

Agency Climate Implementation Plan

Maryland Department of Natural Resources

November 1, 2024



Agency Climate Implementation Plan

Maryland Department of Natural Resources, Climate Implementation Plan required by Executive Order, “Leadership by State Government: Implementing Maryland's Climate Pollution Reduction Plan”

In accordance with Governor Moore’s [Executive Order 01.01.2024.19](#), “Leadership by State Government: Implementing Maryland's Climate Pollution Reduction Plan,” the Department of Natural Resources (DNR) affirms its commitment to:

- Work to address climate change and ensure a just transition to a clean economy;
- Advance environmental justice by working to address the disproportionate impacts of climate change for underserved and overburdened communities, including the application of Justice40 goals, initiatives, and funding;
- Equitably implement all existing laws, regulations, and policies related to climate change, incorporating robust community and stakeholder engagement; and
- Continue to maximize federal funding opportunities on climate.

The Department of Natural Resources hereby submits its own Climate Implementation Plan (CIP) to demonstrate its commitment to a whole-of-government approach to addressing climate change and fully implementing Maryland’s Climate Pollution Reduction Plan (CPRP).

Part 1: Agency Actions Under the Climate Pollution Reduction Plan

Maryland’s Climate Pollution Reduction Plan calls on the Department of Natural Resources to:

Department of Natural Resources

Under the CPRP, the DNR is tasked with many roles. Forestry is a large part of the Forestry and Land Use Policies section of the plan including the 5 Million Trees Initiative, the Forest Preservation and Retention Act, Sustainable Forestry Management, and the United States Department of Agriculture (USDA) Urban and Community Forestry Program. DNR is also named as a partner for coastal wetland management. DNR is one of many agencies called upon to help fund the transition which includes industries, public infrastructure, and incentives for nature-

based solutions. DNR is also responsible for coordinating with other state agencies to remain competitive on federal grants to secure investment in the state of Maryland's efforts.

All Agencies

Apply for federal funding - Under the leadership and coordination of the Governor's Federal Office, all agencies will apply for federal funding to implement actions that support the achievement of this plan. State agencies will work closely with local governments, nonprofits, and community-based organizations to ensure Maryland is competitive for federal climate action implementation funds and to build capacity for local-level implementation. State agencies will offer support to Maryland's businesses and private sector to ensure they are competitive for historic federal investments. State law (MD Code, Environment, § 2-1305) requires that each State agency shall review its planning, regulatory, and fiscal programs to identify and recommend actions to more fully integrate the consideration of Maryland's greenhouse gas reduction goal and the impacts of climate change. The review shall include the consideration of (i) sea level rise; (ii) storm surges and flooding; (iii) increased precipitation and temperature; and (iv) extreme weather events.

Part 2: Recommending Actions to Address Climate Change

In compliance with the law, the Department is taking or recommending the following actions to more fully integrate the consideration of Maryland's greenhouse gas reduction goal and the impacts of climate change. Many of the proposed actions will require additional resources to implement; most actions are not immediately implementable with existing funding, programs, or personnel. Actions have been categorized as Resource Ready and Investment Needed to indicate the Department's current ability to implement the proposed action.

2.1 Renewable and Alternative Energy Infrastructure

2.1.1 Solar (Investment Needed)

Maryland has ambitious goals for advancing solar electricity generation in the state; it aims to source 14.5% of all electricity from solar by 2030. This will require extensive area to be converted to solar production. Currently impervious areas are preferable to avoid loss of natural lands and productive agricultural land, but it is more costly and complicated logistically to install photovoltaics on impervious surfaces. Grid interconnection costs, largely determined by the distance from transmission infrastructure with available capacity, is an important determinant of solar siting as well.

DNR has begun investigating opportunities for installing solar, given the significant acreage of lands, buildings, and parking lots that the department owns. The Maryland Park Service (MPS)

has an assessment for rooftop solar projects agency wide which was completed in 2020. From the original assessment, 15 projects totalling 309.5 kW have been completed through Maryland Energy Administration (MEA) grant funding as of 2024. For example, Deep Creek Lake has installed solar on one of its maintenance buildings and this week (9/3/24) is installing solar on The Discovery Center nature center. Assateague State Park also had rooftop solar panels added. This assessment can be used to continue rooftop solar opportunities as funding allows. For example, Fishing and Boating Services (FABS) manages fishery management propagation areas (approx. 6), fishery management areas (approx. 17), a marina, and field offices – a feasibility study is necessary to determine if there is suitable acreage for solar generation.

There are approximately 220 acres of parking areas total within Maryland Parks, including grass, unpaved, gravel, and paved parking areas. Some of these areas may be suitable for parking structure, overhead-type solar arrays, however, a feasibility study is necessary to determine which of these 220 acres are suitable for solar generation (e.g., access, aspect, shading from nearby trees, surface quality, and proximity to transmission and hookup infrastructure). Provision of shaded parking spaces is a co-benefit for these structures.

Agrivoltaics describes techniques that combine photovoltaics with agricultural production. Unfortunately the dominant crops in Maryland, soybeans and corn, have not been shown to be compatible with solar production. Grazing of sheep works well in combination with solar production, as does production of many vegetables. DNR will assess the viability of transitioning lands that are currently in lease for agricultural production to agrivoltaics or traditional solar fields.

