Maryland
Department of the Environment

Raising State Level Ambition: Role of Natural and Working Lands in Maryland Climate Action

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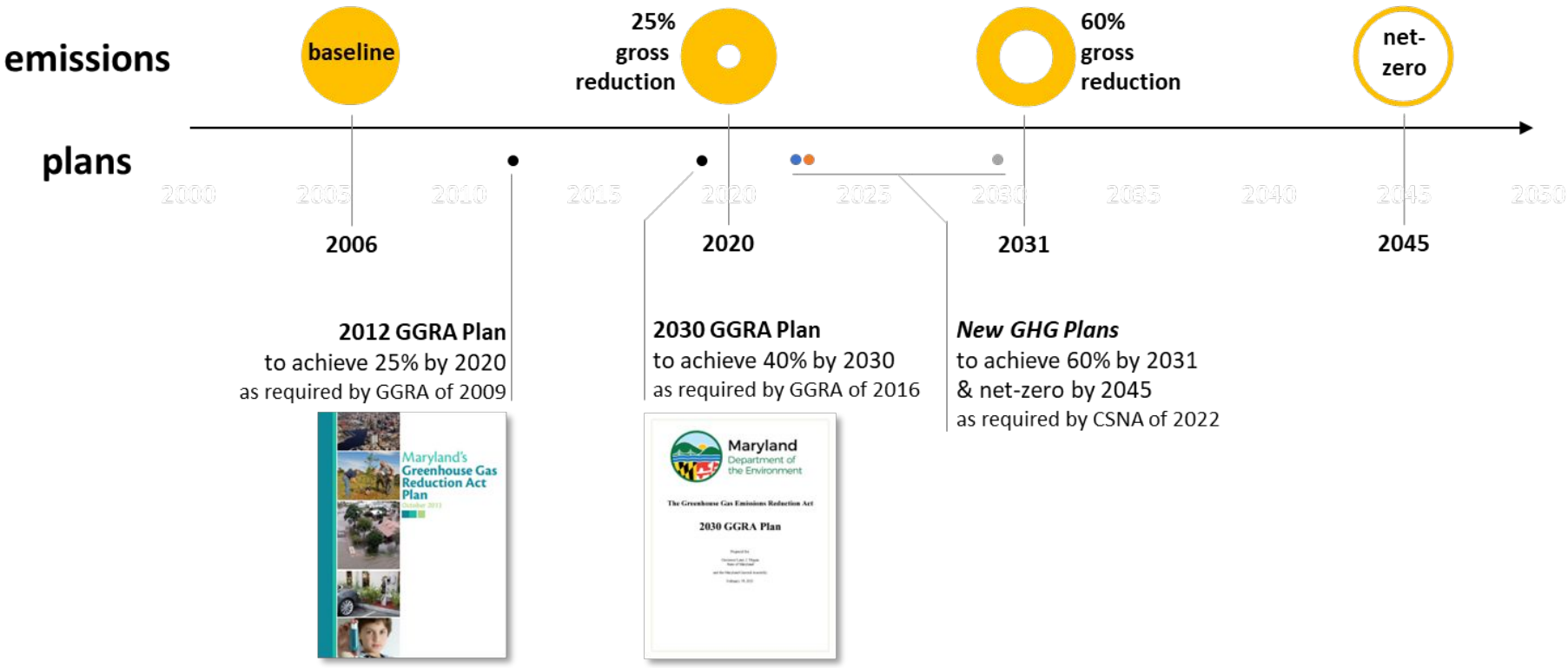
Vimal Amin

