Land Trust Roundtable

May 15, 2025

Maryland Environmental Trust

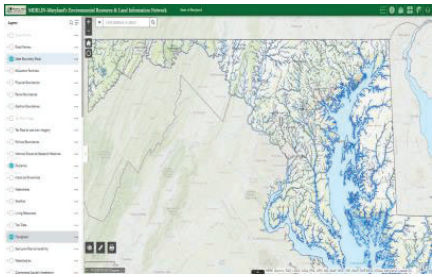
From Data to Conservation

How Maryland's Land Mapping Tools Support Conservation Strategy

Agenda

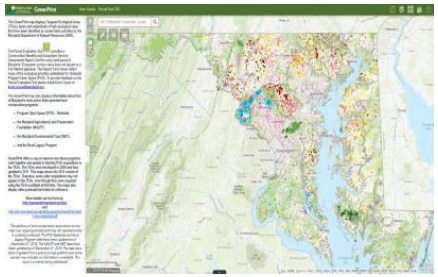
This Roundtable, *From Data to Conservation: How Maryland's Land Mapping Tools Support Conservation Strategy,* will highlight the State's land conservation data and interactive mapping tools. Presentations will include a refresh on the State's efforts to collect comprehensive land trust and local conservation organization, an overview of the different types of data that have been received and updated (since March 2024) and a closer look at how to use Maryland's mapping and planning tools.

Maryland's Mapping Tools



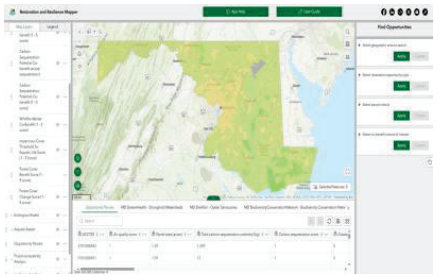
MERLIN

MERLIN Online is part of the MD iMap mapping system. MERLIN allows users to view spatial data and to use that information to make better informed decisions. It allows users to produce a custom map of any location in Maryland, including their choice of base maps and data layers.



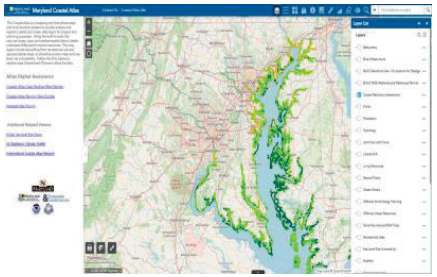
GreenPrint Map

The GreenPrint map displays Targeted Ecological Areas, lands and watersheds of high ecological value that have been identified as conservation priorities by DNR. The map includes the Parcel Evaluation Tool which provides a Conservation Benefits and Ecosystem Service Assessment Report Card for every land parcel in Maryland.



Resilience and Restoration Map

The Resilience and Restoration Map supports restoration and climate resilience activities in Maryland. The tool contains a collection of environmental, hydrological, and social datasets to support landscape and parcel assessment activities. The map includes the "find opportunities" tool.



Coastal Atlas

The Coastal Atlas that allows state and local decision-makers to visually analyze and explore coastal and ocean data layers for project and planning purposes. In addition to the coastal datasets, online tools have been developed to help address specific coastal issues.

A big **THANK YOU** to today's planning team and presenters!

Elliot Campbell, PhD (Watershed and Climate Services, DNR)
Kevin Coyne (Watershed and Climate Services, DNR)
Deborah Herr Cornwell (Natural and Working Lands Unit, MDP)
Rachel Bacher Donnelly (Watershed and Climate Services, DNR)
Jason Dubow (Research, Review and Policy Division, MDP)
Meagan Fairfield-Peak (Geospatial Data & Analysis, MDP)
Rachel Marks (Watershed and Climate Services, DNR)
Ellen Mussman (Geospatial Data & Analysis, MDP)
John Turgeon (Maryland Environmental Trust, DNR)

Maryland Environmental Trust

Maryland
DEPARTMENT OF PLANNING

MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

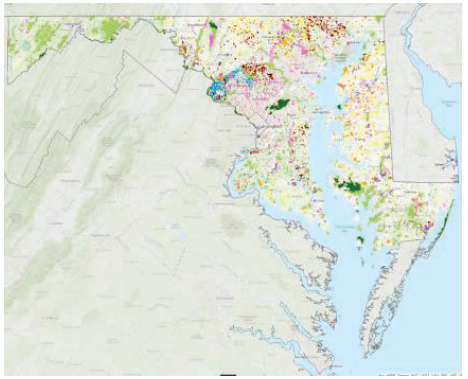
Importance

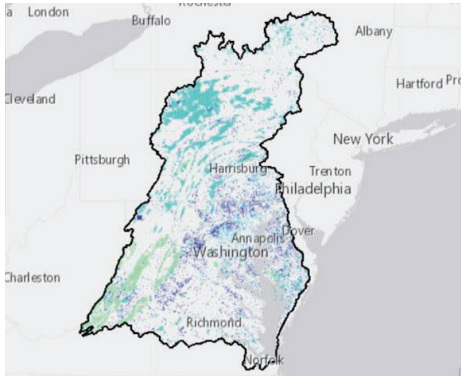
"For decades, partners of the Chesapeake Bay have permanently protected lands with cultural, historical, ecological and agricultural value by holding easements, accepting donations and purchasing properties and development rights. Because protected lands can support sustainable fisheries and wildlife habitat, protect clean water and healthy watersheds, and preserve our cultural values, putting land under protection is one way to ensure the watershed withstands population growth and sustains the plants, animals and people that live here."

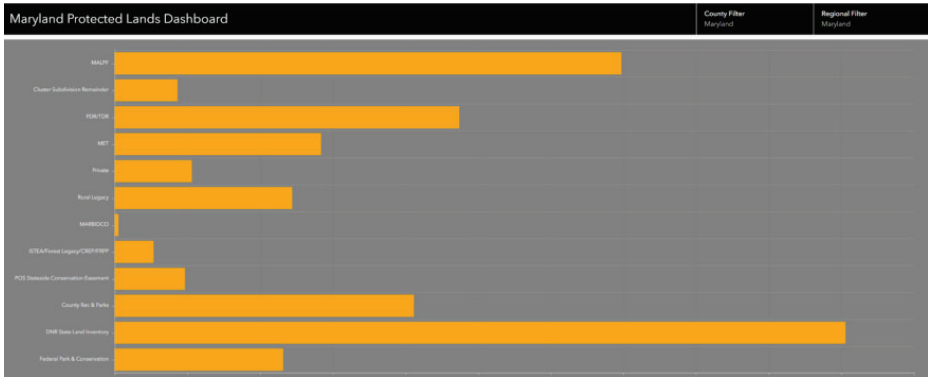
Chesapeake Bay Program. "Protected Land In The Chesapeake Bay Watershed Hits 9.1 Million Acres". 2023. https://thebaynet.com/protected land in the chesapeake bay watershed-hits-9 1 million-acres/

Presentation Outline

1. Outreach for Land Trust Conservation Data - March 2024 Webinar Recap
2. Tabular vs. GIS Data
3. Data Collection
4. March 2024 Update
5. Fall 2024 GIS Update
6. Protected Lands Dashboard
7. Maryland the Beautiful







Outreach for Land Trust Conservation Data - March 2024 Webinar Recap

MET identified 55 conservation organizations working to protect land throughout the state of Maryland .

In March 2024, MET held a joint webinar with DNR and MDP to discuss ways land trusts can share their information so that it can be added into the state's datasets.

Project Summary

Goals:

- To collect the very best and most comprehensive land trust and private conservation organization data.
- Provide accurate mapping of land trust data.
- Ensure that all of solely held land holdings are distinguished and publicized online, such as through the Maryland Protected Lands Dashboard, MERLIN and MD iMap.

Purpose:

- Provide an accurate picture of what lands are currently protected. Information can be used by land trusts to prioritize protection of new land.
- Mapping GIS data enables the Chesapeake Bay Program to track progress toward the Chesapeake Bay Watershed agreement goals.
- Ensures that measurements of progress towards cumulative land preservation goals (e.g., 40% by 2040 goal) are accurate.

Tabular vs. GIS Data for Private Conservation Lands

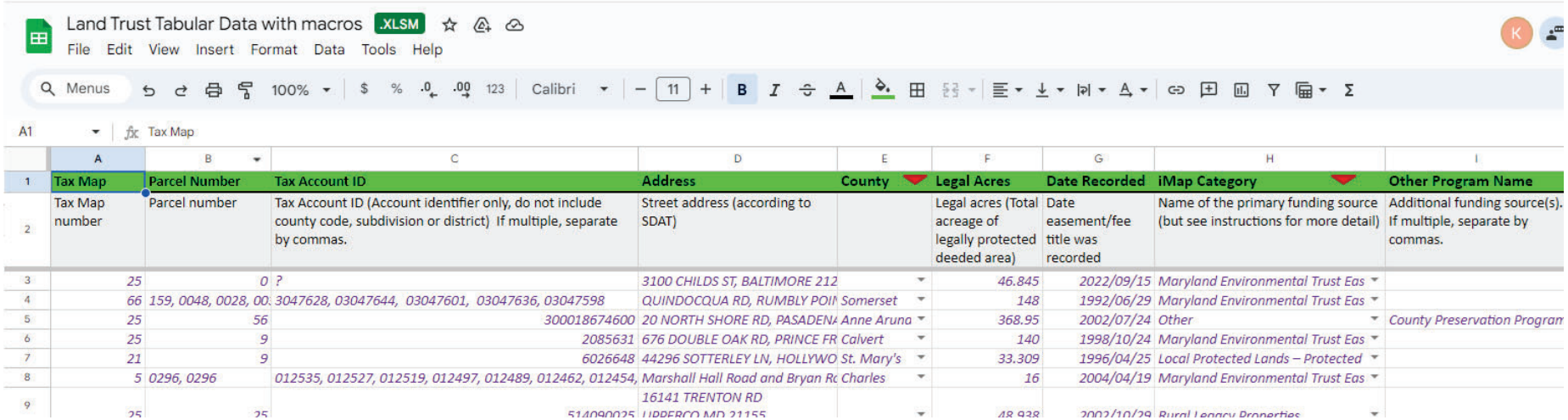
Tabular Data (shown on Dashboard)

- Includes the exact acreage of the easement based on the deed
- May or may not include GIS data
- Reported through LPPRPs (last updated 2022)

GIS Data

- Often includes the entire polygon
- Could be co held with over easement holders such MET, MAPLF, Rural Legacy
- Provided to Counties for their integration or provided directly to DNR/MDP to include on iMap
- Visualized in mapping applications

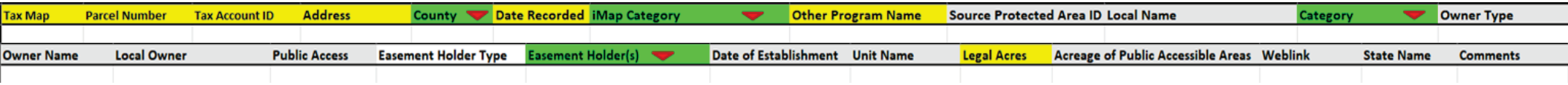
Data Collection - Tabular



	A	B	C	D	E	F	G	H	I
1	Tax Map	Parcel Number	Tax Account ID	Address	County	Legal Acres	Date Recorded	iMap Category	Other Program Name
2	Tax Map number	Parcel number	Tax Account ID (Account identifier only, do not include county code, subdivision or district) If multiple, separate by commas.	Street address (according to SDAT)		Legal acres (Total acreage of legally protected deeded area)	Date easement/fee title was recorded	Name of the primary funding source (but see instructions for more detail)	Additional funding source(s). If multiple, separate by commas.
3	25	0	?	3100 CHILDS ST, BALTIMORE 212		46.845	2022/09/15	Maryland Environmental Trust Eas	
4	66	159, 0048, 0028, 00	3047628, 03047644, 03047601, 03047636, 03047598	QUINDOCQUA RD, RUMBLY POI	Somerset	148	1992/06/29	Maryland Environmental Trust Eas	
5	25	56	300018674600	20 NORTH SHORE RD, PASADENA	Anne Aruna	368.95	2002/07/24	Other	County Preservation Program
6	25	9	2085631	676 DOUBLE OAK RD, PRINCE FR	Calvert	140	1998/10/24	Maryland Environmental Trust Eas	
7	21	9	6026648	44296 SOTTERLEY LN, HOLLYWO	St. Mary's	33.309	1996/04/25	Local Protected Lands – Protected	
8	5	0296, 0296	012535, 012527, 012519, 012497, 012489, 012462, 012454,	Marshall Hall Road and Bryan Rc	Charles	16	2004/04/19	Maryland Environmental Trust Eas	
9				16141 TRENTON RD					

- Our spreadsheet is designed to capture the necessary data to identify and map your organization's protected lands.
- Includes the exact acreage of the easement based on the deed
- Includes the same fields as our GIS (with additional information for mapping purposes)

Instructions for the spreadsheet



Tax Map	Parcel Number	Tax Account ID	Address	County	Date Recorded	iMap Category	Other Program Name	Source Protected Area ID	Local Name	Category	Owner Type
Owner Name	Local Owner	Public Access	Easement Holder Type	Easement Holder(s)	Date of Establishment	Unit Name	Legal Acres	Acreage of Public Accessible Areas	Weblink	State Name	Comments

Required Fields

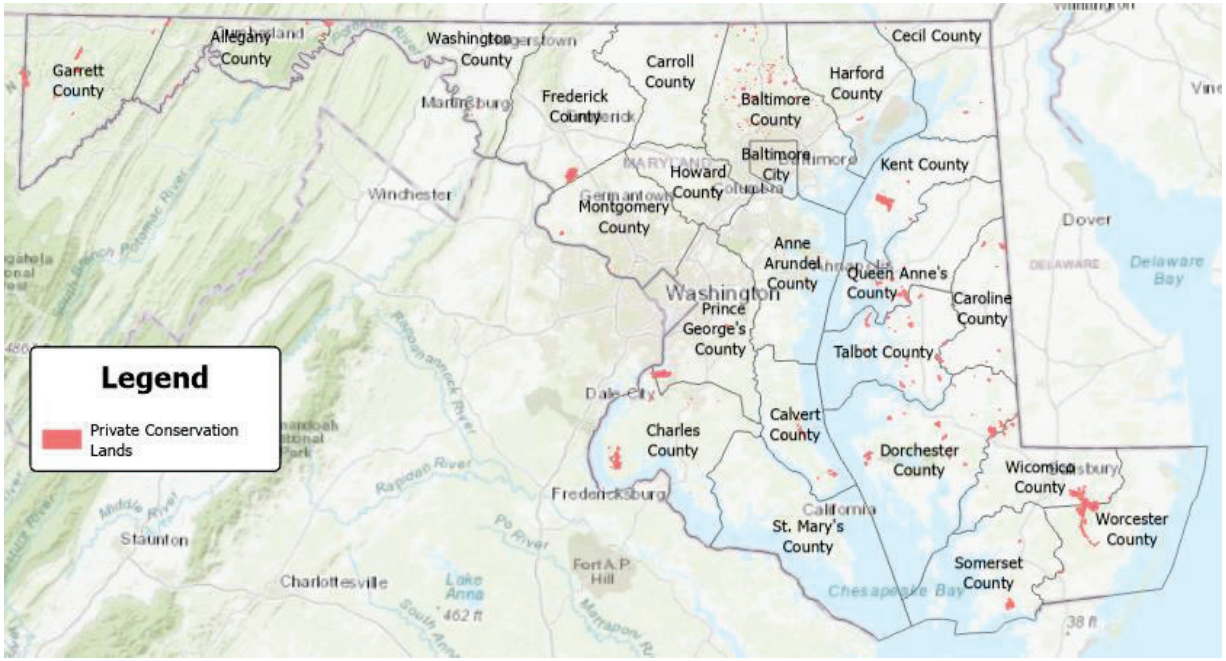
- Column highlighted in yellow are required fields
  - Location based field; Tax Map, Parcel Number, Tax Account ID, Address
  - Date Recorded (YYYY/MM/DD)
  - Other Program Name - secondary funding sources
  - Legal Acres
- Columns highlighted in green with a ▼ are required fields and have a drop down menu for selecting values.
  - County - MD Jurisdiction
  - iMap Category - name of funding source
  - Category - Fee, Easement, Unknown, or Other
  - Easement Holder(s)

Not Required Fields

- Source Protected Area ID - Easement identifier
- Local Name - Public Name
- Owner Type
- Owner Name
- Local Owner
- Public Access
- Easement Holder Type
- Date of Establishment (YYYY)
- Unit Name
- Acreage of Public Accessible Areas
- Weblink
- State Name - Maryland
- Comments

Data Collection - GIS data

- May not include the exact acreage; may include the entire polygon of the parcel instead
- Should include necessary data attributes such as the Easement holder, name, iMap category, etc.
- The spreadsheet is based off the table for the GIS data



Outreach for Land Trust Conservation Data - March 2024 (recap)

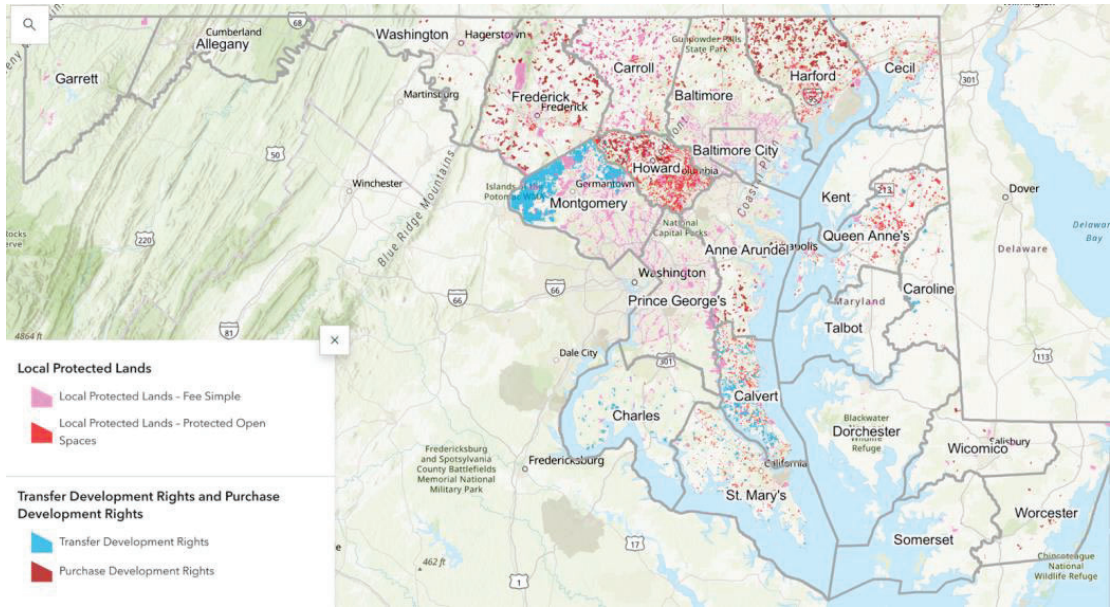
The current MD iMap Private Conservation Lands layer has data from 22 organizations:

Accokeek Foundation	Conservancy for Charles County	Long Green Valley Conservancy	The Aspen Institute
American Chestnut Land Trust	Conservation Alliance	MD Ornithological Society	The Manor Conservancy
Catoctin Land Trust	Eastern Shore Land Conservancy	North American Land Trust	The Nature Conservancy
Chesapeake Bay Foundation	Gunpowder Valley Conservancy	Potomac Conservancy	Wildlife Trust of America
Chesapeake Wildlife Heritage	Izaak Walton League	Save Historic Antietam Foundation	
Chesapeake Wildlife Heritage	Land Preservation Trust (Baltimore County)	Stronghold, Incorporated	

219 of the 604 records (36%) are from the Nature Conservancy.

Fall 2024 Statewide Local Protected Lands Update

MDP updated the out-of-date GIS data for the Local Protected Lands, Transfer and Purchase Development Rights, and Private Conservation Lands that are available on iMap.



Fall 2024 Statewide Local Protected Lands Update

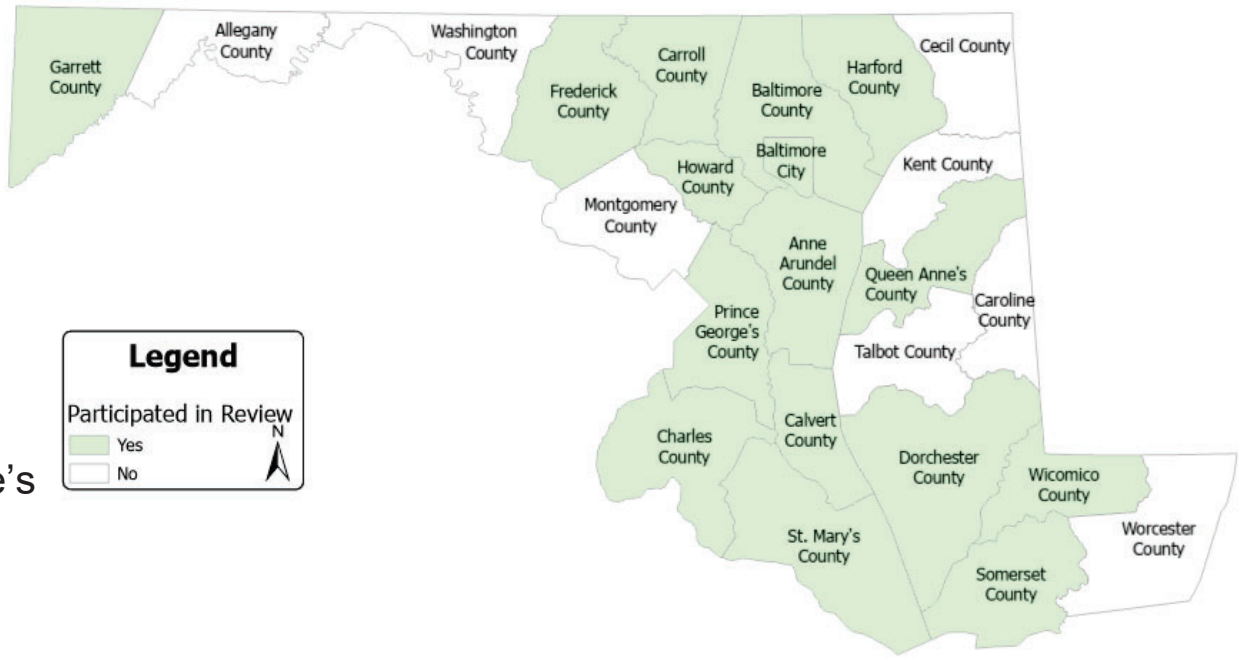
- Standardized the protected lands data by drawing on established practices from the Chesapeake Bay Program and the Protected Areas Database of the United States (PAD-US).
- Aggregated county-submitted GIS data from Land Preservation, Parks, and Recreation Plans (LPPRPs) and the Rural Legacy Program and iMap
- Shared back with the counties for review and adjustment.

Check Out the Protected Lands Storymap!

https://storymaps.arcgis.com/stories/3a0594fef3944e7dbbe4b3f4bf535939

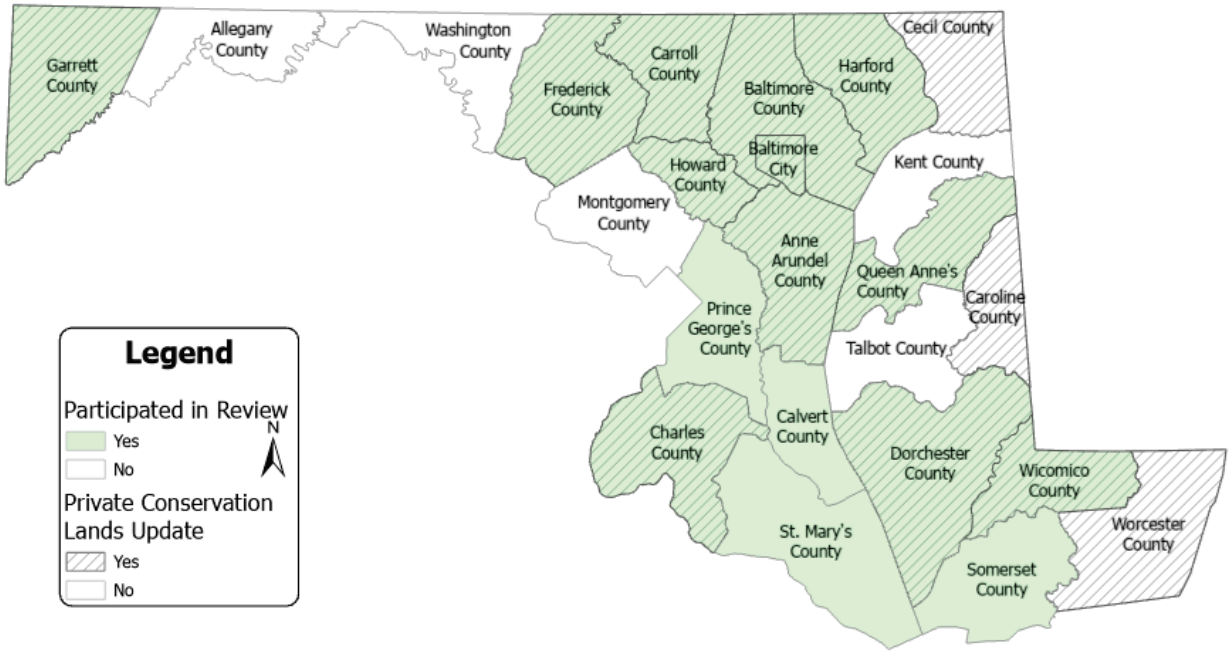
Participated in Data Review

- Anne Arundel
- Baltimore City
- Baltimore County
- Calvert
- Carroll
- Charles
- Dorchester
- Frederick
- Garrett
- Harford
- Howard
- Prince George's
- Queen Anne's
- St. Mary's
- Somerset



Updated Private Conservation Lands

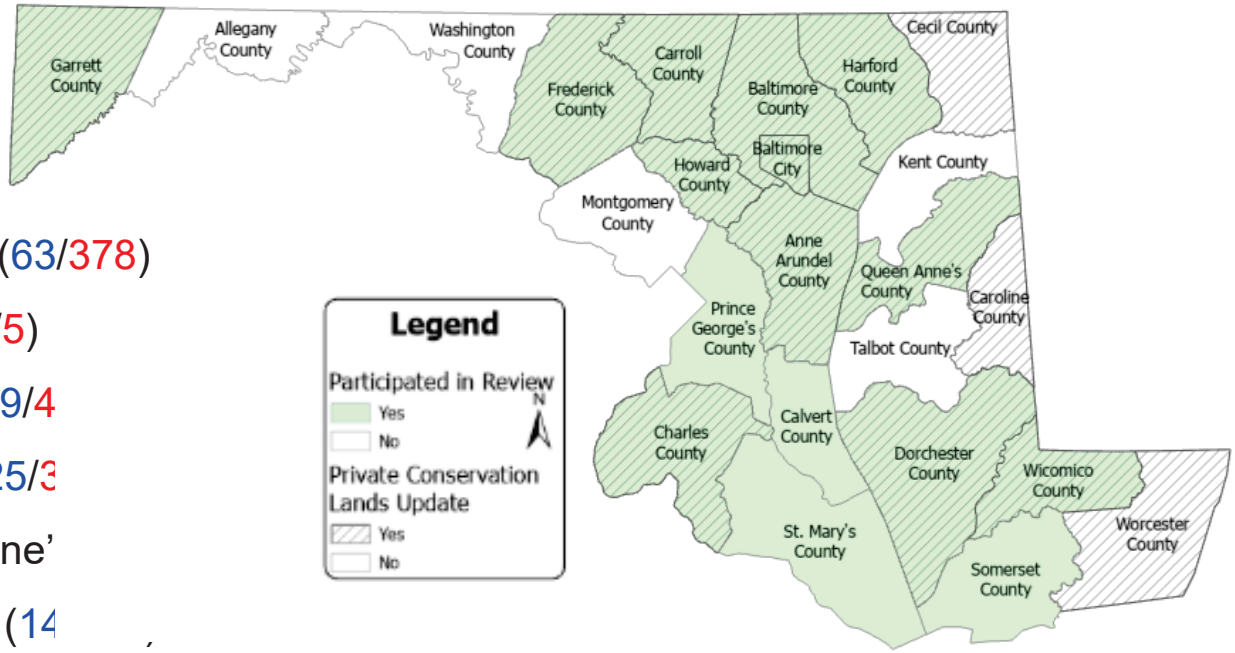
- Anne Arundel
- Baltimore County
- Baltimore City
- Caroline
- Carroll
- Cecil
- Charles
- Dorchester
- Frederick
- Garrett
- Harford
- Howard
- Queen Anne’s
- Wicomico
- Worcester



Updated Private Conservation Lands

Additional (properties/acres)

- Anne Arundel (70/729)
- Baltimore County (8/382)
- Baltimore City (42/55)
- Caroline (6/771)
- Carroll (8/353)
- Cecil (24/1,257)
- Charles (0/0)
- Dorchester (0/0)
- Frederick (63/378)
- Garrett (2/5)
- Harford (39/4
- Howard (25/3
- Queen Anne'
- Wicomico (14
- Worcester (6/616)



Total = 313 properties / 6,270 acres

Next Steps for Private Conservation Lands

If you are a conservation organization and want to provide us Private Conservation Land data directly, please contact us at:

Kevin.Coyne@maryland.gov

If you are providing your county with your data, please reach out to them to ensure they are sending us data, or contact Ellen.Mussman@maryland.gov

Tracking MD Protected Lands

The **Maryland Protected Lands Dashboard** displays the current status of Maryland's land preservation efforts and to access the tabular data that informs the dashboard as well as available land preservation GIS data. Created in coordination with DNR and Planning's Geospatial and Data Analysis Unit, the dashboard incorporates data from local, state, federal, and non-governmental preservation programs.