Recent innovations in maintaining pollinator habitat and native plants beneath solar arrays shows some promise for integrating natural meadows into solar generation sites. There are numerous avenues for advancement and refinement of design specifications and management strategies to optimize this benefit and to integrate habitat associated with solar facilities with off-site resources. Native grass habitats have the additional benefit of sequestering carbon within their soils, further mitigating climate change.

SmartDG+ is a DNR screening tool available to support siting for wind and solar in Maryland. It assesses infrastructure proximity, land suitability, and viable wind speeds; additional screens include protected areas and county zoning. The Fiscal Year 2023 Report breaks down DNR acreage by land type across units and is a resource when assessing land-use decisions.

2.1.2 Woody Biomass (Investment Needed)

Maryland is working to promote the use of locally-produced woody biomass for the generation of thermal energy and electricity through modern wood heat systems with high-performance air quality controls. Energy from forest byproducts can be used to offset fossil fuel-based energy production and associated greenhouse gas (GHG) emissions. The modern wood heat system that is part of the heating, ventilation, and air conditioning (HVAC) at Cypress Branch State Park uses

locally produced pellets that benefit local jobs and markets that enable good forest management. There are many end users in the United States that are successfully employing wood heating and cooling, and Maryland could benefit from such a program. For example, schools, hospitals, and municipalities could utilize local woody biomass for their energy needs. An appropriately scaled woody biomass fuel market would provide an incentive for harvesting low grade wood, a key component of healthy forest management and an incentive for keeping land in forest, a backbone of climate mitigation and adaptation for Maryland.

2.1.3 EVs and Chargers (Investment Needed)

DNR has a large fleet of vehicles and ownership of many public and private chargers. The agency is committed to reaching the Climate Solutions Now Act (CSNA) goal of state vehicle conversion, but will require additional funding to complete the electric fleet build out. The Department is committed to analyzing how quickly vehicles can be transitioned to zero-emissions vehicles and where charging infrastructure needs to be added to support the transition. To this end special needs and standards for our vehicles, such as the need for heavy duty trucks to support field work and facilities maintenance will be evaluated and DNR will discern and coordinate any training needed by State mechanics to properly maintain the vehicles. In addition, DNR is assessing equipment used for land management and transitioning to electric models, where feasible. The information below illustrates progress towards these goals.

DNR is in the process of building out electric vehicle (EV) fleet charger capability agency wide. To date, the Maryland Park Service has installed 131 Level 2 charging ports. 28 additional ports are either awaiting commissioning, construction or contract award. Expected to be completed in early 2025, this will finish the fleet EV charger buildout for MPS fleet operations. The Maryland Forest Service (MFS) is in the process of installing three 180kW DC Fast chargers. One charger will be located in each of the four regions serviced by the MFS.

There are seven public chargers in current use, located at Harriet Tubman Underground Railroad, Bill Burton Fishing Piers/Talbot, Sandy Point State Park, Cunningham Falls/Catoctin Furnace, Western Maryland Rail Trail/Big Pool and Hancock, Rocky Gap State Park/Day Use and Casino. An additional five public chargers, all awaiting award of Maryland Clean Energy Commission grant, are to be located at Assateague State Park, Gunpowder Falls State Park/Hammerman Area, Gunpowder Falls State Park/Sparks Nature Center, Pocomoke River State Park/Shad Landing Area, and Rosaryville State Park. DNR will continue to assess additional State Parks for the utility of installing public chargers.

The vehicle fleet at DNR includes over 1100 vehicles of which 18 are fully electric. Only approximately 26% will be considered eligible for conversion to electric vehicles due to the special performance requirements of many unit vehicles which can include wildland fire suppression and heavy duty capabilities.

2.1.4 Heat Pumps (Investment Needed)

DNR is evaluating potential for converting existing HVAC and water heating systems into electric-based and hybrid systems for its buildings. DNR owns over 6,000 buildings, many with the potential to convert to more efficient electric based or hybrid heat pumps. Conversion to electric heat pumps can be accomplished long term through a replacement strategy through Critical Maintenance or Capital funding initiatives. While many DNR buildings are residential in scale, there are commercial scale buildings. Commercial scaled Heat Pump systems (>50 ton) are replacing traditional chiller and boiler systems, and higher performance systems such as geothermal heat pumps and cooled variable refrigerant flow systems are being explored.

2.1.5 Innovative Technology and Industries (Resource Ready)

DNR will remain committed to its role in fostering the growth of innovative technologies and industries. The Department will continue to review and distribute funding for innovative technology proposals as part of the MTech Maryland Industrial Partnerships (MIPS) grant program and Chesapeake Bay Seed Capital Fund. Past funding has included investments in numerous companies with significant potential to mitigate carbon emissions. The Innovative Technology Fund is currently funded at \$1,000,000 per year.

As an official member of the Green and Blue Infrastructure Policy Advisory Commission, the Department will explore the facilitation of ecosystem marketplaces by developing guidance on when they may be appropriate and considering regulatory requirements¹.

DNR also recognizes that new industries will need assistance in their development. The Department is committed to building up innovative adaptation industries in cross-cutting sectors such as agroforestry, green and blue restoration projects, renewable wood products, and the decentralization of energy distribution². To foster its commitment to adaptation and maintaining the health of existing sectors, DNR will encourage innovation and the adoption of new technologies via pilot projects and regulatory flexibility. This will help enable people such as farmers, foresters, landowners and watermen to increase the sustainability, profitability and resiliency of their operations in a way where the data and success is trackable³. New technologies may assist in the management of sustainable fisheries. Technology enhancements and innovations will aid in expanding access to invasive species control and raw materials such as lower quality wood.