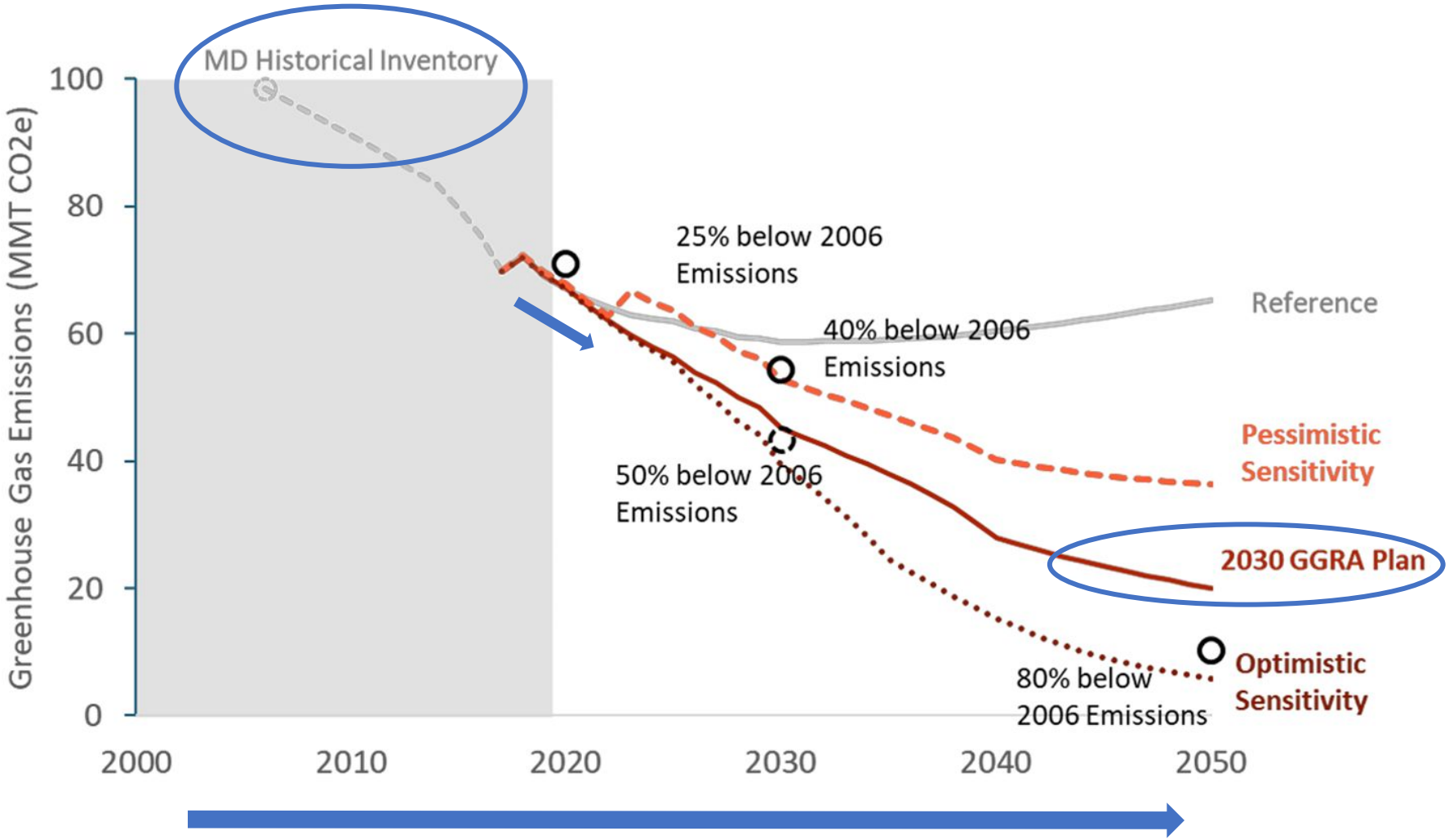
Science and Technical Working Group

February 17, 2023

MD GHG Reduction Planning

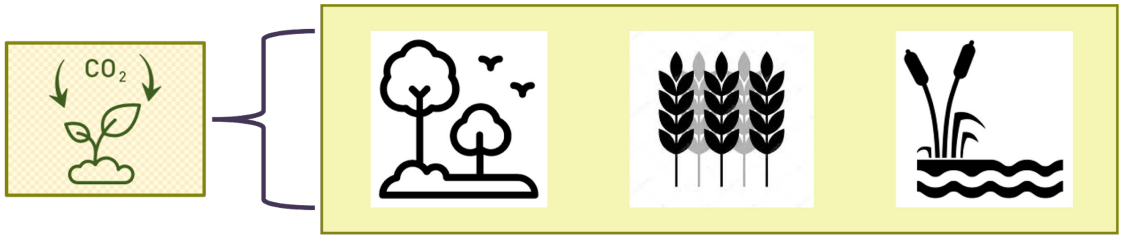


MD GHG Reduction Planning Tools



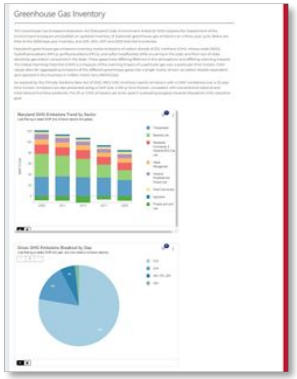
Topics

Natural and Working Lands (NWL)

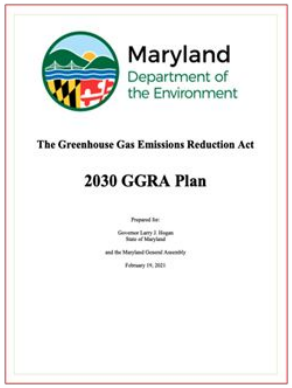


Assessment and Planning Tools

Emissions Inventory

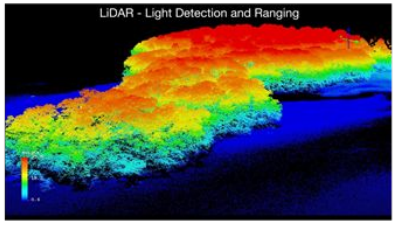


Reduction Plan



Progress Tracking

Improved Science

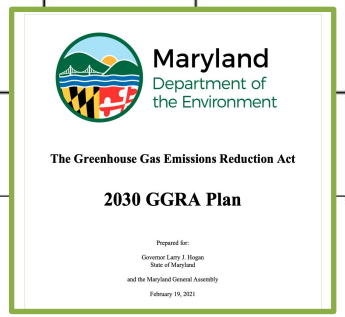


Informing GGRA Planning (Soft Targets)

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.

actual/known program implementation

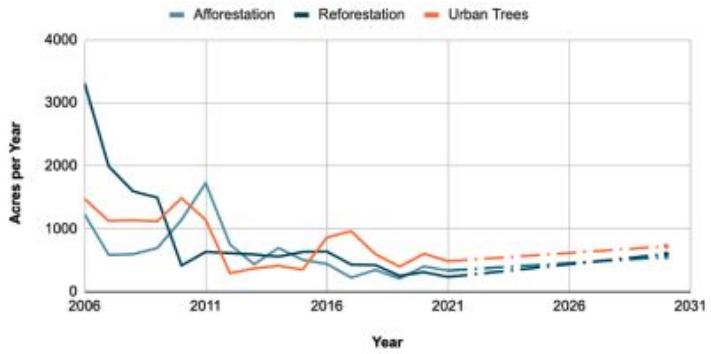


Figure 26. Implemented acres of afforestation, reforestation and urban tree planting[12] from the GGRA of 2016 baseline year of 2006 through 2021 and the estimated acreage target for each practice in 2030 based on the 2030 GGRA Plan. (Click figure to expand).

