Posted on 16 Jan 2023 — The copyright holder is the author/funder. All rights reserved. No reuse without permission. — https://doi.org/10.22541/essoar.167388122.21169453/v1 — This a preprint and has not been peer reviewed. Data may be preliminary.

Leveraging High-Resolution Forest Carbon Science to Support Maryland's Net-Zero GHG Reduction Goal

Rachel Lamb[1], G Hurtt[1], L Ma[1], E Campbell[1], Q Shen[1], F M Panday[1], and M Stewart[1]

[1]Maryland Department of the Environment, Department of Natural Resources, University of Maryland College Park Maryland

January 16, 2023

Maryland
Department of
the Environment

Leveraging High-Resolution Forest Carbon Science to Support Maryland's Net-Zero GHG Reduction Goal

December 14, 2022

Rachel Lamb, PhD[1,2]

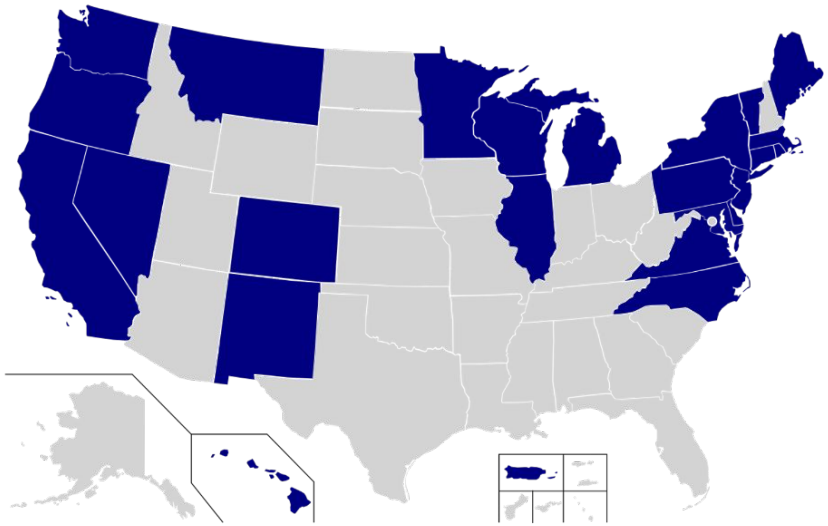
G. Hurtt[2], L. Ma[2], E. Campbell[3], Q. Shen[2], F.M. Panday[2], M. Stewart[1]

Maryland Department of the Environment,
University of Maryland College Park
Maryland Department of Natural Resources