¹ Next Generation Adaptation Plan, Working Lands and Natural Resources Based Ecosystems, Investment Needed Priority 1

² Next Generation Adaptation Plan, Climate Jobs and Training, Resource Ready Priority 1

³ Next Generation Adaptation Plan, Working Lands and Natural Resources Based Ecosystems, Investment Needed Priority 3

2.2 Carbon Sequestration

Additional detail on these actions can be found in DNR's Annual Maryland Commission on Climate Change Report.

2.2.1 Afforestation (Resource Ready + Investment Needed)

Planting trees expands forest cover and associated carbon stocks by regenerating or establishing healthy, functional forests through practices such as soil preparation, erosion control, supplemental planting and full site planting. These actions help to ensure optimum conditions to support forest growth and expand forest area. DNR is the state's leader in implementing tree planting, the implementation goal of this program was to achieve the afforestation and reforestation of 43,030 acres in Maryland by 2020. This goal was exceeded in 2019 with 44,931 cumulative acres planted through 2020. In 2021 the Tree Solutions Now Act was passed, establishing the goal of planting 5 million trees by 2031, in addition to the tree planting goals established in Maryland's 2019 GHG reduction plan. The Tree Solutions Now Act has a clear focus on equity and environmental justice, with 500,000 of those trees to be planted in underserved areas. As of March 2024 over 478,000 trees have been planted towards the goal, with over 41,000 in urban areas. DNR was also recently awarded funding through the Climate Pollution Reduction Grant (CPRG) to plant and maintain 500 acres of trees on the lower Eastern Shore as well as engaging in an Natural Resource Conservation Service (NRCS) funded Regional Conservation Partnership to plant up to 2000 acres of trees in riparian and upland areas on agriculturally designated land. In support of these efforts, our agency has evaluated areas on public lands with opportunities to plant trees, especially in urban and underserved areas where urban heat island effect is most prominent.

2.2.2 Climate Smart Forestry Management (Resource Ready)

DNR is employing sustainable forestry management to promote capture carbon in existing forests on both public and private lands. Enrolling unmanaged forests into forest management plans and implementing sustainable forest best management practices can enhance forest productivity, which increases rates of carbon sequestration in forest biomass and the amount of carbon stored in harvested durable wood products, and decreases the risk of forest pest or disease outbreaks. The CSNA 2031 goals of this program are to improve sustainable forest management on 38,000 acres of private land annually, and ensure greater than 50 percent of state-owned forest lands will continue to be third-party certified as sustainably managed. This annual acreage target was exceeded in 2020, 2021 and 2022. DNR was also awarded funds through the CPRG to develop regional forestry management plans for 1000 acres of land on the lower Eastern Shore.

2.2.3 Blue Carbon (Resource Ready)

Blue carbon in Maryland refers to the carbon captured by the ocean and coastal ecosystems, including coastal salt marshes and seagrasses. DNR is currently pursuing the creation, protection,

and restoration of wetlands to promote carbon sequestration through several means including the Natural Filters Program provided through the Chesapeake and Atlantic Coastal Bays Trust Fund. The Natural Filters Program restores wetlands and buffers on state and public lands to meet water quality goals. These protection tools help to facilitate the migration of marsh habitats as sea levels rise on private properties.

The CPRG, mentioned above, will support marsh restoration, tidal connectivity, living shorelines to protect marshes, and marsh migration through Coastal Resilience Management Plans. DNR anticipates GHG reductions of approximately 367,700 mt CO₂e by 2050 from these efforts.

DNR is also supporting the Maryland Department of Planning (MDP) in the development of an interagency Wetland Adaptation Strategy, which outlines opportunities and goals for wetland preservation in Maryland, including policy and partnership opportunities.

In 2022 Maryland became one of the first states to integrate blue carbon into its GHG inventory, allowing the state to better understand how progress in wetland restoration impacts our GHG balance. For the Maryland GHG inventory, blue carbon stocks and fluxes comprise the state's estuarine wetlands and seagrasses, otherwise referred to as submerged aquatic vegetation (SAV). Many of the wetland projects do not have benefits to Maryland's carbon sink, primarily due to emissions of methane, a powerful greenhouse gas, but all are important in providing climate resilience benefits, wildlife habitat, and improving water quality (see DNR's Annual Climate Report for additional information).

The Critical Area (CA) in Maryland is the land extending 1000 feet inland from tidal water and wetlands. These areas are on the front line of climate change, particularly vulnerable to sea level rise. Critical Area State Regulations (2015) - require state projects to preserve, protect, and maintain wetland migration areas if possible. In 2024, HB233 - Critical Area updates - wetland migration is included as part of climate resilience actions that will now be applied in all policies and regs and local CA programs.