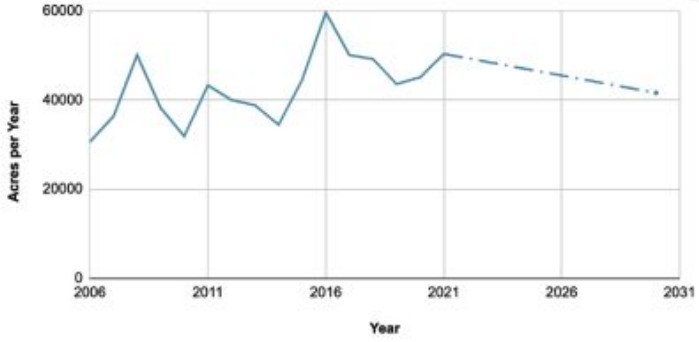
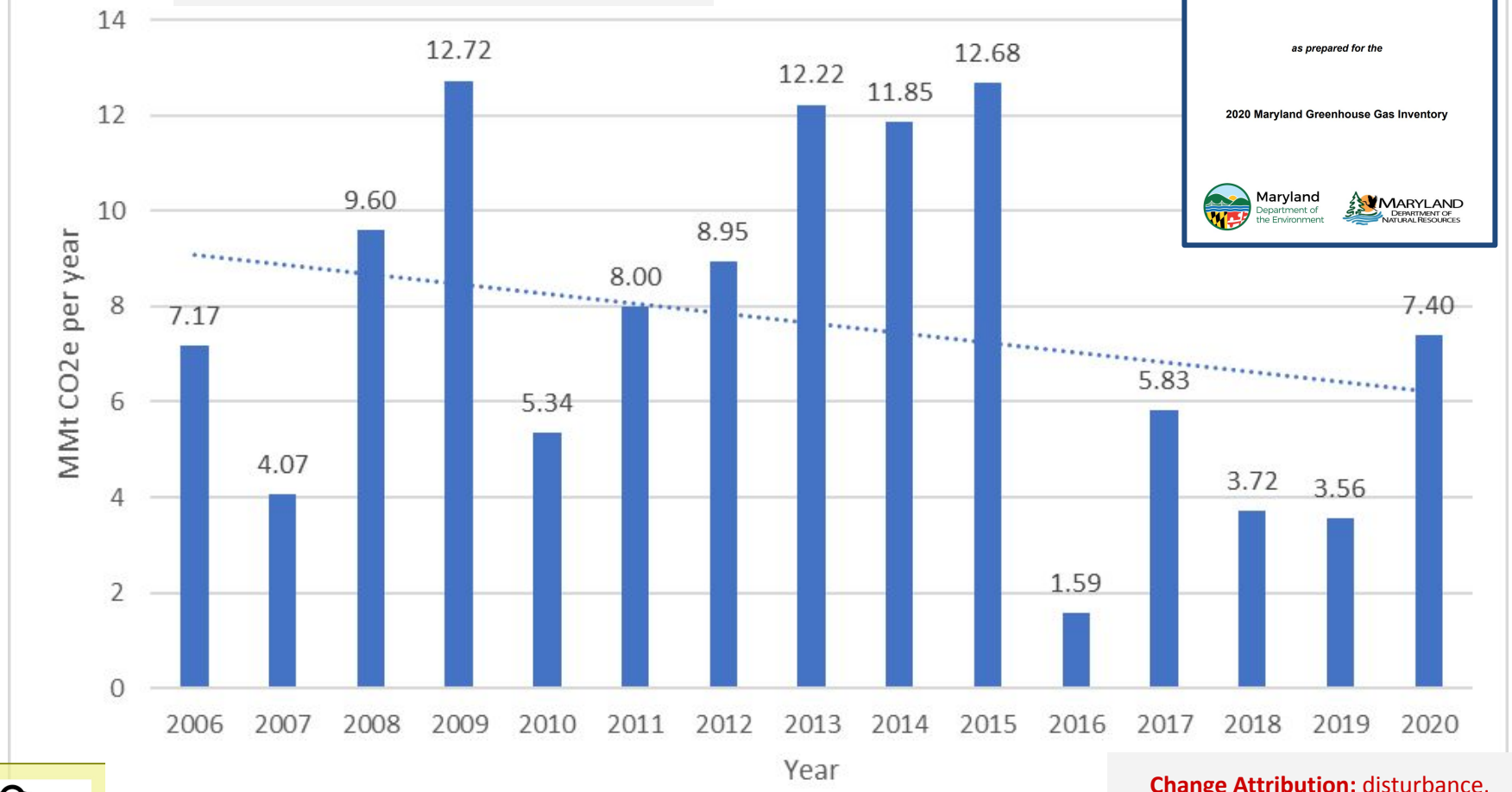


Figure 27. Acres under forest management in Maryland from the GGRA of 2016 baseline year of 2006 through 2021 and the estimated acreage target for 2030 based on the 2030 GGRA Plan. (Click figure to expand).

