Roots for Resilience: Strong Roots for a Changing Landscape - Living Shorelines

Targeting Layers Map

Technical Guide

01

Tool explanation

We encourage users to navigate to [the Targeting Map link](#) while reading through this guide in order to familiarize themselves with the features and uses of the tool.

Living shoreline in Wicomico County. Photo by Maggie Cavey (DNR).

Overview

The State of Maryland received funding through a Climate Pollution Reduction Grant (CPRG) from the U.S. Environmental Protection Agency (EPA). This grant funding will support efforts to enhance carbon sequestration and reduce greenhouse gas emissions through the conservation and restoration of natural resources, while also strengthening community resilience to climate-related hazards. To achieve these goals, Maryland Department of Natural Resources (DNR) will support a suite of nature-based climate solutions, including living shoreline (LS) restoration projects. To lead this work, DNR launched Roots for Resilience: Strong Roots for a Changing Landscape—a new initiative focused on supporting Maryland's Lower Eastern Shore adapt to the impacts of climate change. Through the Roots for Resilience Initiative, DNR has committed to protect 400 acres of wetlands on the Lower Eastern Shore of Maryland by funding LS projects. To support project selection, DNR developed a [Targeting Map](#) to help applicants identify suitable locations for living shoreline projects.

Purpose

[The Targeting Map](#) provides information on site eligibility, land ownership, and estimates of potential benefits and limitations of living shoreline projects across different areas. It is intended to help applicants understand the environmental context of proposed sites and ensure their projects align with both the eligibility criteria and the broader goals of the *Roots for Resilience* Initiative.
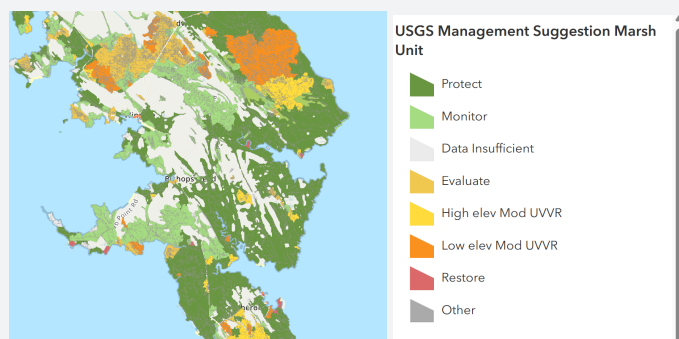
Users

The tool is a simple web map that allows users to toggle on and off layers that will be helpful for assessing project benefits. Users are expected to be potential applicants to DNR's solicitation for LS projects that will restore coastal shorelines and protect tidal marsh habitat, while supporting DNR's *Roots for Resilience* commitments. The Request for Proposals (RFP) invites applications to be submitted for the design, construction, and/or design/build of living shoreline projects on the Lower Eastern Shore. Applications are due 4/6/2026. Contact Ari Engelberg for more information at [Ari.Engelberg@maryland.gov.](mailto:Ari.Engelberg@maryland.gov)
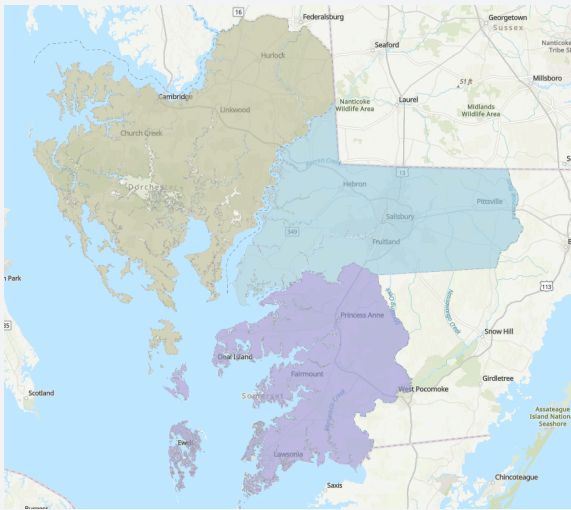
Key features