2.2.4 Geologic Sequestration (Investment Needed)

Geological carbon sequestration differs from other discussed sequestration methods because it captures carbon at the source or through direct air capture and transports it to a sequestration site. Maryland, through DNR's Maryland Geological Survey (MGS), is one of eight partner states in the Midwest Region Carbon Sequestration Partnership whose role is to identify, locate, and characterize potential geologic storage opportunities. This has evolved into the MidWest Region Carbon Initiative which is a coordination of over 12 states, the nonprofit Battelle Memorial Institute, and the U.S. Department of Energy (DOE). More than 10 gigatonnes of storage capacity has been identified within the terrestrial portion of Maryland (103 years of storage capacity at current CO₂ estimated production rate of 97 million metric tons per year). In the offshore region ranging from Maryland to New York, an estimated 450 gigatonnes of geologic capacity has been calculated. MGS, Battelle, and a private industrial partner in Maryland have

been working together to achieve US DOE funding to establish a pilot project. Nationwide, there are 15 carbon capture and storage (CCS) facilities in operation and an additional 121 CCS are in planning or development (Congressional Budget Office, Dec 2023). Federal tax credits and federal financial support are assisting in this technological development.

2.2.5 Regenerative Agriculture (Investment Needed)

In partnership with the Maryland Department of Agriculture (MDA), DNR provides funding for best management practices on agricultural lands that both improve water quality and sequester carbon through the Healthy Soils and Cover Crop Programs.

DNR leases approximately 10,000 acres of land for agriculture to Maryland farmers, and the vast majority of these areas are in traditional, high-intensity corn/soybean row crop rotations. DNR is currently engaged in a pilot project with Beauty Blooms Farm for implementing regenerative agriculture practices at Patuxent River State Park, and anticipates expanding this initiative once a site suitability analysis and replicable legal framework for implementation are established. Regenerative agriculture is a form of land management and stewardship approaches that draws on traditions and innovations from African, Indigenous, and original land stewards; promotes culturally important food, climate justice programs and initiatives to provide the greatest community benefits. Regenerative agriculture improves soil health and water quality, enhances ecosystem biodiversity, sequesters carbon in the soil, and reduces fossil fuel consumption in the production process. These practices include multi-species cover crops, crop rotation, low to no-till, mulching, roller-crimping, silvopasture and composting. Many agroforestry practices can also be considered regenerative agriculture, such as multi-story food forests. The MFS has helped create a demonstration food forest at White Marsh Park in Queen Anne's Co. and federal funding awarded to the MDA will be available in coming year to support agroforestry practices on private lands. These practices both mitigate carbon emissions and help to increase the resilience of agricultural land to climate impacts like increased frequency of droughts and high intensity rain events.⁴ Regenerative agriculture has a longer return-on-investment than traditional agriculture, and soil health restoration takes several years to show results. Therefore, to pursue regenerative agriculture, DNR is examining the potential for longer-term lease agreements for these properties.

Additionally, not all areas currently in active, row crop agriculture on DNR lands will be suitable for regenerative agriculture. Areas with degraded soils, existing erosion problems, and minimal community support for traditional agriculture may also be converted to wildlife habitat (including afforestation and meadow creation) to benefit water quality and reduce carbon inputs. Some of these areas may also be suitable candidates for renewable energy generation (e.g., ground solar arrays and small-scale wind turbines).

⁴ [Study in Preparation for a Maryland Agriculture Climate Vulnerability Assessment, Harry R. Hughes Center for Agro-Ecology](#)

2.3 Funding the Transition

2.3.1 State Funding

The Department is responsible for administering the distribution of state funds across many different sectors. DNR will continue to ensure that funding streams will remain consistent to award grants and loans for emissions reduction and carbon sequestration projects along with other co benefits prioritized by state legislature.

2.3.2 Federal Funding

As the recipient of federal funding, DNR will lead by example in promoting conservation, increasing resiliency, implementing responsible stewardship of state lands, planting trees, and stewarding the health of the Chesapeake Bay and its tributaries. DNR will continue to pursue appropriate federal funding to supplement these goals along with the other actions outlined in this plan.

Part 3: Considering Greenhouse Gas Emissions Reductions and Impacts on Disproportionately Affected Communities

State law (MD Code, Environment, § 2-1305) requires that each State agency, when conducting long-term planning, developing policy, and drafting regulations, shall take into consideration: (1) the likely climate impact of the agency's decisions relative to Maryland's greenhouse gas emissions reduction goals; and (2) the likely impact of the agency's decisions on disproportionately affected communities identified according to the methodology adopted under § 1-702 of the Environment article. Furthermore, Governor Moore's Executive Order 01.01.2024.19 requires each agency to report on how the agency will advance environmental justice by working to address the disproportionate impacts of climate change for underserved and overburdened communities.

In compliance with the law and Executive Order 01.01.2024.19, DNR is taking the following steps to meet these requirements.

3.1 Projected GHG Reductions

DNR tracks the greenhouse gas benefits of its programs through the departmental annual climate report to the state legislature and Maryland's CPRP includes estimates of the Forest and Land-use sector, including blue carbon, at the state level for 2031 and 2045, given projected state action to increase those sinks. Cumulative tree planting since 2006 in Maryland are estimated to increase Maryland's annual carbon sink by approximately 100,000 metric tons of

carbon dioxide equivalent (mt CO₂e) in 2022 (see DNR's 2023 climate report). Additional tree planting through the dedicated funding of the 5 Million Trees and related programs is projected to increase the annual carbon sink by approximately 50,000 mt CO₂e per year in 2031 and 67,000 mt CO₂e per year in 2045 (see Maryland's CPRP Technical Appendix).

Maryland DNR has estimated the GHG benefit of the actions described in the states CPRG (described above). Cumulatively, the actions falling under the "blue carbon" category are estimated to have a benefit of between 134,725 to 164,200 mt CO₂e over a 25 year period. These benefits come from the avoided loss of carbon stored in marshes that will be protected by living shorelines, the passive conversion of lands under coastal resilience easements, and active marsh restoration/creation.