Total Protected Acres (Based on Tabular Data)

1,875,719

Total statewide acres protected by all categories.
Best available data as of March 2025

Statewide Acres by Category

52, 871

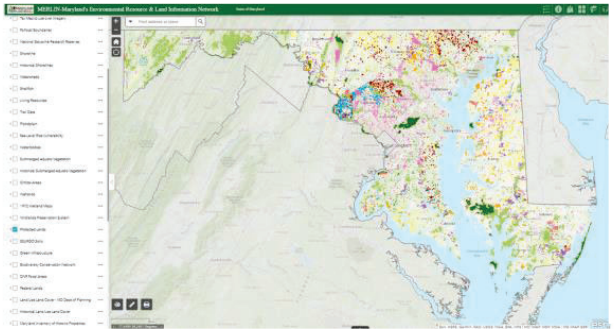
Acres protected by private conservation organizations.
Best available data as of February 2024

Statewide 30% by 2030

101%

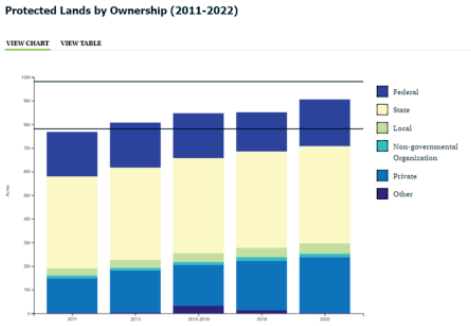
Progress towards meeting the Statewide 30% by 2030 Land Conservation Goal

Mapping Common Datasets



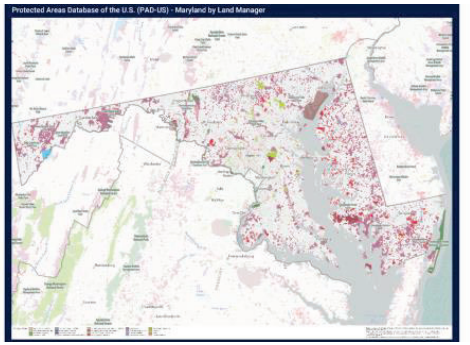
Maryland iMap

MD iMAP is the authoritative source for GIS data, maps, and applications for the State of Maryland. The data in iMap feeds the MERLIN and GreenPrint applications



Chesapeake Bay Progress

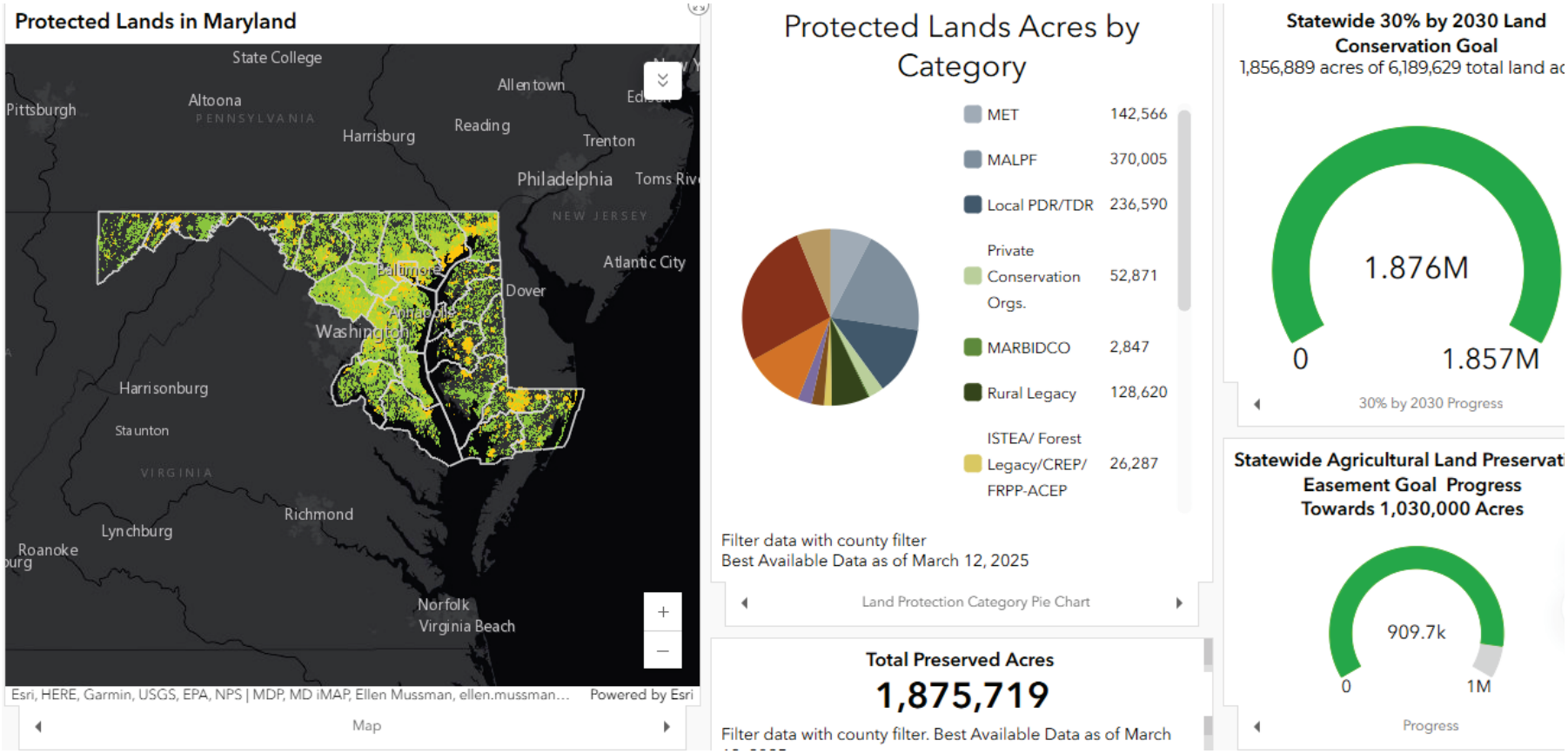
State agencies, in collaboration with land trusts and local partners, are the largest entity contributing to land protection: they own approximately 45% of the protected acres in the watershed.



Protect Areas Database of the United States (PAD-US)

PAD-US is the nation's official inventory of public open space and private protected areas. https://www.usgs.gov/programs/gap-analysis-project/science/protected-areas

Maryland Protected Lands Dashboard



https://maryland.maps.arcgis.com/apps/dashboards/0f3ffd3350b24b17bd3b8e1705af3df5

Maryland the Beautiful Act

CH546

The Maryland the Beautiful Act of 2023 established ambitious land conservation goals: conserve 30% of the state by 2030 (30 by 30) and conserve 40% of the state by 2040 (40 by 40).

The Maryland the Beautiful Act requires the Sustainable Growth Subcabinet to develop and publish a plan that outlines how to meet the goals in the legislation, provide an annual report on the state's progress, and update the plan at least every five years through 2040.

Progress to date:

Through the combined efforts of state agencies, local governments, the federal government, and nonprofit land trusts, the first goal to conserve 30% of Maryland land (1,856,889 of 6,189,629 land acres) was achieved in 2024, well in advance of the 2030 goal year. The Maryland Department of Planning's Protected Lands Dashboard is regularly updated to show progress toward the 40 by 40 goal.

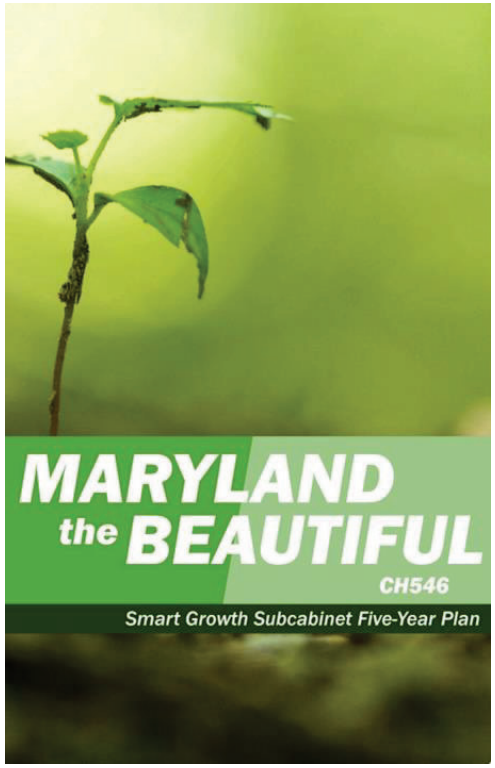
2023 | First Maryland the Beautiful Plan was completed (available online)

2024 | Greenspace Equity Program launched

2024 | Maryland achieves 30 by 30 goal

2024 | First annual report completed (available online)

2025 | Next annual report is due end of 2025




The New York Times

50 STATES, 50 FIXES

Maryland Protected Nearly a Third of Its Land, and It's Reaching for More

Nine states have set goals to conserve 30 percent of their land by 2030. Maryland got there first.

Protected Lands in Maryland

Thank you!

Maryland Department of Planning

- Meagan Fairfield-Peak (Lead GIS Analyst, Geospatial Data & Analysis)

Maryland Department of Natural Resources

- Kevin Coyne (Division Director, Center for Geospatial Products and Services)

Maryland Environmental Trust

- John Turgeon (Director)
- Michelle Grafton (Outreach and Engagement Manager)

Special Thanks to all the Land Trusts!

Questions?

From Data to Decisions:

How Maryland's Mapping Tools Support Natural Resource Management Strategies

Rachel Marks
Elliott Campbell

Watershed and Climate Services
Office for Socioecological and Geospatial Science
Maryland Department of Natural Resources

Email:
Rachel.Marks@maryland.gov
Elliott.Campbell@maryland.gov

Discussion Objectives

- **What data layers are available to guide conservation and restoration planning and decision making?**
- **What web-based maps and tools are available for viewing and "analyzing" this data?**
- **How can these data and tools be applied to various types of activities?**

Discussion Objectives

Conservation

Maryland Green Print

+

Parcel Eval tool

Restoration

Maryland Restoration Resilience Mapper

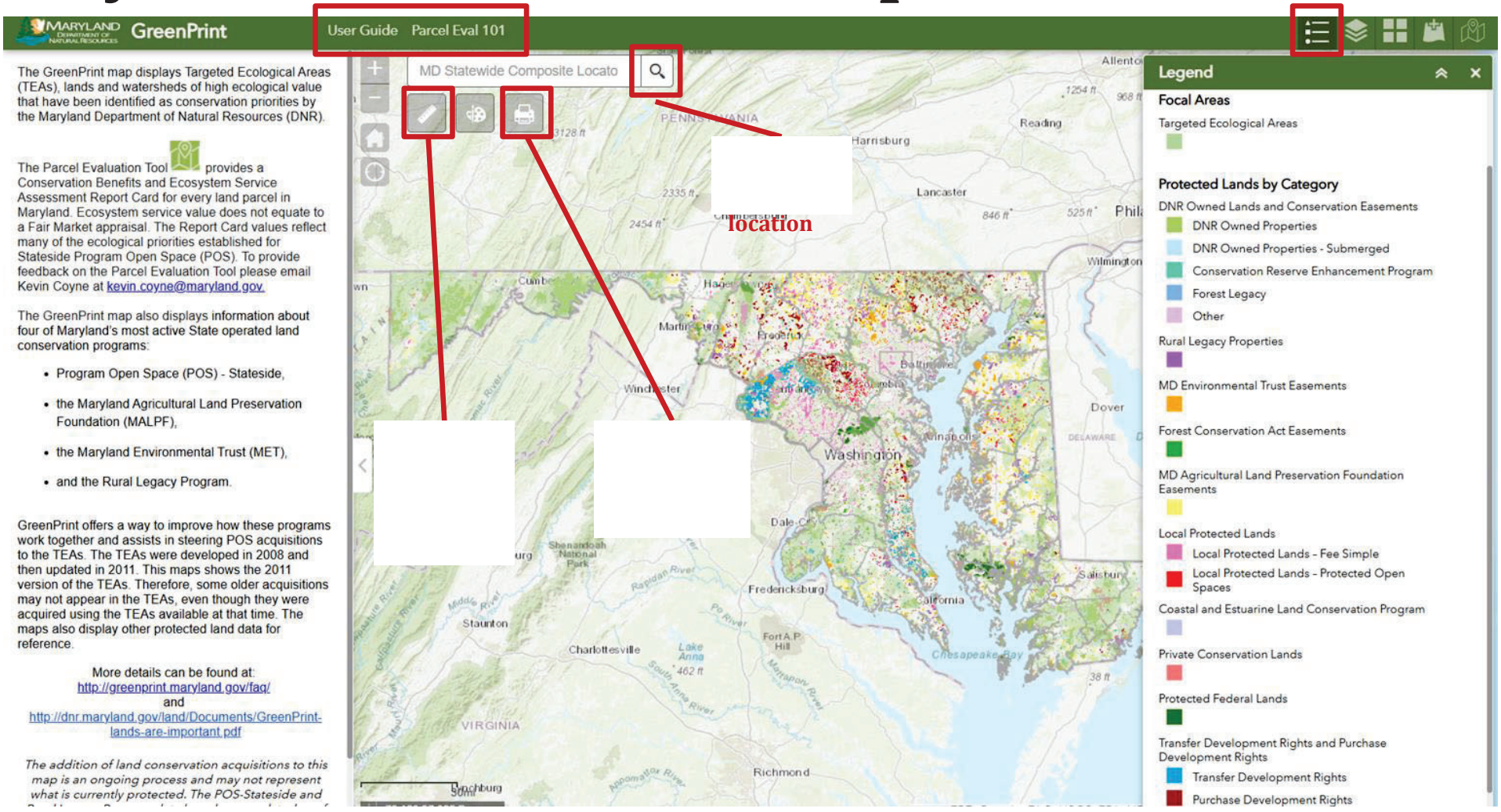
+

Find Opportunities tool

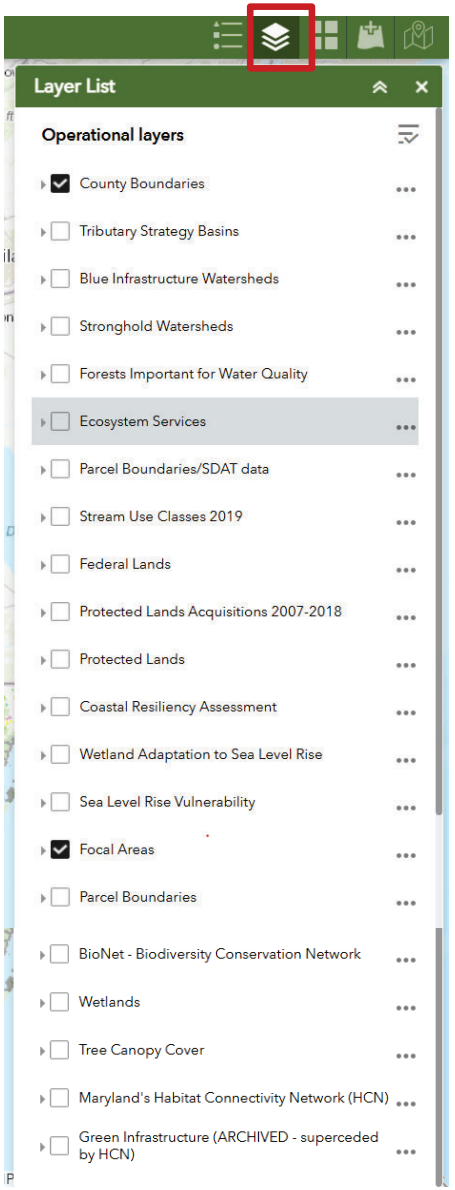
Maryland's GreenPrint

Link to Map

Maryland's GreenPrint Map

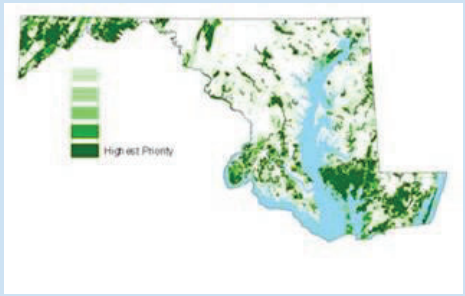


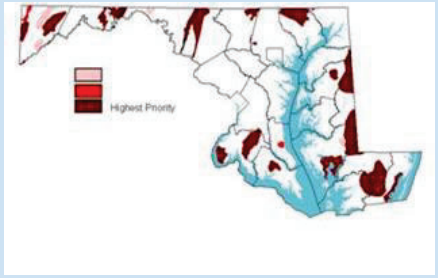
Maryland's GreenPrint Map



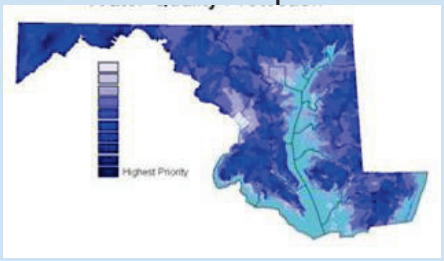
Layers View

Theme 1:
Wildlife and Rare Species Habitat

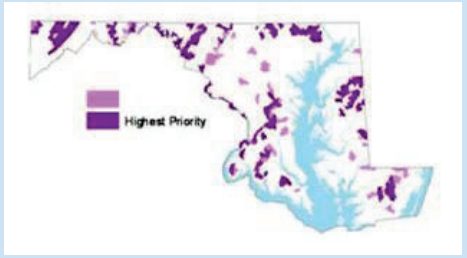




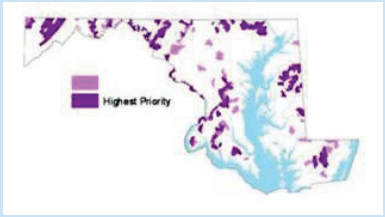
Theme 2:
Wildlife and Rare Species Habitat



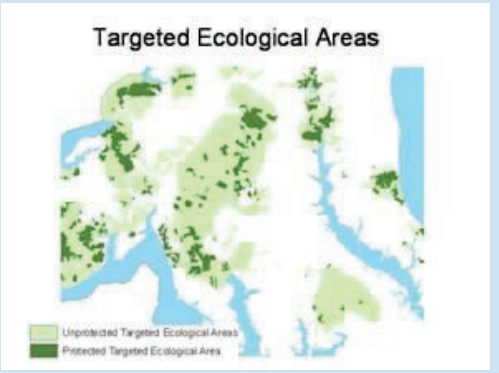
Theme 3:
Nontidal Fisheries, Rivers and Streams



Theme 4:
Tidal Fisheries, Bay, and Coastal Ecosystems

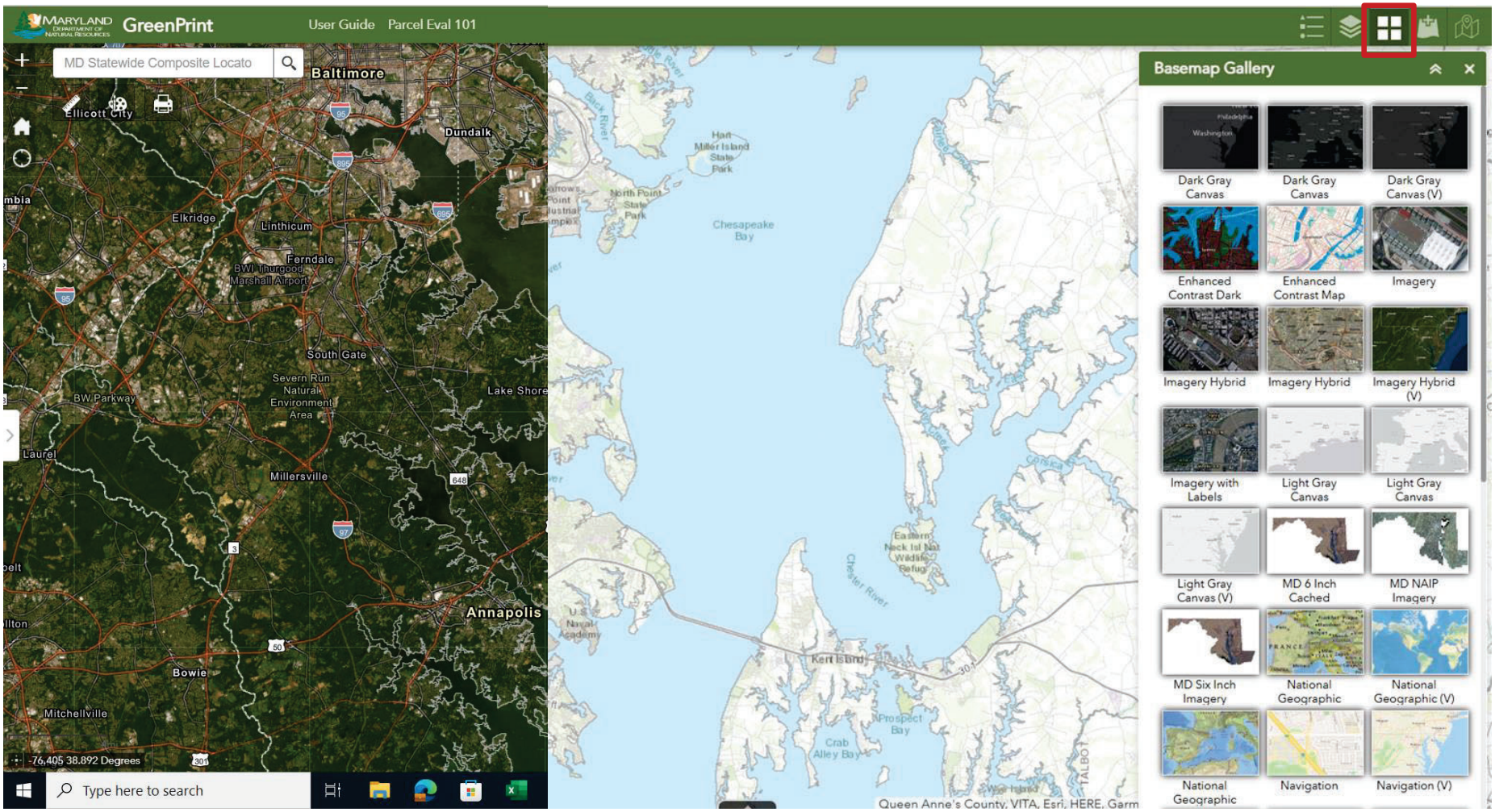


Theme 5:
Wetland Adaptation Areas



Protected areas

Maryland's GreenPrint Map

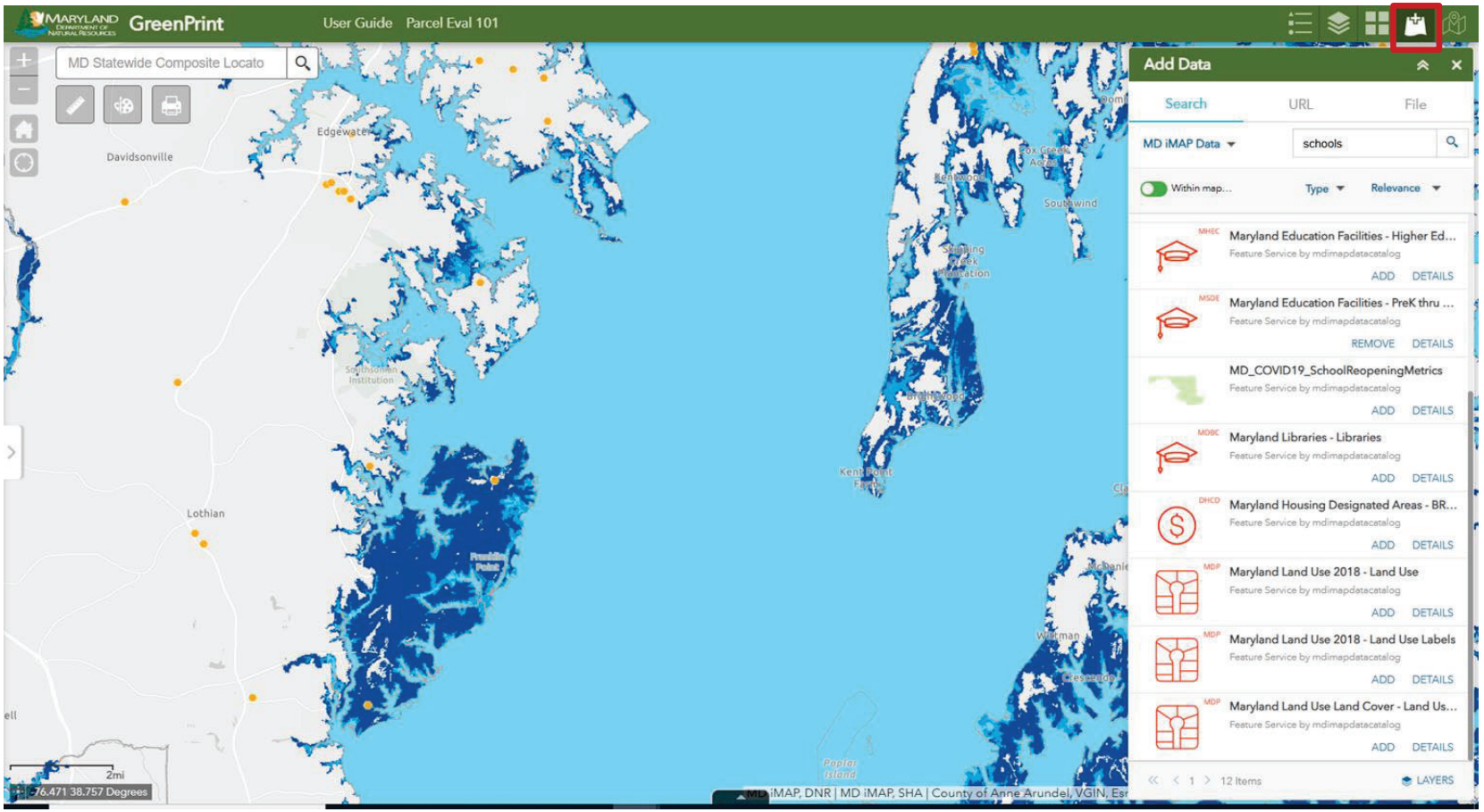


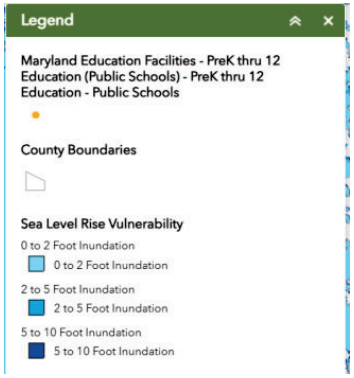
Maryland's GreenPrint Map

Add Data

Data can be added in several ways:

- By searching for a layer from MD iMap
- By copying and pasting a service URL
- By uploading a zipped shapefile





Service URL:
https://services.arcgis.com/njFNhDsUCentVYJW/arcgis/rest/services/Maryland_K_12_Schools/FeatureServer/0

Maryland's GreenPrint:

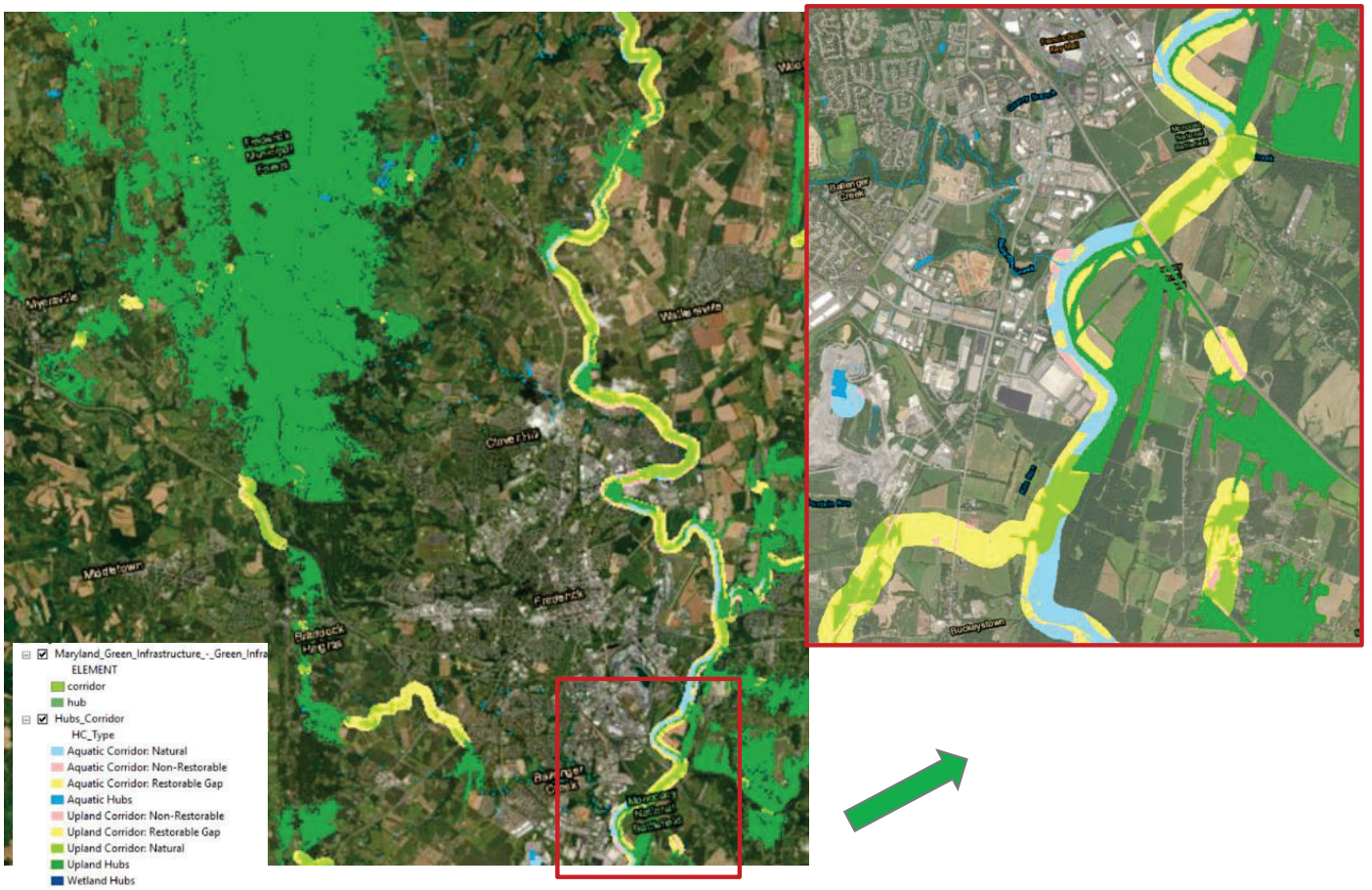
Data Layers

Greenprint Data: Habitat Connectivity Network

(formerly Green Infrastructure)

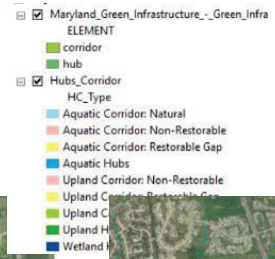
Maryland's Habitat Connectivity Network (HCN)

- The Habitat Connectivity Network (HCN) is a connected network of:
  - **Hubs** - large contiguous blocks of forests and wetlands
  - **Corridors** – linear features connecting hubs that enable animals and plant propagules to move between hubs.
  - **Gaps** – areas of non-natural landuse that could be potential candidates for restoration activities
- Update analysis uses the Chesapeake Conservancy Landcover Landuse dataset, which is based on **1m lidar** and aerial imagery, collected in **2018/2019**

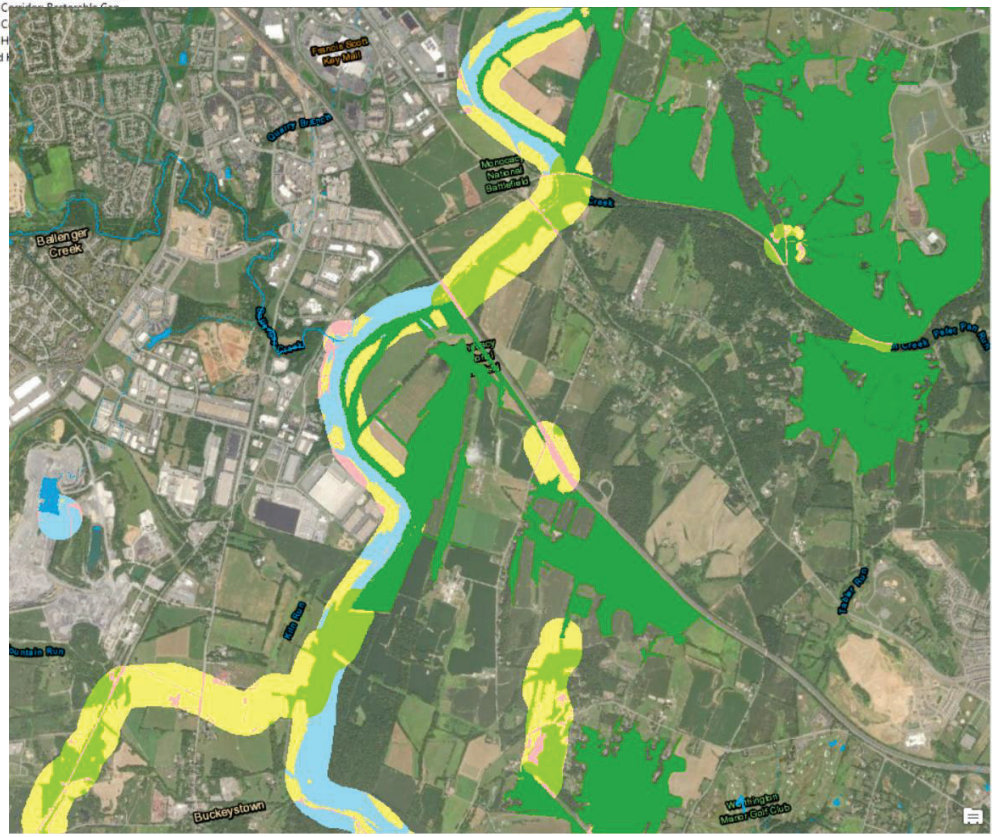


Maryland's Habitat Connectivity Network

Original GI Hubs and Corridors



New HCN Hubs and Corridors



Maryland's Habitat Connectivity Network

Maryland Habitat Connectivity Network (previousy Green Infrastructure)			
COUNTY	Corridor Percent Protected	Hub Percent Protected	HCN_Percent_Proteced
Allegany	0.10	0.37	0.36
Anne Arundel	0.19	0.40	0.39
Baltimore	0.33	0.65	0.60
Baltimore City	0.19	0.86	0.60
Calvert	0.14	0.36	0.35
Caroline	0.21	0.32	0.31
Carroll	0.33	0.44	0.41
Cecil	0.15	0.28	0.26
Charles	0.19	0.33	0.33
Dorchester	0.19	0.44	0.43
Frederick	0.17	0.37	0.34
Garrett	0.11	0.33	0.33
Harford	0.20	0.38	0.36
Howard	0.40	0.74	0.69
Kent	0.41	0.34	0.35
Montgomery	0.67	0.82	0.80
Prince George's	0.27	0.39	0.38
Queen Anne's	0.31	0.41	0.40
Somerset	0.17	0.50	0.49
St. Mary's	0.15	0.22	0.22
Talbot	0.15	0.24	0.22
Washington	0.20	0.37	0.35
Wicomico	0.09	0.41	0.40
Worcester	0.36	0.45	0.45
State % Protected	**0.23**	**0.4**	**0.39**

Green Print Data:

Ecosystem Service Assessment

What are Ecosystem Services?

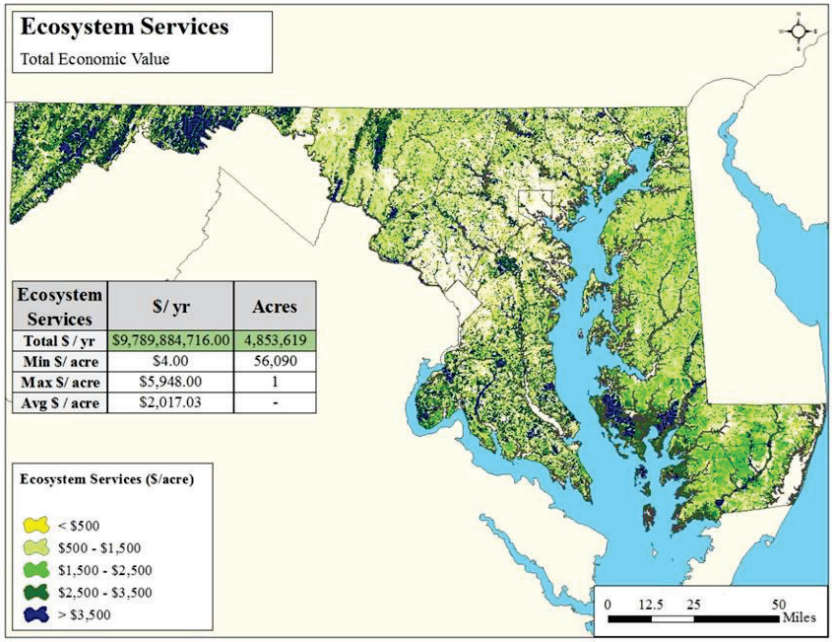
"Benefits gained by people from the environment that are not already being paid for in a market and are contributing to a marginal increase in human well-being"

DNR analyzed the biophysical and economic value of separate ecosystem services provided by forests and wetlands across the state.

Leveraged existing state and federal models to estimate the biophysical value of 7 ecosystem services:

- Carbon sequestration
- Air pollution removal *(8 individual air pollutants)*
- Wildlife habitat and biodiversity potential
- Nitrogen uptake
- roundwater recharge
- Stormwater and flood mitigation
- Surface water protection

NOTE: Ecosystem service monetary values are meant to inform decision making and tradeoffs but do not imply market value or value to be paid by the state for land acquisition

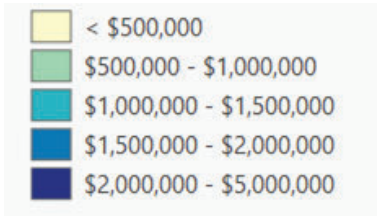


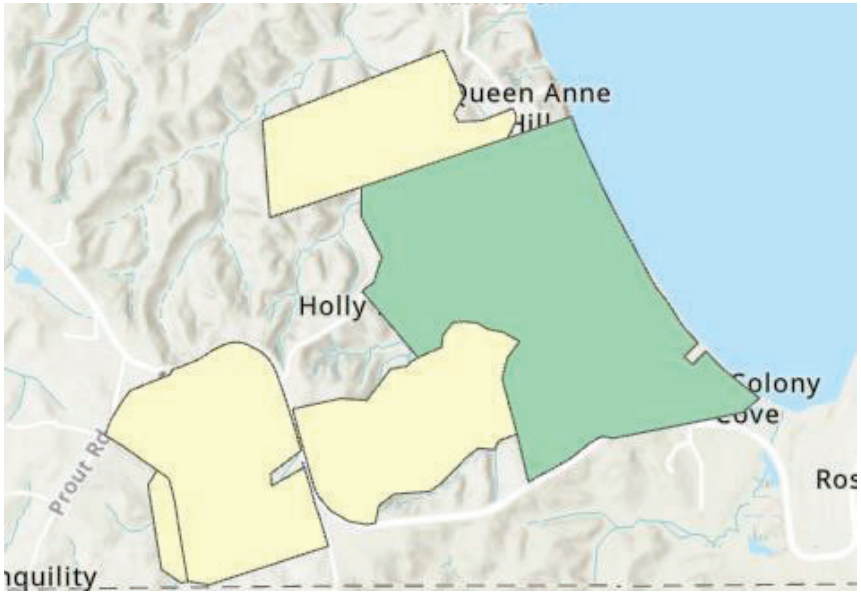
Ecosystem Services	$/ yr	Acres
Total $ / yr	$9,789,884,716.00	4,853,619
Min $/ acre	$4.00	56,090
Max $/ acre	$5,948.00	1
Avg $ / acre	$2,017.03	-

MET Easements: Ecosystem Services

co_kg_s	co_d_s	no2_kg_s	no2_d_s	so2_kg_s	so2_d_s	o3_kg_s	o3_d_s	p25_kg_s	p25_d_s	p10_kg_s	p10_d_s	carb_mt_s	carb_d_s	gw_m3_s	gw_d_s	nutr_i_mn	nutr_d_s	sw_i_mn	sw_d_s	wild_i_mr
3.51696	0.094145	56.188609	1.790956	7.65456	0.090469	250.697172	56.892716	11.254272	82.093681	46.547997	5.856809	7.86144	1094.621101	752.716782	4001	1	368	2.375	8762	46.437
23.7694	0.636283	379.75113	12.104187	51.733401	0.611437	1694.338677	384.509837	76.062081	554.830746	314.594978	39.583284	50.385575	7089.542549	4937.76001	26714	1	2499	2.175	56587	74.49687
32.294559	0.864493	515.953102	16.445489	70.288161	0.830736	2302.032112	522.418572	103.342593	753.826971	427.42797	53.78027	61.480497	9147.367499	6718.706942	36726	1	3521	2.346512	80718	75.80465
33.40262	0.894155	533.655983	17.009751	72.69982	0.859239	2381.017248	540.343292	106.888385	779.691559	442.093474	55.625528	74.521154	10382.469534	9830.09497	38000	1	3495	2.3696	86545	27.67891
31.620339	0.846445	505.181444	16.102153	68.820741	0.813392	2253.972128	511.511934	101.185089	738.089173	418.504472	52.657489	69.670463	9730.162763	8037.945916	35969	1	3317	2.175781	74460	53.81445
88.532599	2.369929	1414.438506	45.083813	192.688601	2.277387	6310.811754	1432.163011	283.304322	2066.5481	1171.754926	147.433722	185.141708	26531.121705	22288.122215	101296	1	15478	2.083862	205903	51.62341

- Original ES data provides values at a 30m resolution
- Values for individual ES can are summarized a the easemen level
- This image shows the total ES value for a subset of easements





all_d_s
20412.439896
160197.818638
222143.535046
176319.892824
198231.183756
538275.99895

MET Easements: Ecosystem Services

	Biophysical	Economic ($/year)
Carbon Monoxide (kg)	30,916.56	2,957.22
Nitrous Oxide (kg)	248,252.56	10,082.21
Sulfur Dioxide (kg)	95,339.87	1,102.24
Ozone (kg)	1,539,019.69	399,372.00
PM 2.5 (kg)	47,160.45	512,920.90
PM 5 (kg)	338,159.31	129,736.01
Carbon Sequestration (Mt)	32,079.08	5,668,711.43
Groundwater Recharge (m3)	10,067,161.64	27,671,556.00
Nutrient Reduction Index		14,852,979.00
Stormwater Mitigation Index		70,600,346.00
Wildlife Habitat Index		59,333,351.00
Surface Water Protection		9,434,330.00
Total		**188,617,444.34**

Green Print Data:

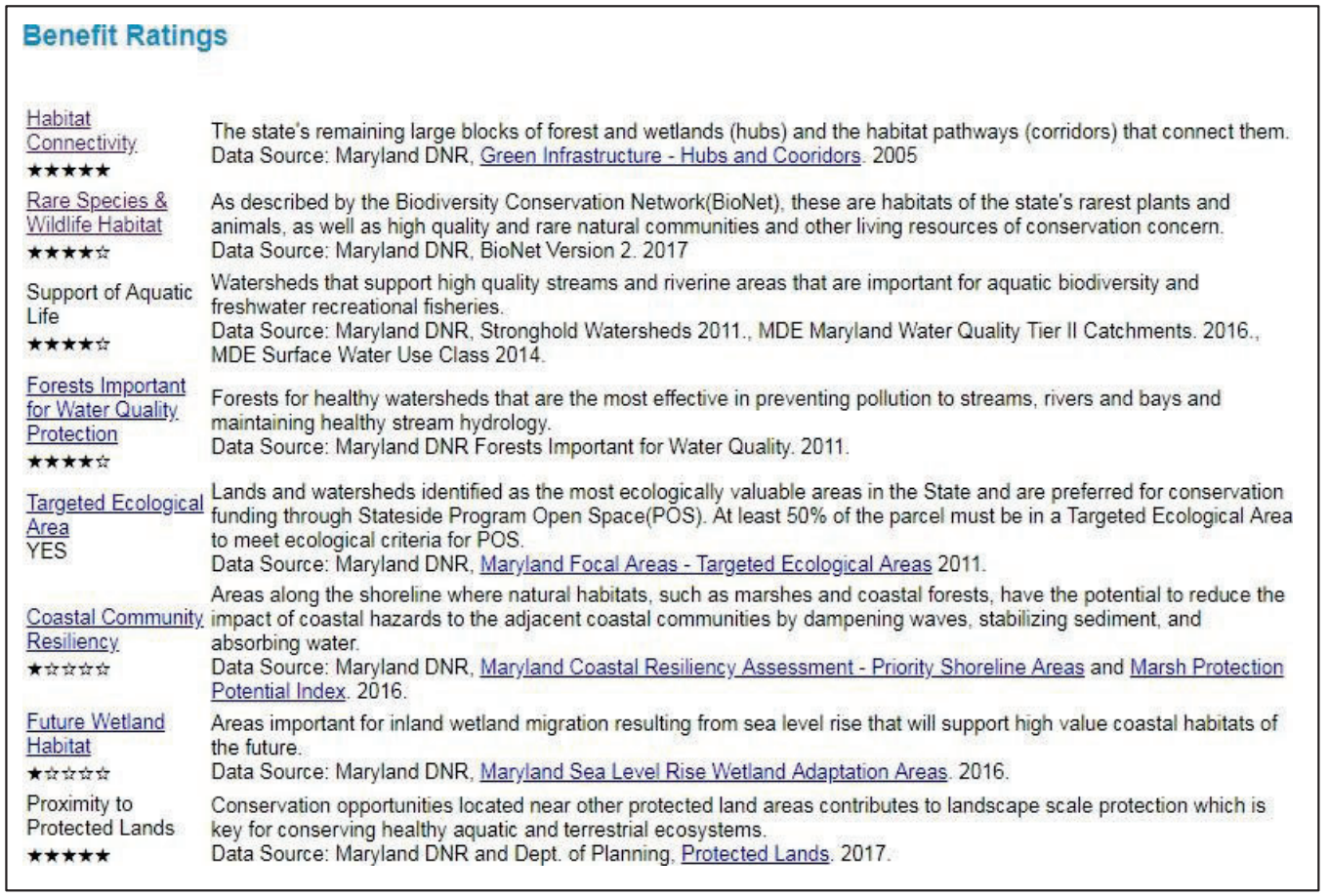
Consrvation Co-Benefits

Conservation Benefit Assessment

- Provides a “star” benefit rating (1= low to 5= high) for each of seven categories of ecological benefit at the individual parcel level

- Benefit rating valuation methods were developed in consultation with experts from units across DNR

- Values can be used to identify parcels having desired co-benefits, or to compare relative benefits between multiple parcels



Benefit Ratings

Habitat Connectivity ★★★★★	The state's remaining large blocks of forest and wetlands (hubs) and the habitat pathways (corridors) that connect them. Data Source: Maryland DNR, Green Infrastructure - Hubs and Cooridors. 2005
Rare Species & Wildlife Habitat ★★★★☆	As described by the Biodiversity Conservation Network(BioNet), these are habitats of the state's rarest plants and animals, as well as high quality and rare natural communities and other living resources of conservation concern. Data Source: Maryland DNR, BioNet Version 2. 2017
Support of Aquatic Life ★★★★☆	Watersheds that support high quality streams and riverine areas that are important for aquatic biodiversity and freshwater recreational fisheries. Data Source: Maryland DNR, Stronghold Watersheds 2011., MDE Maryland Water Quality Tier II Catchments. 2016., MDE Surface Water Use Class 2014.
Forests Important for Water Quality Protection ★★★★☆	Forests for healthy watersheds that are the most effective in preventing pollution to streams, rivers and bays and maintaining healthy stream hydrology. Data Source: Maryland DNR Forests Important for Water Quality. 2011.
Targeted Ecological Area YES	Lands and watersheds identified as the most ecologically valuable areas in the State and are preferred for conservation funding through Stateside Program Open Space(POS). At least 50% of the parcel must be in a Targeted Ecological Area to meet ecological criteria for POS. Data Source: Maryland DNR, Maryland Focal Areas - Targeted Ecological Areas 2011.
Coastal Community Resiliency ★☆☆☆☆	Areas along the shoreline where natural habitats, such as marshes and coastal forests, have the potential to reduce the impact of coastal hazards to the adjacent coastal communities by dampening waves, stabilizing sediment, and absorbing water. Data Source: Maryland DNR, Maryland Coastal Resiliency Assessment - Priority Shoreline Areas and Marsh Protection Potential Index. 2016.
Future Wetland Habitat ★☆☆☆☆	Areas important for inland wetland migration resulting from sea level rise that will support high value coastal habitats of the future. Data Source: Maryland DNR, Maryland Sea Level Rise Wetland Adaptation Areas. 2016.
Proximity to Protected Lands ★★★★★	Conservation opportunities located near other protected land areas contributes to landscape scale protection which is key for conserving healthy aquatic and terrestrial ecosystems. Data Source: Maryland DNR and Dept. of Planning, Protected Lands. 2017.

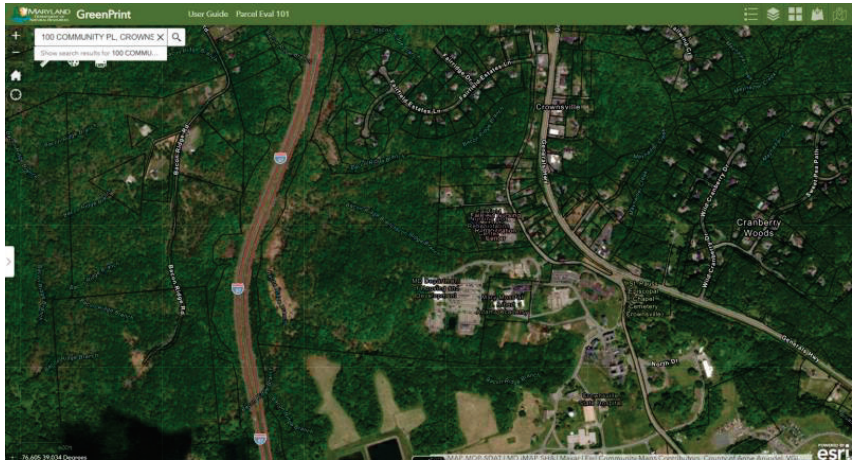
GreenPrint:

Parcel Eval Tool

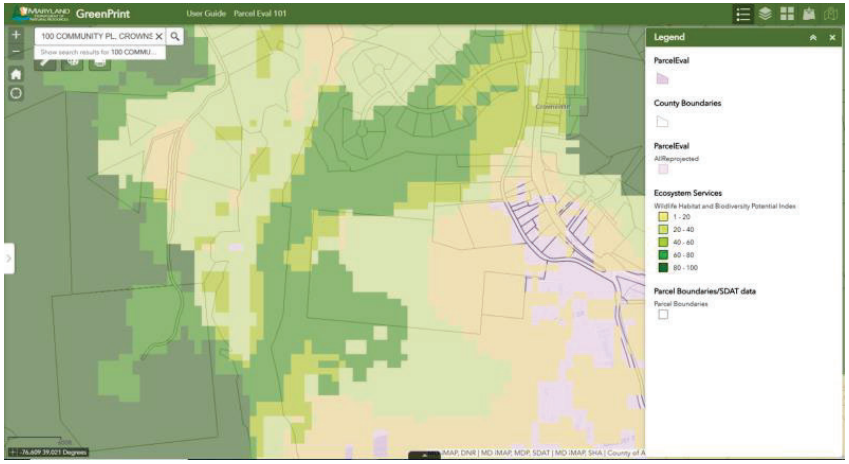
Maryland's GreenPrint Map

Can visually compare data layers for area of interest

100 Community Place

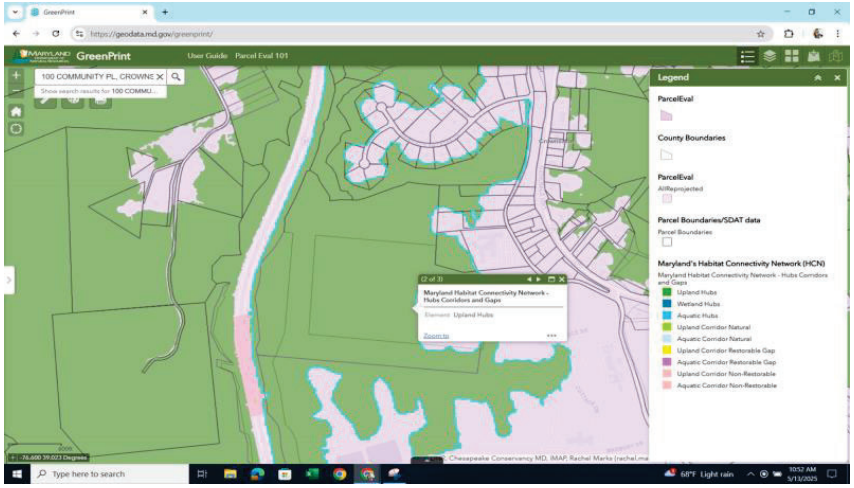


Ecosystem Service: Wildlife Index



Bionet

Habitat Connectivity Network



Can click on a data layer to get value for that area

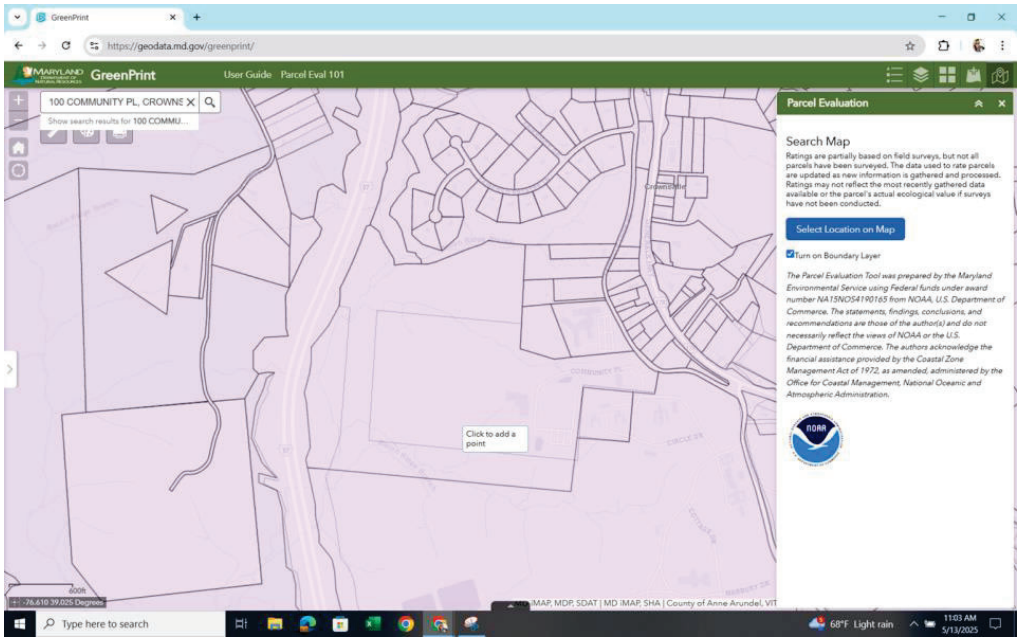
MD DNR Parcel Evaluation Tool

- The **Parcel Evaluation Tool** provides a ***Conservation Benefits and Ecosystem Service Assessment Report Card*** for every land parcel in Maryland

- Report card values reflect many of the ecological priorities established for **Stateside Program Open Space (POS)**

- Additionally, **land trusts** have asked for this information to help them target and evaluate lands for protection, as well as to document conservation values for tax benefits

