Forest Carbon Market Decision-Support Workshop
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Grounding Climate Solutions:

efforts to advance Climate-Smart Forestry in Pennsylvania

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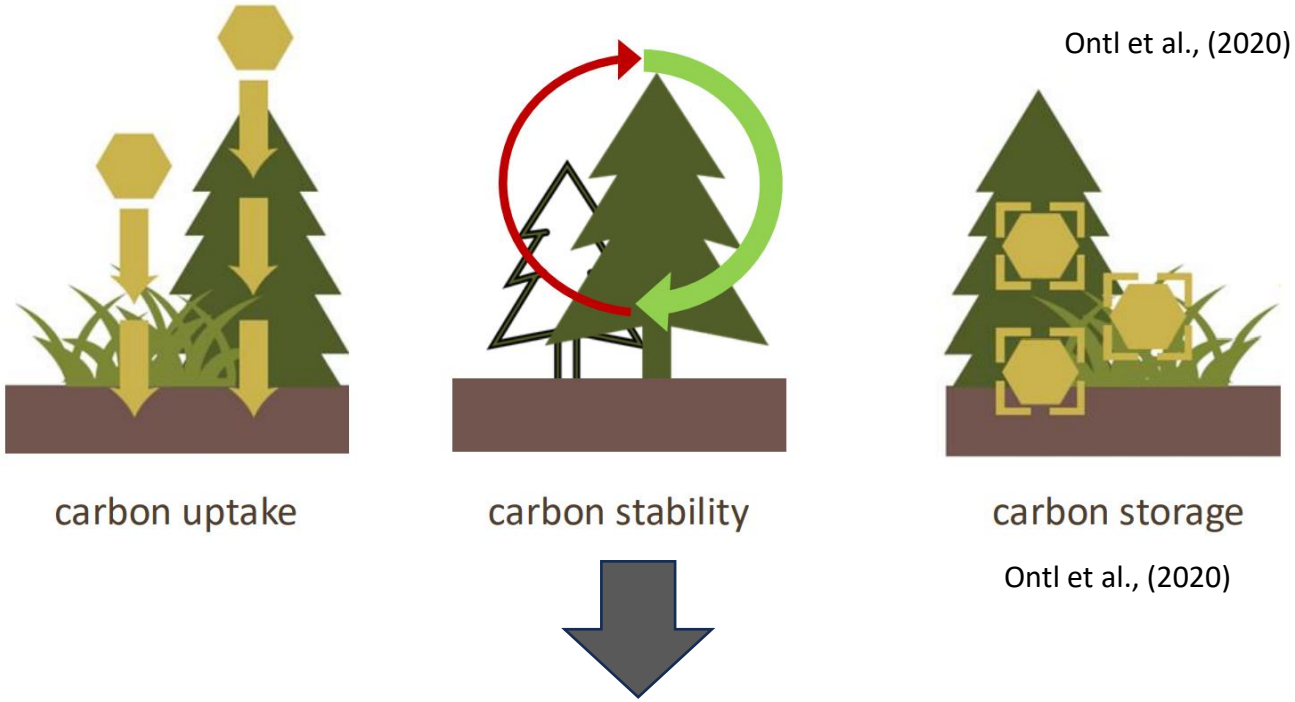
In a warming world, the way we manage small private forests in the US could shape big climate solutions.

Pennsylvania's forests offset up to **10% of the state's total greenhouse gas emissions** (PA Forest Action Plan, 2020; PA GHG Emission Report, 2023).



Ontl et al., (2020)

Ontl et al., (2020)

Climate-Smart Forestry can help **C stability** by minimizing the risk of reversal due to disturbance or land-use change.

Pennsylvania's forests could help fight climate change and protect wildlife

CARBON

CO-BENEFITS

WE NEED DATA AND WE NEED IT ASAP

But many private forests are in poor condition and not managed in ways that maximize those co-benefits.

PA could **lose 11% of its terrestrial carbon pools** and shift from a **carbon sink to a source** between **2025 and 2100.**

(Birdsey et al., 2023; Papa et al., 2023)

“Advancing the Co-benefits of Climate-Smart Forestry through Research and Extension in Pennsylvania’s Private Forestlands”

FOCCE
Forest Owner Carbon and Climate Education

USDA
NIFA

PI: Dr. Melissa Kreye, Co-PI: Dr. Margarita Fernández

PennState
College of Agricultural Sciences

Analyze the relationship between forest structural diversity and carbon storage outcomes of climate-smart forestry protocols

Analyze how climate-smart forestry protocols impact forest structure and bird habitat availability.