Actions falling under climate smart forest management are essential for maintaining forest health and increasing forest resilience to climate impacts, but are more difficult to directly translate into GHG benefits. This is due to site and practice specific factors, along with the need to compare the observed or projected carbon outcome to a scenario of no action.

In analyzing the potential of forestation in Maryland the University of Maryland Department of Geography assessed scenarios of an additional 100,000, 200,000, 400,000 and 1.992 million acres of tree planting. The 1.992 acres represents planting trees on all available land, including agricultural land and the 400,000 acres represents planting all non-forest, wetland, or agriculture available land based on analysis by the Chesapeake Conservancy Forest Technical Study. These plantings would increase the forest carbon sink in Maryland between ~100,000-700,000 mt CO₂e per year in 2031 and ~420,000 - 2.8 million mt CO₂e per year in 2045. This would represent an increase of between 5 to 35% in the annual forest carbon sink, assuming the existing forest area is maintained.

While active wetland restoration and protection has carbon benefits, the largest influence on coastal wetland change for the foreseeable future will be loss and gain of wetland area due to sea level rise. Maryland has simulated sea level impacts on wetlands using SLAMM (Sea Level Affecting Marshes Model) and found that Maryland's blue carbon sink is projected to increase by 14%, from 336,000 metric tons of CO₂e per year in 2020 to 383,000 metric tons of CO₂e per year in 2045. This is due to the projected expansion of coastal wetlands into areas that are currently uplands, primarily on the Eastern Shore. This projection does not factor in the loss of carbon that is currently stored in the forests and agricultural lands that are likely to be impacted. Preliminary estimates indicate that loss of the carbon in forests and agricultural land will exceed the increase in the blue carbon sink.

3.2 Environmental Justice Impacts and Initiatives

In support of this work, DNR recently adopted a new Diversity, Equity, Inclusion, Justice, and Accessibility (DEIJA) statement, which reads "Maryland DNR commits to fostering a culture and workforce that is inclusive, equitable, and representative of the State's diversity. We are committed to increasing accessibility to our public lands, waterways, and natural resources for all

communities to enjoy. By engaging and understanding communities that have historically been left behind, we strive to address and remove systematic barriers that perpetuate environmental injustices. Through this work, we celebrate these values within nature, our partnerships, and the communities we serve.”

We will take the following actions to ensure that environmental justice is embedded throughout this plan. These actions include, but are not limited to:

- Use the state’s Climate Vulnerability tool and the Environmental Justice Screening Tool alongside other relevant state and federal tools indicative of climate vulnerability to ensure resources are allocated equitably;
- Prioritizing grant funding and programs in underserved and overburdened communities;
- Establish a community liaison program to ensure underserved and overburdened communities have a voice in our work and decision making;
- Provide technical assistance to underserved and overburdened communities; through our programming; and
- Provide equitable and accessible public access opportunities through these climate projects.

This work is currently being implemented via several initiatives and programs at DNR that include Greenspace Equity Program, Community Forestry Catalyst Fund, Whole Watershed Act and Fund, Grants Gateways Program, and partnerships like Envision the Choptank.

In 2024, the Maryland General Assembly directed the Critical Area Commission to update the Critical Area Program with respect to environmental justice, which includes considering the equitable distribution of the benefits and burdens of development, restoration, mitigation, conservation and adaptation to climate change; as well as ensuring equitable representation and participation in these processes. The Commission will promulgate regulations that specify how State agencies and local jurisdictions shall incorporate environmental justice considerations in their projects and local Critical Area programs. Once promulgated, all 64 local jurisdictions with Critical Area Programs will update their Critical Area ordinances to (1) identify underserved and overburdened communities within the Critical Area, (2) include measures to ensure the equitable distribution of the benefits and burdens of development, restoration, and mitigation within the Critical Area, (3) include measures to ensure equity in the public participation process, and 4) include measures to ensure public access to the water, shoreline, and other natural areas for underserved or overburdened communities. These regulations will address existing development and new development in the Critical Area.

Part 4: Resources for Implementation

4.1 Implementing Maryland’s Climate Pollution Reduction Plan

4.1.1 Million Trees Initiative

The Tree Solutions Now Act of 2021 calls for \$15 million of state funds annually through 2031, with \$10 million supporting the 10% of trees in urban underserved areas through the Chesapeake Bay Trust, and \$2.5 million each to MDA and DNR for other implementation needs. Additional funding sources are being pursued to reach the ambitious tree planting goal. DNR is engaging in a Regional Conservation Partnership with NRCS over the next 5 years with the goal of planting trees in riparian buffers and on marginal agricultural lands, along with providing climate smart forest management on private timber lands. This will be done in partnership with the Alliance for the Chesapeake Bay and the Chesapeake Bay Foundation. Federal funds from the United State Forest Service (USFS), Environmental Protection Agency (EPA), NRCS are also being dedicated to tree planting.

4.1.2 Forest Preservation and Retention Act

This legislation, passed in 2023, strengthens the Forest Conservation Act by requiring local governments and developers to comply with more rigorous forest conservation standards and clarifies the requirements for forest conservation banks in the state. It includes a new restoration option for qualifying forest conservation to mitigate forest clearing, which will help with forest resilience to climate change, while the forest retention mitigation banking option provides an important conservation pathway in developed areas. Higher replacement ratios in most areas will help the state comply with the requirement for the state to maintain a minimum of 40% forest cover.