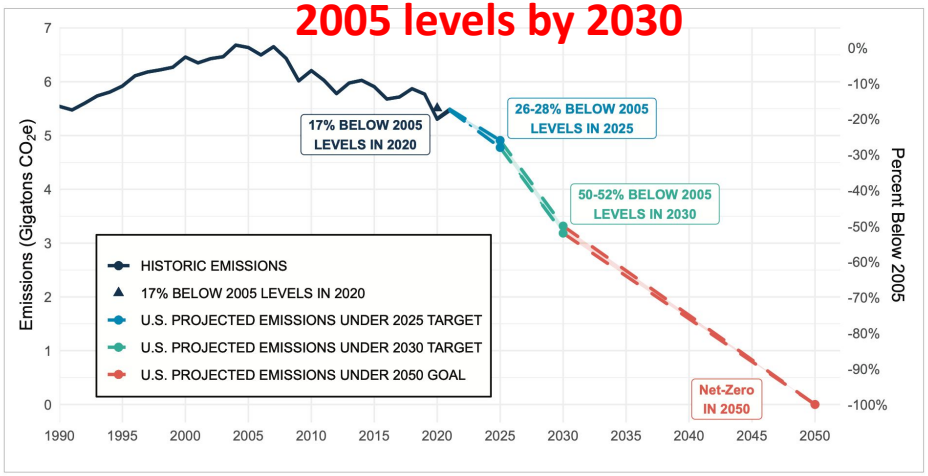
Centering Subnational Action

UNITED NATIONS
PARIS CLIMATE AGREEMENT
ENTRY INTO FORCE
— 4 NOVEMBER 2016 —

UNITED STATES CLIMATE ALLIANCE
STATES UNITED FOR CLIMATE ACTION

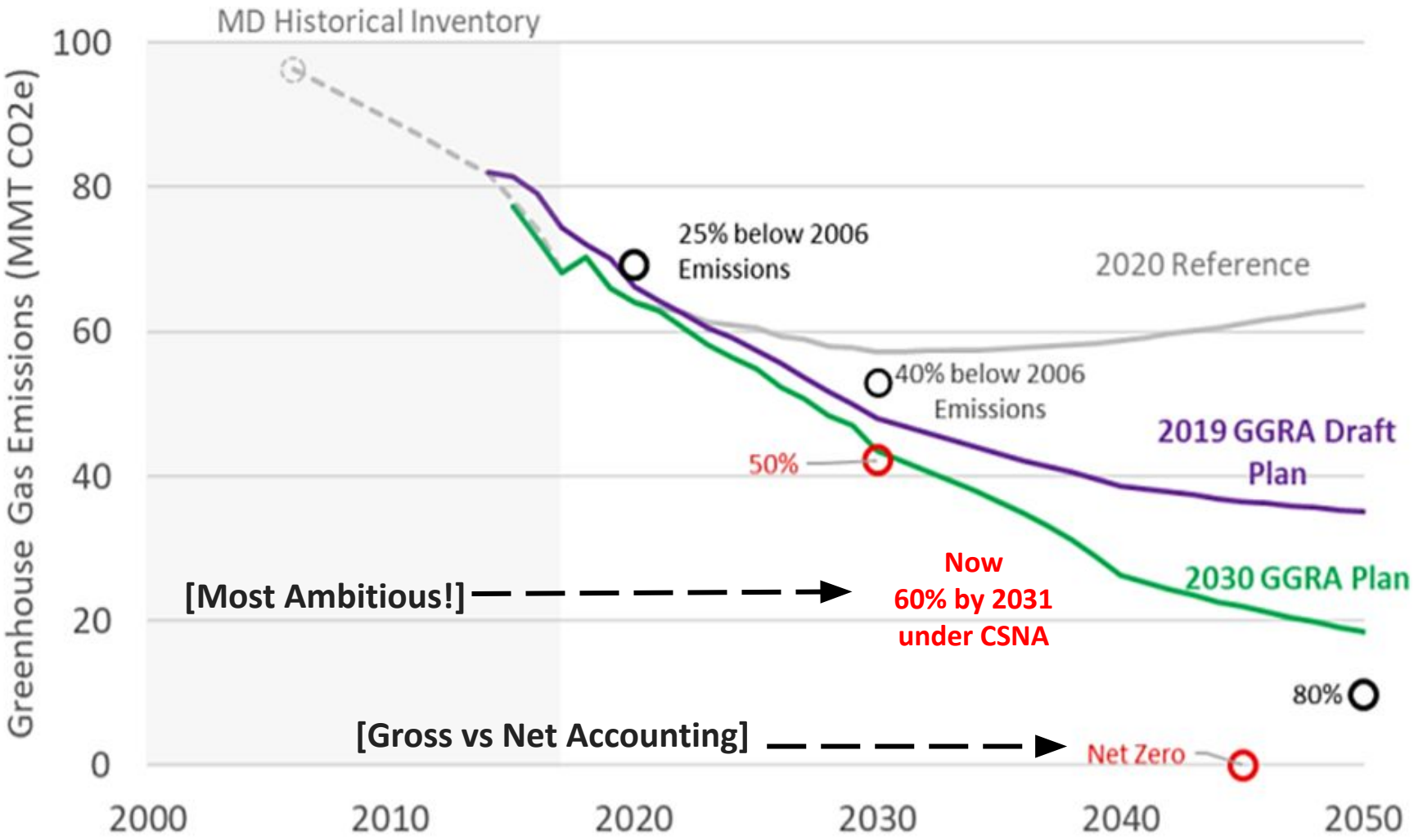


Recent U.S. – 50-52% net reduction from 2005 levels by 2030



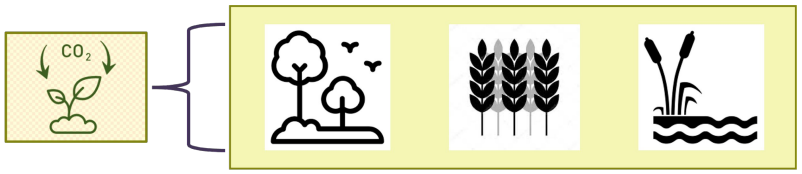
- Ambitious GHG reduction goals
- Accelerating mitigation/resilience policy
  - Centering equity, just transition
  - Tracking and reporting progress
  - Special focus on role of nature

MD Greenhouse Gas Reduction Act



GGRA Tools

Natural and Working Lands (NWL)



Maryland
Department of
the Environment

The Greenhouse Gas Emissions Reduction Act

2030 GGRA Plan

Prepared for:

Governor Larry J. Hogan
State of Maryland

and the Maryland General Assembly

February 19, 2021

Planning Tool

Maryland
Department of
the Environment

Larry Hogan
Governor
Boyd Rutherford
Lieutenant Governor
Ben Grumbles
Secretary

State of Maryland
2017 Greenhouse Gas
Emission Inventory
Documentation

July 26, 2019

Prepared by:
Maryland Department of the Environment

Assessment Tool

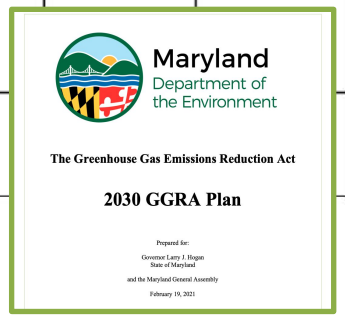
www.mde.maryland.gov/ggra

Informing GGRA Planning (Soft Targets)

Table 3.2-10. Summary of DNR GGRA Plan Projections.

Qualitative to Quantitative