The tool is a simple web map that allows users to toggle on and off layers that will be helpful for assessing project benefits.

| → Project siting	→ Marsh status
	The tool includes a layer provided by USGS "USGS Fabric Coastal View" that uses marsh health and elevation to categorize marshes into

The tool includes a layer of three counties "CPRG Counties" where living shorelines projects can be sited under the CPRG funding: Dorchester, Wicomico, and Somerset.

four categories: restore, protect, evaluate and monitor. This layer can be used to prioritize the location of a living shoreline. For example, if a living shoreline proposal will include some marsh restoration, and the marsh close to the shoreline is "protect" or "monitor" versus "restore" or "evaluate", this could prioritize where that practice is proposed.

➔ Marsh size estimation
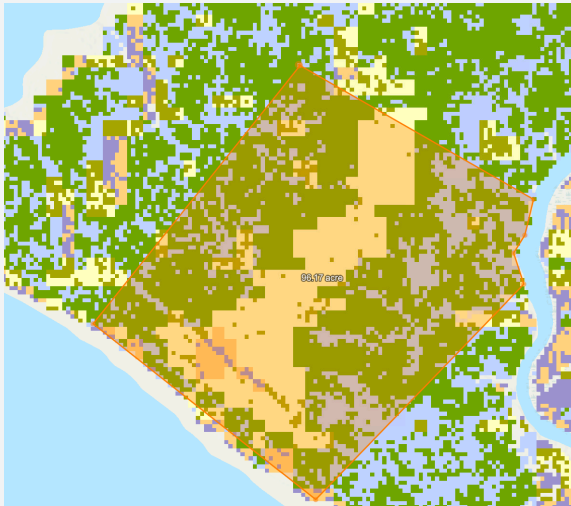
The "USGS Fabric Coastal View" layer can be used to estimate the marsh size behind a potential living shoreline project. Users can use the straight line measurement to estimate the length of the living shoreline, and then the area

➔ Shoreline Management Model

The map includes a group VIMS' Shoreline Management Model related layers (MD Inventory and SMM Layers). This group includes multiple sublayers, one of which is "Maryland

measurement to estimate the marsh protected by the potential living shoreline. For most applicants, we recommend measuring up to a maximum of 1000 meters into the marsh behind the living shoreline. The exact boundary may vary based on hydrologic barriers that can impede wave action such as roads, large channels, elevation changes or marsh unit boundaries.

SMM" which is automatically turned on. This model shows the recommended practices for a shoreline - either "living shoreline (blue)", "undetermined (yellow)" or "structural shoreline stabilization measure(orange)". This can help users determine if a shoreline is suitable for living shoreline work. This group also includes "SAV Habitat 2016-2020" which can be useful for understanding permitting roadblocks for a shoreline.

➜ Public lands, parcel boundaries
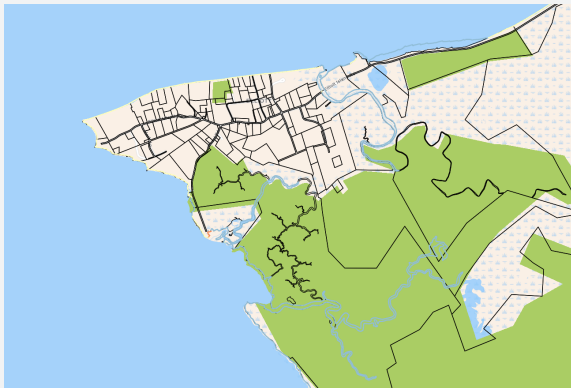
Applicants may use any combination of the layers "MD Protected Lands", "MD Protected Lands - DNR Owned Lands within CPRG", and "MD Parcel Boundaries" to prioritize public lands such as MD DNR owned lands to propose for living shorelines projects.