4.1.3 Sustainable Forestry Management

DNR provides cost-share for sustainable forest management through the Woodland Incentive Fund, with approximately \$200,000 per year for 2,000 acres of forest practices, and technical assistance covering 400+ landowners and more than 20,000 acres annually in Forest Stewardship Plans designed to maintain healthy forest cover. The NRCS Regional Conservation Partnership Program also includes over \$700,000 of funding over 5 years for climate-smart forest management. These are practices that increase carbon sequestration over time or lower the risk of disturbances, such as wildfire or insect outbreaks.

On State Forest land, Climate Adaptation Plans have been completed for Pocomoke State Forest and Chesapeake Forest Lands on the Eastern Shore. Similar plans for Western Region State Forests are proposed, covering Green Ridge, Potomac/Garrett, and Savage River State Forests. State Forests are certified for sustainable forest management through two separate programs, Forest Stewardship Council and Sustainable Forestry Initiative, and steady harvest rates are designed to support habitat diversity, native forest regeneration, and a local resource-based economy. Forest management plans include a large commitment to maintaining mature forest conditions and protecting designated old-growth forests. Of over 215,000 acres of State Forest lands, 40%+ (over 86,000 acres) is managed for mature or old-growth conditions, including Old-

Growth Ecosystem Management Areas, Wildlands, and Forest Interior. These areas will maintain abundant carbon storage while more actively managed areas will provide higher rates of carbon sequestration over time while contributing a mosaic of more diverse habitats, strategic fire risk reduction, and durable wood products with lower carbon footprints than alternative materials.

MFS will develop and promote dynamic, user-friendly online content accessible through DNR web pages. Content will be structured to enhance landowners' personal understanding and participation in Maryland's climate plans, encouraging increased community engagement and support.

4.1.4 USDA Urban and Community Forestry Program

This program provides funding for boosting the nation's tree cover in urban, suburban and rural communities nationwide, with significant additional funding made available through the Inflation Reduction Act. In 2022 DNR was awarded \$5 million through this program to support urban tree planting, and in 2023 partner groups throughout the state received over \$34 million through this program.

4.1.5 Coastal Wetland Restoration and Management

The CPRG on which Maryland is a partner will provide \$43 million dollars to DNR to be spent over the next 5 years for tree planting, coastal restoration, and conservation planning on lands projected to be impacted by sea level rise to be done in the federally determined Climate & Economic Justice areas on the lower Eastern Shore of Maryland. Starting in January DNR will hire the staff funded under this grant and begin to identify suitable projects for these funds, with implementation to begin in 2026.

4.2 Implementing this Climate Implementation Plan

The below table provides funding estimates for the actions proposed in Part 2. The proposed actions for supporting the CPRP will largely require additional resources to implement and are not immediately actionable with existing funding, programs, or personnel.

Action	Estimated Cost (5 years)	Possible Sources	Available Funding	Anticipated Gap
1. Renewable and Alternative Energy Infrastructure				
1.1 Solar	MPS; 15 projects annually at \$1.2M x 5 years = \$6M	MEA IRS Elective Pay	0	\$6M
1.2 Woody Biomass	1 heating system conversion annually at \$80,000 X 5 years = \$400,000	NRDF	0	\$400,000
1.3 EV Chargers	Level 2 charger dual port at \$30,000 each, estimate 60 installations over 5 years = \$1.8M	IRS Elective Pay DOT		\$1.8M
1.3 EVs	294 Vehicles to be transitioned to EVs. Assume a premium of \$10k per vehicle compared to gas alternative= \$2,940,000	IRS Elective Pay?	Existing budget for vehicle replacement	\$2,940,000, this may be an overestimate as EVs are anticipated to reach price parity with gas vehicles
1.4 Heat Pumps	\$20,000 retrofit avg, for residential units* assume additional 100 units for conversion= \$2M, \$3M for Weaver Building conversion	NRDF?	0	\$5M

1.5 Innovative Technology and Industries	\$5 million	Chesapeake and Atlantic Coastal Bays Trust Fund	\$1 million per year, \$5 million total	\$0
2. Carbon Sequestration				
2.1 Afforestation	\$260 million-estimated cost for planting 5 million trees	Trust Fund, Bay Restoration Fund, NRCS, USFS	\$100+ million (\$100 million state funds, additional federal funds allocated to local/NGOs)	Approximately \$100 million
2.2 Climate Smart Forestry Management	\$1.7 million over 5 years	Woodland Incentive Fund, NRCS RCPP	\$1.7 million (TNC has \$50 million of CPRG funds over the next five years for forest management)	0, but gap is uncertain given uncertain demand
2.3 Blue Carbon	\$35 million over 5 years	EPA CPRG	\$35 million	\$0
2.5 Regenerative Agriculture ⁵	\$1.6M total over 5 years			\$1.6M
Total	\$319.44 M		\$141.7M	\$117.74 M**

* Funding estimates do not account for staff and administrative costs for implementing the proposed actions.