Summary of DNR GGRA Plan Projections	Avg. Annual 2020-2030 Low	Avg Annual 2020-2030 Medium	Avg. Annual 2020-2030 High	Avg. Annual 2020-2030 DNR Target		2030 Low	2030 Medium	2030 High	2030 DNR Target
Forest Management, public lands	1,500	2,000	3,000	1,600	Acres per year	0.020	0.020	0.021	0.020
Forest Management, private lands	35,000	50,000	60,000	38,000	Acres per year	0.86	1.04	1.16	0.92
Planting Forests	2,000	3,000	4,000	2,550	Acres per year	0.28	0.32	0.36	0.30
Urban Tree Canopy	150,000	350,000	500,000	265,000	Trees planted per year	0.003	0.004	0.005	0.0035
Avoided Forest Conversion	500	800	1,300	800	Acres per year	0.10	0.15	0.24	0.15
Tidal Wetland Restoration	100	250	500	300	Acres per year	0.008	0.011	0.016	0.011
Total ($MMtCO_2e$ per year)						**1.27**	**1.54**	**1.80**	**1.40**



known state and federal programs + potential scale of implementation + projected C benefits

GGRA Progress Report (Program Metrics)

Metric

Trees and Forests

Acres of afforestation and reforestation, acres under forest management, and number of urban trees.

Goal

DNR estimates an average annual target of 550 acres of afforestation, 600 acres of reforestation, between 150,000 and 500,000 urban trees planted, and sustainable forest management on 38,000 acres of private land.

Metric

Tidal Wetlands

Acres of restored wetlands.

