



# Climate-Smart Forestry: Supporting Forests Under Climate Change

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Goddard Forum: Visioning Climate-Smart  
Forestry in the Mid-Atlantic Region

Penn State

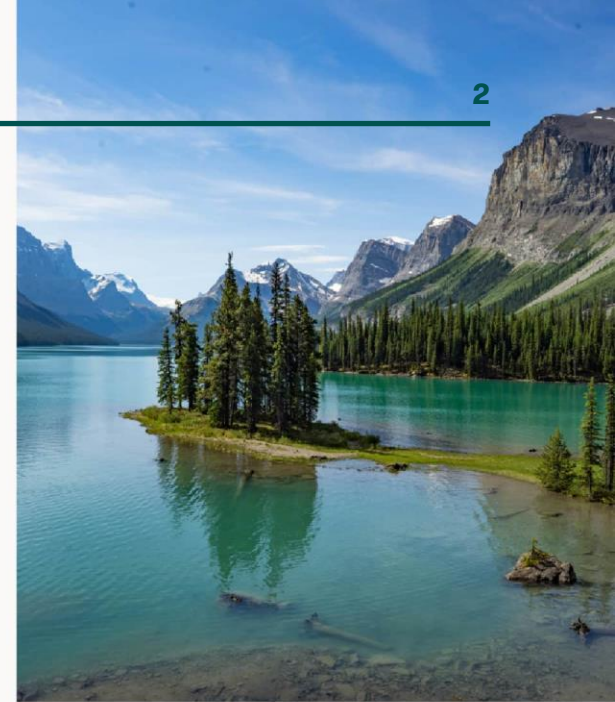
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American Forests creates healthy and resilient forests, from cities to large landscapes, that deliver essential benefits for climate, people, water and wildlife.

We build local partnerships and use science-based principles to advance our mission.

## About Us





# Climate-smart forestry

Climate-smart forestry (CSF) balances the ability of forests to:

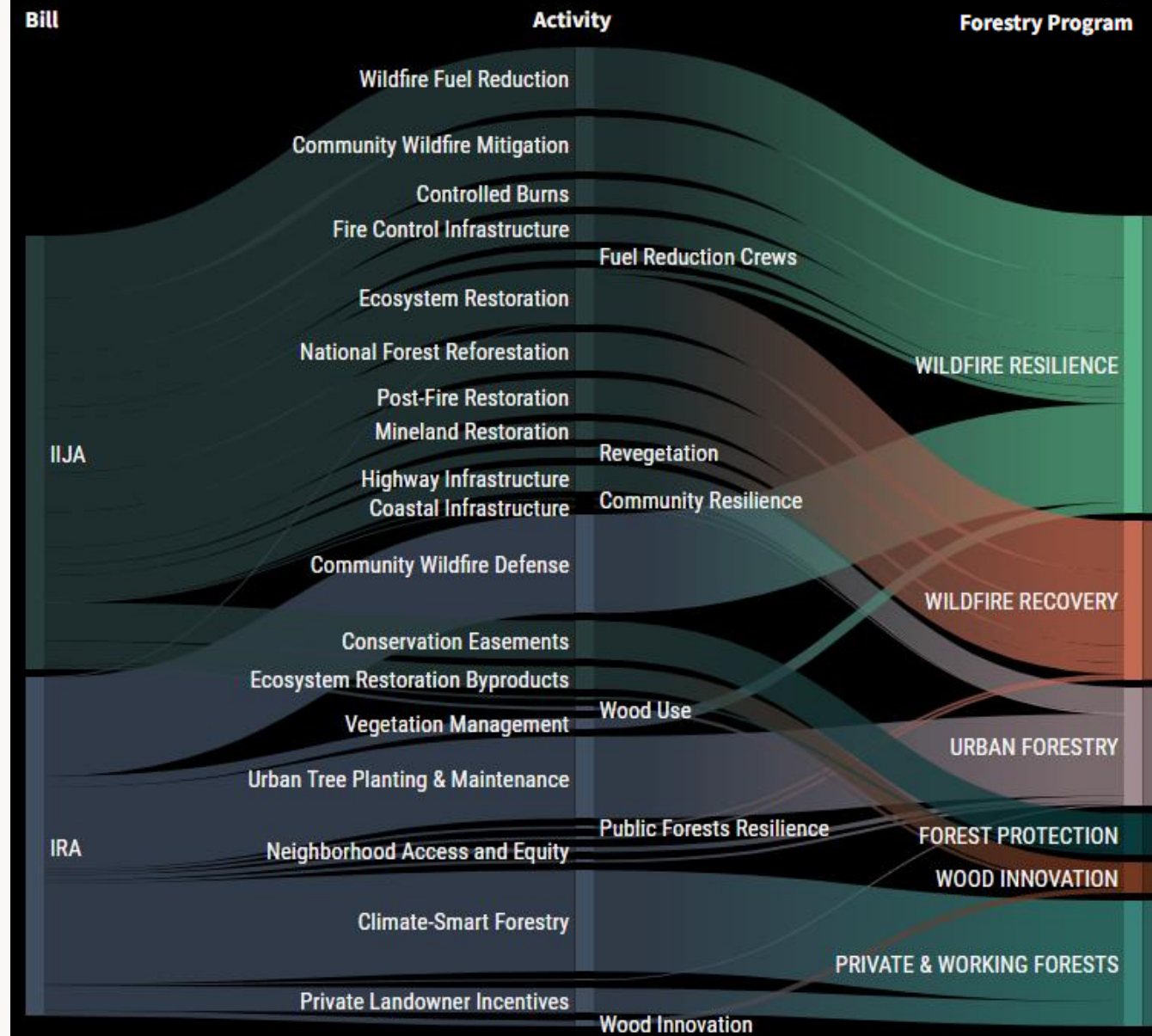
- **adapt to** climate change
- **mitigate** climate change
- provide fundamental **co-benefits** such as wood products, water, or wildlife habitat