** Available funding + Anticipated Gap does not equal estimated cost due to uncertainty in availability of funding from partners

⁵ Estimating approximately 50 acres in regenerative agriculture in 5 years. Avg \$/acre rent for ag leases on DNR land is \$135. Used 750 as the midpoint between 500 and 1,000 acre goal. Assumed we would gradually increase from 0 ac. to 750 ac. over 15 years, 50 ac./yr. Rent is paid annually, so the total here includes total lost revenue between 2025-2040. More staff for enforcement and inspection, total includes est. \$60K/yr salary for one, full-time Agricultural Planner/Inspector and \$100k for vehicle/equipment/etc. Needed to fulfill this duty. Finding farmers willing to invest money in building infrastructure they do not own is difficult, used \$200k/yr as an estimate for what would benefit regenerative tenants

Part 5: Outcomes from Implementation

Many of the actions outlined below are priorities pulled directly from the Next Generation Adaptation Plan produced by the Adaptation and Resiliency Working Group (ARWG) under the Maryland Commission on Climate Change. Investing in these actions will increase Maryland's resistance to climate change and its associated impacts. Through the implementation of the Next Generation Adaptation Plan, DNR will support Maryland's adaptation through the following actions.

5.1 Climate Jobs and Training

DNR will continue to use its position as the chair of the ARWG to work with other relevant working groups (e.g. Just Transition working [JTWG]) to identify opportunities for workplace upskilling and retraining needs⁶. DNR will implement specific approaches to develop a skilled workforce that can construct and adaptively manage nature-based solutions. Furthermore, DNR's Innovative Technology Fund supports climate job growth and retention. The Department will seek to increase the diversity of participants by leveraging transitional educational opportunities (e.g. conservation corps), involving mentorship for industry professionals, distributing materials in multiple languages, and expanding program outreach to underrepresented communities⁷.

The Office of Outdoor Recreation is partnering with the Park Service, HRS, the Department of Labor, and the Department of Budget and Management to design a registered apprenticeship for Park Technicians. This apprenticeship will train participants in implementing, maintaining, and operating climate adaptation practices such as renewable energy installation, shoreline mitigation, and green infrastructure installation.

5.2 Climate Adaptation & Recreation

DNR's Office of Outdoor Recreation works to engage partners to analyze the impacts of climate change on recreation to plan and accommodate for changing outdoor recreation conditions. This includes working with AllTrails and the UMD PALS program to study the impacts of climate change on state trail systems, and support climate education engagement on our public lands. The inaugural Outdoor Recreation Summit in October 2024, included a session about the impacts of climate change on recreation opportunities across the state and how this impacts outdoor businesses such as ski resorts and outfitters. The Office works to support and promote the connection of trail systems that can be used for commuters wishing to reduce greenhouse gas emissions by opting to travel by foot or bike instead of by car.

⁶ Next Generation Adaptation Plan, Natural Resources and Ecosystems, Resource Ready Priority 3

⁷ Next Generation Adaptation Plan, Working Lands and Natural Resources Based Industries, Investment Needed Priority 2

5.3 Climate Education and Equity

Pursuant to the Maryland Outdoor Learning Partnership EO 01.01.2024.15, DNR will continue its commitment to making Maryland climate-ready by promoting environmental literacy and climate education to create stewardship in our youth. DNR will continue to support meaningful outdoor educational experiences through the K-12 setting and beyond. DNR will continue to support teachers by hosting climate related trainings and support the development of climate related education materials. DNR will also support sustainable schools and green workforce development through partnerships with other state agencies, local education authorities and nonprofits.

DNR is committed to its relationship with communities and local nonprofits. The Department will continue to market outreach events and materials to multicultural communities to include those disproportionately impacted by the effects of climate change. Education will focus on engaging communities to solicit their needs and promoting open space as a mechanism to reduce risk and increase climate resilience⁸, and community health. DNR's existing Recruitment, Retention and Reactivation team and the office of Outdoor Recreation will incorporate adaptation messaging in work with recreational communities and industry partnerships⁹ The Department maintains close relationships with university partners across the state of Maryland and will continue to promote opportunities for fellowships, year of service opportunities, or service corps that support climate adaptation¹⁰.

In furthering the goals of equitably addressing climate, DNR will utilize tools such as the Park Equity Mapper to improve the availability, quality and access to green spaces in historically underserved and environmental justice communities¹¹. DNR will continue to assess access to public land by working with public land managers, community planners and advocates to evaluate existing vulnerabilities to climate impacts and improving messaging about how these lands convey resilience benefits.¹² The Critical Area Program also emphasizes the importance of balancing public access to the water while minimizing natural resource impacts with their "Public Pathways Guidance" document and its specific recommendations on how to best design and construct public trails and riparian access points. With the passage of HB233, their work will also continue to prioritize access particularly in underserved communities and ensure environmental justice is incorporated into projects that require Critical Area Commission approval,¹³ as well as local Critical Area Programs.