Identify the factors influencing landowners and stakeholders to adopt climate-smart forestry and bird habitat conservation on their land

This project aims to inform forest management practices that not only **maintain productivity** but also **enhance climate resilience** and **biodiversity**.

Landowners are trying out different silvicultural practices with help from agencies and private partners (e.g., NRCS).

MS Josh Rittenhouse

Study sites-Focus treatments

Low shade removal

Crop tree release

Overstory removal

1. Assessing forest structural diversity and carbon storage and sequestration

Canopy gap at DeHart Reservoir.

Regeneration assestmnt.

Sites: Bedford, Huntingdon, Everett, Centre, Julian.

Field measurements ~120 plots (may-july 2025)

- Basal area/species
- Structural diversity (Shannon and Gini indices)
- Biomass and carbon stocks (AGB+BGB)
- CWD (coarse woody debris)
- Standing dead wood-Cavities presence

2. Bird surveys using ARUs audio recordings

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Analyze how climate-smart forestry protocols impact **forest structure** and **bird habitat availability**.

ARU deployed at DeHart Reservoir.

- 84 recording units deployed
- Over 1,680 hours of recordings
- Using Opensoundscape software (https://github.com/kitzeslab/opensoundscape) to process audio, with the species classifier HawkEars (Jan Huus et al. 2025), and a top-down supervised classification approach.

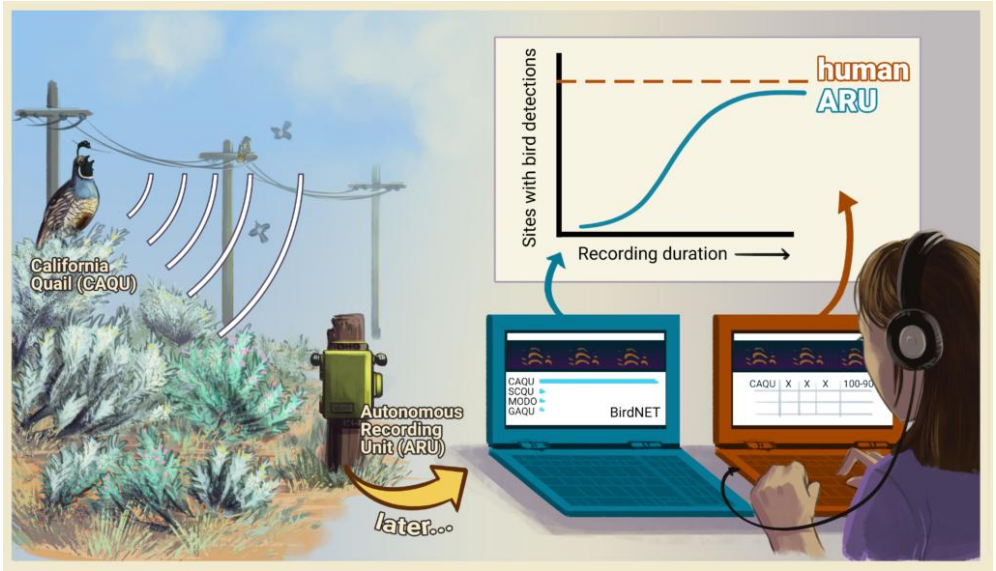
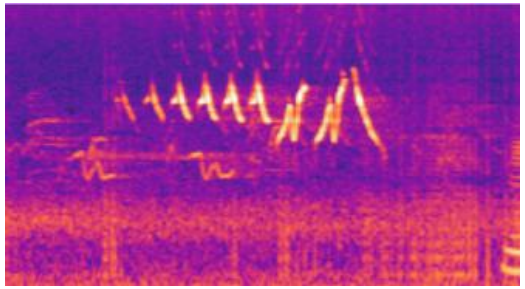
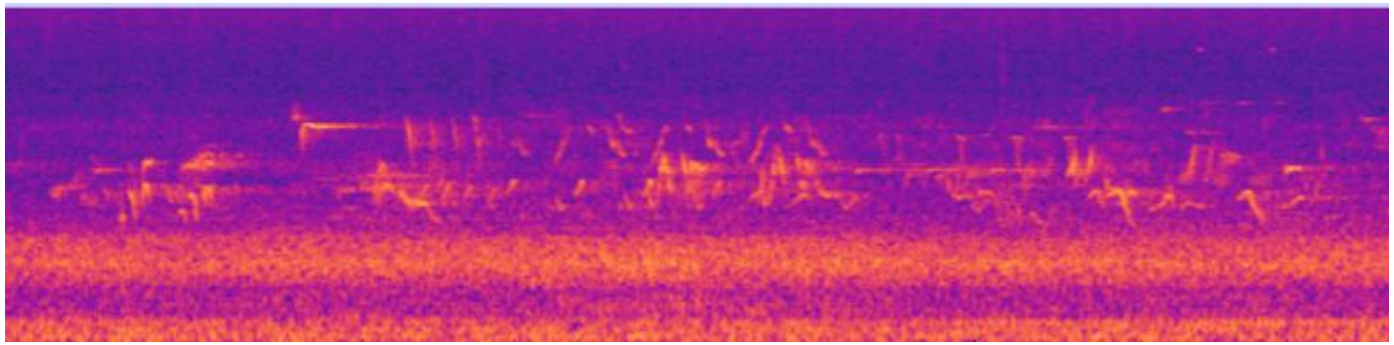