CSF techniques can be used for:

- Wildfire resilience and recovery
- Forest protection
- Sustainable management of private & working forests
- Urban forestry
- Innovative uses of wood products

## Investing in #Forests4Climate

<https://datastories.americanforests.org/investing-in-forests4climate/>



# Modeling state & regional climate-smart forestry

✓ Partners in 7 US states (**MD**, **PA**, MN, MI, WI, OR & CA)

## Objectives:

- Model carbon impacts of forest management, wood utilization, and natural disturbance scenarios
  - Ecosystem + wood products + substitution (+ economics)
- Understand climate mitigation potential of scenarios & identify **climate-smart forestry** practices
- Integrate carbon in forest management and planning
- Integrate forests as natural climate solutions in state climate planning and funding





# Climate-smart forestry in the Mid-Atlantic

- ✓ **Maintain and increase forest extent** through *reducing deforestation, afforestation, and silvopasture* (the integration of low-density tree canopy into active pastureland without removing the land from productive pasture use).
- ✓ **Protect the ability of forests to naturally regenerate** and foster forest diversity by *controlling deer browse* and *restocking understocked stands* where it is ecologically appropriate to add more trees.
- ✓ **Encourage sustainable management practices** on private lands, e.g., by *reducing diameter limit cuts* (also known as high grading, an ecologically damaging practice which encourages landowners to harvest the largest and most valuable trees from their forests and leave only smaller or stunted trees behind).
- ✓ **Increase forest carbon stocks while sustaining timber supply** by *extending rotations* to optimize tree growth.
- ✓ **Prepare for potential negative impacts of climate change**, especially from increasing forest pests and diseases.



Forest Carbon and Climate Program  
Department of Forestry  
MICHIGAN STATE UNIVERSITY

## Impact of Forest Management and Wood Utilization on Carbon Sequestration and Storage in Pennsylvania and Maryland



Major finding:

Climate-smart forestry can increase the forest carbon sink by 29% in Maryland and 38% in Pennsylvania by 2030.

Source: DeLyser et al. 2022, Papa et al. 2023



# The reforestation pipeline

Setting reforestation targets is only part of the solution – we also need the trees to plant


- This requires **nursery space** and **climate-adapted seeds**, among other things

Seed collection networks help ensure **genetic diversity** and **local adaptation** for nursery-grown seedlings

- In Tennessee & Kentucky, focused on oak species and white oak restoration
- AF is building partnerships with both public and private landowners
- Sustains forest products industry (white oak barrels!)

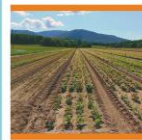


### THE NEED FOR FOREST TREE SEED - THE "RIGHT" SEED



Tennessee forests

The scarcity of hardwood seed orchards, particularly oak orchards, in North America is forcing nurseries to rely on seed vendors and/or wild seed collections. Often, there is limited information about the seed source and genetic diversity of collected seeds, which can impact the long-term survival and adaptability of planted trees at local or regional sites.