Goal

230 acres of tidal wetland restored per year by 2030.

www.mde.maryland.gov/ggra

GGRA Progress Report (Program Metrics)

Progress

Table 1. Afforestation, reforestation, forest management and urban tree planting activities in Maryland over the past three years relative to the GGRA of 2016 baseline in 2006.[11] (Click table to expand).

actual/known program implementation

Forest activities	2006	2019	2020	2021
Afforestation acres	1233.9	272.3	402.6	337.8
Reforestation acres	3318	254.2	312	234.6
Forest management acres	30,629.7	43,566	45,096	50,327
Urban trees planted	665,628	179,398	271,431	218,923

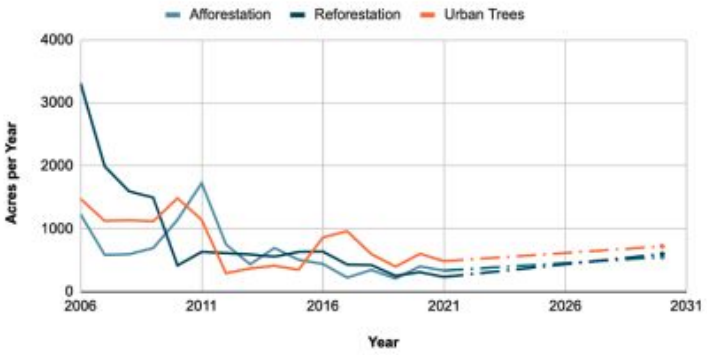


Figure 26. Implemented acres of afforestation, reforestation and urban tree planting[12] from the GGRA of 2016 baseline year of 2006 through 2021 and the estimated acreage target for each practice in 2030 based on the 2030 GGRA Plan. (Click figure to expand).

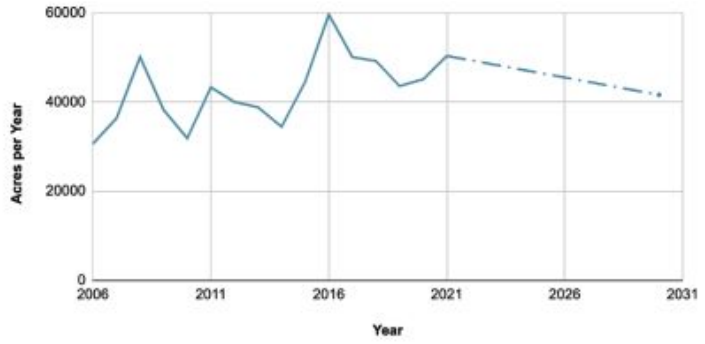
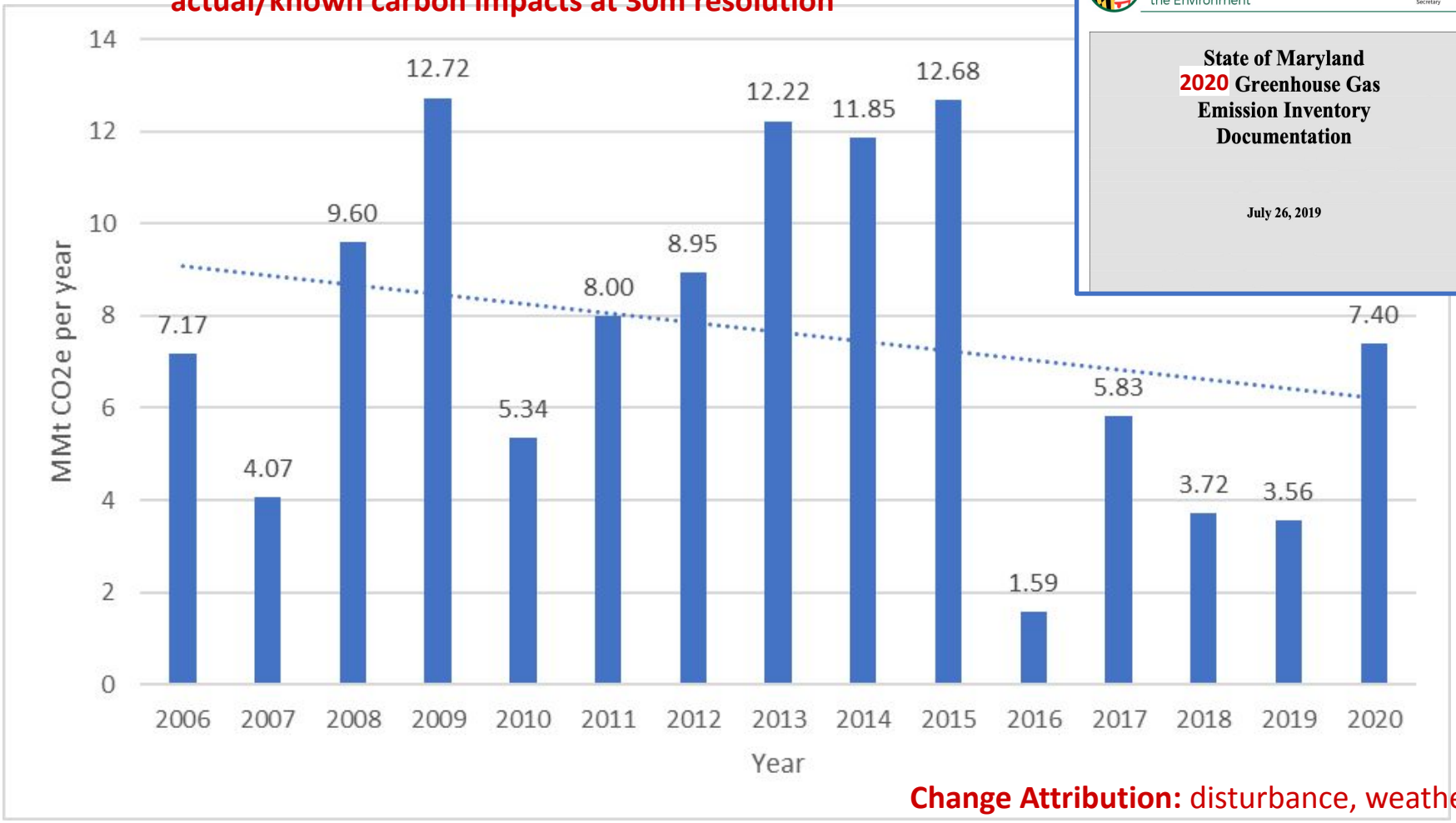