➜ Additional layers
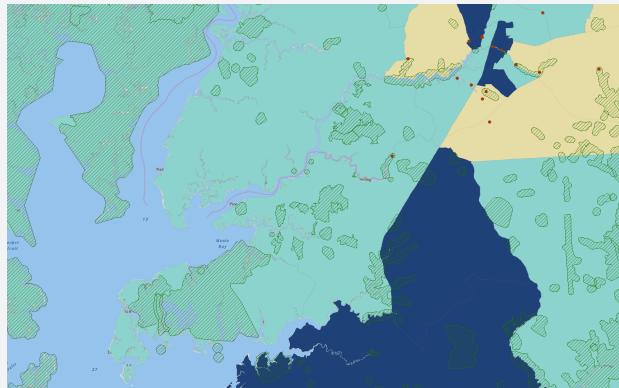
The mapper includes additional layers that users can explore and use as they deem necessary. Some of the additional layers that may be useful are the "MD Shoreline Changes-Raters of Change Transects" to estimate the erosion or accretion that has occurred on a shoreline in the past, the "MHHW Coastal Explorer" layer to see where the high water line is on a shoreline, and the "MD WetlandAdaptationtoSealevelRise" layers to understand future marsh migration and wetland adaptation areas.
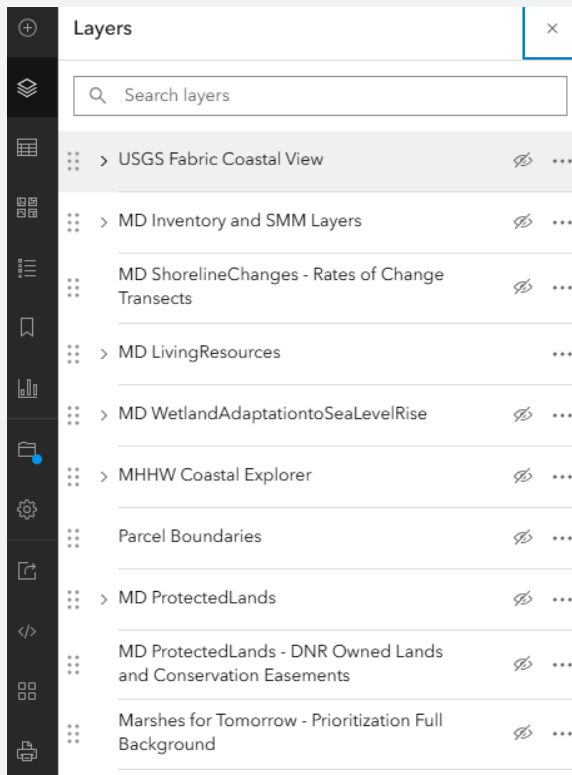
Living shoreline in Chestertown, MD. Photo by CBP.

TIPS AND TRICKS

The map is created using ESRI Web Mapping, so we have provided some tips below about using this type of mapper below.

➔ Turning on and off layers

Along the left side of the tool are a number of views. You will notice the layers being shown on the map are listed, and there is an "eyeball" (👁) to the right side of each layer that allows users to toggle on and off the layers. Many of the layers have sublayers that can be viewer by clicking the small arrow (>) just to the left of the layer group to drop down the list of sublayers.

➔   The measure tool
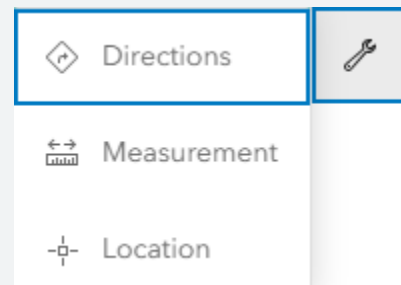
There is a bar on the right side of the map that includes a wrench tool which is where the "measurement" tool is located. This is a useful tool for quick rough estimates of length of shoreline (meters preferred) and area of marsh behind shoreline (square meters or acres preferred).