Tennessee State Nursery

Establishing a statewide seed collection network from naturally occurring trees will help ensure that seedlings grown in state-run nurseries for reforestation or restoration are both diverse and well-adapted. To achieve this goal, a partnership has been formed among the

To faithfully improve and protect the forest.



University of Tennessee's Tree Improvement Program (UT-TIP), the Tennessee Department of Agriculture, Division of Forestry (TDF), and American Forests (AF). This collaboration aims to supply the state nursery with seeds from suitable sources for purposes such as reforestation, enrichment, and habitat enhancement.

American Forests, founded in 1875, is the nation's oldest nonprofit conservation organization, dedicated to maintaining healthy and resilient forests across the country. The TDF, established in 1915, has been committed to protecting, conserving, and enhancing Tennessee's forest resources for more than a century. Founded in 1959, UT-TIP is dedicated to improving and protecting a variety of tree species in Tennessee's forests and manages the Tennessee Seed Orchard System, which provides seeds for the Tennessee Department of Forestry's State Nursery.



Southern crabapple flower and fruit

### TENNESSEE WILD FOREST SEED COLLECTION NETWORK

UT-TIP, TDF, and AF have collaborated to establish the Tennessee Wild Forest Seed Collection Network,




Ninebark flowers and fruit

focusing on 11 forest tree and shrub species, including three oak species. The selected species include: white, swamp chestnut, and swamp white oaks, sweet and Southern crab apples, mockernut, shagbark, and shellbark hickories, ninebark, redbud,




Large white oak tree and acorns



Crabapple loaded with fruits

and pawpaw. This network includes trees located on both public and private lands where landowners have granted permission for seed collection in areas where there is a viable crop. Large, mature trees are located, to provide significant seed crops for collection. Data on seed production and characteristics from each tree are collected over time to assess the frequency and quantity of seed crops. The harvested seeds are then transported to the East Tennessee State Nursery, where they are cultivated to meet the needs of landowners. In addition, these located trees are propagated to develop seed orchards for future seed supplies.



Southern and sweet crabapple propagation bed

## ORIGINAL RESEARCH article

Front. For. Glob. Change. 03 February 2021  
 Sec. Forest Management  
 Volume 4 - 2021 | <https://doi.org/10.3389/ffgc.2021.629198>

This article is part of the Research Topic  
 Achieving Climate Change Mitigation in the Forest Sector

[View all 5 articles >](#)

## Challenges to the Reforestation Pipeline in the United States

- Joseph Fargione<sup>1\*</sup>
- Diane L. Haase<sup>2</sup>
- Owen T. Burney<sup>3</sup>
- Olga A. Kildisheva<sup>4</sup>
- Greg Edge<sup>5</sup>
- Susan C. Cook-Patton<sup>6</sup>
- Teresa Chapman<sup>7</sup>
- Austin Rempel<sup>8</sup>
- Matthew D. Hurteau<sup>9</sup>
- Kimberley T. Davis<sup>10</sup>
- Solomon Dobrowski<sup>11</sup>
- Scott Enebak<sup>12</sup>
- Rafael De La Torre<sup>13</sup>
- Arvind A. R. Bhuta<sup>14</sup>
- Frederick Cubbage<sup>15</sup>
- Brian Kittler<sup>8</sup>
- Daowei Zhang<sup>16</sup>
- Richard W. Guldin<sup>17</sup>

# Climate change vulnerability

Some trees will be vulnerable to future climate conditions

- **Assisted migration** can help species keep pace with climate change
- AF scientists work with partners to identify vulnerable species and conduct assessments and field studies of assisted migration potential\*

\*Mostly in the Western US, but relevant in the East too, building on seed collection networks

Urban areas will also be impacted by climate change and need climate-smart urban forestry resources

- Climate change **vulnerability assessments** can accompany planting lists to add climate resilience information into planning and planting processes
- AF helps community partners create climate-ready tree lists and identify climate adaptation actions

## CLIMATE ADAPTATION ACTIONS FOR URBAN FORESTS AND HUMAN HEALTH



### CLIMATE CHANGE VULNERABILITY OF URBAN TREES INDIANAPOLIS, INDIANA

**URBAN ADAPTABILITY:**  
 + **High:** Species may perform better than modeled  
 - **Medium:** Species may perform worse than modeled  
 - **Low:** Species may perform worse than modeled

