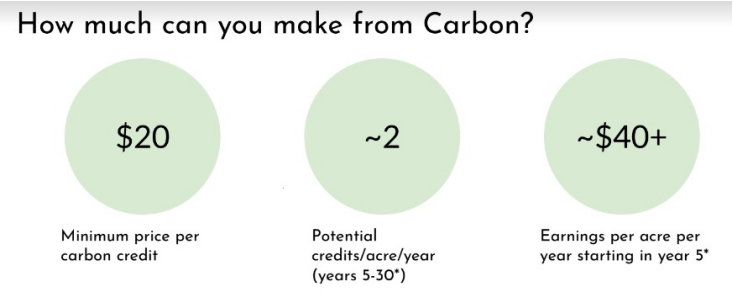
The Evolution of Carbon Markets: How to make them work?

Working Trees

- Carbon stored in trees planted on pasture (aka Silvopasture)
  - Eligible lands: Must be in pasture for 10 years or longer
- Data collected through smartphone and satellite imagery
- No acreage requirement

WORKING TREES

For more information:
https://www.workingtrees.com/



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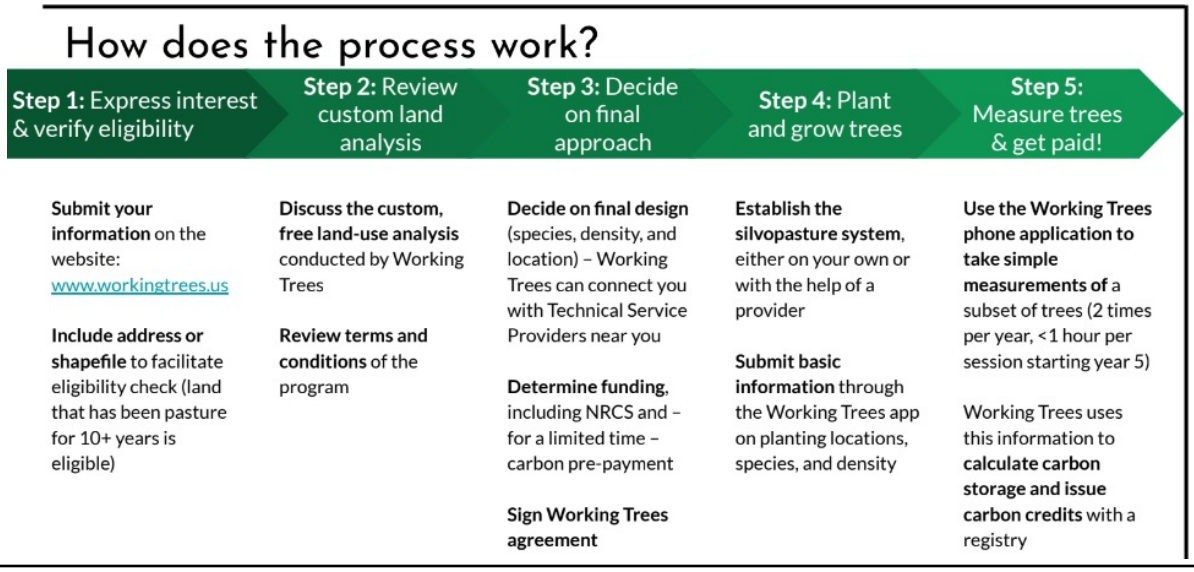
Working Trees



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Thank you for your time!

Questions?

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Additional References

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