MD ProtectedLands - DNR Owned Lands and Conservation Easements

Print

Marshes for Tomorrow - Prioritization Full Background
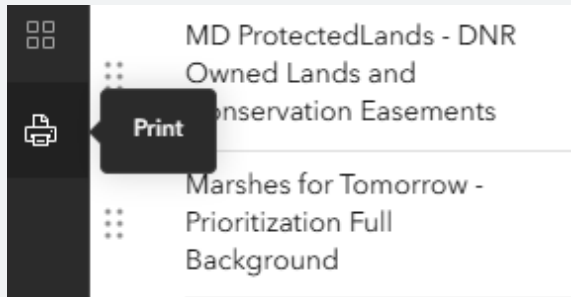
At the bottom of the tools on the left is a printer icon. This can be used to save a PDF of the map view, including legend, which can be inserted in a proposal.

Layers

×

Search layers

› USGS Fabric Coastal View

› MD Inventory and SMM Layers

Legend

horelineChanges - Rates of Change Transects
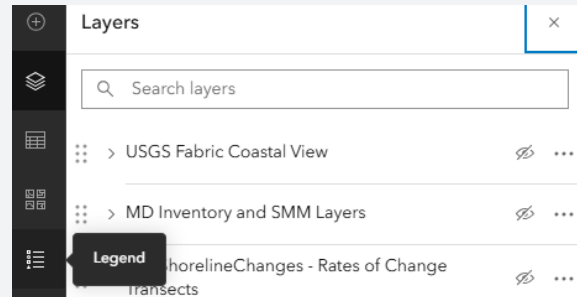
The legend for the layers currently displayed on the map can be displayed by clicking on this icon.

02

Tool documentation

LAYER RESOURCES

Explanation for each layer and layer simplified metadata

🌎**USGS Management Suggestion Marsh unit**

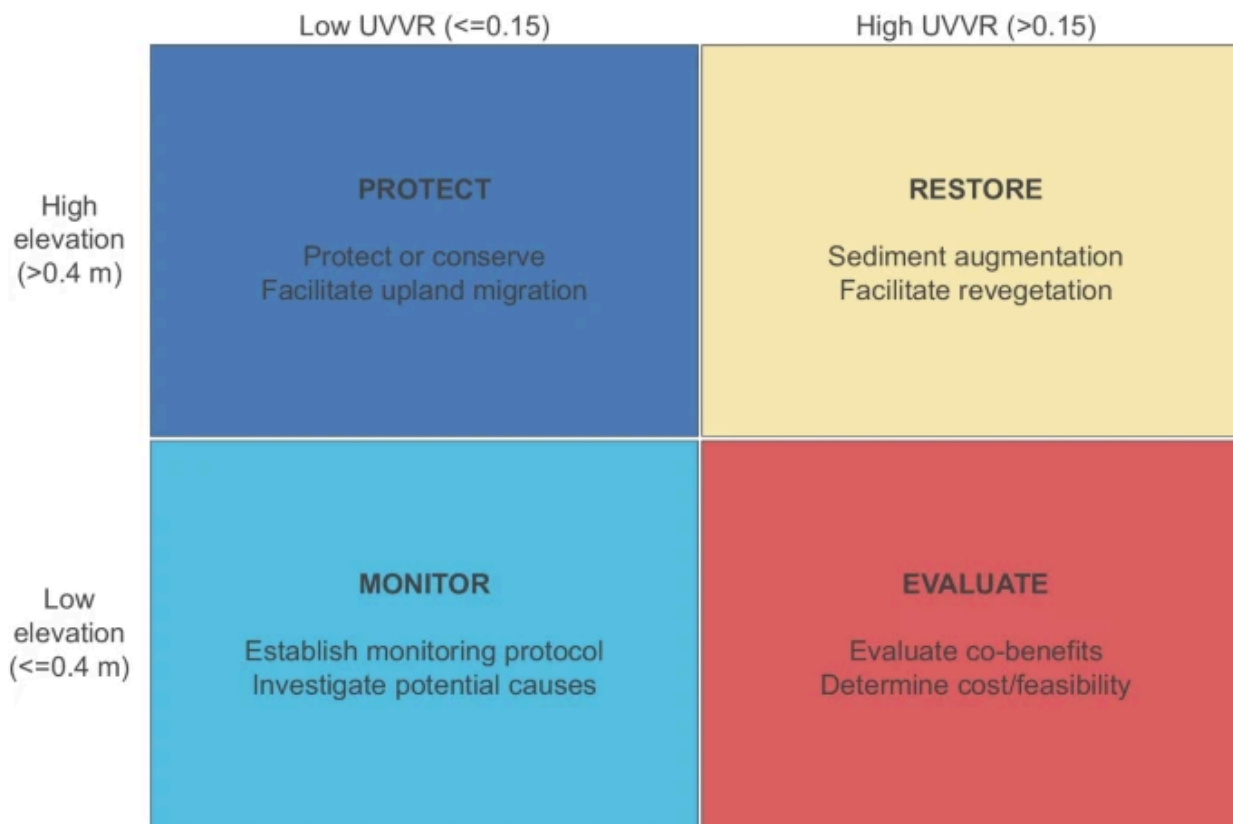**Source:** [USGS Fabric](), analyzed and republished by Maryland DNR Watershed and Climate Services Unit for use within the Marsh Protection Index. Data in review for iMap publishing. Additional information [here]().