- Tool compliments existing internal DNR parcel evaluation process

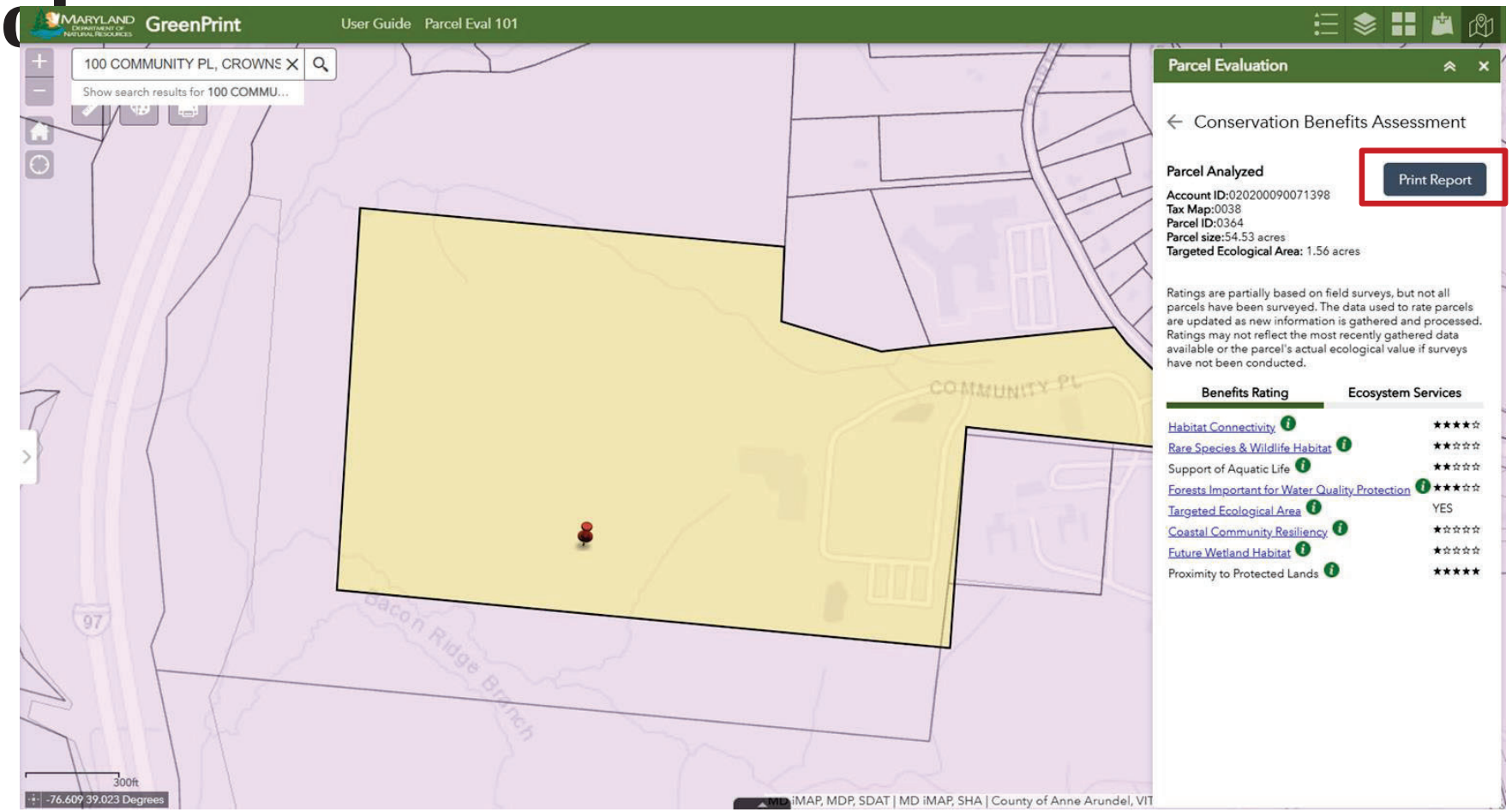


Two components:

1) **Conservation Benefit Assessment**

1) **Ecosystem Service Assessment**

MD DNR Parcel Evaluation Tool



Can print report

MD DNR Parcel Evaluation Tool

Parcel Evaluation

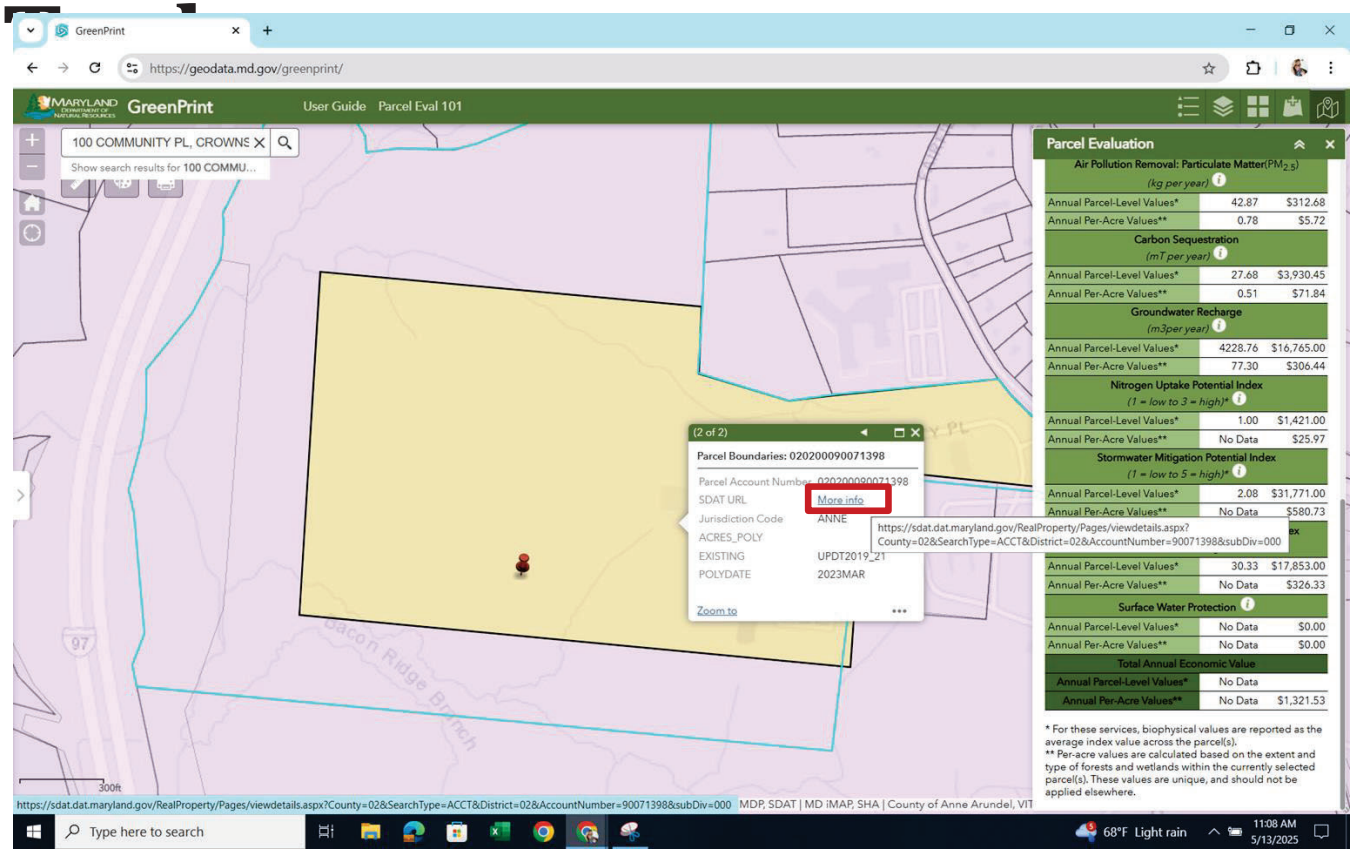
Benefits Rating | Ecosystem Services

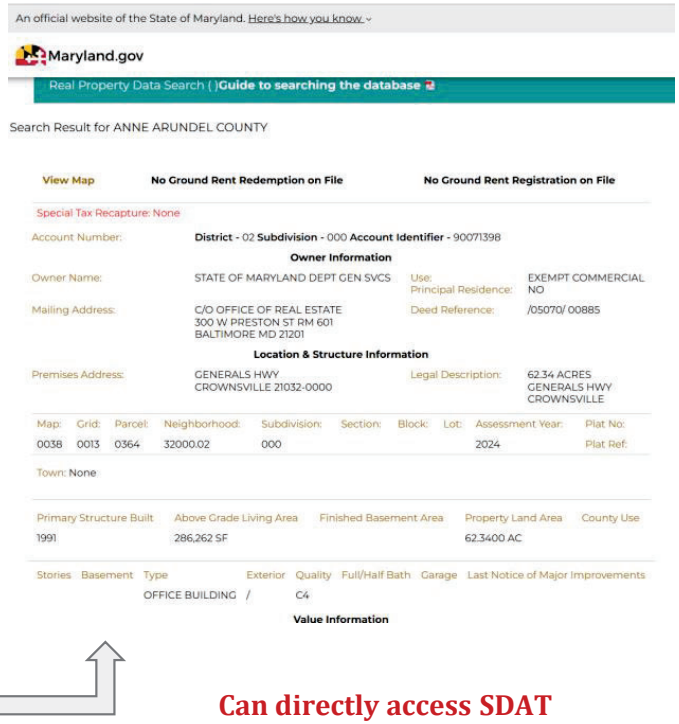
Ecosystem Service Name (and biophysical unit)	Biophysical	Economic
Air Pollution Removal: Carbon Monoxide (CO) *(kg per year)*		
Annual Parcel-Level Values*	13.40	$0.36
Annual Per-Acre Values**	0.24	$0.01
Air Pollution Removal: Nitrogen Dioxide(NO_2) *(kg per year)*		
Annual Parcel-Level Values*	214.01	$6.82
Annual Per-Acre Values**	3.91	$0.12
Air Pollution Removal: Sulfur Dioxide(SO_2) *(kg per year)*		
Annual Parcel-Level Values*	29.15	$0.34
Annual Per-Acre Values**	0.53	$0.01
Air Pollution Removal: Ozone (O_3) *(kg per year)*		
Annual Parcel-Level Values*	954.85	$216.69
Annual Per-Acre Values**	17.45	$3.96
Air Pollution Removal: Particulate Matter(PM_{10}) *(kg per year)*		
Annual Parcel-Level Values*	177.29	
Annual Per-Acre Values**	3.24	
Air Pollution Removal: Particulate Matter($PM_{2.5}$) *(kg per year)*		
Annual Parcel-Level Values*	42.87	$312.68
Annual Per-Acre Values**	0.78	$5.72
Carbon Sequestration *(mT per year)*		
Annual Parcel-Level Values*	27.68	$3,930.45
Annual Per-Acre Values**	0.51	$71.84
Groundwater Recharge *(m3per year)*		
Annual Parcel-Level Values*	4228.76	$16,765.00
Annual Per-Acre Values**	77.30	$306.44
Nitrogen Uptake Potential Index *(1 = low to 3 = high)**		
Annual Parcel-Level Values*	1.00	$1,421.00
Annual Per-Acre Values**	No Data	$25.97
Stormwater Mitigation Potential Index *(1 = low to 5 = high)**		
Annual Parcel-Level Values*	2.08	$31,771.00
Annual Per-Acre Values**	No Data	$580.73
Wildlife Habitat and Biodiversity Potential Index *(0 = low to 100 = high)**		
Annual Parcel-Level Values*	30.33	$17,853.00
Annual Per-Acre Values**	No Data	$326.33
Surface Water Protection		
Annual Parcel-Level Values*	No Data	$0.00
Annual Per-Acre Values**	No Data	$0.00
Total Annual Economic Value		
Annual Parcel-Level Values*	No Data	
Annual Per-Acre Values**	No Data	$1,321.53

Benefits Rating | Ecosystem Services

Habitat Connectivity	★★★★☆
Rare Species & Wildlife Habitat	★★☆☆☆
Support of Aquatic Life	★★☆☆☆
Forests Important for Water Quality Protection	★★★☆☆
Targeted Ecological Area	YES
Coastal Community Resiliency	★☆☆☆☆
Future Wetland Habitat	★☆☆☆☆
Proximity to Protected Lands	★★★★★

MD DNR Parcel Evaluation





Can directly access SDAT property records by clicking in parcel the clicking "More Info"

GreenPrint:

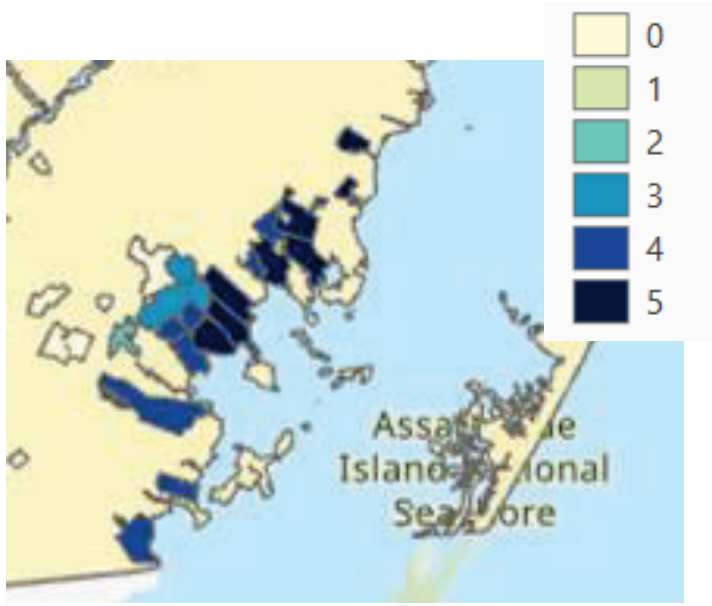
Parcel Eval Tool - Additional Ideas

Conservation Opportunities: Site Level Ideas

- Visually compare parcel level conservation co-benefits and ecosystem service values of interest

- Use select by attributes to select parcels based on desired thresholds of desired attributes

Climate Resiliency



Habitat Connectivity

Summary GreenPrint Use Ideas

Within GreenPrint:

- Visually "analyze" and compare data layers for area of interest
- Manually add study area polygons or additional context layers
- Use parcel eval tool generate and compare parcel level reports of ecosystem services and conservation benefits

Outside of GreenPrint: (with some S skills)

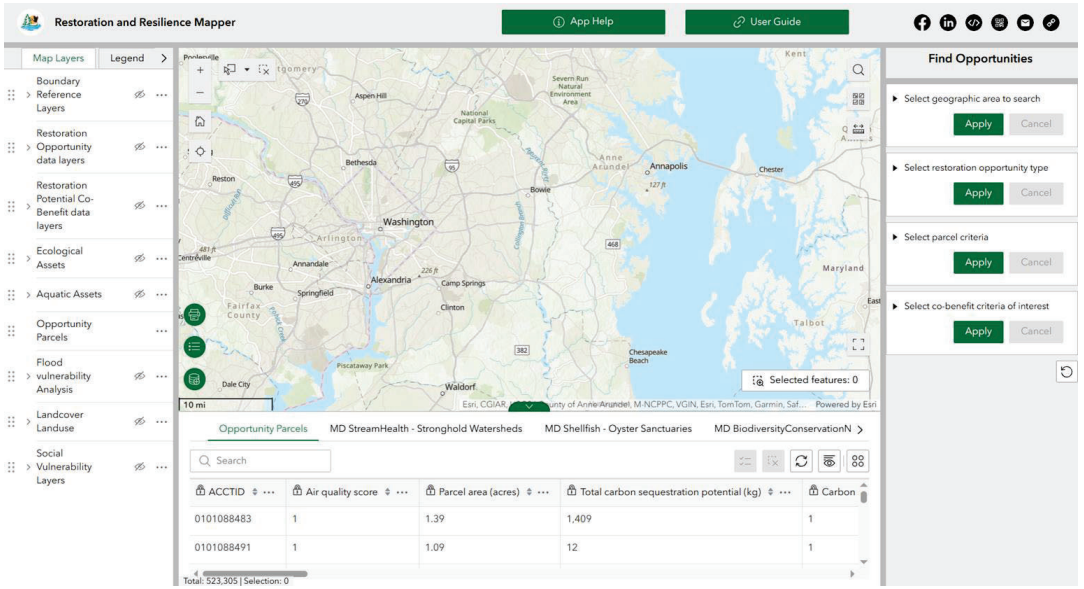
- Visually compare parcel level conservation co-benefits and ecosystem service values of interest
- Use select by attributes to select parcels based on desired thresholds of desired attributes
- Calculate conservation co-benefits and ecosystem services summaries for areas of interest

Maryland's Restoration and Resilience Mapper

Link to Map

Maryland Restoration and Resilience Map

- This webmap provides a central platform to visualize DNR"s suite of restoration opportunity, restoration co-benefits, and flood vulnerability and risk data
- The webmap also includes a ind Opportunities Tool, which allows users to search for restoration opportunities based on desired criteria, such as location (specific county or watershed), restoration type/opportunity size acres), specific potential co-benefits
- The tool provides a table that highlights all parcels meeting the defined criteria, as well as a summary of relevant attributes for each parcel
- The underlying parcel shapefile containing parcel level values is not currently publically available, but can be provided to partners who would like to use it for subsequent desktop analysis.



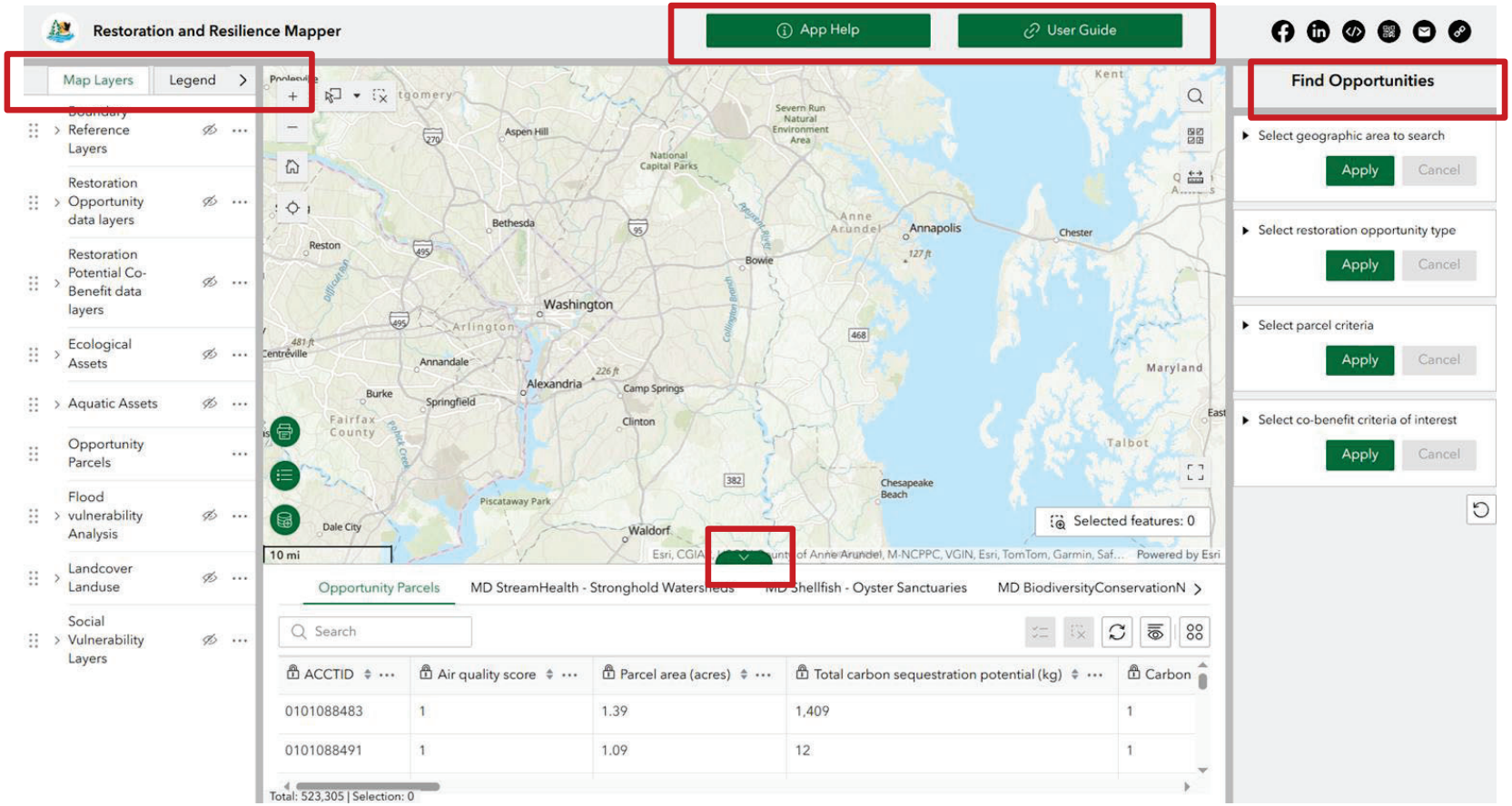
Primary audience: project reviewers and external partners that may be evaluating restoration alternatives and submitting proposals

Maryland's Restoration and Resilience Mapper

More thorough explanation of tool functionality here

Can switch between "Data Layer" and "Legend" view

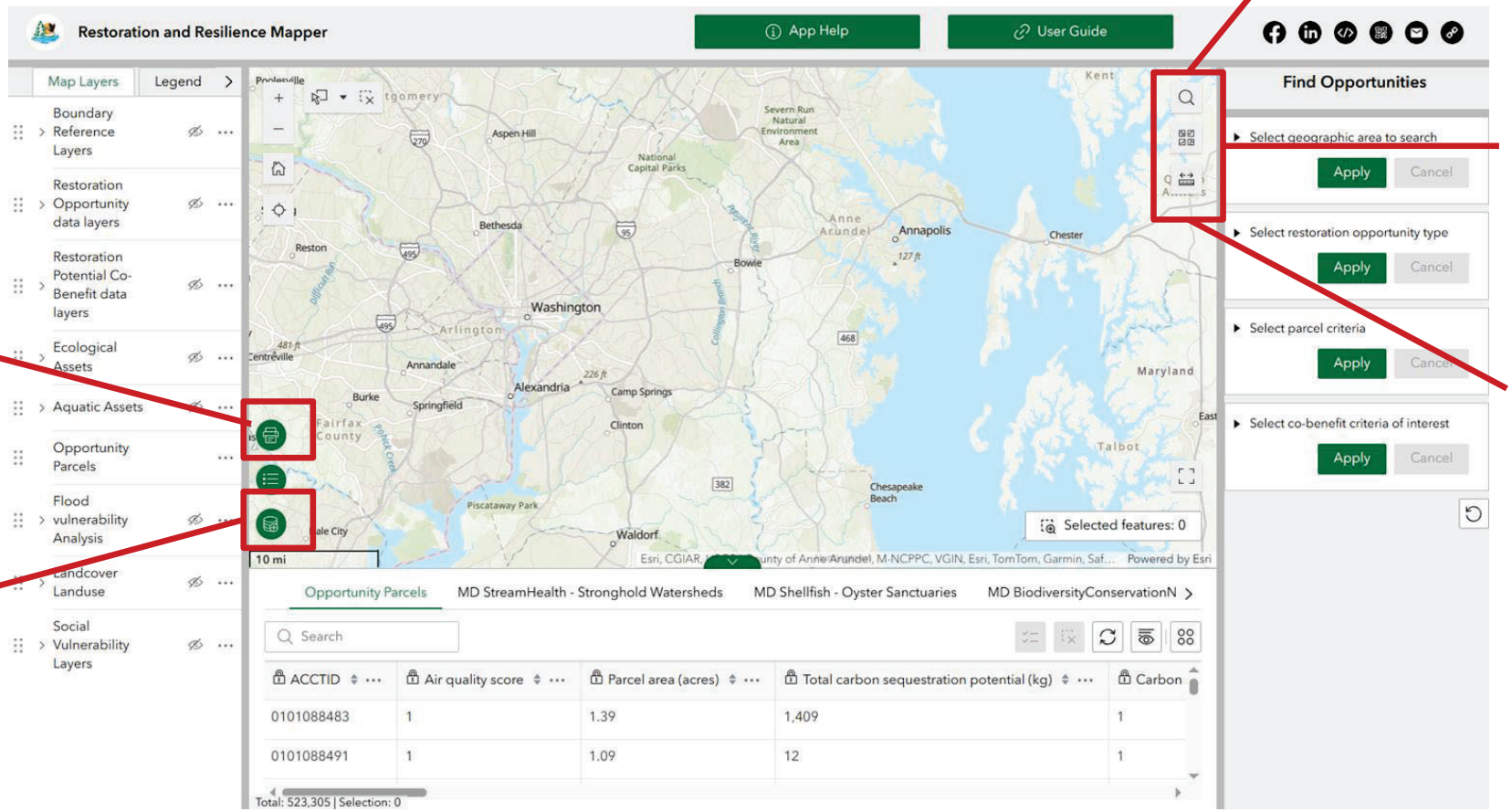
Can turn data layers on/off in "Data Layer" view



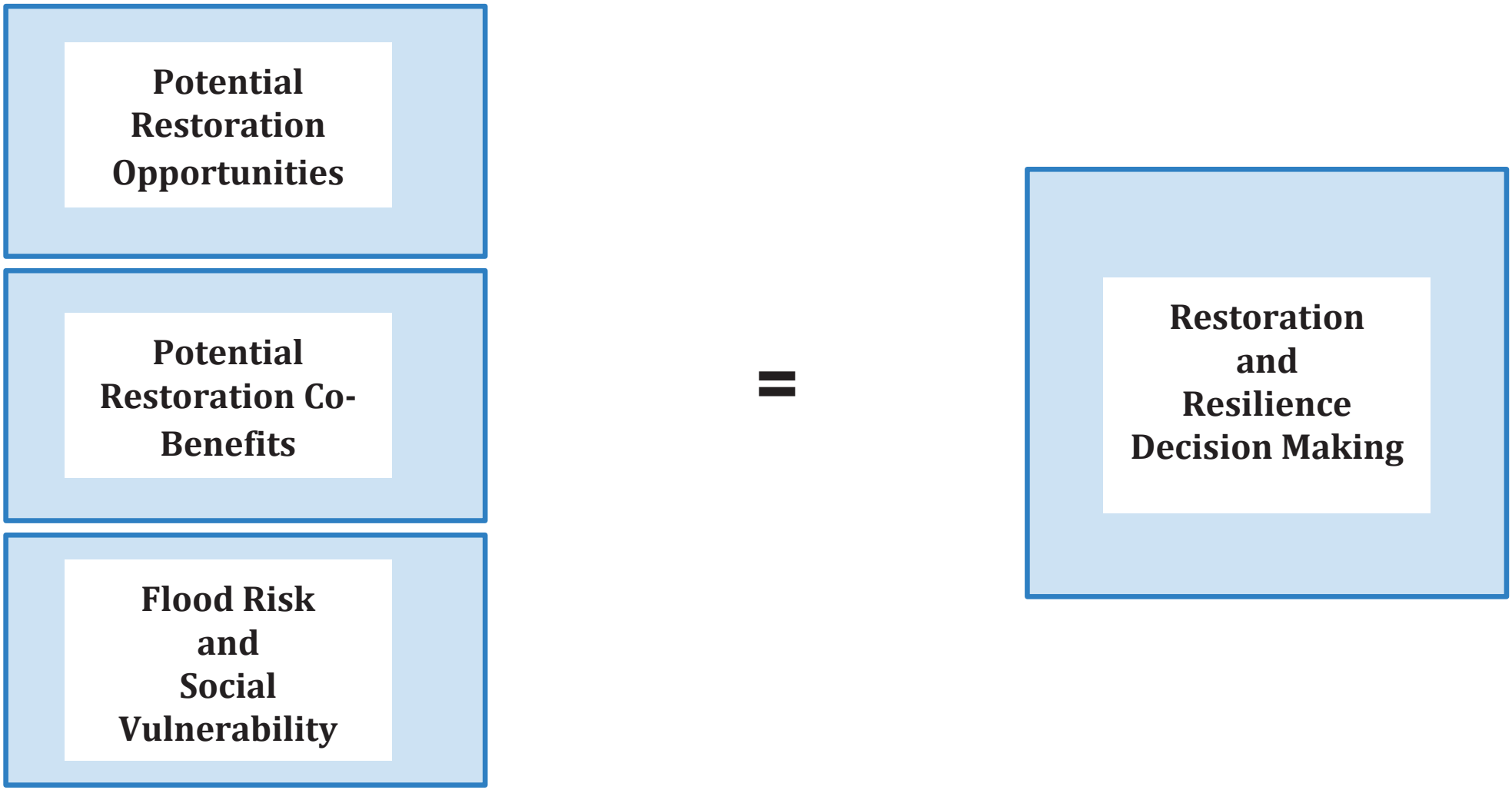
Can view the data tables associated with map layers

Can turn table view off/on by clicking green arrow

Maryland's Restoration and Resilience Mapper



Maryland Restoration and Resilience Map



Maryland's GreenPrint:

Data Layers

Potential Restoration Opportunities

Upland Tree planting

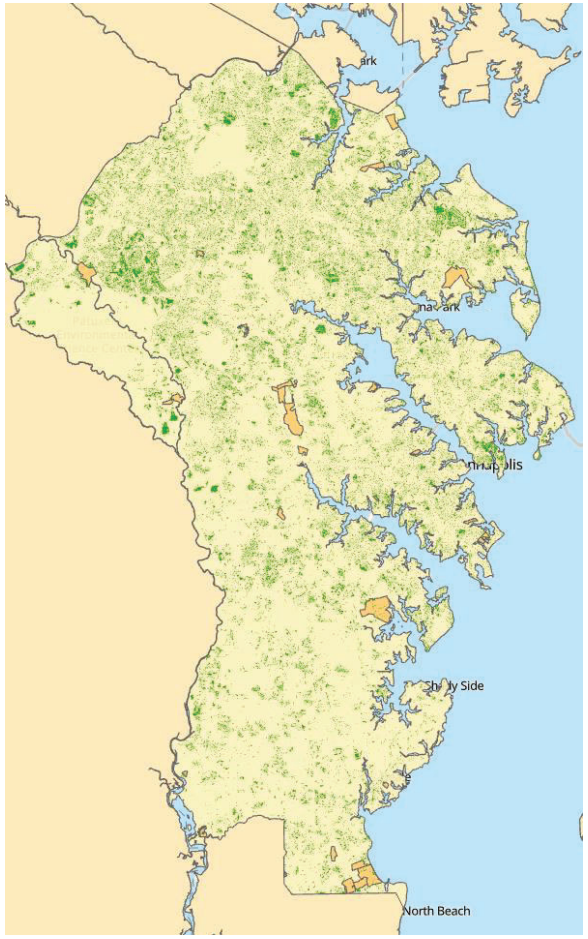
Riparian Tree Planting

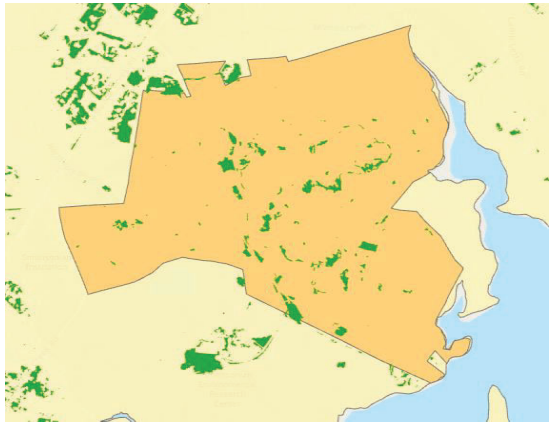
Inland Wetland Restoration

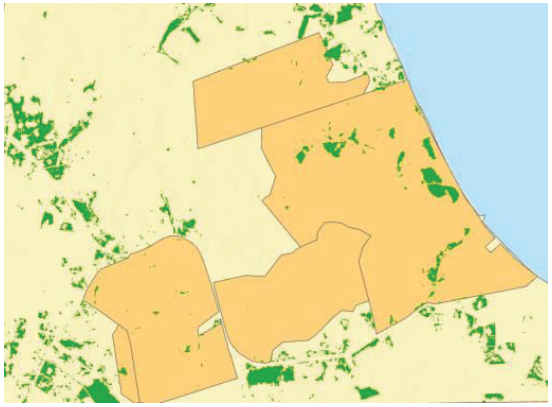
Coastal Wetland Restoration

Tree Planting Opportunities

- Leveraged Chesapeake Conservancy "Plantable Area" data, created as part of the Maryland Forest Technical Study
- We can look at different thresholds to narrow down potential tree planting opportunities
- This map looks at contiguous areas greater than 1 acre
- *Note, this data does not include planting opportunities on agricultural lands*

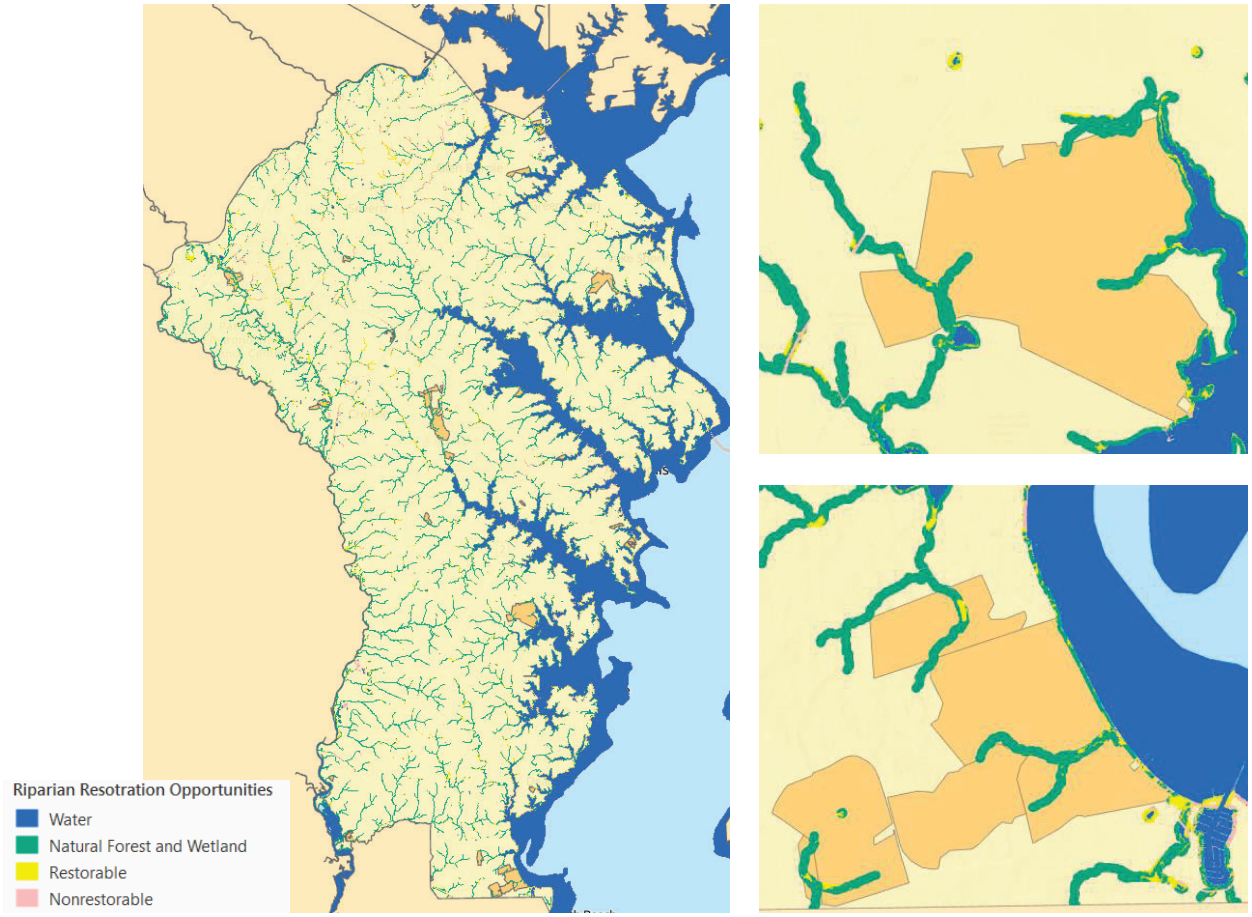






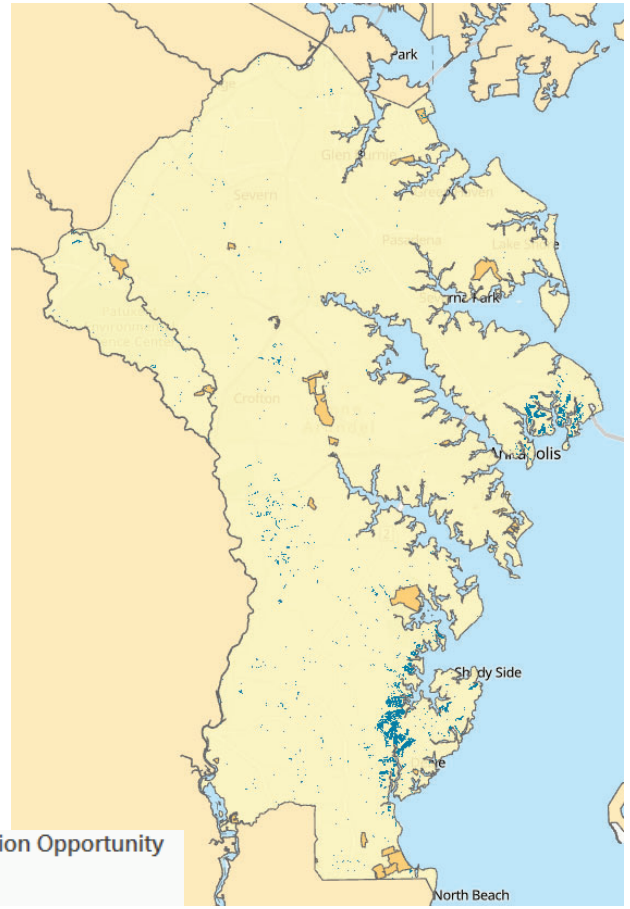
Riparian Tree Planting Opportunities

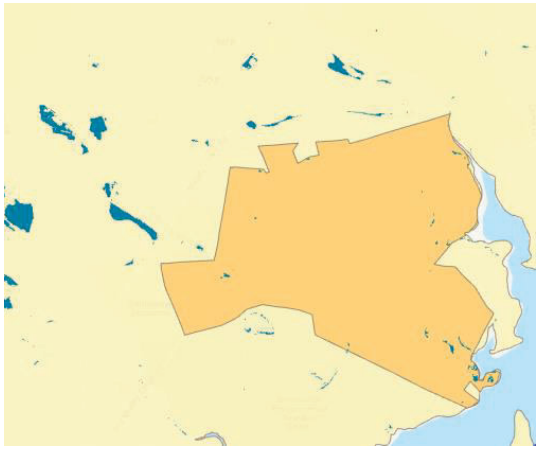
- Leveraged Chesapeake Conservancy "Riparian Land Cover" dataset
- Provides 1m land cover within a 100 ft buffer from stream lines.
- Land cover grouped into 4 classes:
  - Water
  - Existing natural forest and wetland
  - Restorable land cover (low veg and shrub/scrub)
  - Non-restorable (barren and impervious)
- *Note, this data DOES include restorable opportunities on agricultural lands*

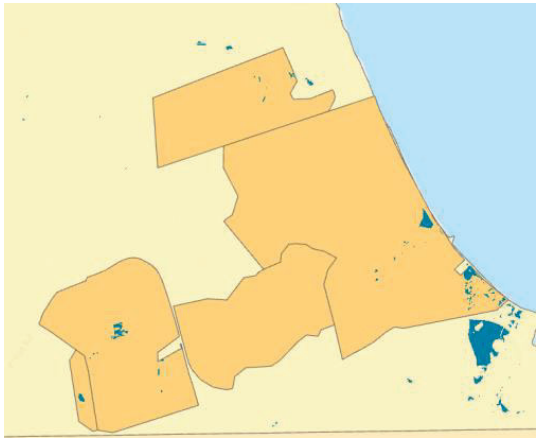


Inland Wetland Restoration Opportunities

- Leveraged the “absolute factors” of the Watershed Resources Registry (WRR) model, to consider :
  - Soil Type (hydric soil)
  - Size of parcel
  - Existing and prior land use

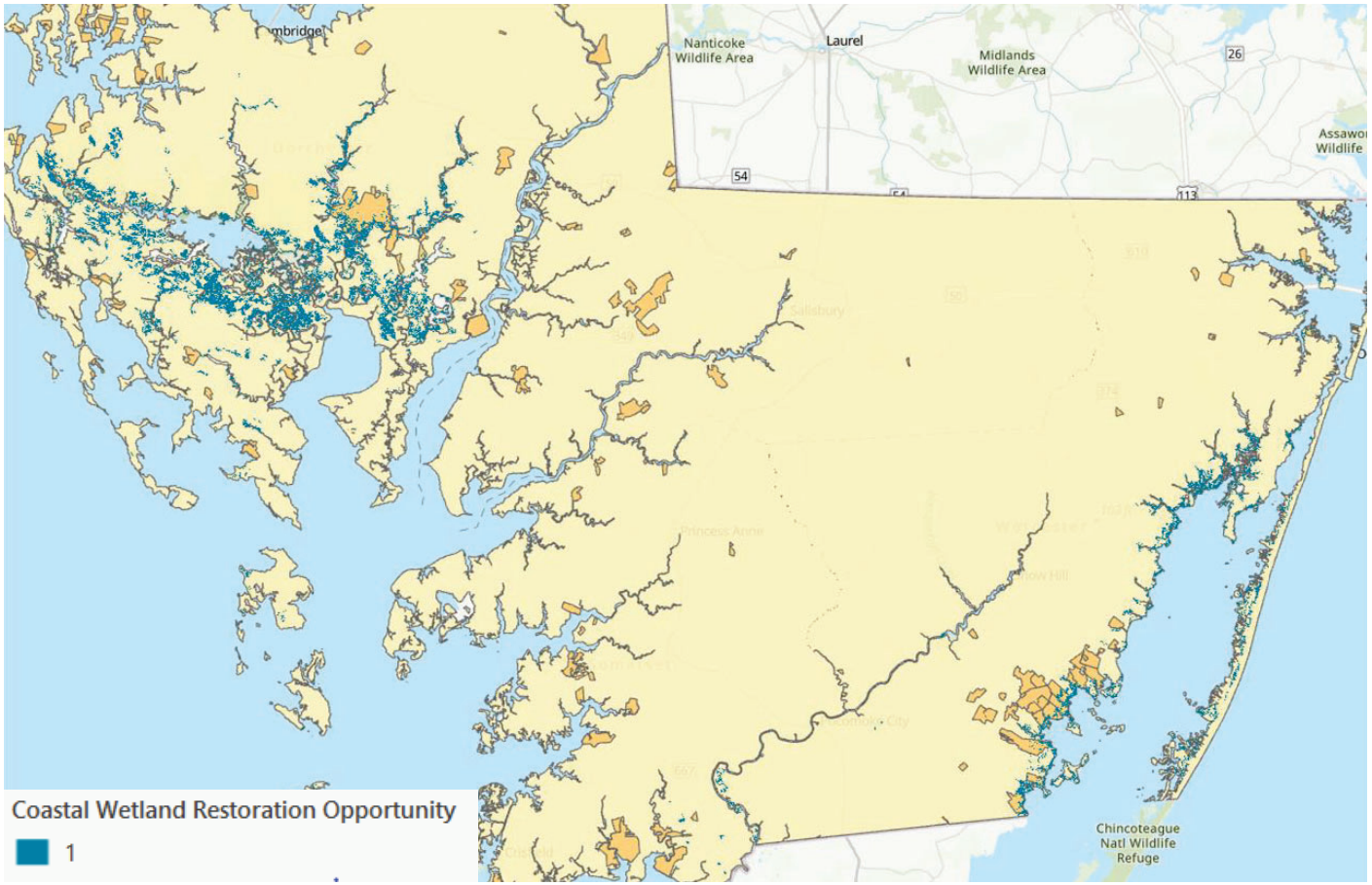






Coastal Wetland Restoration Opportunities

- Created a tidal wetland layer from the 1m LU data
- Leveraged the Sea Level Affecting Marshes Model (SLAMM) model for years 2050, 2070, and 2100, to identify areas expected to:
  - convert from upland to wetland
  - be completely drowned
- Areas expected to convert from upland to wetland, but NOT drowned by 2070 identified as opportunities.



Potential
Co-benefits of Restoration

Carbon Sequestration

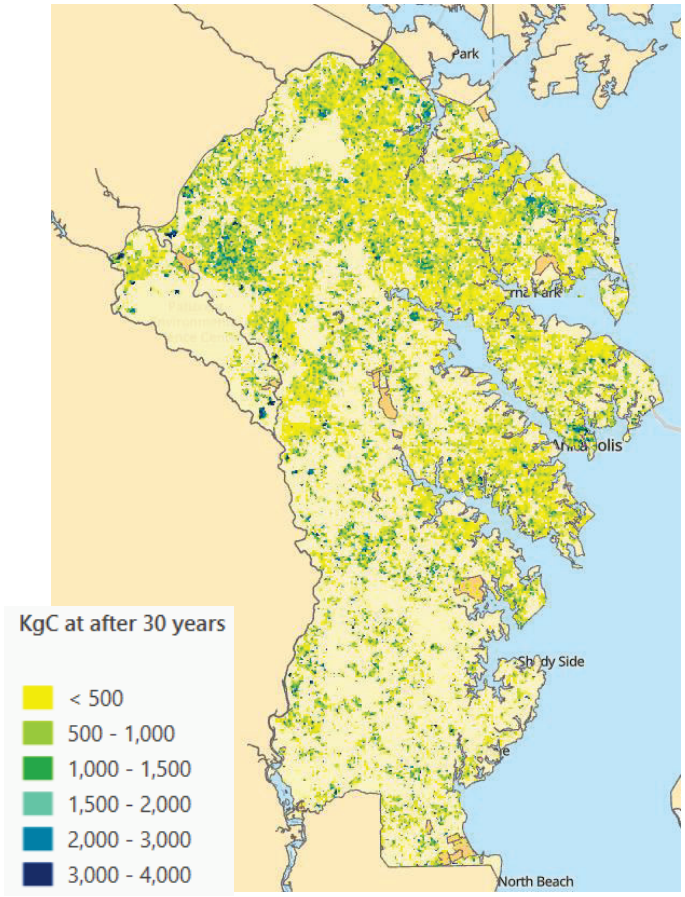
Air Quality Benefits

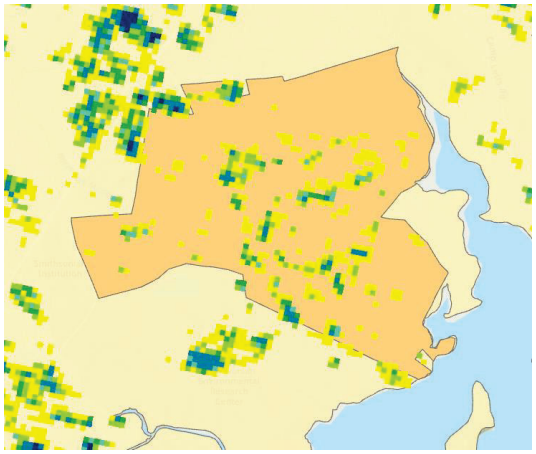
Wildlife abitat

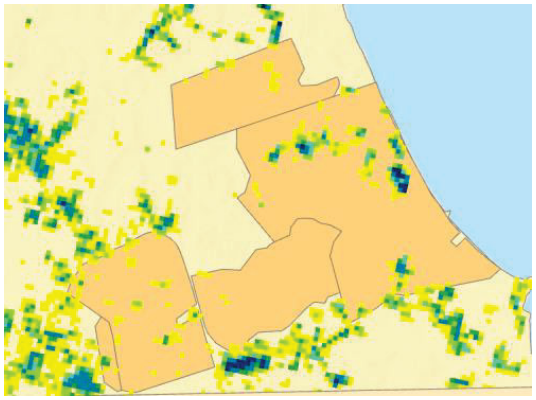
Watershed Vulnerability

Carbon Sequestration
Potential Carbon (kg in 30 year)

- Combined the plantable area analysis with UMD model of potential carbon sequestration through tree planting over different time periods (showing 30 years year)
- Larger planting opportunities with better site conditions will sequester more carbon
- Doesn't consider planting densities or species assumes native species community similar to nearby sites)

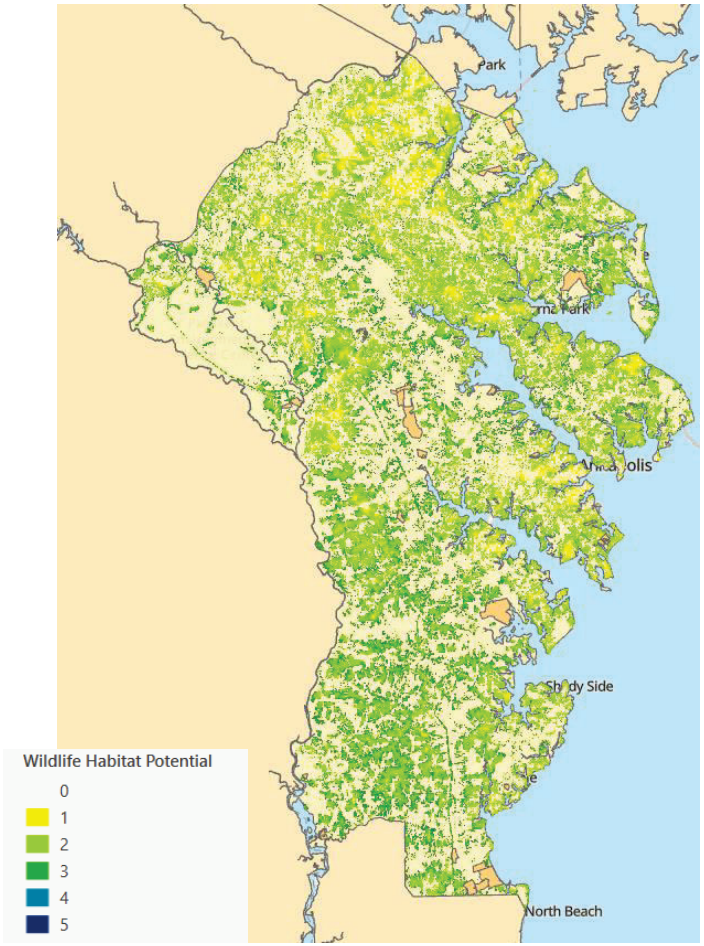


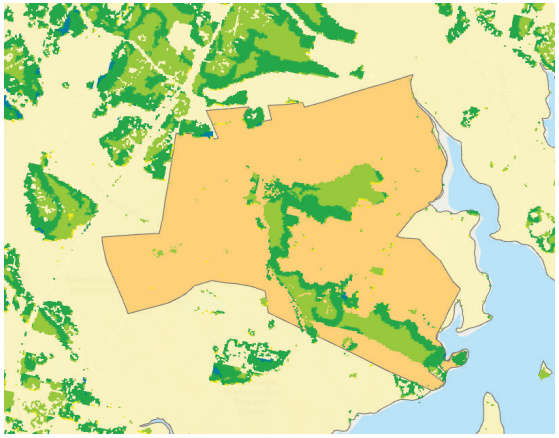


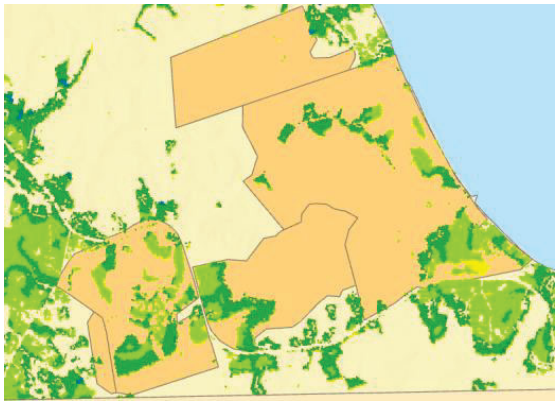


Wildlife Habitat Potential

- Areas that are not currently forest or wetlands, but are:
    - located closer to existing habitat features increases score)
    - located near developed lands (lowers score)



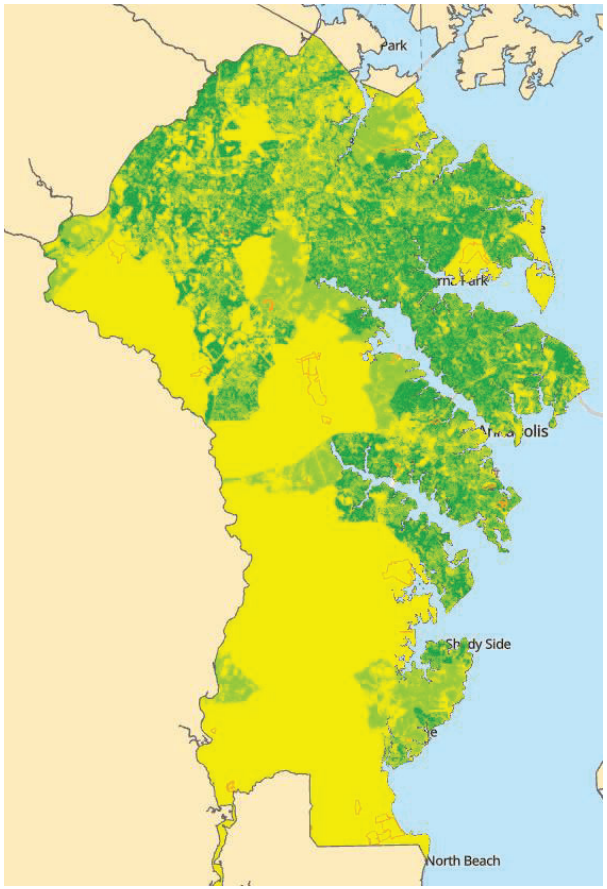




Air Quality

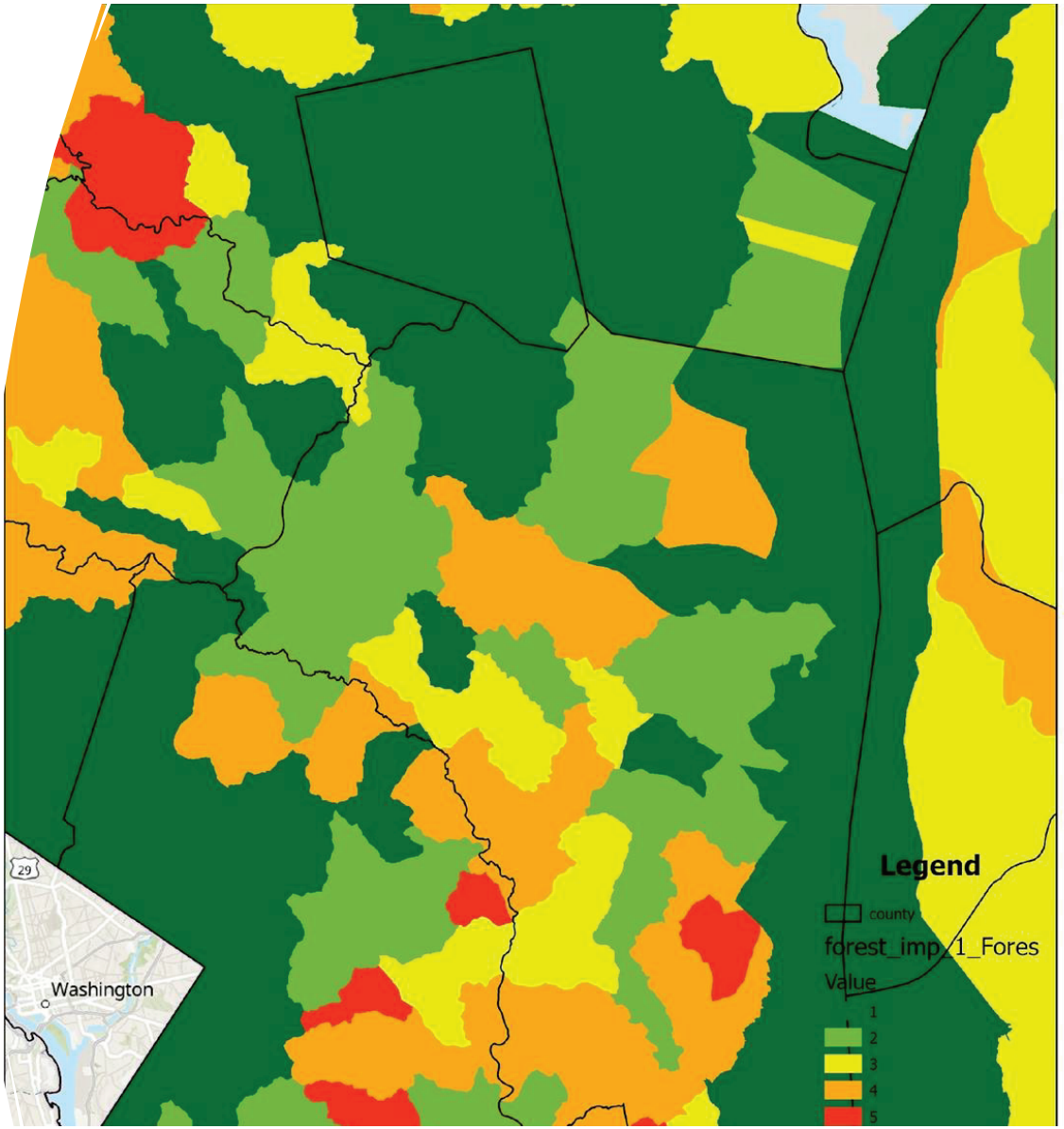
- Based on the i-Tree Landscape tool for air pollutant:
  - removal rates by tree canopy
  - the economic value of that removal based on avoided health costs in nearby populations

- Applied those rates to the tree planting opportunity areas



Vulnerable Watersheds ***

- Looks at 3 criteria for MD watersheds:
    - Change in forest and impervious area between 2013 to 2018
    - Proximity of watershed forest cover to 40% threshold
    - Proximity of watershed impervious cover to 10 % threshold
- Meant to look at watersheds approaching “tipping points” for ability to support aquatic species