Flux Assessment via GHG Inventory

actual/known carbon impacts

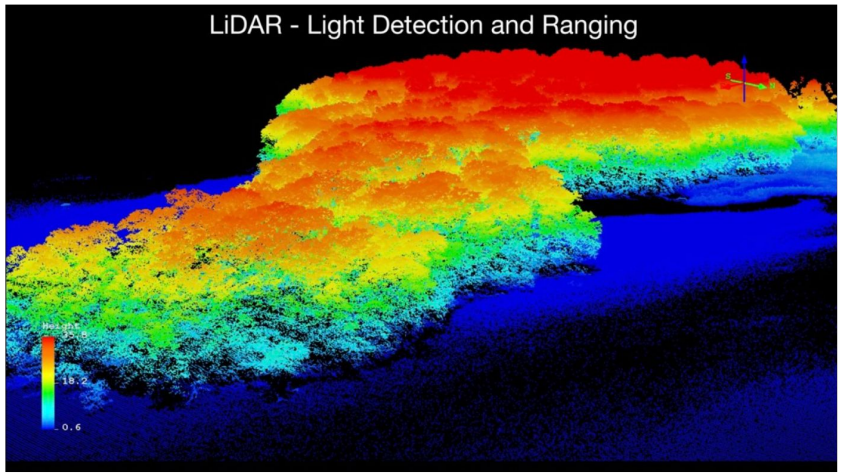


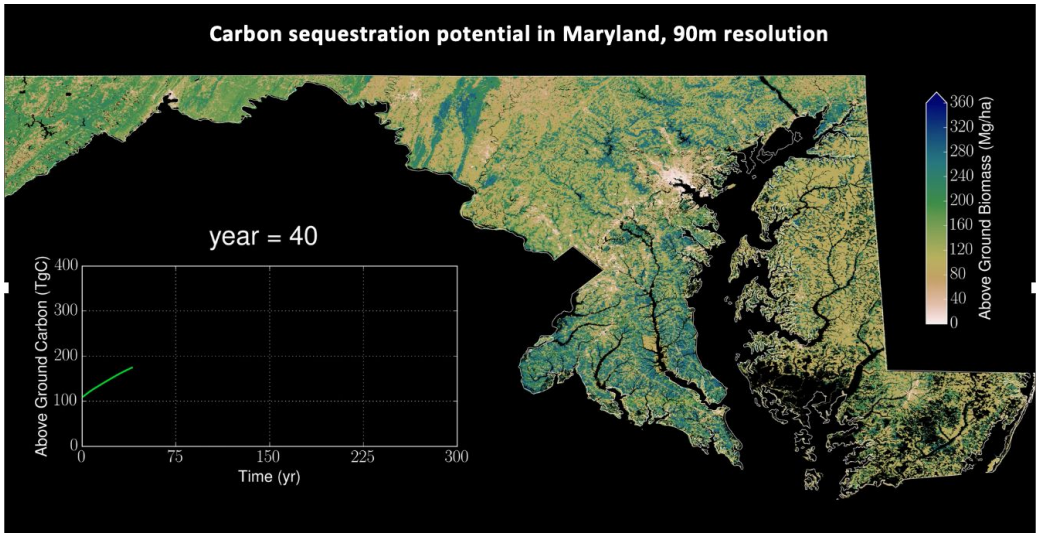
Change Attribution: disturbance, weather, atmospheric CO2, regrowth

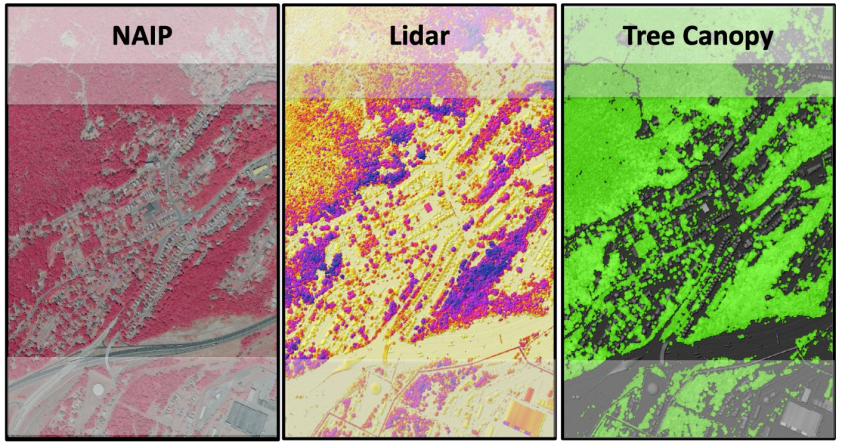
Figure 1. Trend of Forest Ecosystem Carbon Sequestration Per Year Over Time.

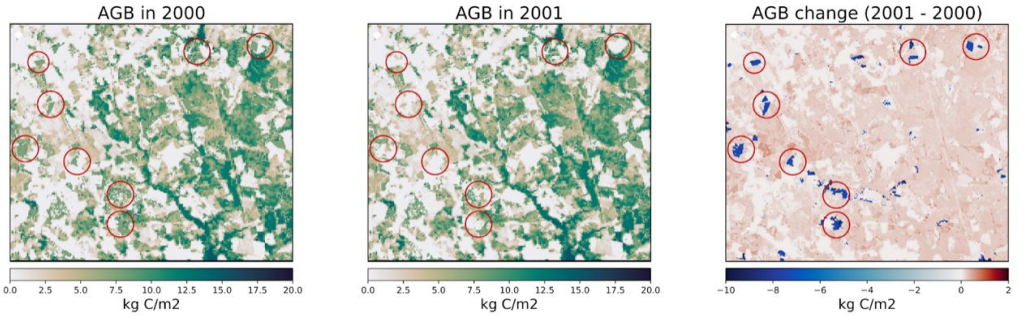
Connection to Global Science

Hurtt et al 2019, ERL
Ma et al 2021, ERL
Tang et al 2021, ERL
Hurtt et al 2023, in prep









DEPARTMENT OF GEOGRAPHICAL SCIENCES

NASA Carbon Monitoring System

The goal for NASA's CMS project is to prototype the development of capabilities necessary to support stakeholder needs for Monitoring, Reporting, and Verification (MRV) of carbon stocks and fluxes.

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?

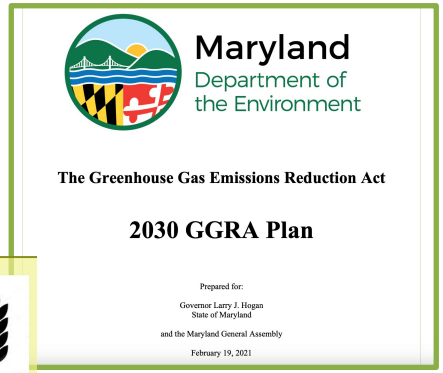
Informing GGRA Planning (Soft Targets)

Qualitative to Quantitative

Greenhouse Gas Reductions From Agriculture: Menu of Recommended Practices

GHG estimates from comet-planner.nrel.colostate.edu/COMET-Planner_Report_Final.pdf

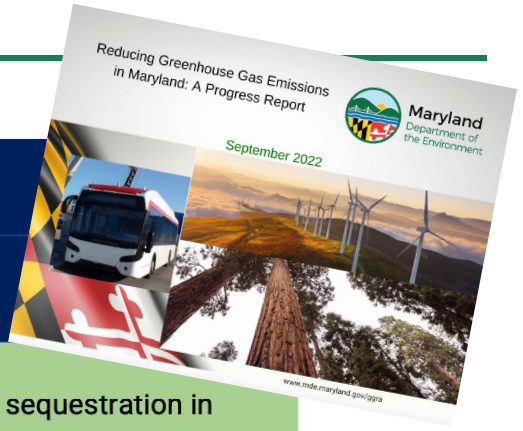
NRCS Conservation Practices		GHG Reduction Mt CO2e/ac/yr		
Cropland Management	**Description of practice**	**CO_2**	**N_2O**	**Sum**
Conventional Tillage to No Till (CPS 329)		0.42	-0.11	0.31
Conventional Tillage to Reduced Tillage (CPS 345)	Reduced tillage = strip till	0.13	0.07	0.20
N Fertilizer Management (CPS 590)	Improve N fertilizer management to reduce by 15% through 4R or nitrification inhibitors	0.00	0.11	0.11
Replace N Fertilizer w/ Soil Amendments (CPS 590)	Soil amendments include compost, manure	1.75	0.00	1.75
Conservation Crop Rotation (CPS 328)	Decrease fallow or add perennial crop to rotation	0.21	0.01	0.22
Cover Crops (CPS 340)	Add seasonal cover crop to cropland	0.32	0.05	0.37
Insert forage planting into rotation (CPS 512)	Add annual or perennial forage to rotation	0.21	0.01	0.22
Mulching (CPS 585)	Add high carbon mulch to cropland	0.32	NA	0.32