**ZONE SUITABILITY:**  
 ✓ Suitable  
 ✗ Not Suitable

**VULNERABILITY:**  
 ▼ **Low:** Suitable zone, high adaptability  
 ● **Low-moderate:** Suitable zone, medium adaptability  
 ⊕ **Moderate:** Suitable zone, low adaptability or zone not suitable, high adaptability  
 ○ **Moderate-high:** Zone not suitable, medium adaptability  
 ▲ **High:** Zone not suitable, low adaptability

\*Invasive species \*\*Species should be monitored due to elevated pest and disease susceptibility

COMMON NAME	LOW EMISSIONS			HIGH EMISSIONS			COMMON NAME	LOW EMISSIONS			HIGH EMISSIONS		
	ADAPT	ZONE SUIT	VULN	ZONE SUIT	VULN	ADAPT		ZONE SUIT	VULN	ZONE SUIT	VULN		
Ash, Black**	-	✗	▲	✗	▲	▲	Hickory, Mockernut	-	✓	●	✓	●	○
Ash, Green**	-	✓	●	✓	●	●	Hickory, Pignut	-	✓	●	✗	○	○
Ash, White**	-	✓	●	✓	●	●	Hickory, Sand	-	✓	●	✓	●	○
Aspen, Bigtooth	-	✗	▲	✗	▲	▲	Hickory, Shagbark	-	✓	●	✗	○	○
Aspen, Quaking	-	✗	▲	✗	▲	▲	Hickory, Shellbark	-	✓	⊕	✗	▲	▲
Baldcypress	+	✓	▼	✓	▼	▼	Honeylocust	-	✓	●	✓	●	○
Basswood	-	✓	●	✓	●	○	Hophornbeam, American	+	✓	▼	✓	▼	▼
Bayberry, Northern	+	✓	▼	✗	○	○	Hoptree	-	✓	●	✓	●	○
Beech, American**	-	✓	●	✓	●	●	Hornbeam, American	+	✓	▼	✓	▼	▼
Birch, Gray	-	✗	▲	✗	▲	▲	Locust, Black	-	✓	●	✓	●	○
Birch, Paper	-	✗	○	✗	○	○	Magnolia, Cucumber	+	✓	▼	✗	⊕	⊕
Birch, River	-	✓	●	✓	●	○	Magnolia, Star	-	✓	●	✓	●	○
Birch, Yellow	+	✗	▲	✗	▲	▲	Magnolia, Umbrella	-	✓	●	✓	●	○
Blackhaw viburnum	+	✓	▼	✓	▼	▼	Maple, Black	-	✓	●	✗	○	○
Boxelder	-	✓	●	✓	●	○	Maple, Red	-	✓	●	✓	●	○
Buckeye, Ohio	-	✓	●	✓	●	○	Maple, Silver	-	✓	●	✗	○	○

### Assisted Population Migration

Collecting seeds from warmer, lower elevations and planting them at higher elevations where the species already grows.