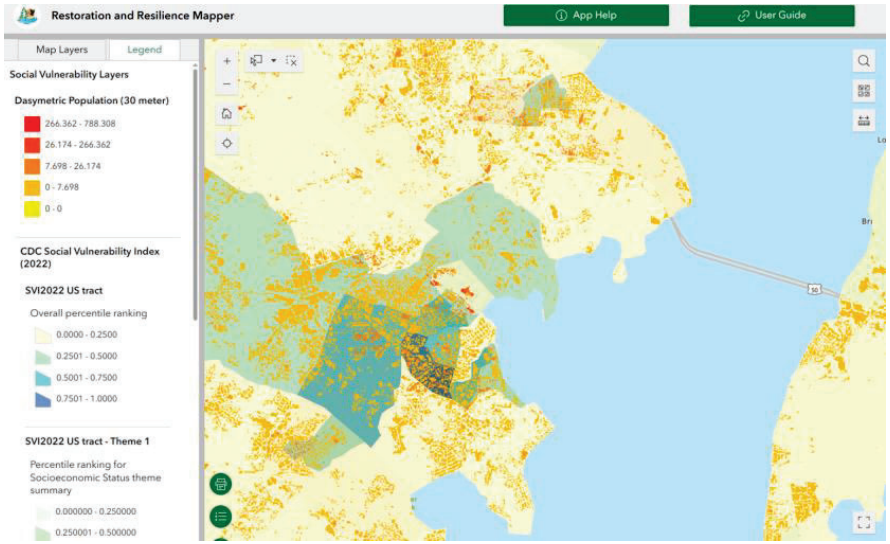
Flood Risk and Vulnerability Analysis

Flood Risk

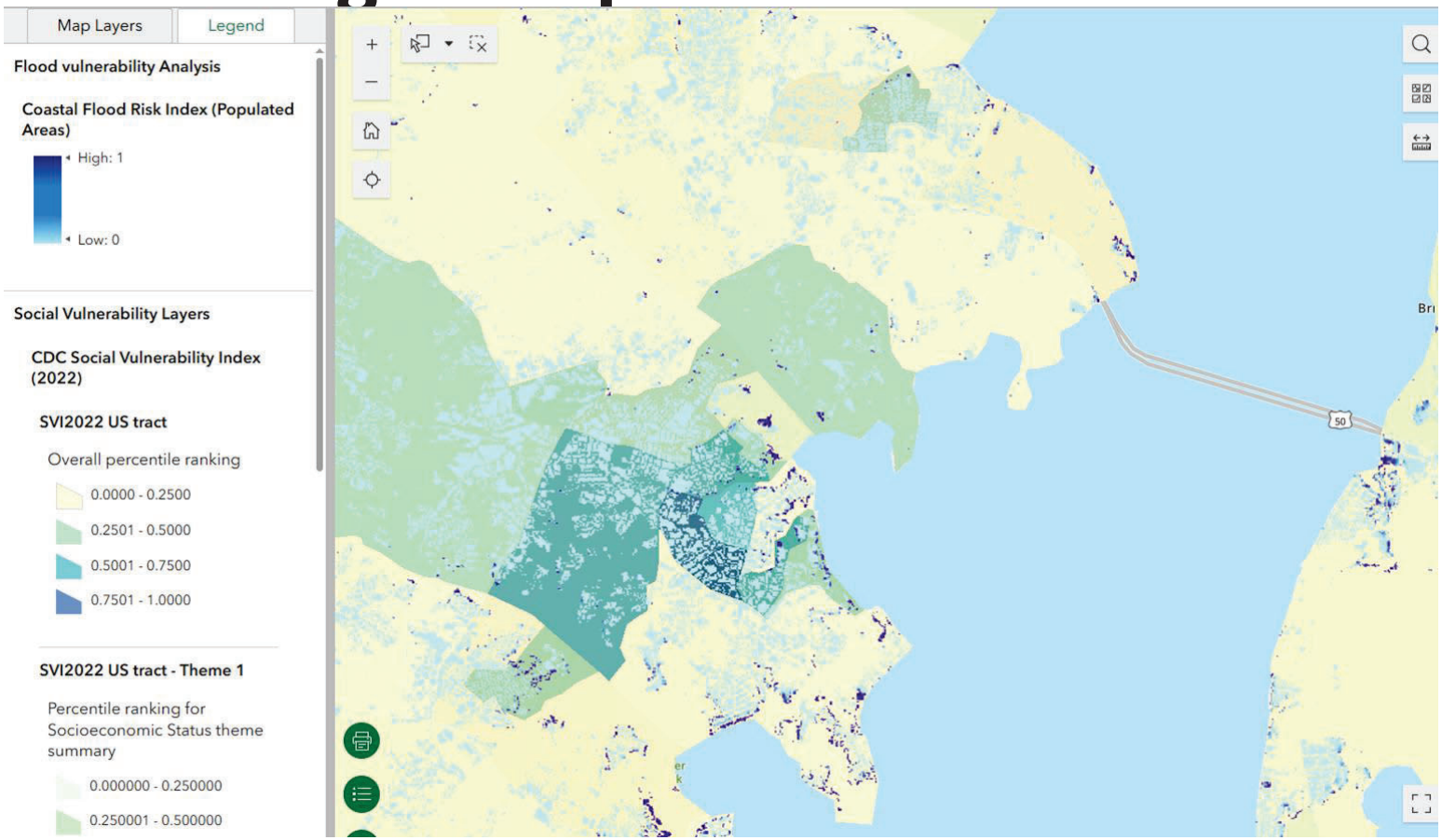
- Created a layer representing inland and coastal flooding
  - Created harmonized statewide layers for coastal and riverine CRAB
  - MDOT Mean Sea Level 100 year storm flood depth (2050 projection
  - MDOT Nuisance Flooding (2050 projection)

Flood Vulnerability

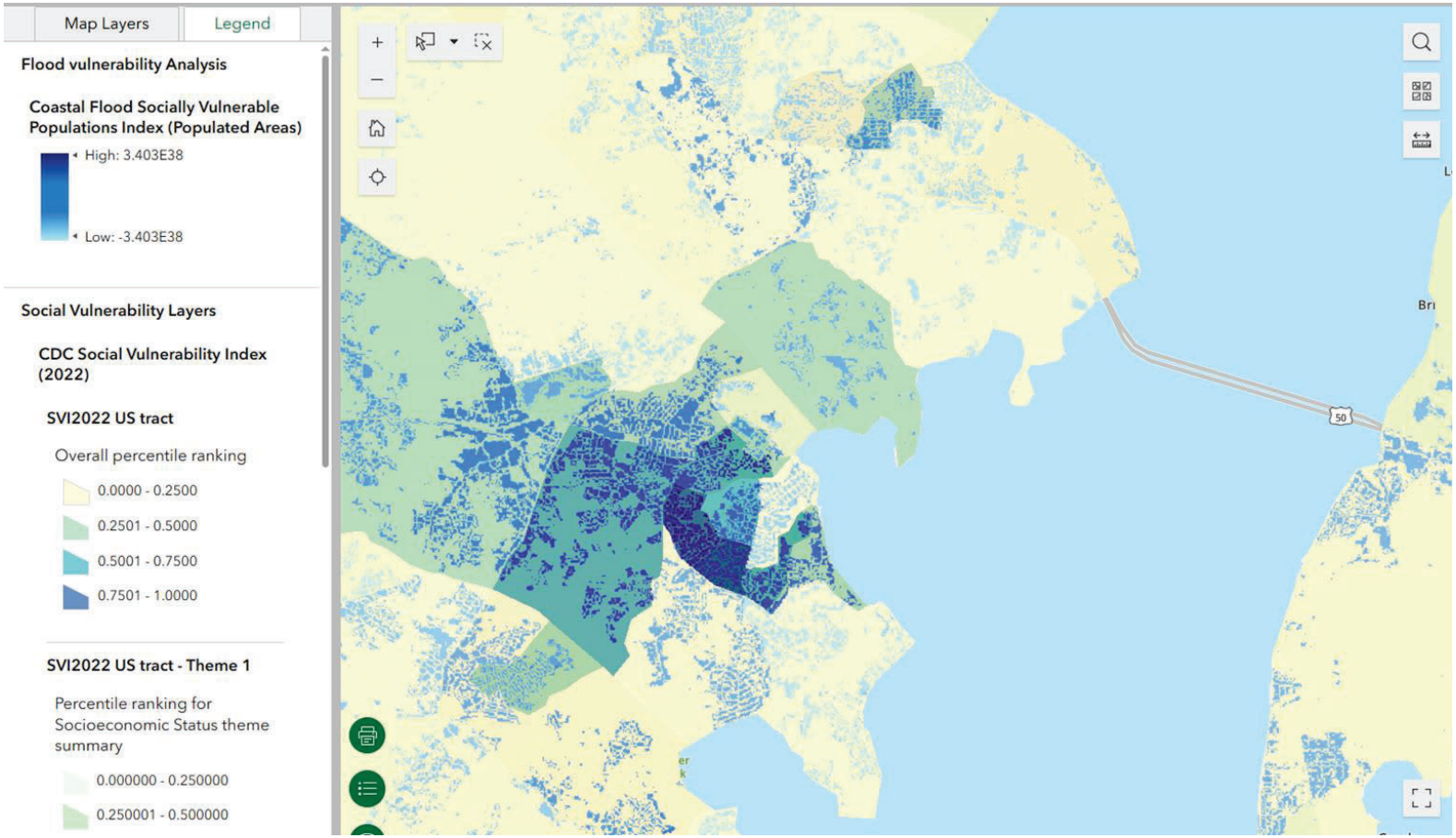
- Represented social vulnerability using census tract level CDC Social Vulnerability ndex (SVI)
    - Reclassed SVI to a 1 - 5 index, 5 being highest social vulnerability
- Determined likely location of populations within census tract areas using Landsat based 30m resolution dasymetric data
- Created layers showing overlap of coastal and riverine flood risk with ANY populated areas
- Created layer showing overlap of coastal and riverine flood risk with SOCIALLY VULNERABLE populations.



Flood Vulnerability:
Coastal Flooding vs Populated Areas



Flood Vulnerability:
Coastal Flooding vs Socially Vulnerable Populated Areas



Maryland Restoration and Resilience Map:

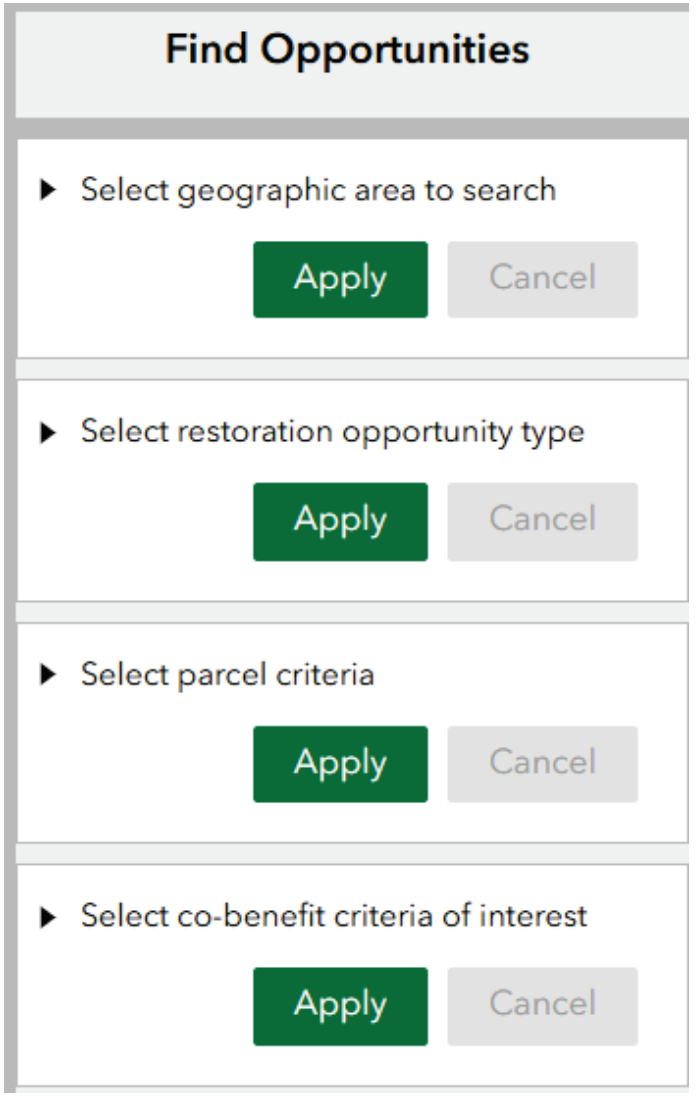
Find Opportunities Tool

Find Opporunities Tool

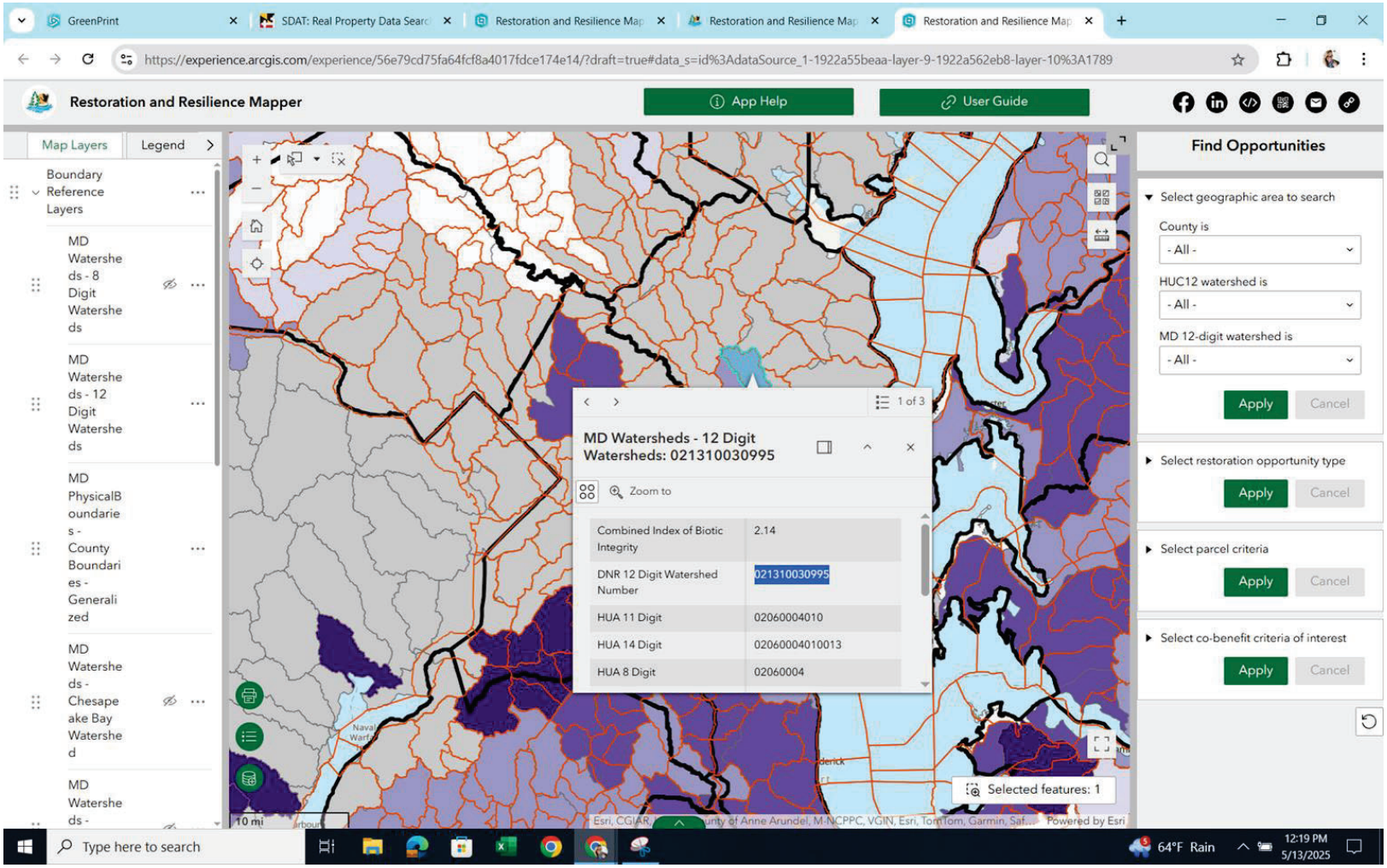
The Find Opportunities Tool allows users to search for restoration opportunities based on desired criteria, such as location (specific county or watershed), restoration type/opportunity size (acres), specific potential co-benefits

The tool provides a table that highlights all parcels meeting the defined criteria, as well as a summary of relevant attributes for each parcel

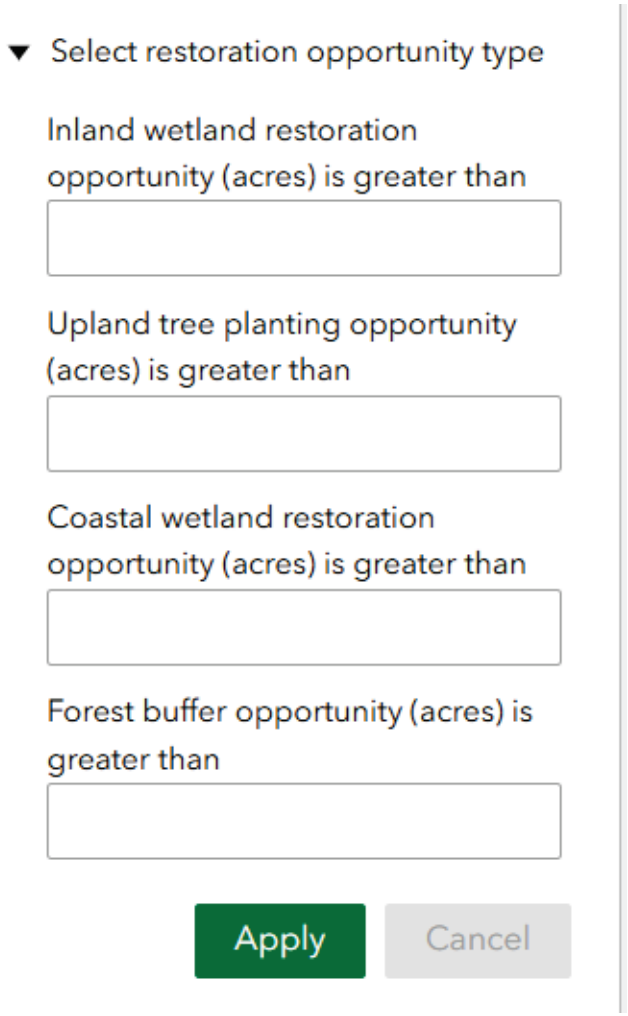
***The underlying parcel shapefile containing parcel level values is not currently publically available, but can be provided to partners who would like to use it for subsequent desktop analysis.*

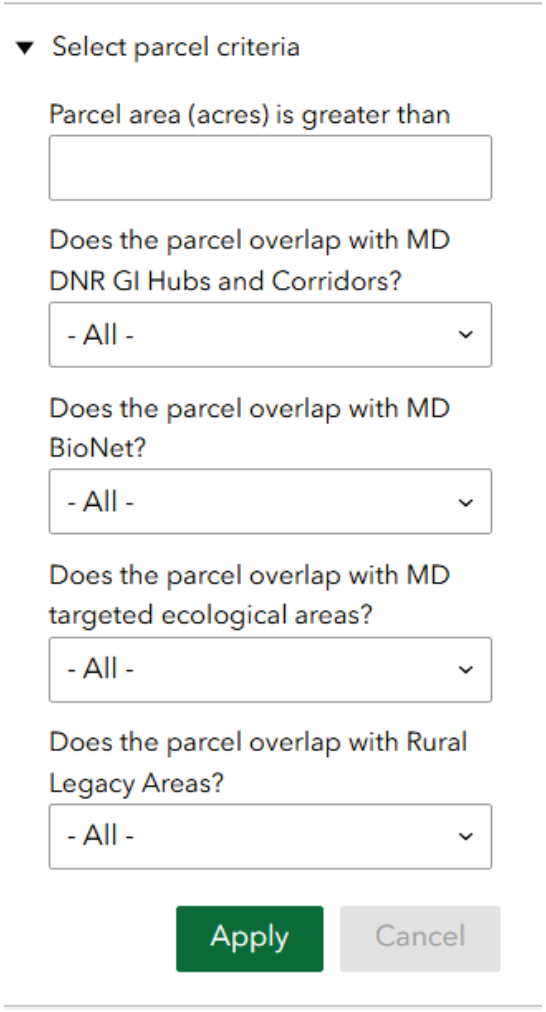


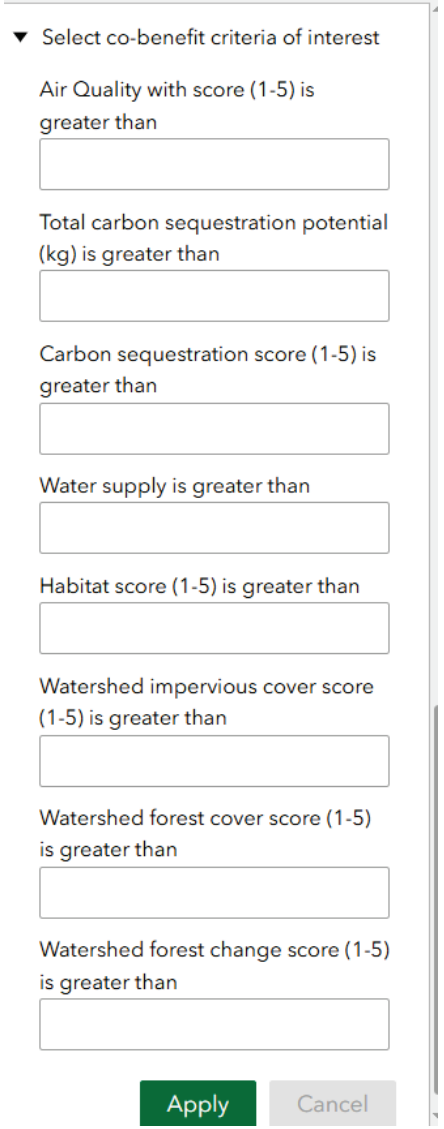
Find Opportunities Tool



Find Opportunities Tool







Find Opportunities Tool

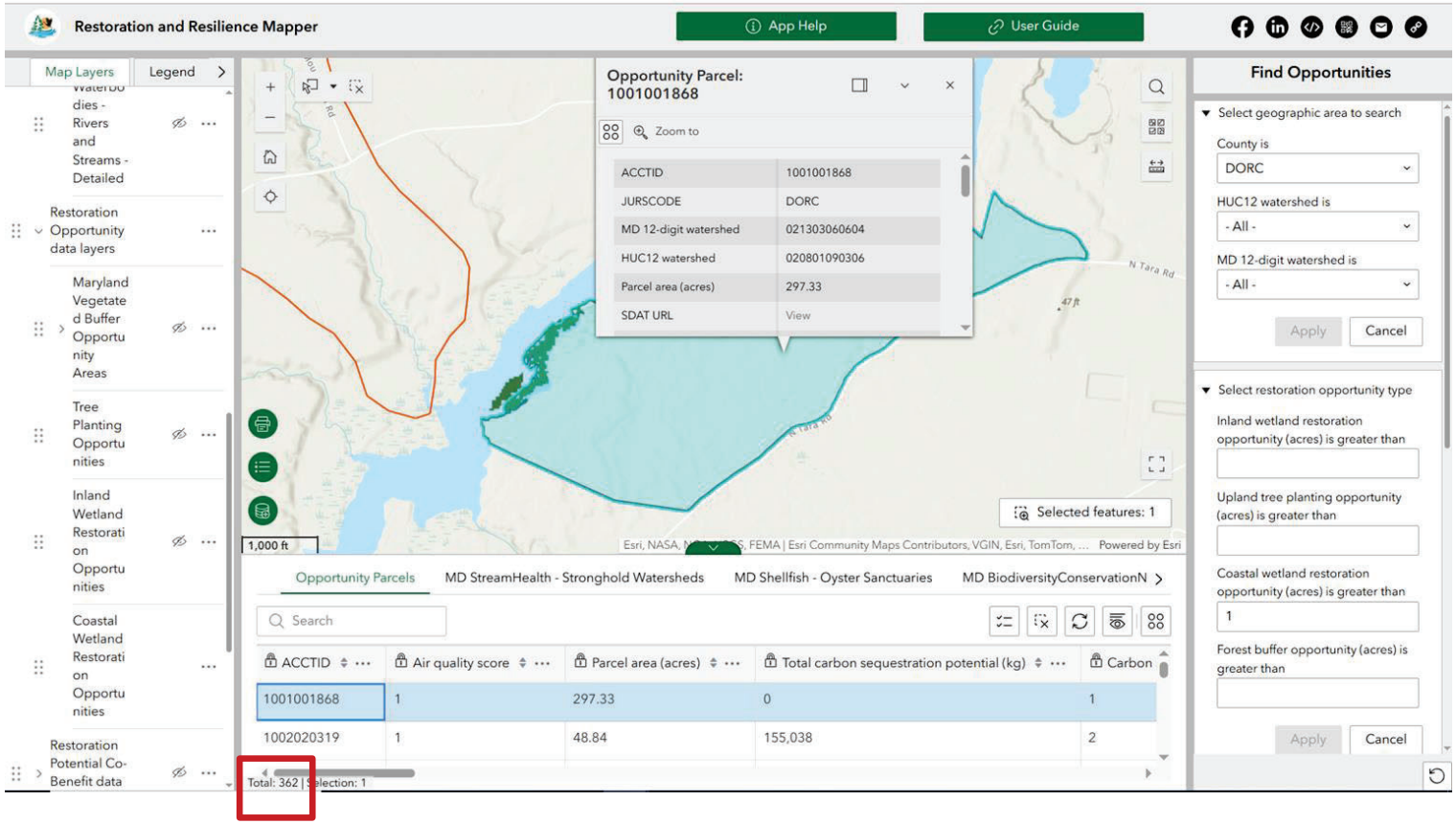
Search Criteria

Geographic Area:
Dorchester County

Restoration Opportunity Type:
Coastal Wetland Creation > 1 acre

Results:

362 parcels selected in Dorchester County with > 1 acre potential wetland restoration opportunity

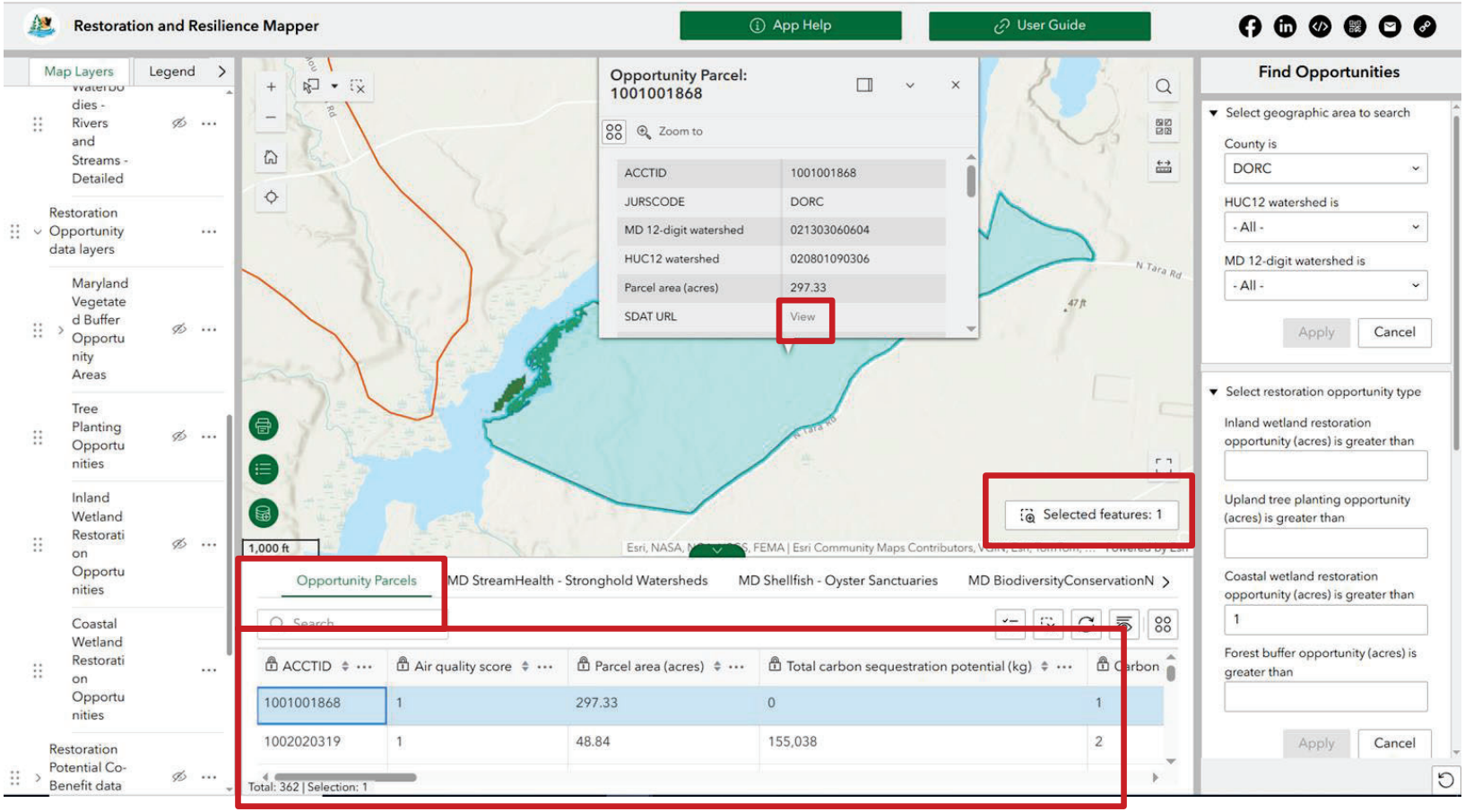


Number of parcels selected

Find Opportunities Tool

To investigate selected parcels:

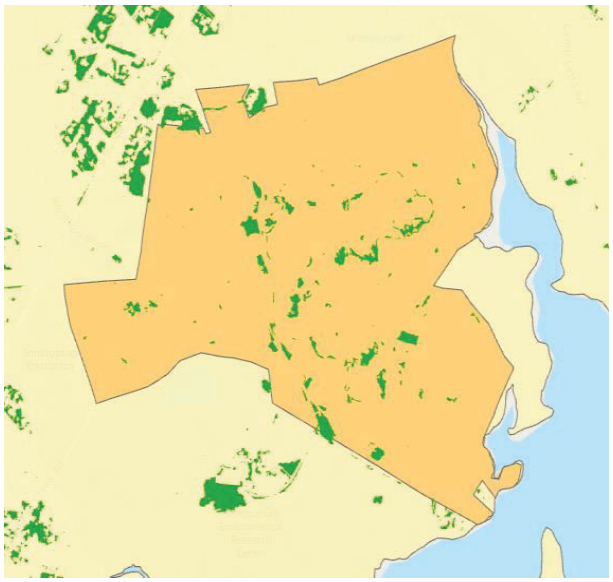
- Click on individual parcel row in the "Opportunity Parcels" table
- Click on "Selected Features" button
- Map will zoom to selected parcel
- Pop-up will appear that shows subset of parcel data
- Click on "View" in pop-up to open SDAT page for selected parcel
- Can turn on data layers of interest to further investigate parcel



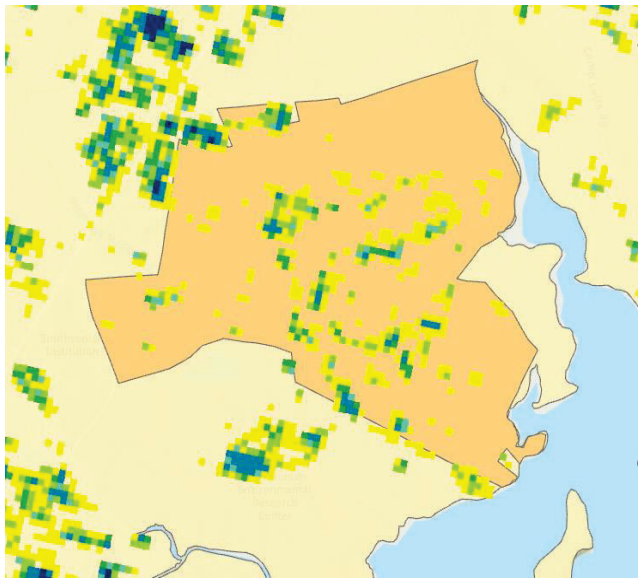
Opportunity Parcels table shows ecological values for selected parcels

Restoration Opportunities:
Site-level Considerations (R&R Tool)

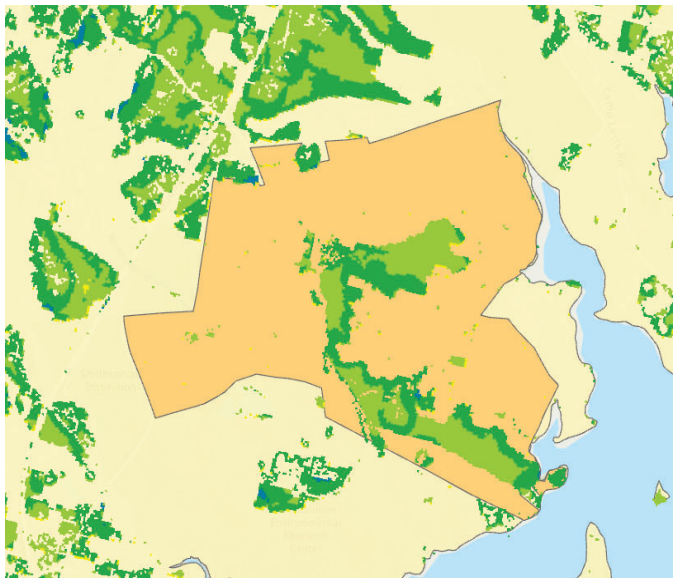
Plantable Area Opportunities



Carbon Sequestration Potential



Wildlife Habitat Potential



Example:
MET Potential Restoration Opportunities

Restoration Opportunity	Acres
Tree Planting	378.23
Riparian Planting	6,812.67
Inland Wetland	10,182.00
Coastal Wetland	148.73
Total	**17,521.64**

Riparian Type	Acres
Open Water	4,991.54
Natural	23,896.36
Restorable	6,812.67
Non-Restorable	272.05
Total	**35,972.62**

Summary Restoration and Resilience Mapper Use Ideas

Within Mapper:

- Visually “analyze” and compare data layers for area of interest
- Manually add study area polygons or additional context layers
- Use “Find Opportunities tool to select parcels that meet defined restoration criteria of interest
- Visualize and compare potential restoration opportunities and associated co-benefits across selected parcels

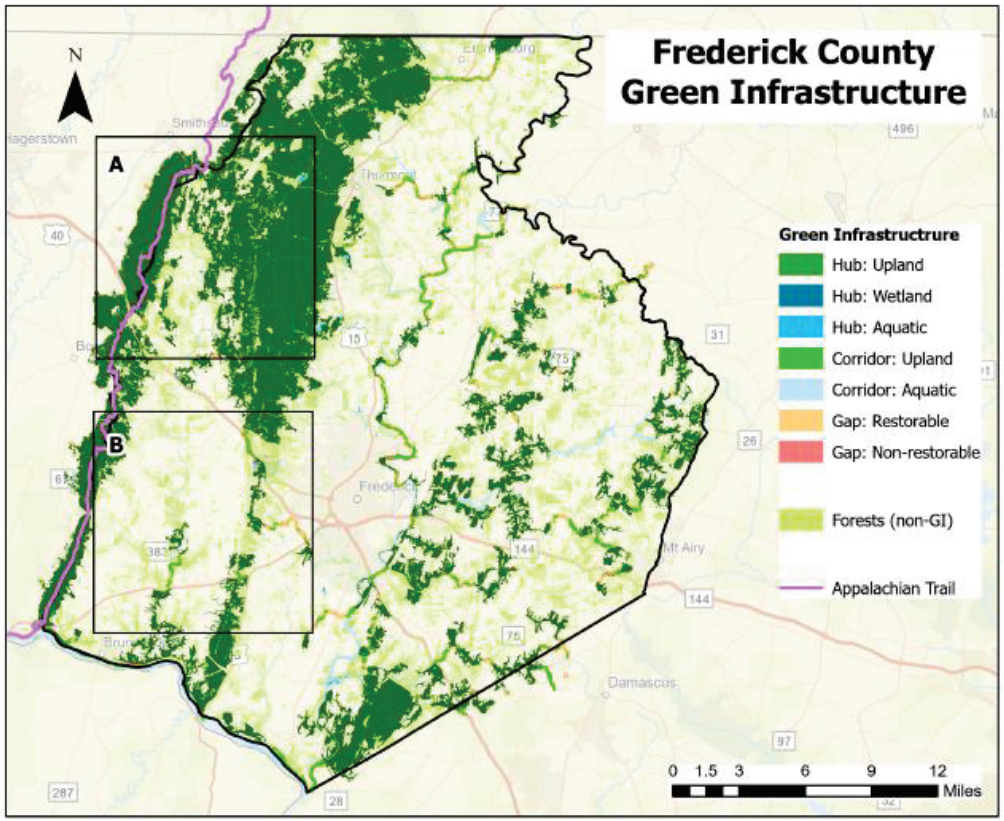
Outside of Mapper: with some S skills)

- Visually compare parcel level restoration opportunities and potential co-benefits of interest
- Use select by attributes to select parcels based on desired thresholds of desired attributes
- Calculate summaries of acres of restoration opportunities and associated co-benefits across parcels

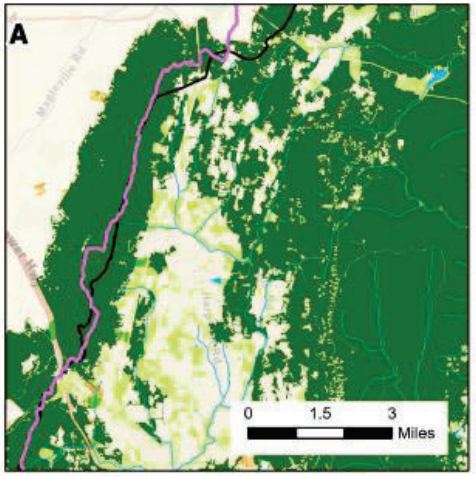
Bringing it All Together

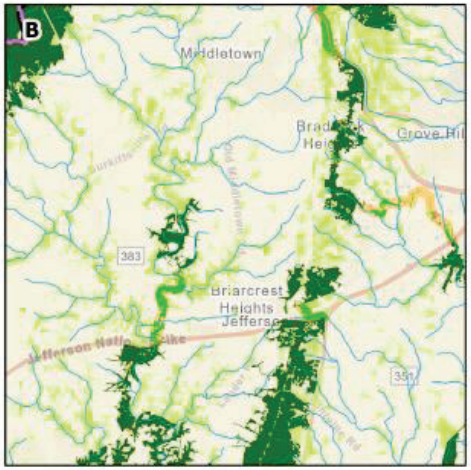
Wildlife Habitat/ Connectivity Example)

Conservation Opportunities: Landscape-level Considerations



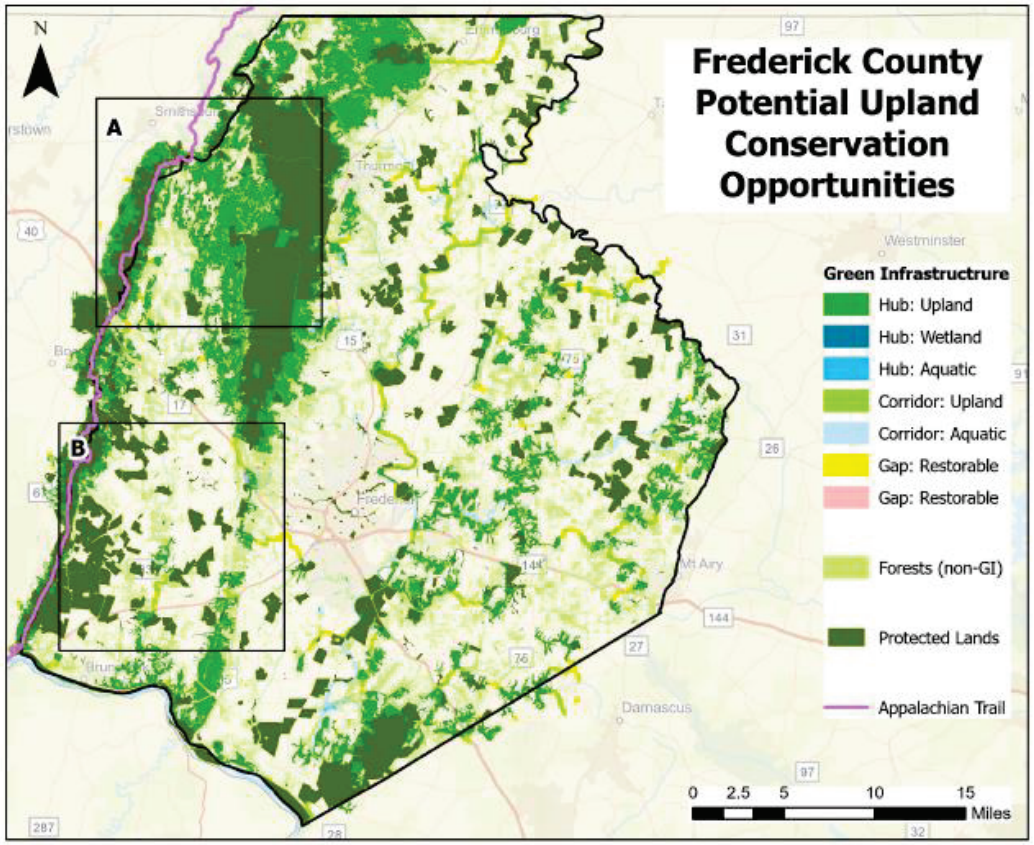
This map shows existing CN hubs and corridors identified in Frederick County, MD.





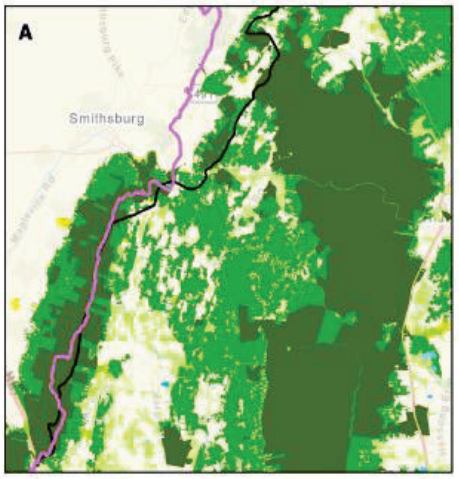
Conservation Opportunities:

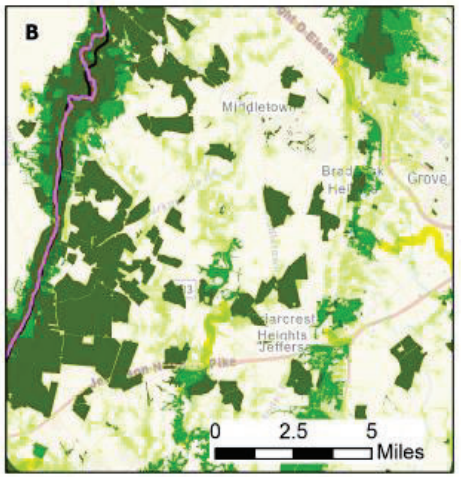
Landscape Level Considerations



Data Use Ideas:

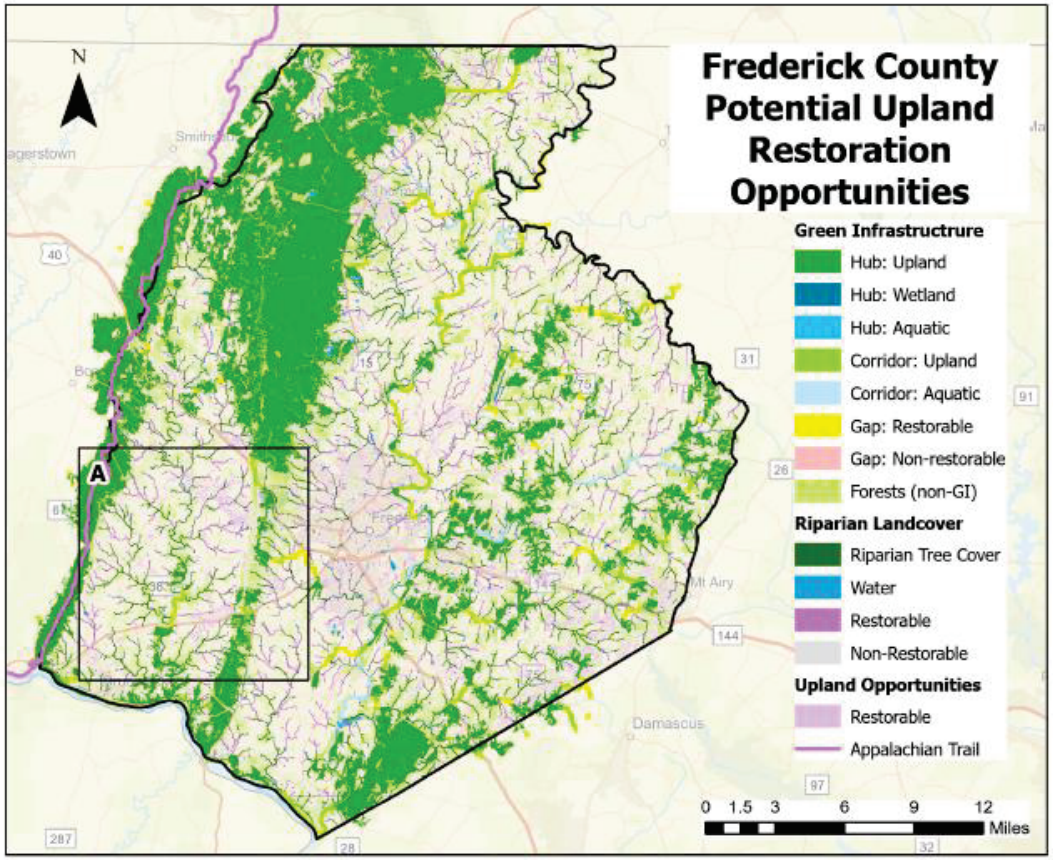
- Project scale: Unprotected , Bionet, high eco-score, high conservation co-benefit potential
- Landscape Scale: prioritize natural areas important to connectivity

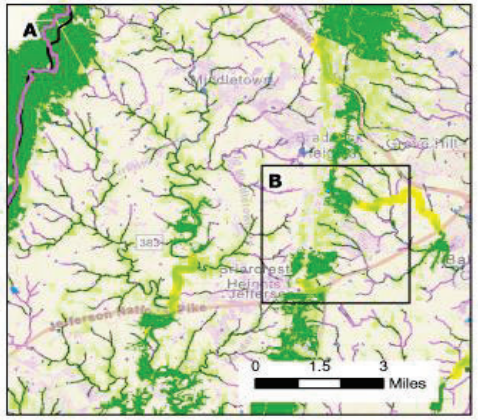


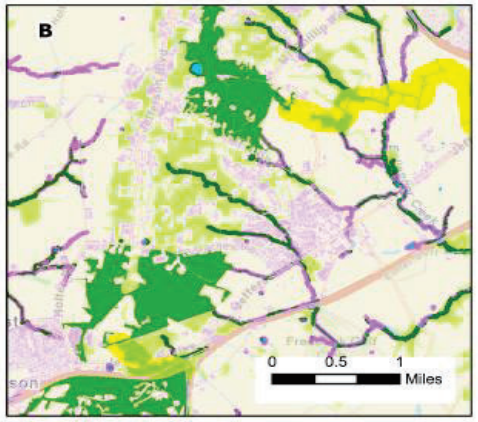


Restoration Opportunities:

Landscape Level Considerations







**** Plantable area doesn't include agricultural land; however agricultural areas ARE partially captured via inclusion in the Riparian Restoration layer and HCN restorable gaps.**

The Coastal Atlas & Data Tools

Rachel Donnelly (Bacher)
GIS Analyst
Watershed & Climate Services

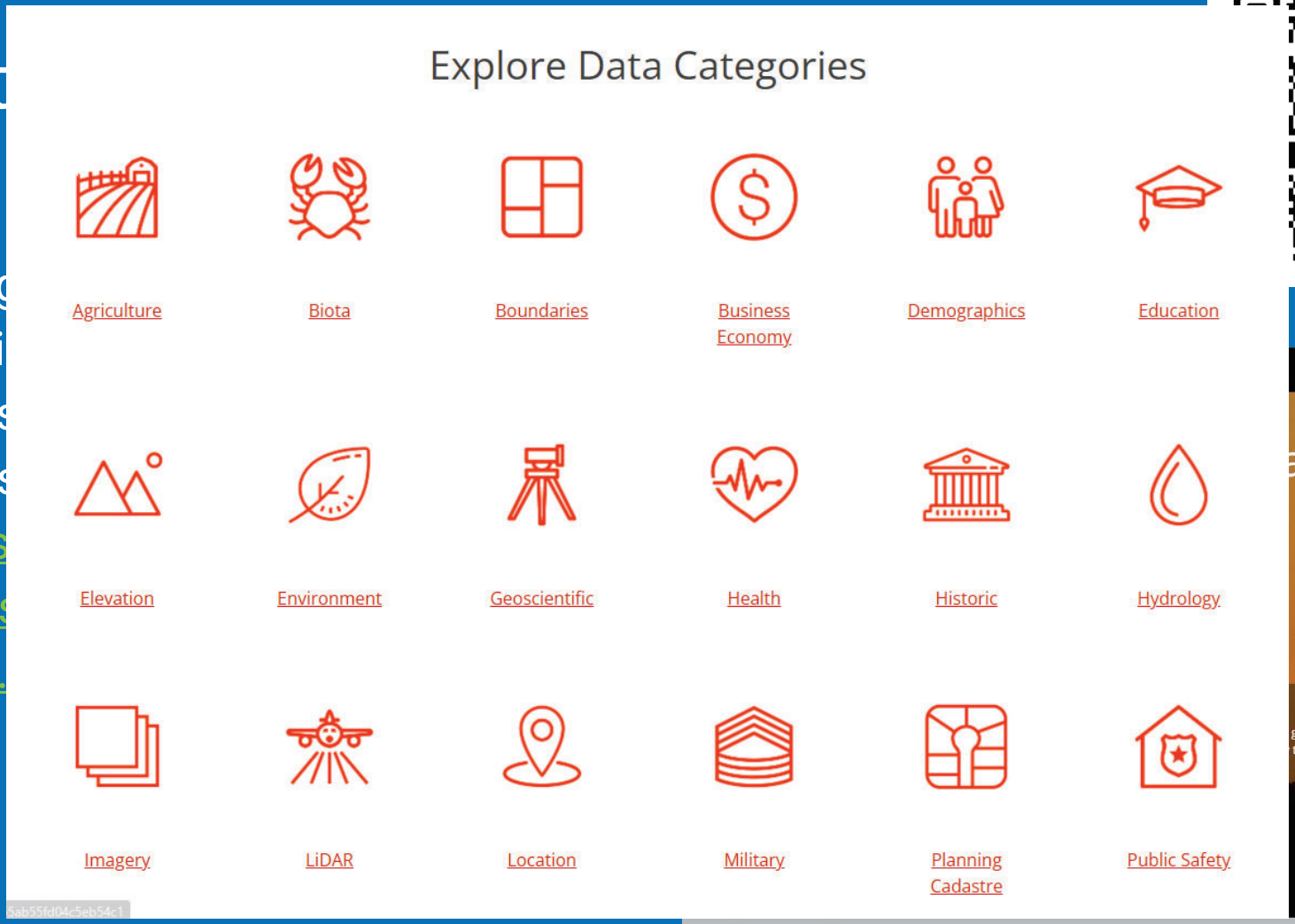
MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

Coastal Atlas

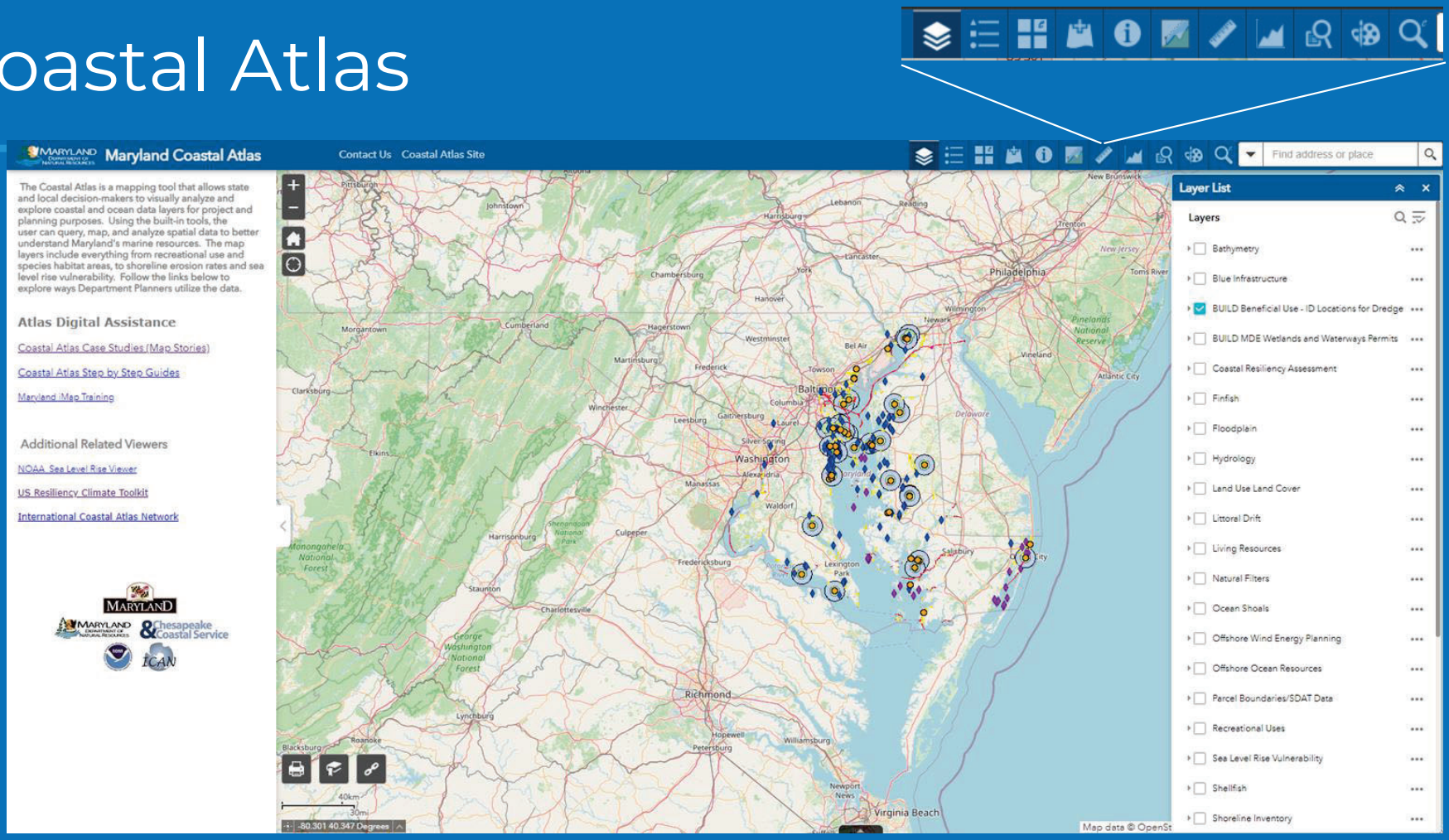
- Interactive mapping tool that allows state and local decision-makers to visually analyze and explore coastal and ocean data layers for project and planning purposes
- Developed in early 2000s
- Managed by Rachel B.
- Step-by-step guides are available online for new users
- Re-vamped Coastal Atlas in the future - date TBD

Coast

- Desig
maki
areas
- Webs
https
lAtlas
- data.



Coastal Atlas



Popular Layers & Groups

BUILD (Beneficial Use: Identifying Locations for Dredge)

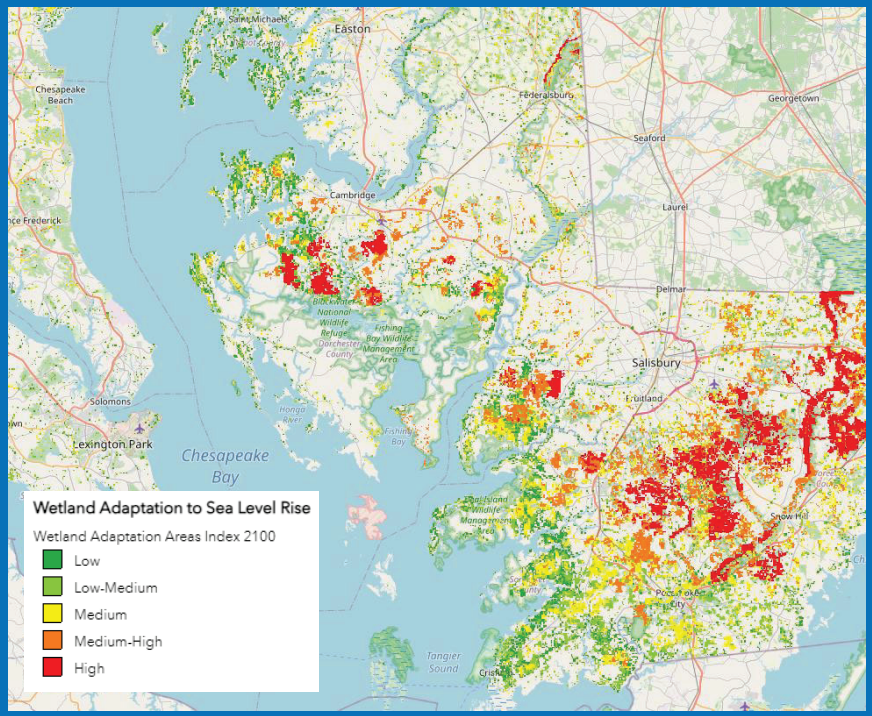
Coastal Resiliency Assessment

Land Use Land Cover

Parcel Boundaries

Shoreline Rates of Change

Wetland Adaptation to Sea Level Rise



Coastal Atlas Demonstration

https://dnr.geodata.md.gov/CoastalAtlas

The Coastal Atlas is a mapping tool that allows state and local decision-makers to visually analyze and explore coastal and ocean data layers for project and planning purposes. Using the built-in tools, the user can query, map, and analyze spatial data to better understand Maryland's marine resources. The map layers include everything from recreational use and species habitat areas, to shoreline erosion rates and sea level rise vulnerability. Follow the links below to explore ways Department Planners utilize the data.