COMET-Planner NRCS USDA Colorado State University
Carbon and greenhouse gas evaluation for NRCS conservation practice planning

known range of climate smart activities
+ potential scale of implementation
+ projected C benefits

GGRA Progress Report (Program Metrics)



Metric

Agricultural Soils

Acres of agricultural land under climate-friendly agricultural practices.

Goal

Additional acres with Best Management Practices that increase carbon sequestration in agricultural soils.

actual/known program implementation

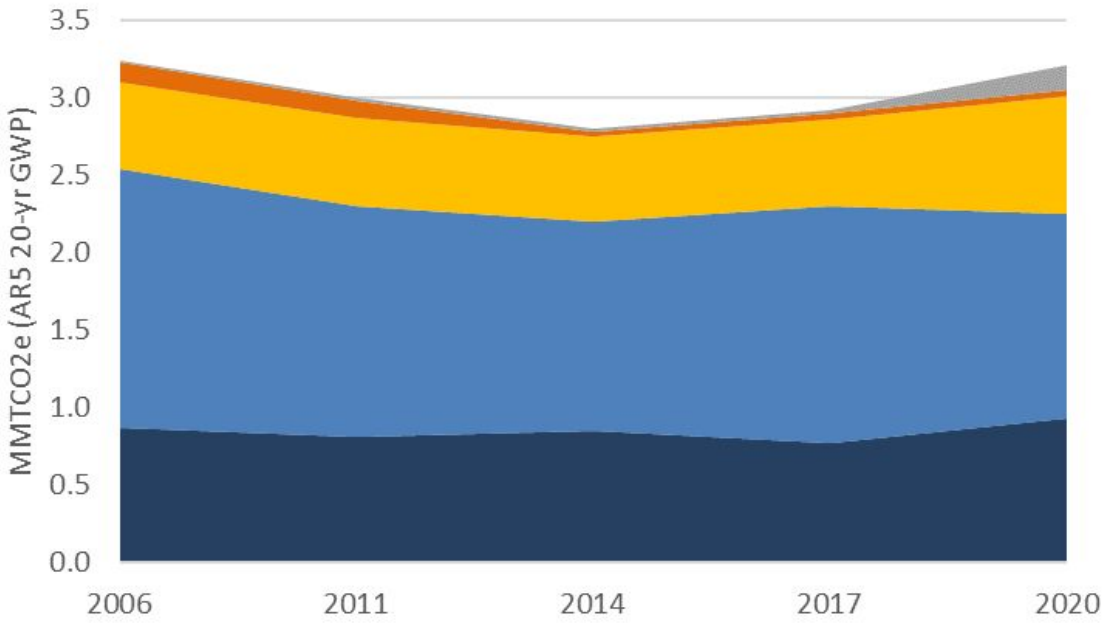
Progress

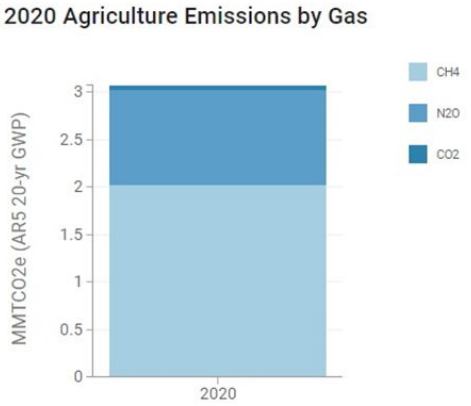
Table 2. Implemented acres of key agricultural practices in Maryland over the past three years relative to the GGRA of 2016 baseline in 2006. Note: Acres are fiscal year, not calendar year. (Click table to expand).

Conservation Practices[16]	Acres in 2006	Acres in 2019	Acres in 2020	Acres in 2021
Conventional Tillage to No Till, annual (CPS 329)	524,923	647,072	647,072	647,072
Conventional Tillage to Reduced Tillage, annual (CPS 345)	167,021	194,122	194,122	194,122
Cover Crops, annual (CPS 340)	127,614	481,904	488,685	434,426
Land Retirement, cumulative (CPS 327, 342 and 512)	20,377	23,730	24,939	25,040
Forest Buffers and Tree Plantings, cumulative (CPS 391 and 612)	16,972	20,714	21,839	21,821
Prescribed Grazing, cumulative (CPS 528)	3,292	10,287	10,250	10,217

Assessment via GHG Inventory

actual/known CO2 emissions equivalents
Ag Emissions: Ag Soils: EPA State Inventory Tool