Description: USGS characterized 'Conceptual Marsh Units (CMU's)' summarized by the dominant 'management suggestion' category that characterizes the marsh unit allowing for easier interpretation. A CMU is a digitally delineated section of salt marshes, created using high-resolution elevation data (DEMs) and flow accumulation, to help managers assess marsh vulnerability and ecosystem services by defining **distinct drainage areas** and identifying critical features like drainage points and ridge lines for understanding water flow and resilience to sea-level rise. See matrix below for how each management suggestion is defined by USGS.

Use status: Key decision layer

Suggested use: Determine overall marsh area condition as it relates to health/stability (UVVR) and elevation. Users can prioritize one part of a shoreline based on the management suggestion for any specific unit, for example a 'protect' or 'monitor' unit may be prioritized for restoration/living shoreline protection over an 'evaluate' or 'restore' unit.

Fig. 8

	Low UVVR (<=0.15)	High UVVR (>0.15)
High elevation (>0.4 m)	**PROTECT** Protect or conserve Facilitate upland migration	**RESTORE** Sediment augmentation Facilitate revegetation
Low elevation (<=0.4 m)	**MONITOR** Establish monitoring protocol Investigate potential causes	**EVALUATE** Evaluate co-benefits Determine cost/feasibility

Restoration decision matrix based on elevation and UVVR thresholds. Ensuing map (Fig. 9) uses a 0.4 m vegetated plain elevation threshold, and the established 0.15 UVVR threshold. Decisions within the matrix represent potential options; managers with specific mandates and considerations must establish options that conform to their goals, objectives, and constraints

(**Full size image >**)

See more details on the above matrix in white paper here
https://link.springer.com/article/10.1007/s12237-023-01275-x#Sec7

🌍USGS Fabric coastal View

Source: USGS Fabric. Additional information here.
Description: Data provided by USGS showing a combination of UVVR and elevation, at a finer scale than the version above. See more details on this calculation here
https://link.springer.com/article/10.1007/s12237-023-01275-x#Sec7
Use status: Contextual
Suggested use: Additional analysis of marsh area condition, at a finer scale. Automatically turned off in map but can be toggled on.

🌎MD Inventory and SMM Layers

Source: Maryland Department of the Environment's and Virginia Institute of Marine Sciences [Maryland Shoreline Stabilization Mapper](#). [REST Directory](#).
Description: VIMS/MDE classification of all Maryland shorelines with suggestions of the type of shoreline best suited for the area: living shoreline, structure shoreline, or undetermined.
Use status: Key decision layer
Suggested use: Users can determine locations where a structural shoreline or living shoreline would be best suited, and get an idea of the permitting that would be required for an area of interest.