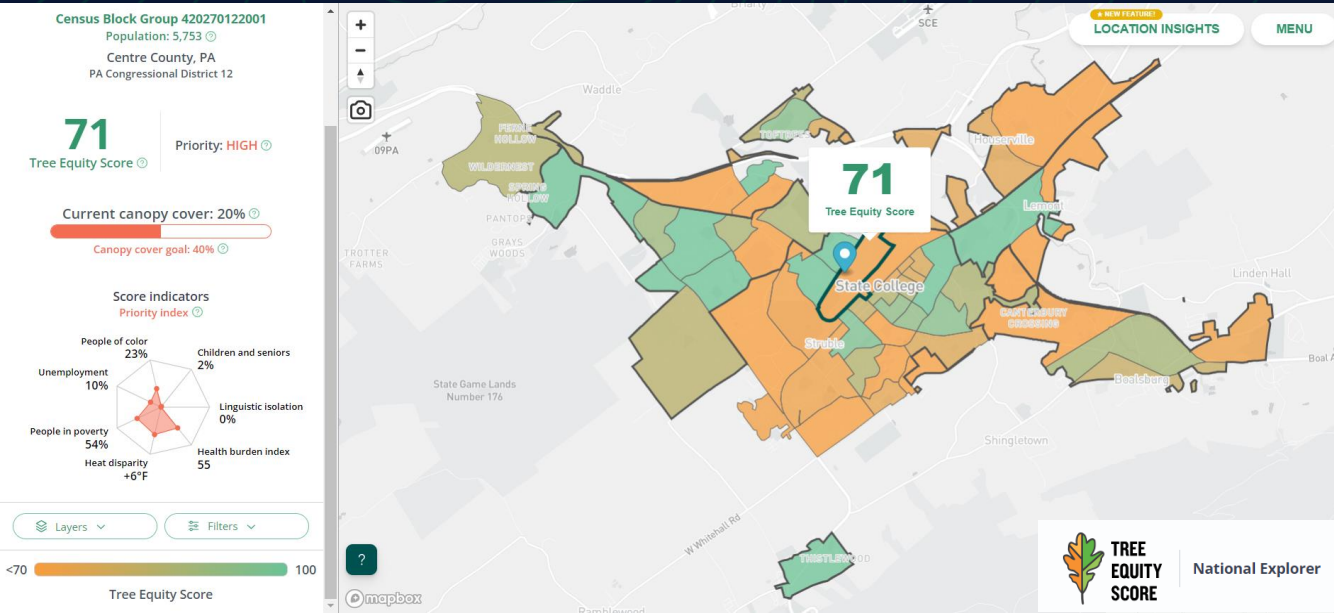
### Assisted Range Migration

Planting seeds at the edge of their current range to speed up their natural movement across a landscape.

### Assisted Species Migration

Planting seeds far beyond their natural range in locations where they will thrive in predicted climate conditions.





# Catalyzing Tree Equity

Trees are life-saving infrastructure, but tree cover is not equitably distributed in cities

- AF's **Tree Equity Score** tool helps identify neighborhoods that need more tree cover to achieve Tree Equity, part of the **500 million trees** needed nationwide

## ANNOUNCING

# Our First Catalyst Fund Grantees!

**\$25+ million** granted to 36 communities to advance Tree Equity



USDA and American Forests are equal opportunity providers and employers.

## Introducing our first Catalyst Fund Grantees!

- ▶ City of Kewanee, IL
- ▶ City of Springfield, IL
- ▶ Village of Rantoul, IL
- ▶ City of Bloomington, IN
- ▶ City of Elkhart, IN
- ▶ City of Goshen, IN
- ▶ City of Huntington, IN
- ▶ City of Ann Arbor, MI
- ▶ City of Jackson, MI
- ▶ City of Kalamazoo, MI
- ▶ City of Pontiac, MI
- ▶ City of Sterling Heights, MI
- ▶ City of Richfield, MN
- ▶ City of Shoreview, MN
- ▶ City of Albany, NY
- ▶ City of Glens Falls, NY
- ▶ City of Kingston, NY
- ▶ City of Long Beach, NY
- ▶ City of Syracuse, NY
- ▶ (Onondaga Earth Corps), NY
- ▶ City of Utica (Olmsted City), NY
- ▶ City of Yonkers, NY
- ▶ Town of Smithtown, NY
- ▶ Village of Haverstraw, NY
- ▶ Village of Hastings-on-Hudson, NY
- ▶ Village of Lancaster, NY
- ▶ City of Bowling Green, OH
- ▶ City of Coshocton, OH
- ▶ City of Fostoria, OH
- ▶ City of Obetz, OH
- ▶ City of Port Clinton, OH
- ▶ City of Xenia, OH
- ▶ Borough of Mechanicsburg, PA
- ▶ City of Allentown, PA
- ▶ City of Easton, PA
- ▶ City of Johnstown (Community Foundation for the Alleghenies, Inc), PA
- ▶ City of Lancaster, PA

AF's **Tree Equity Catalyst Fund** helps scale up the Tree Equity movement nationwide

- Leverages IRA funding “to help establish and implement Tree Equity programs including equitable tree planning and planting, nursery development, community engagement, workforce development and more”
- Brings cooler temperatures and climate justice to vulnerable communities through critical tree infrastructure – including the use of climate resilient species to provide long-lasting benefits





# Building a climate-smart movement

- We build coalitions and work with partners to advocate for climate-smart forest policies and programs
- We convene experts and practitioners to provide technical expertise for decision makers



Wildfire funding fix

Great American Outdoors Act

REPLANT Act

Community Forest Program

Forest Stewardship Program

Farm Bill



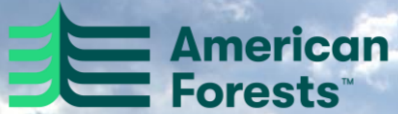
James Ritter / American Forests



Rayon Richards / 1t.org / American Forests







# Questions?

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**Read more about our carbon modeling:**

[www.AmericanForests.org/ClimateSmartForestry\\_MD](http://www.AmericanForests.org/ClimateSmartForestry_MD)

[www.AmericanForests.org/ClimateSmartForestry\\_PA](http://www.AmericanForests.org/ClimateSmartForestry_PA)