⁸ Next Generation Adaptation Plan, Natural Resources and Ecosystems, Investment Needed Priority 3

⁹ Next Generation Adaptation Plan, Natural Resources and Ecosystems, Investment Needed Priority 3

¹⁰ Next Generation Adaptation Plan, Climate Jobs and Training, Investment Needed Priority 2

¹¹ Next Generation Adaptation Plan, Human Health, Resource Ready Priority 1

¹² Next Generation Adaptation Plan, Natural Resources and Ecosystems, Investment Needed Priority 3

¹³ Next Generation Adaptation Plan, Natural Resources and Ecosystems, Investment Needed Priority 3

5.4 Community Adaptation & Local Government Assistance

DNR has been at the forefront of providing technical and financial support to propel community adaptation and ensure local governments have the resources they need to be successful. This includes a specific emphasis to build capacity in small and underserved communities that typically have fewer resources to apply for and manage grants¹⁴. These efforts utilize federal and state funding sources to support local mechanisms like capacity building and resilience authorities and provide data, tools guidance to support planning and decision making processes¹⁵¹⁶. DNR will develop resources and skill-based trainings that show the ecosystem service benefits of Maryland's diverse natural features and how they are essential component of how Maryland's communities will build resilience and adapt to climate impacts¹⁷

5.5 Climate Adaptive Regulations

DNR, as the chair of the Coast Smart Council, will continue to ensure that all state agencies have awareness of and are in compliance with the Coast Smart Construction Program and its affiliated regulations. The Coast Smart Council will explore the expansion of the Coast Smart law to reflect climate hazards across the state of Maryland and to ensure state funding is invested intelligently. New buildings should be sited and designed with climate in mind and balanced with the protection of natural areas.

The Critical Area Commission will promulgate regulations that specify how State agencies and local jurisdictions shall assess and adapt the Critical Area for climate resiliency which includes adapting for sea level rise, saltwater intrusion, wetland migration, storm surge, precipitation-induced flooding and other extreme weather events. Once promulgated, all 64 local jurisdictions with Critical Area Programs will update their Critical Area ordinances to (1) identify areas vulnerable to climate change, (2) include mitigation and adaptation measures that address climate resiliency, and (3) enhance the climate resiliency of the Critical Area by creating, protecting and restoring natural and nature based features. These regulations will address existing development and new development in the Critical Area.

5.7 Ecosystem Service Benefits

The actions described in this climate implementation plan will result in many ecosystem service co-benefits in addition to mitigating carbon emissions. Expanding tree canopy removes pollutants from the air, reducing the risk of health impacts for the surrounding population and has been shown to increase property values. Forests and wetlands filter and take up nutrient and sediment runoff, helping the state to make progress towards water quality goals for the Chesapeake and Atlantic Coastal Bays and protecting our drinking water sources. Natural lands

¹⁴ Next Generation Adaptation Plan, Natural Resources and Ecosystems, Resource Ready Priority 3

¹⁵ Next Generation Adaptation Plan, Natural Resources and Ecosystems, Investment Needed Priority 1

¹⁶ Next Generation Adaptation Plan, Water Resources, Resource Ready, Priority 2

¹⁷ Next Generation Adaptation Plan, Natural Resources, Investment Needed, Priority 1

provide habitat for the wildlife of Maryland, helping to combat another global crisis, that of biodiversity loss. Using DNR's Accounting for Maryland's Ecosystem Services framework¹⁸, the actions laid out in this plan are likely to increase ecosystem services in the state by approximately \$20 million per year in non-market benefits.

5.8 Climate Adaptive Land Management

In support of DNR's carbon sequestration goals, DNR is committed to adaptively managing our state lands to support the long-term preservation of our ecological, historical, cultural, and recreational resources. DNR will continue developing climate adaptation plans for state-owned lands¹⁹ and to incorporate climate change considerations into land acquisition criteria to address land retention and aquatic habitat changes²⁰. These strategies will be inclusive of interests and address issues of affected farmers, foresters, watermen, and landowners. Where feasible, strategies will take a regional scope²¹. DNR will develop tools and raise awareness of available resources to support adaptive management on non-state-owned lands, scaling potential carbon sequestration benefits across the state²². One such set of tools are Coastal Resilience Easements and Coastal Resilience Management Tools. These easements support private landowners in adapting their lands to sea level rise impacts, supporting the inland migration of coastal marshes, and integrating climate smart management into existing forestry and agricultural easement terms.

5.9 Climate Adaptive Habitat & Species Management

Natural resource management for carbon sequestration will also evaluate potential impacts and climate adaptation opportunities for critical habitats and species. DNR aims to develop conservation targets for habitat types to ensure the longevity of critical habitats²³ and the benefits they provide. DNR will also develop or re-design management, restoration, and monitoring plans and strategies that reflect anticipated future conditions to aid in planning for climate change impacts to Maryland's habitats, species²⁴, and carbon sinks. DNR developed the Habitat Connectivity Network that identifies habitat "hubs", blocks of forests and wetlands meeting scientifically determined size criteria, and the "corridors" between these hubs that are most likely to facilitate species movement, viewable on the Maryland Greenprint Webmap²⁵. DNR aims to identify a suite of climate variables that should be measured to understand climate adaptation of Maryland's water resources²⁶.

¹⁸ <https://dnr.maryland.gov/ccs/Pages/Ecosystem-Services.aspx>

¹⁹ Next Generation Adaptation Plan, Natural Resources, Investment Needed, Priority 1

²⁰ Next Generation Adaptation Plan, Working Lands, Resource Ready, Priority 1

²¹ Next Generation Adaptation Plan, Working Lands, Investment Needed, Priority 1

²² Next Generation Adaptation Plan, Natural Resources, Investment Needed, Priority 1

²³ Next Generation Adaptation Plan, Natural Resources, Resource Ready, Priority 1

²⁴ Next Generation Adaptation Plan, Natural Resources, Resource Ready, Priority 1

²⁵ <https://geodata.md.gov/greenprint/>

²⁶ Next Generation Adaptation Plan, Natural Resources, Resource Ready, Priority 1