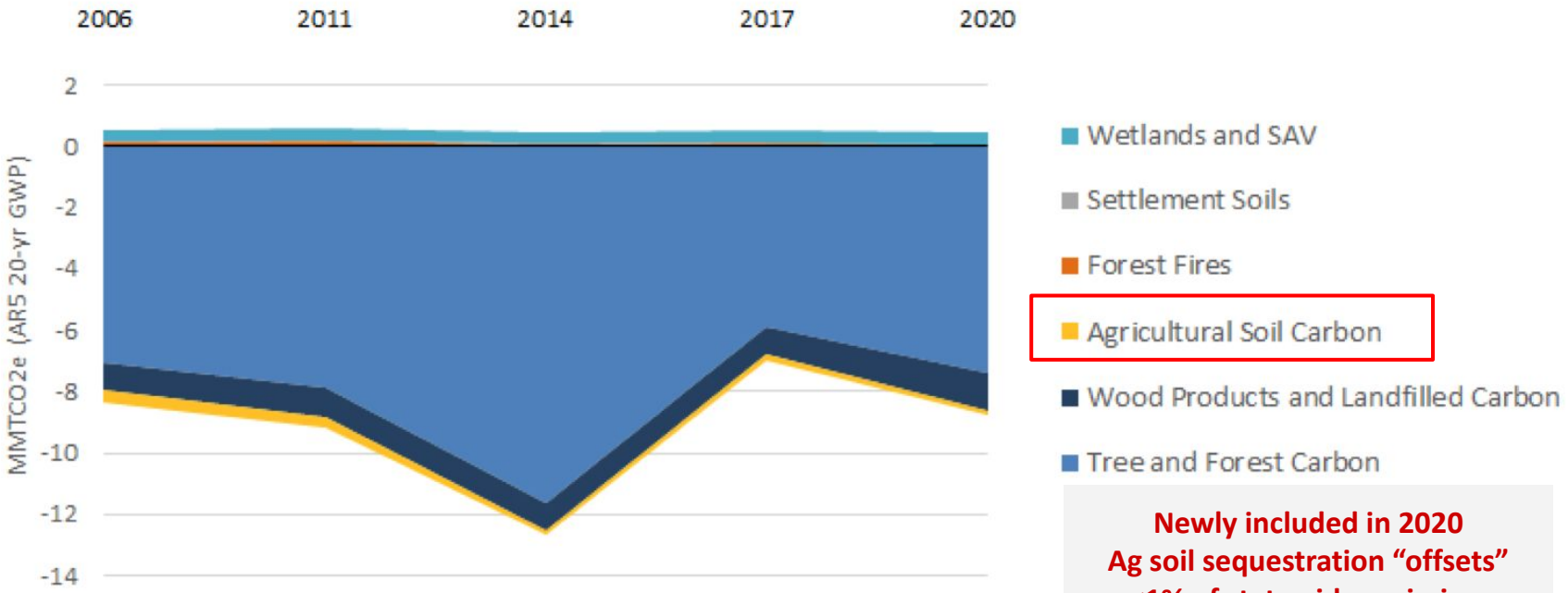




Remains fairly constant over time, 4% of total statewide emissions in 2020

Assessment via GHG Inventory

actual/known carbon impacts
Ag Soils: EPA State Inventory Tool



Newly included in 2020
Ag soil sequestration "offsets"
<1% of statewide emissions

Figure 14. Net emission impact of different sources and sinks within the forestry and land use sector. (Click figure to return).

Updated Science to Capture Impact

- 2022 USCA Technical Assistance Grant
- Partnership between MDE & MDA
- Goals using **state-specific** data:
  - 1) historical annual agricultural soil fluxes (2006-2021)
  - 2) method to quantify annual soil fluxes for future inventories
  - 3) estimated future soil fluxes under a range of planning scenarios (e.g., ongoing BMP implementation)

GGRA Planning/Progress Report

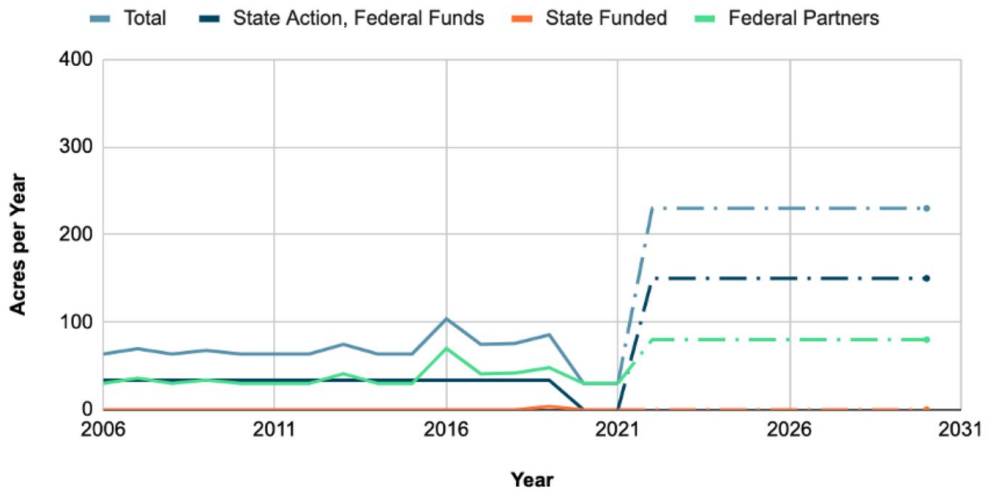
Metric

Tidal Wetlands

Acres of restored wetlands.

Goal

230 acres of tidal wetland restored per year by 2030.