Illustration by Lauren Helton/IBP

Different bird species have different spectograms (i.e., fingerprint of the birds call)

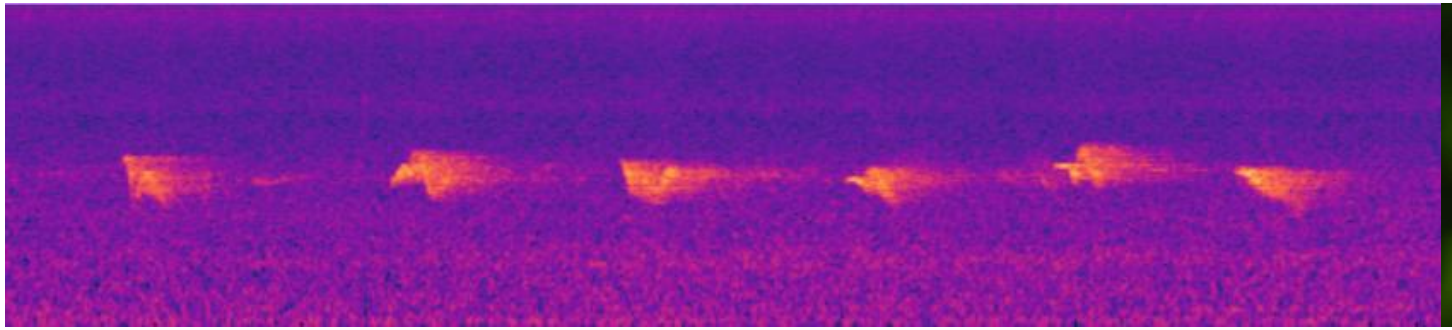
Chestnut-sided warbler

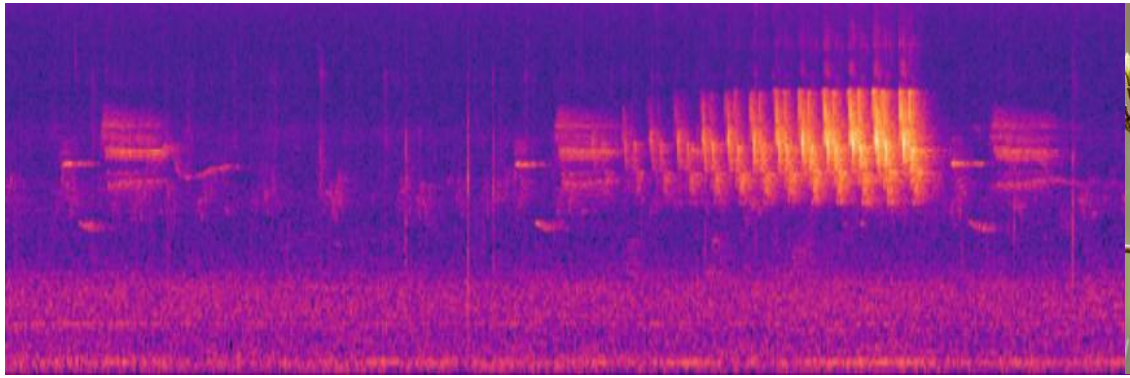




Multiple birds singing

Red-eyed vireo





Eastern towhee

Oven bird

Expected results

An aboveground forest carbon budget comparing different climate-smart forestry scenarios using both public and locally collected inventory data in private lands.

A quantitative assessment of forest structural diversity and its relationship to carbon storage, identifying management strategies that optimize both.

A protocol to predict bird habitat availability based on forest structure, using occupancy models and data from private forestlands.