Figure 27. Acres under forest management in Maryland from the GGRA of 2016 baseline year of 2006 through 2021 and the estimated acreage target for 2030 based on the 2030 GGRA Plan. (Click figure to expand).

Flux Assessment via GHG Inventory

actual/known carbon impacts at 30m resolution



Maryland
Department of
the Environment

Larry Hogan
Governor
Boyd Rutherford
Lieutenant Governor
Ben Grumbles
Secretary

State of Maryland
2020 Greenhouse Gas
Emission Inventory
Documentation

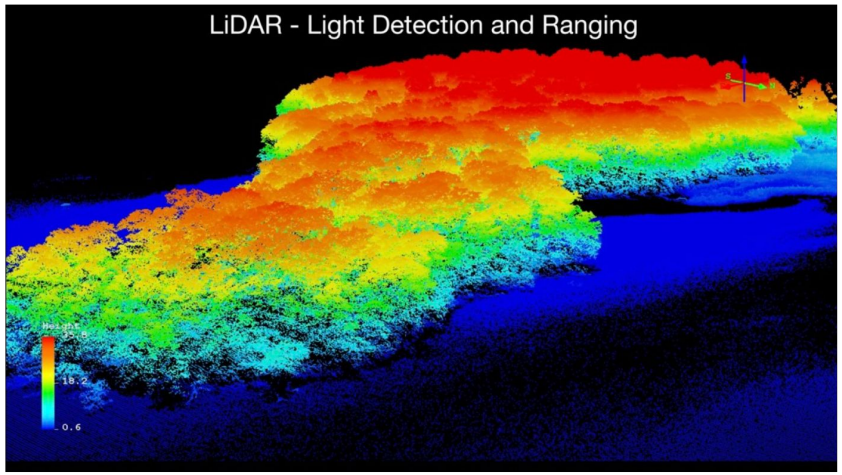
July 26, 2019

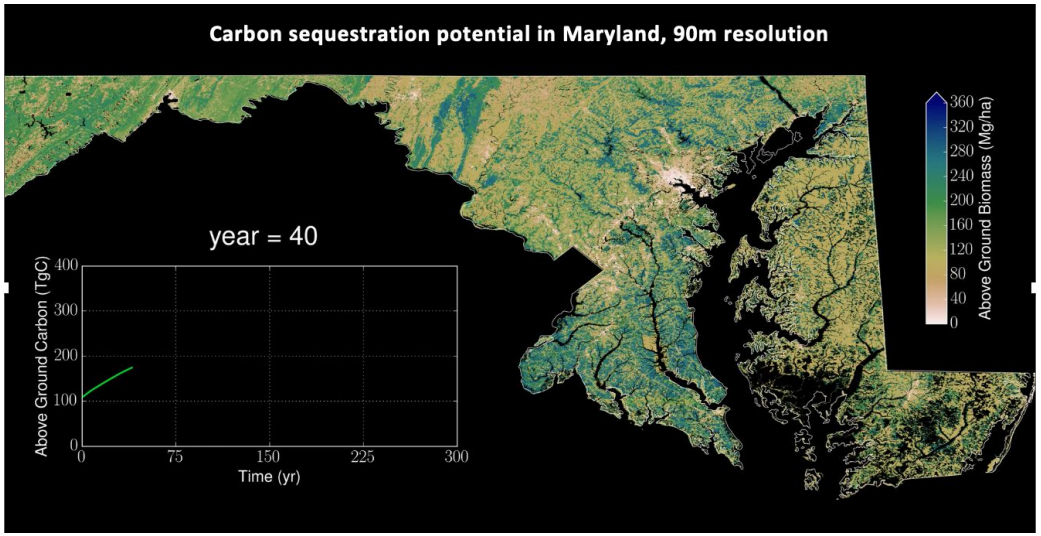
Change Attribution: disturbance, weather, atmospheric CO2, regrowth

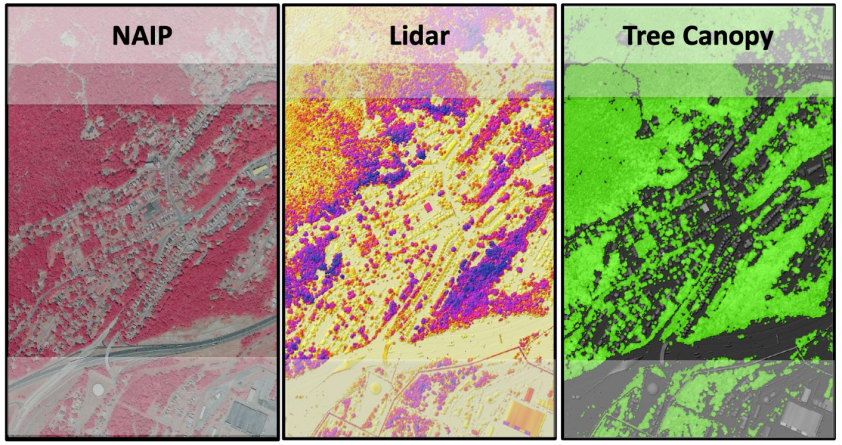
Figure 1. Trend of Forest Ecosystem Carbon Sequestration Per Year Over Time.

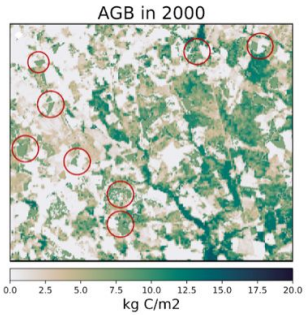
Connection to Global Science

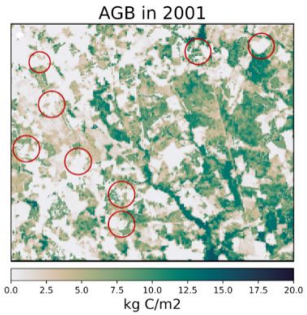
Hurtt et al 2019, ERL
Ma et al 2021, ERL
Tang et al 2021, ERL
Hurtt et al 2022, in prep