🌎MD Shoreline Changes - Raters of Change Transects

Source: [Maryland DNR](#)
Description: To quantify rates of change (erosion or accretion) along coastal and estuarine shorelines in Maryland, the Maryland Geological Survey (MGS), in conjunction with Towson University's Center for Geographic Information Sciences (CGIS) and the U.S. Geological Survey (USGS), installed and ran a computer program, the Digital Shoreline Analysis System (DSAS), using as input a series of digital shoreline vectors dating from 1841-1995. Shorelines were derived from three sources: (1) maps from a Historical Shorelines and Erosion Rates Atlas (Conkwright, 1975), (2) Coastal Survey maps (topographic or T-sheets) produced by the National Ocean Service (NOS), a branch of the National Oceanic and Atmospheric Administration (NOAA), and (3) a digital wetlands delineation based on photo interpretation of digital orthophoto quarter quads. DSAS constructed a "baseline" landward of and approximately parallel to the shorelines, inserted nodes every 20 m along the baseline, and cast straight-line transects from each node, perpendicular to the baseline, across the shorelines. Based on the time elapsed and the along-transect distance between shoreline pairs, DSAS calculated rates of change for each transect.

Subsequently, updates began in 2015 is updating by county the DSAS process using newer Shoreline data and refined calculations to update the Rates of Change erosion values by county. Currently Anne Arundel,

Baltimore, Calvert, Harford and Prince George's counties have the newest erosion rate values contained in this Data set.

Use status: Key decision layer

Suggested use: Users can use this dataset to determine if a shoreline is accreting sediment, or eroding and the rate of the erosion if that is the case.

🌎MD Living Resources

Source: [Various, hosted on MD DNR Coastal Atlas](#)

Description: A composition of layers pertaining to habitat establishments and diversity for select species throughout Maryland's Chesapeake and Coastal Bays.

Use status: Contextual

Suggested use: Layers within the living resources group can be used to further understand impacts to wildlife, including waterfowl habitats and sensitive species.

🌎Active Aquaculture Leases

Source: [Maryland Aquaculture Siting Tool](#)

Description: Layer showing active aquaculture leases in Maryland that may impact siting for living shorelines.

Use status: Decision layer

Suggested use: Turn on to see where aquaculture leases are sited in Maryland and for users to avoid building a living shoreline where a lease may be impacted.

🌎SAV Protection Zones View

Source: [Maryland Aquaculture Siting Tool](#)

Description: Layer showing buffer of SAV from 2019-2023 in Maryland that may impact siting for living shorelines.

Use status: Decision layer

Suggested use: Turn on to see where the SAV buffer lies for users to avoid building a living shoreline or understand the permitting complications with building a living shoreline close to the SAV boundary.

🌎MD Wetland AdaptationtoSeaLevelRise

Source: [MD DNR](#)

Description: In the Chesapeake Bay, relative sea level rise (SLR) is impacting coastal lands at some of the highest rates in the U.S. Identifying long-term planning options to increase resiliency against coastal storm surge, flooding, and erosion is an important step in protecting Maryland's coastal zone. Much of our natural buffering capacity against these coastal hazards comes from our coastal wetlands. In order to better understand the impacts sea level rise may have on the state's coastal marsh system, the Sea-Level Affecting Marshes Model (SLAMM) was run for all 16 coastal counties and Baltimore City. The results of SLAMM were analyzed for specific conservation criteria for long-term planning that may help increase coastal resiliency in Maryland. The conservation criteria include areas that may support future wetland migration; wildlife habitat and corridors; high priority terrestrial living resources; vulnerable wetland habitat; and suitable hydric soils for wetland establishment. From these criteria, a conservation model was developed to prioritize the most important areas for wetland adaptation. As a result, the top priorities were used to create the Wetland Adaptation Areas (WAA) in three future timesteps: 2050, 2070, and 2100. Within the 2021 SLAMM run, it is projected that Maryland's coastal waters will rise by 1.37 feet in 2050, 2.32 feet in 2070, and 4.03 feet under a scenario of rising greenhouse gas emissions with a probability of at least 17%, using reported base sea levels in the year 2010. For more information and results from Maryland's 2021 SLAMM run, please refer to Warren Pinnacle Consulting, Inc. https://warrenpinnacle.com/prof/SLAMM/EESLR_MD/ For more information on the SLR projections that the EESLR study is based on, please refer to the 2018 UMCES SLR Report: https://www.umces.edu/sites/default/files/Sea-Level%20Rise%20Projections%20for%20Maryland%202018_0.pdfLast Updated: 05/23/2023 Note: In ArcGIS Online web maps, the raster service displays with all layers displayed. In ArcMap and ArcPro the layers can be added individually to a map.