FOCCE
Forest Owner Carbon and Climate Education

Audubon
MID-ATLANTIC

Educational and outreach guidelines for private forest landowners, co-developed with key stakeholders, promoting benefits of climate-smart and biodiversity-friendly practices.

Complementary projects in SVF and institutional synergies

1. **CCAR**- Carbon and Climate Adaptation Research. 60% BA removal to increase C seq + assisted regeneration treatments.
2. **FLORES**- 60% BA removal to increase C seq + NTFP

Dr. Margot Kaye (PI)

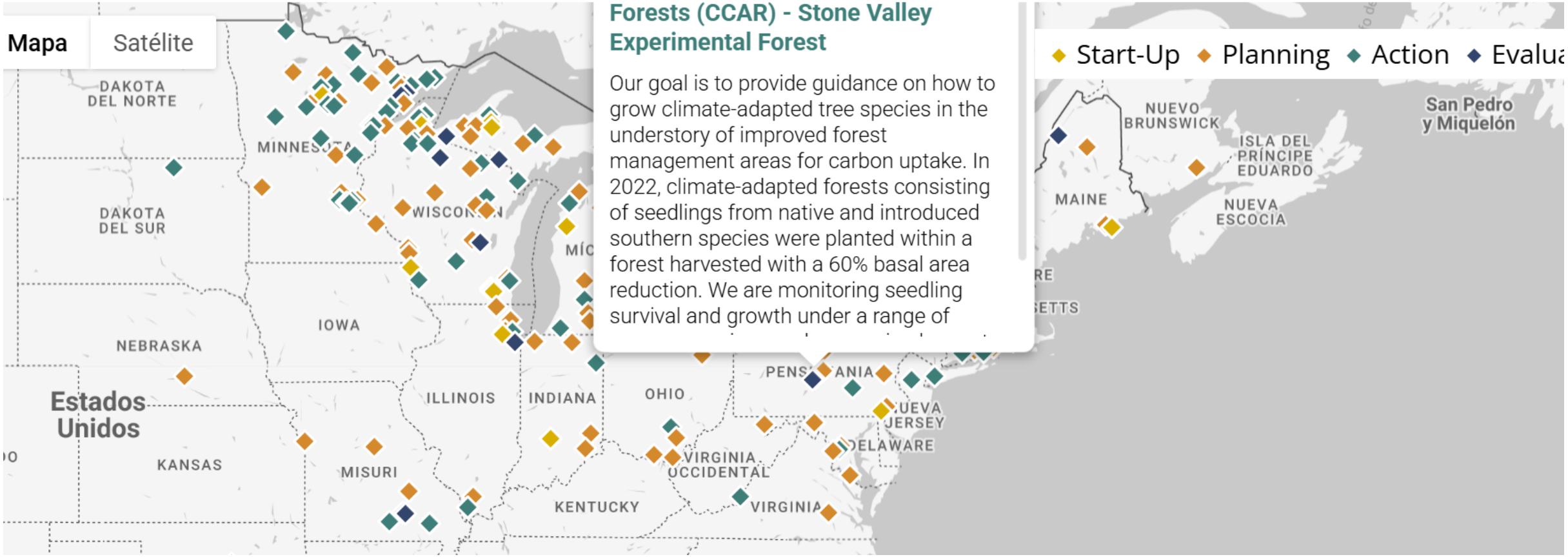
3. **"Long-term carbon storage in managed forests"**
   Dr. Ben Lockwood (Co-PI)
   Quantify long-term dynamics of C in stands under different management regimes in SVF. Dendrochronology.

SVF is part part of national efforts on adaptive silviculture

CLIMATE CHANGE RESPONSE FRAMEWORK

Who we are | Assess | Adapt | Learn | Focus | Contact

Home » Overview » Demonstration Projects



https://forestadaptation.org/adapt/demonstration-projects

FINAL THOUGHTS

- Climate-Smart Forestry is an ever-evolving concept.
- Landowners' needs and perspectives are essential for guiding policy and outreach programs on Climate-Smart Forestry.
- There are multiple ongoing efforts on private forestlands with great potential to inform quantitative research and management decisions.
- Recent research in Stone Valley Forest shows that carbon goals can align with biodiversity conservation and long-term climate mitigation.

"Impacts of management on ecosystem service capacity in northeastern U.S. Appalachian forest stands"

(in press, Canadian Journal of Forestry)

Ben Lockwood[1*], Margot Kaye[1], Erynn Maynard-Bean[2], Margarita Fernández[1]

The most promising management strategies for **multiple benefits** include **low-intensity selective thinning** and **recovery periods longer than 15 years**.

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