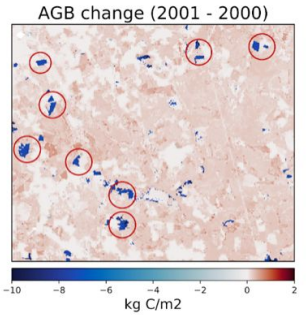












UNIVERSITY OF MARYLAND 18 56

DEPARTMENT OF GEOGRAPHICAL SCIENCES

FOREST SERVICE US DEPARTMENT OF AGRICULTURE

Connection to Global Goals

Goal: **One trillion trees conserved, restored and grown globally by 2030.**

Maryland
Department of the Environment

Pledge by State of Maryland

State of Maryland - Growing Five Million Trees by 2030

Total Trees Pledged: 5,000,000

Supporting actions: Sustainable Forestry, Avoided Deforestation, Nursery Development, Data and Technological Tools, Science and Technical Assistance, Tree Protection through Management, Forest Product Markets and Innovation, Workforce Development, Environmental Education, Conservation Finance

Opportunity for Science Alignment

The Tree Solutions Now Act of 2021

Final Plan for Growing 5 Million Trees in Maryland

5 MILLION TREES FOR MARYLAND

1. **Report afforestation activity** (# trees, species, size, location, etc)

2. **Initiate regrowth** in model prior to remote sensing detection (forests and TOF)

3. **Monitor in the field/via remote sensing** for long-term assessment

UNIVERSITY OF MARYLAND 1856 DEPARTMENT OF GEOGRAPHICAL SCIENCES

NASA

GEDI ECOSYSTEM LIDAR

CONSERVATION INNOVATION CENTER CHESAPEAKE CONSERVANCY

Landsat

University of Vermont Spatial Analysis Lab

lidar and tree cover refresh?

Iterate Process with New Net Zero Target

Progress Report: Does actual implementation align with what was planned? Why or why not?

GHG Inventory: How do our carbon sinks support our GHG goals? What are the dominate factors affecting change?

New 2031 Climate Plan: Given these assessments, do we need additional programs or policies to reach existing (or new) targets?

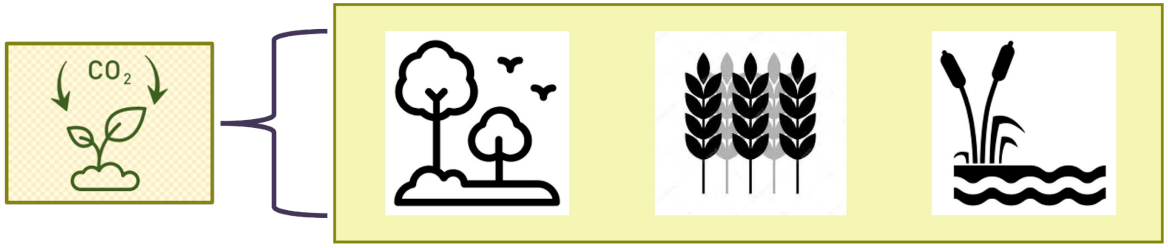
- *Establish formal NWL GHG targets for 2045?*
- *Connect to complementary goals for certain sectors?*

Example: 10% of new trees must be planted in underserved urban areas *(equity and EJ)*

relevance for spatial planning

Challenges and Opportunities

- Clarify role of NWL in a decarbonized future
- Align planning tools with assessment tools
- Evaluate carbon progress in context of complementary goals
- Maximize range of data/tools (field data, modeling, and RS)
- Communicate intervention opportunities (where, when, how)
- Expand framework to other sinks (e.g., ag soils / tidal wetlands)



Contact

Rachel Lamb, PhD
Agency Lead, Natural Carbon Sequestration
Designated Administrative Manager
Maryland Department of the Environment
rachel.lamb@maryland.gov