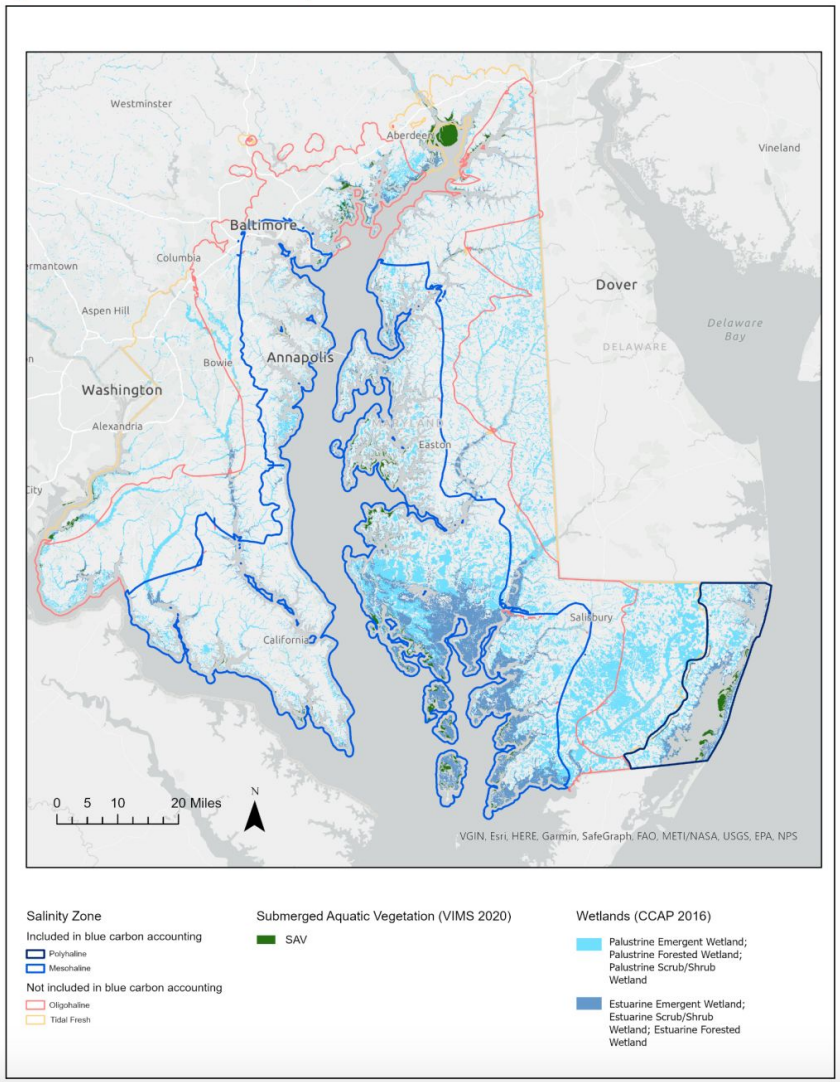


Connections to Maryland's new interagency wetlands action plan under the Bay Program

Figure 29. Implemented acres of wetland restoration from the GGRA of 2016 baseline year of 2006 through 2021 and the estimated acreage target for each activity category in 2030 based on the 2030 GGRA Plan. (Click figure to expand).

Assessment via GHG Inventory

Figure 1: Wetland and SAV extent in Maryland



Maryland Blue Carbon Flux: Estuarine Wetlands and Submerged Aquatic Vegetation

Data and Methodology Documentation

as prepared for the

2020 Maryland Greenhouse Gas Inventory

Maryland Department of the Environment

MARYLAND DEPARTMENT OF NATURAL RESOURCES

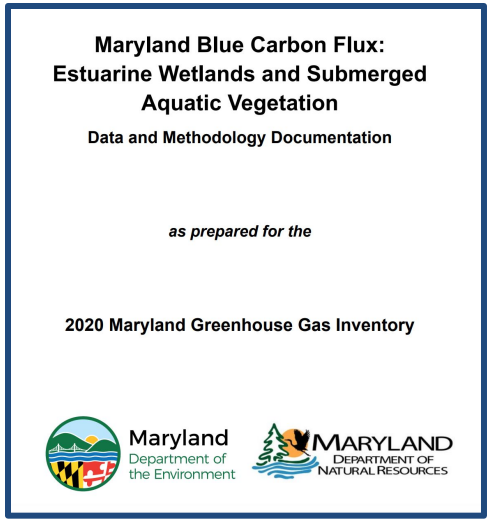
Newly included in 2020
Targeted improvements:

1. mapping against salinity gradient
2. geographically refined rates of carbon sequestration and methane
3. submerged aquatic vegetation

Assessment via GHG Inventory

Table 11. Annual Maryland blue carbon net greenhouse gas flux (Mg CO2e yr-1, 100-yr GWP)

Ecosystem Type	2006	2011	2014	2017	2020
Coastal Bays Estuarine Wetland	-48,950	-48,966	-48,939	-48,927	-48,927
Mesohaline Estuarine Wetlands	-252,126	-254,352	-254,286	-254,238	-254,238
Freshwater SAV	-4,755	-3,682	-3,611	-4,708	-4,369
Oligohaline SAV	-2,567	-1,113	-1,276	-1,937	-1,870
Mesohaline SAV	-607	-1,004	-1,452	-2,472	-952
Coastal Bays SAV	-2,344	-1,804	-2,065	-1,795	-1,674
Total, Wetlands	-301,076	-303,317	-303,224	-303,165	-303,165
Total, SAV	-10,272	-7,603	-8,404	-10,912	-8,865
Total, Land Use Change[4]	11,722	9,993	9,990	9,987	9,984
Net GHG Flux (Mg CO2e/yr)	-299,626	-300,927	-301,638	-304,090	-302,046
Net GHG Flux (MMTCO2e/yr)	**-0.2996**	**-0.3009**	**-0.3016**	**-0.3041**	**-0.3020**



With a 20-yr GWP for methane, these systems represent a net source of GHG emissions

Changing impacts to flux with sea level rise and wetland migration?