Use status: Contextual

Suggested use: Multiple layers available, users can look at future wetland migration areas by using "Wetland Adaptation Areas 2050", "Wetland Adaptation Areas 2070" and "Wetland Adaptation Areas 2100".

🌎MHHW Coastal Explorer

Source: [Maryland DNR Coastal Flood Explorer](), [Layers here]()

Description: This dataset represents flood inundation values derived from a modified bathtub model. It employs a simplified hydrologic connection approach rather than a full engineering-grade hydrologic network analysis. To improve data clarity, presumed hydrologically unconnected inundation areas smaller than 1/10 acre have been removed to reduce noise in the underlying elevation data. Additionally, areas presumed hydrologically unconnected and larger than 1/10 acre have their expected depth values reset to an unknown placeholder (e.g., 99999) to highlight their unverified status.The base elevation data are sourced from the most recent county LiDAR collection available at the time of the study, with datum transformations applied from NAVD88 to tidal MHHW using corresponding NOAA tide stations as control points. The methodology is adapted from NOAA's "Detailed Method for Mapping Sea Level Rise Inundation" (January 2017): NOAA Report.https://coast.noaa.gov/data/digitalcoast/pdf/slr-inundation-methods.pdfLast Updated: 03/03/202

Use status: Contextual

Suggested use: Use this layer to identify the high water line on the shoreline being considered for restoration.

🌎Dead Tree Density Hotspots

Source: University of Virginia

Description: Tree death density within tree death hostspots in the Eastern US. Results from individual tree detection using sub-meter airborne imagery and deep learning. The dead tree count map displays number of dead trees per hectare, taking place within 50 m above sea level and 10 km from the coast. Hotspots highlight areas below 5 m elevation with clustered dead trees. Note that insect- or fire-induced mortality was not masked out in the map. See more information here: https://www.researchsquare.com/article/rs-6396849/v1 or here: https://ee-chihgyeung.projects.earthengine.app/view/treedeath-atlanticus

Use status: Contextual

Suggested use: Users are encouraged to use this layer to identify ghost forest locations in the vicinity of the area where work is proposed. Where a ghost forest is present, restoration may provide further protection of the wetlands and people behind them.

🌎Parcel Boundaries

Source: [Maryland Department of Planning](#)

Description: This dataset contains parcel polygons of the entire state. Minimum attributes are available. This data is used to make a cached map service. For more information see https://planning.maryland.gov/pdf/OurProducts/propertyMapProducts/mdpusr.pdf

The parcel polygons can be downloaded from the Maryland Department of Planning's website at https://planning.maryland.gov/Pages/OurProducts/DownloadFiles.aspx.

Use status: Contextual

Suggested use: Identifying where one parcel ends and the next begins. For ease of data loading, users are not able to click on a parcel to identify ownership. For more information on parcel ownership, visit [MERLIN Online](#).