Iterate with new 2031 and 2045 Targets

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

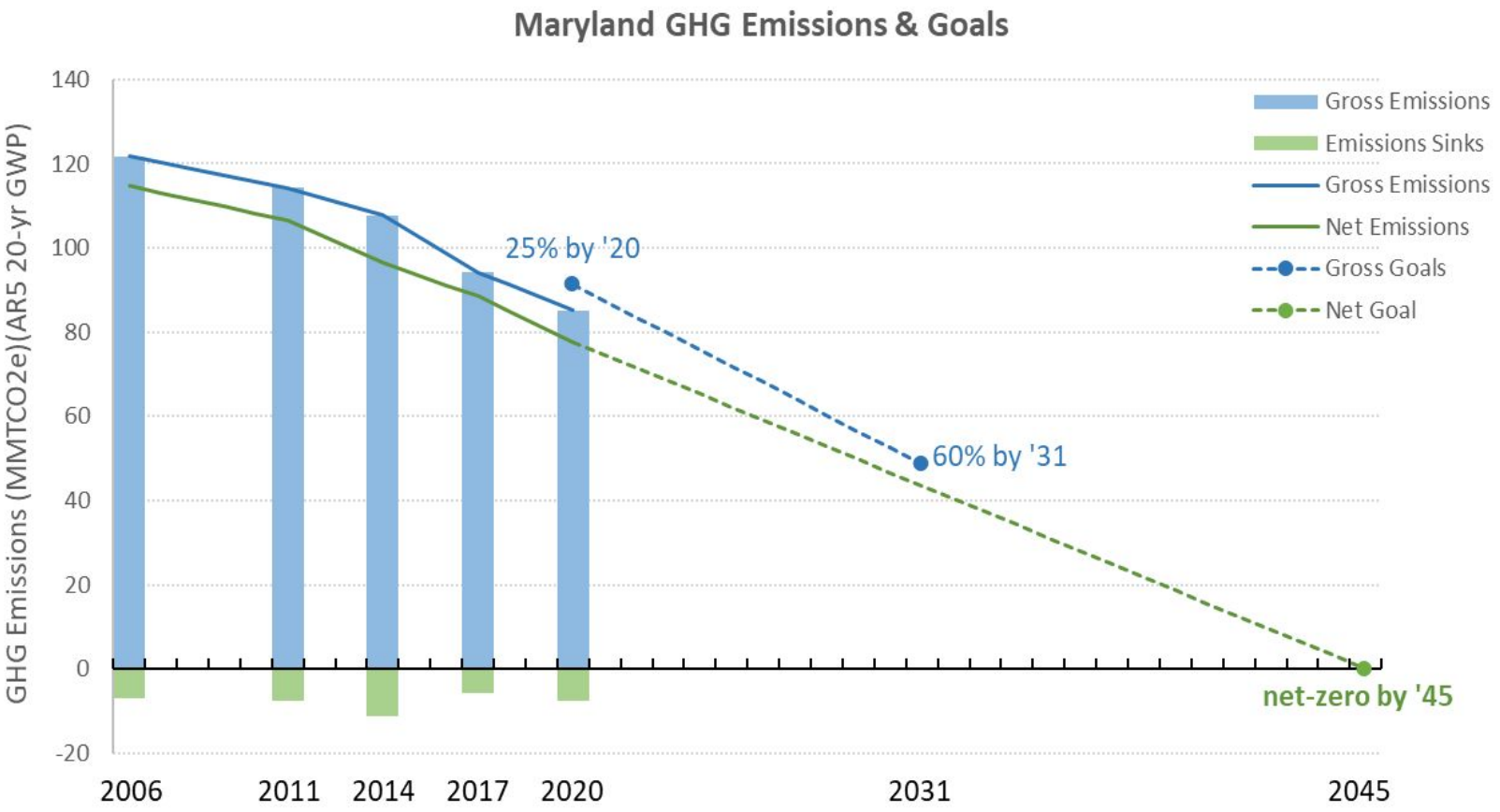
GHG Inventory: How do our carbon sinks support our GHG goals? What are the dominate factors affecting change?

New 2031 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?*

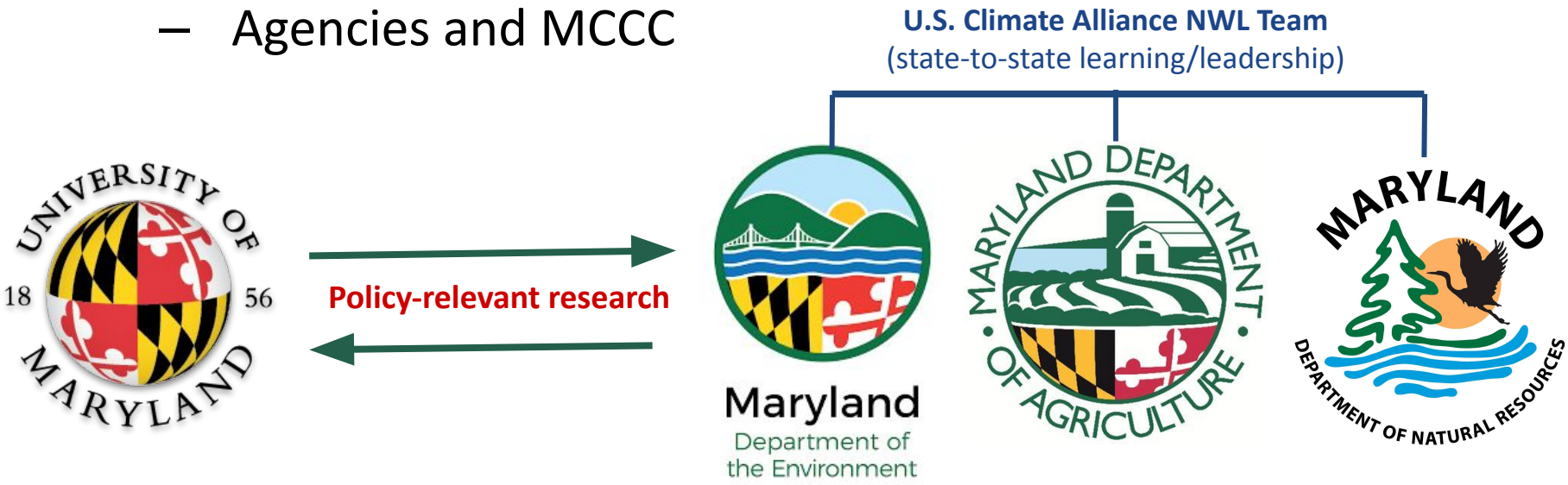
e.g., 10% of new trees must be planted in underserved urban areas *(equity and EJ)*

2045 Net Zero Trajectory



Next Steps with 2031 Plan

- Evaluating GCAM applications for Maryland NWL
  - Technical alignment
  - Role of supplemental analyses
- High level (June), detailed discussions (December)
  - Policy and program ambition
  - Agencies and MCCC



Contact

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Links to more resources

2030 GGRA Plan:
https://mde.maryland.gov/GGRA

GGRA Progress Report:
https://mde.maryland.gov/GGRA

GHG Emissions Inventory:
https://mde.maryland.gov/programs/air/ClimateChange/Pages/GreenhouseGasInventory.aspx

Trees and Forest Data and Methodology Documentation:
https://mde.maryland.gov/programs/air/ClimateChange/Documents/VIMAL/MD_ForestCarbon_Flux_Methodology_01.06.23.pdf

Blue Carbon Data and Methodology Documentation:
https://mde.maryland.gov/programs/air/ClimateChange/Documents/VIMAL/MD_BlueCarbon_Flux_Methodology_01.06.23.pdf

Agricultural Soil Carbon Project Brief:
https://mde.maryland.gov/programs/air/ClimateChange/Documents/VIMAL/MD_AgriculturalSoils_Flux_Project_01.06.23.pdf