🌎MD ProtectedLands

Source: [Maryland Department of Natural Resources](#)

Description: Polygon boundaries of various protected lands in Maryland including: DNR Owned Properties and Conservation Easements, Rural Legacy Properties, MD Environmental Trust Easements, Forest Conservation Act Easements, MD Agricultural Land Preservation Foundation Easements, Local Protected Lands, Coastal and Estuarine Land Conservation Program, Private Conservation Lands and Protected Federal Lands. Information on the number of acres protected in Maryland can be found on the Maryland Protected Lands Reporting site at http://dnrweb.dnr.state.md.us/gis/plreports/.

Use status: Contextual

Suggested use: Identify already protected lands that may be more likely to host a living shoreline or restoration project.

🌎MD Protected Lands - DNR Owned Lands within CPRG

Source: [Maryland Department of Natural Resources](#)

Description: Polygon boundaries of DNR Owned Properties within the CPRG project area boundaries.

Use status: Contextual

Suggested use: Identify already protected DNR lands that may be more likely to host a living shoreline or restoration project.

🌎Marshes for Tomorrow - Prioritization Full Background

Source: [Marshes for Tomorrow](#)

Description: Marshes for Tomorrow identified "Priority Marsh Areas" within the project focal geographies, for long-term maintenance through restoration, as high marsh habitat for Saltmarsh Sparrow. Resources should be focused on Priority Marsh Areas, and restoration projects implemented according to a schedule. The full list of criteria considered in the marsh prioritization is provided in Table 1 below. Four of the criteria were included as weighted factors in a Prioritization Model, and the other five criteria were considered separately as visual overlays.

Use status: Contextual data, if interested in saltmarsh sparrow

Suggested use: If users would like to further prioritize marshes, one can use this layer to see how Audubon and the Marshes for Tomorrow project prioritized marshes for Saltmarsh Sparrow habitat.

🌎Climate Vulnerability Score

Source: [Maryland EnviroScreen](#)

Description: The Climate Vulnerability Score (CVS) evaluates communities disproportionately affected by climate impacts at the census tract level using MDEnviroScreen's Environmental Justice Score as a proxy for underserved and overburdened communities, the proportion of tree canopy cover within a census tract, and its exposure to four additional climate indicators. The four additional climate indicators are 1. Urban Heat Island: Identifies certain areas of cities that are hotter than the average temperature for that same city based on heat severity 2. Drought: Maps the percent area and intensity of drought conditions over time from abnormal to exceptional and 3. Storm Surge and 4. Flooding: Identifies watersheds with significant existing and future flood impacts (coastal, riverine, pluvial) based on potential for run-off, risk to infrastructure, and historical and future flood risk. Together these datasets define climate vulnerability as a function of climate exposure and community impact to classify communities as having a baseline, low, moderate, or high vulnerability. Read the full methodology [here](#).

Use status: Decision layer

Suggested use: Users can explore climate vulnerability score for the area where a potential project will be proposed and use higher scores to prioritize projects. The layer displays the overall score but can be toggled for users view how each area scored for different indicators such as flooding & storm surge, canopy cover, or EJ percentile.

🌎MD Dasymetric Mosaic

Source: [Maryland Restoration and Resilience Mapper](#) and [UMD](#)
Description: a 30-m resolution population estimate for Maryland. The workflow dasymetrically distributes Census block level population estimates across all non-transportation impervious surfaces within each Census block.
Use status: Contextual layer
Suggested use: Determining if there are homes or small communities close by to a potential living shoreline project location.

🌎CPRG Living Shorelines Counties

Source: [Maryland iMap](#)
Description: Counties included in the CPRG funding: Dorchester, Somerset, and Worcester Counties.
Use status: Decision layer
Suggested use: Determining if your potential project falls within the CPRG funding area.

ADDITIONAL INFORMATION RELATED TO THE CPRG GRANT

The CPRG Grant also includes funding to promote tree planting, coastal habitat restoration, and community engagement. Please use some of the links below to explore other parts of the project.

[Overview of the grant](#)

[Article about the award](#)

[DNR's Roots for Resilience Webpage](#)