Atlas Digital Assistance

Coastal Atlas Case Studies (Map Stories)

Coastal Atlas Step by Step Guides

Maryland iMap Training

Additional Related Viewers

NOAA Sea Level Rise Viewer

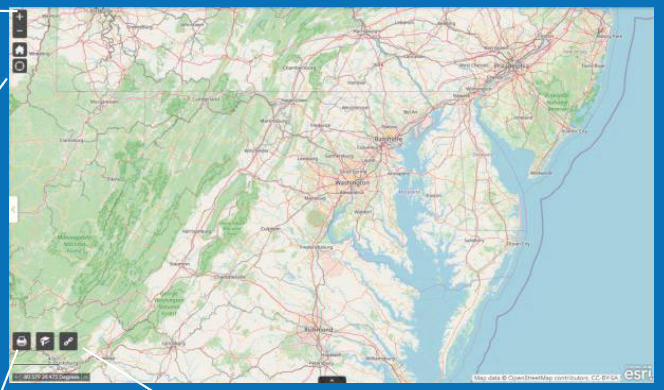
US Resiliency Climate Toolkit

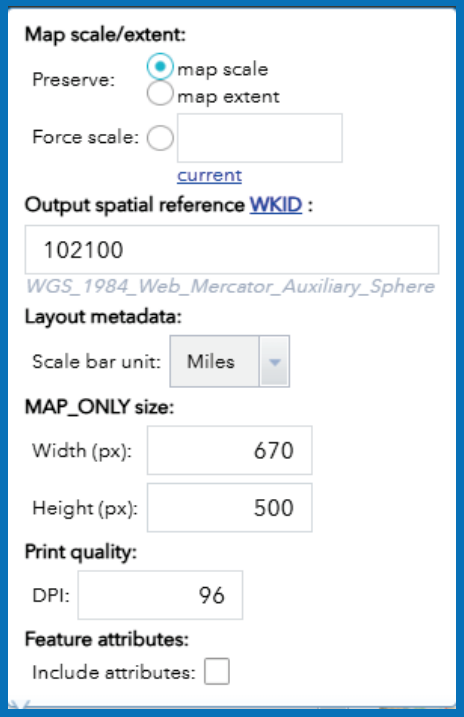
International Coastal Atlas Network

Zoom

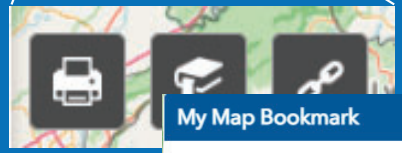
Default Extent

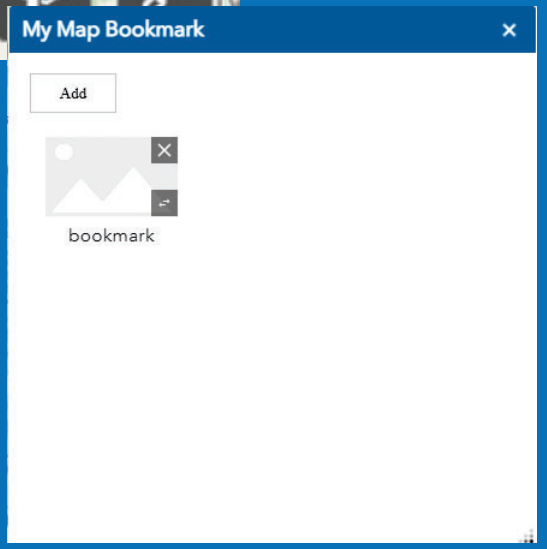
Location Services



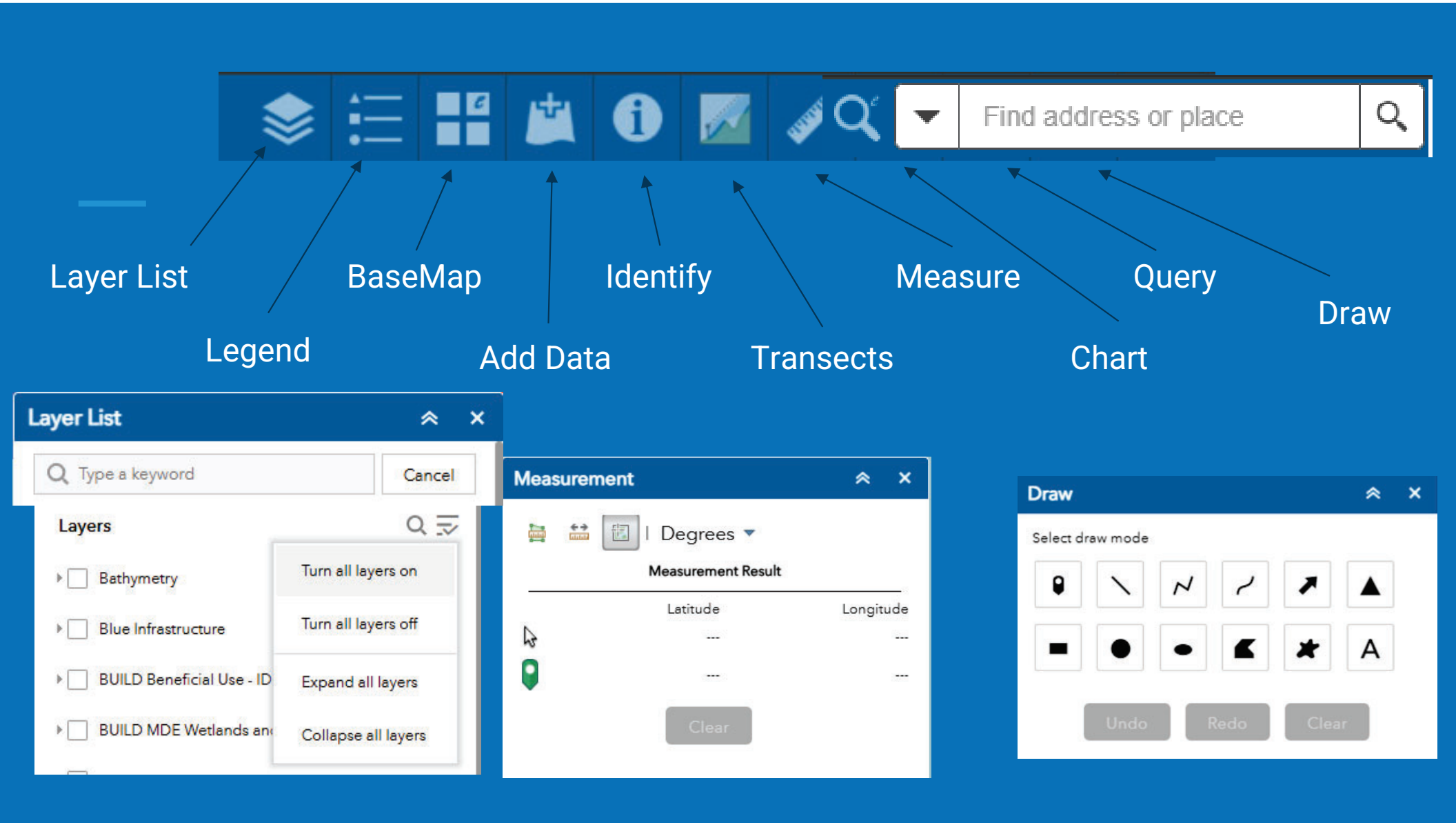


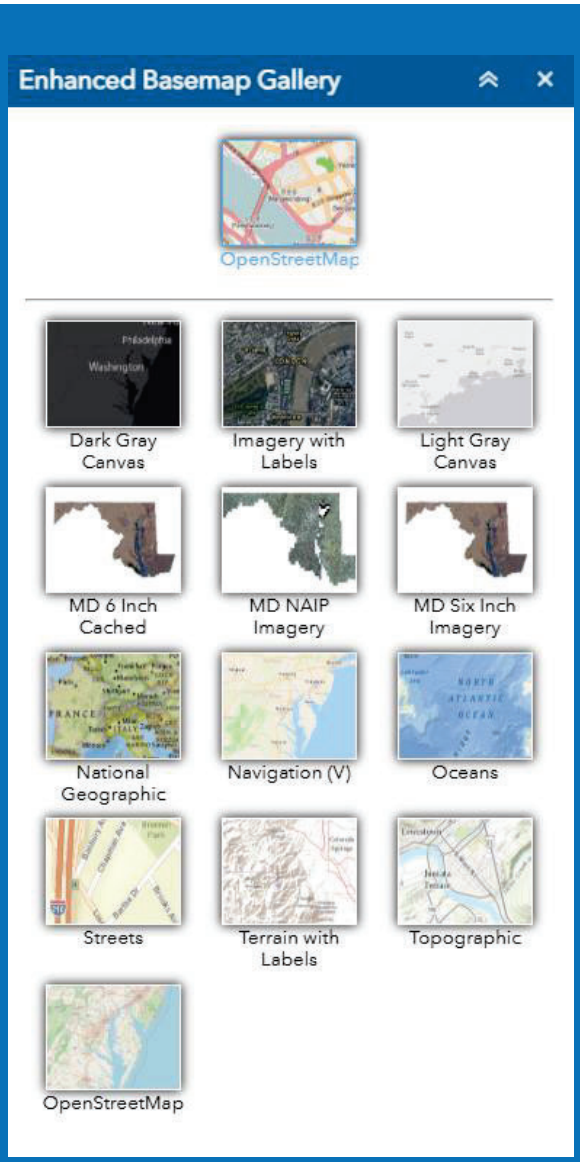
Print

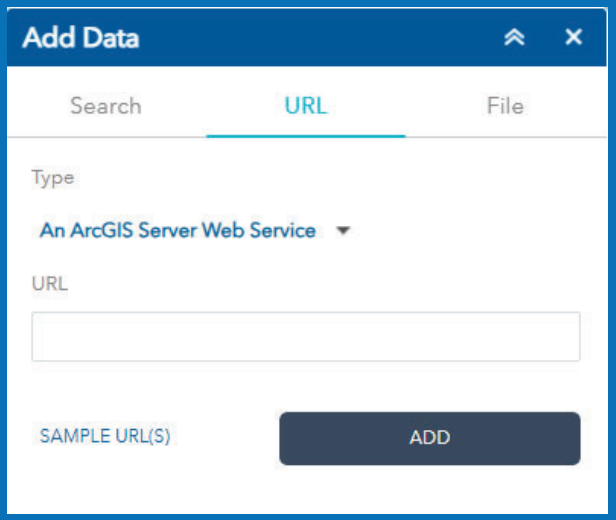


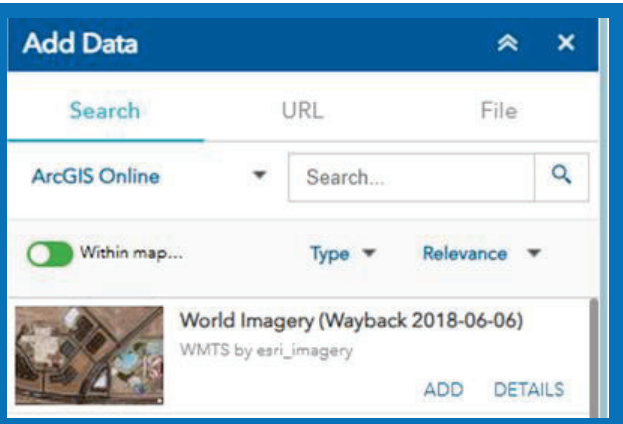


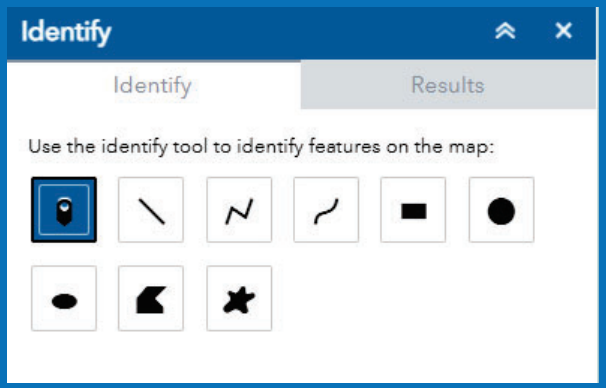
Attribute Table

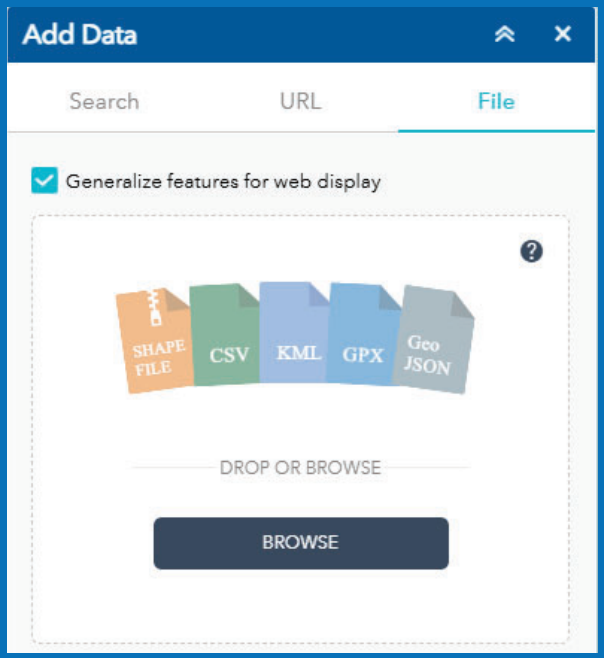

Find address or place
Layer List
Legend
BaseMap
Add Data
Identify
Transects
Measure
Chart
Query
Draw
Layer List
Type a keyword
Cancel
Layers
Bathymetry
Blue Infrastructure
BUILD Beneficial Use - ID
BUILD MDE Wetlands an
Turn all layers on
Turn all layers off
Expand all layers
Collapse all layers
Measurement
Degrees
Measurement Result
Latitude
Longitude
Clear
Draw
Select draw mode
A
Undo
Redo
Clear


Enhanced Basemap Gallery
OpenStreetMap
Dark Gray Canvas
Imagery with Labels
Light Gray Canvas
MD 6 Inch Cached
MD NAIP Imagery
MD Six Inch Imagery
National Geographic
Navigation (V)
Oceans
Streets
Terrain with Labels
Topographic
OpenStreetMap

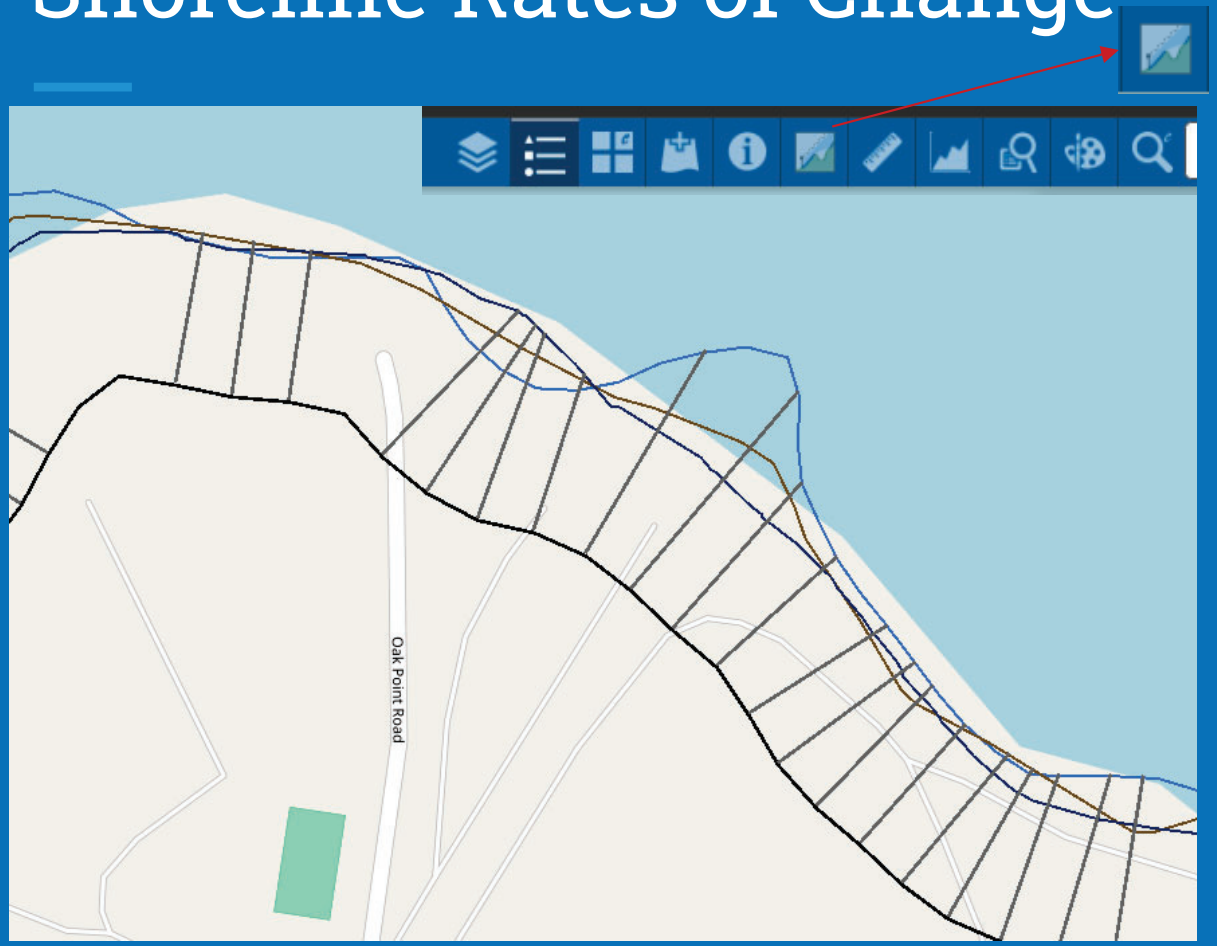

Add Data
Search
URL
File
Type
An ArcGIS Server Web Service
URL
SAMPLE URL(S)
ADD

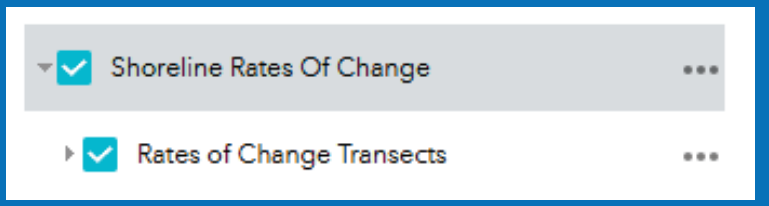

Add Data
Search
URL
File
ArcGIS Online
Search...
Within map...
Type
Relevance
World Imagery (Wayback 2018-06-06)
WMTS by esri_imagery
ADD
DETAILS


Identify
Identify
Results
Use the identify tool to identify features on the map:


Add Data
Search
URL
File
Generalize features for web display
SHAPE FILE
CSV
KML
GPX
Geo JSON
DROP OR BROWSE
BROWSE

Shoreline Rates of Change





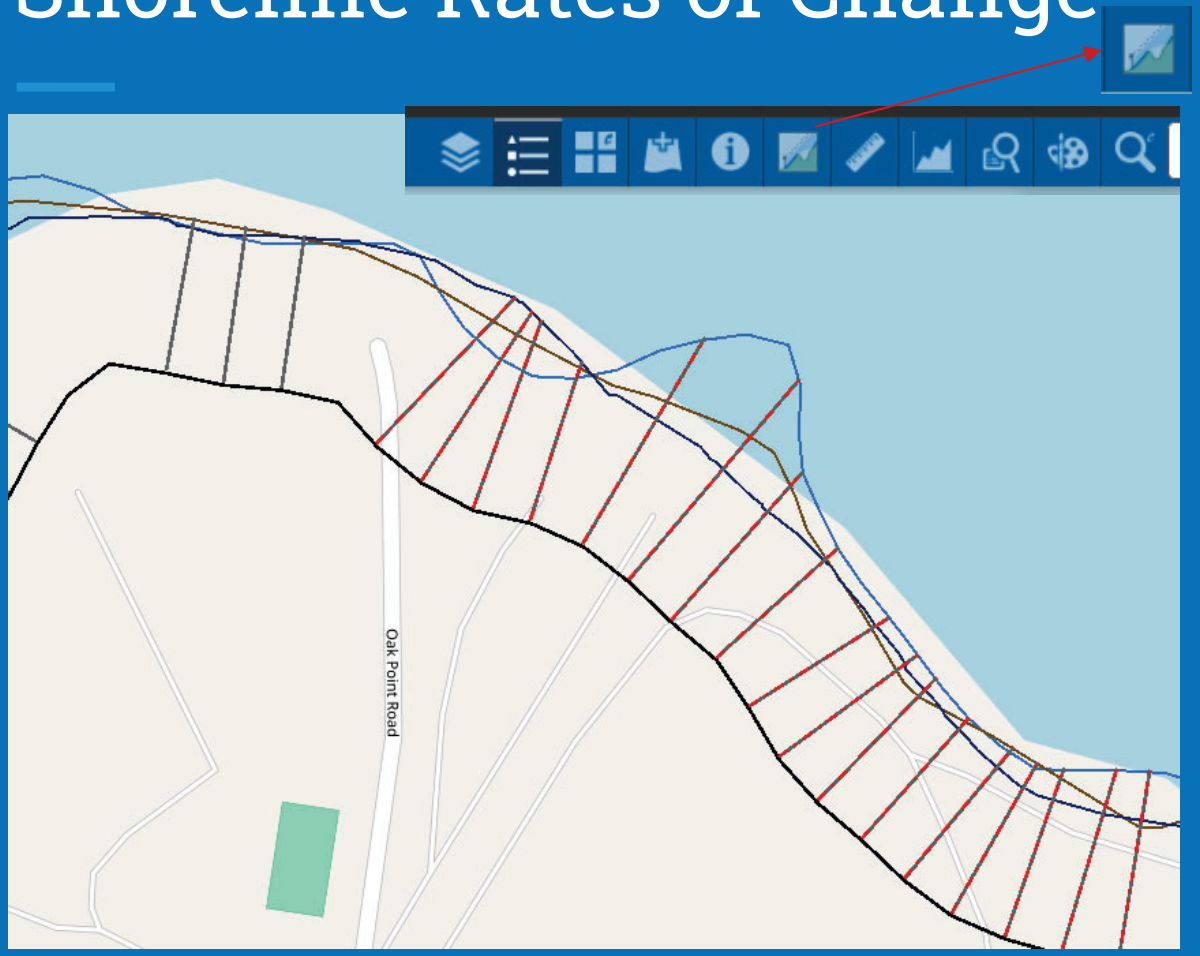
~ 2015

County-dependent

Calculated by DSAS GIS tool

- historical shorelines, topo maps, aerial photos

Shoreline Rates of Change



Transects

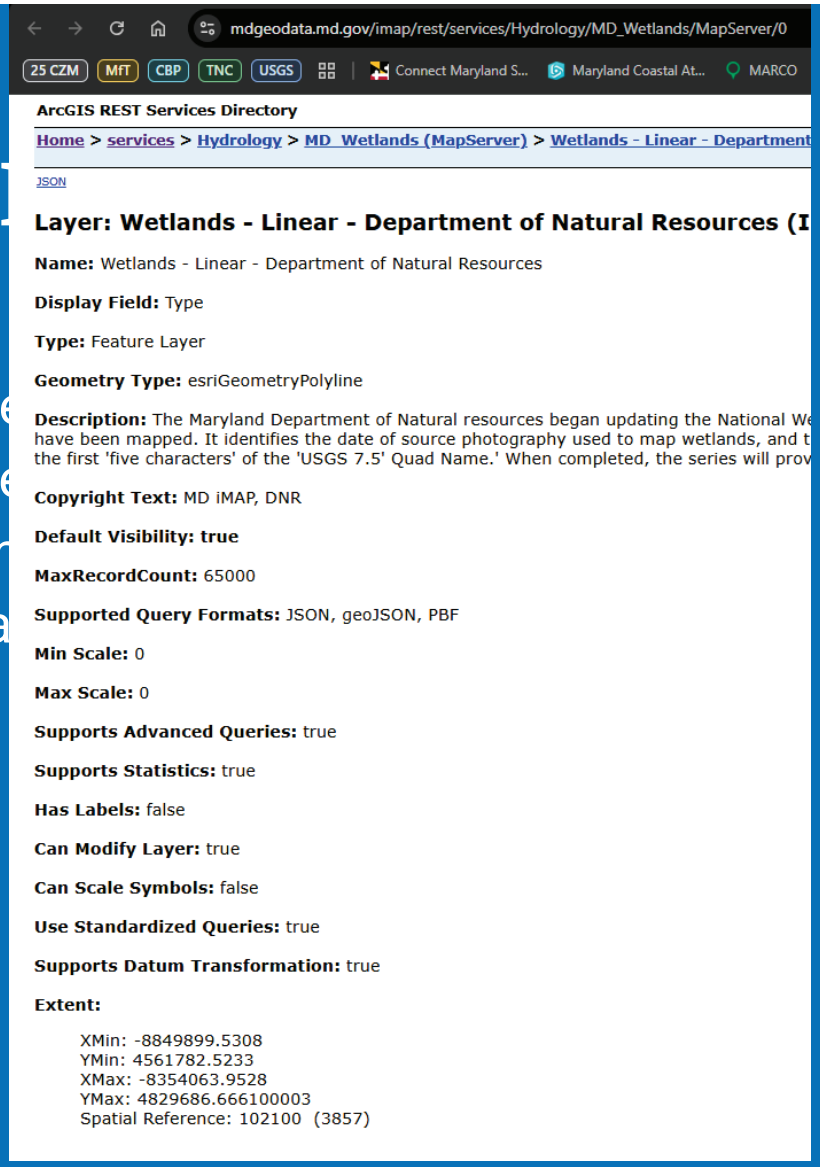
Select Transects | Clear Selection

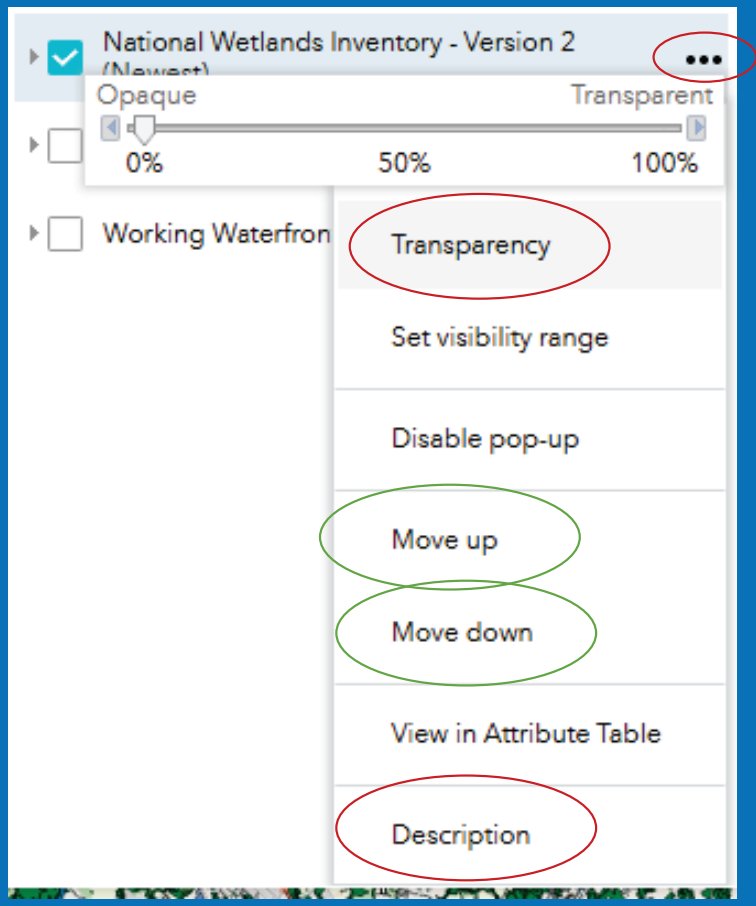
Number Selected: 17
Transect Average: -0.10 ft.

Zoom	Recent Rate
	-0.92
	-0.72
	-0.59
	-0.52
	-0.49
	-0.46
	-0.23
	-0.16
	-0.03
	0.1
	0.13
	0.16
	0.2
	0.23
	0.43
	0.49
	0.69

Layer I

- Change
- Change
- View m
- Open a

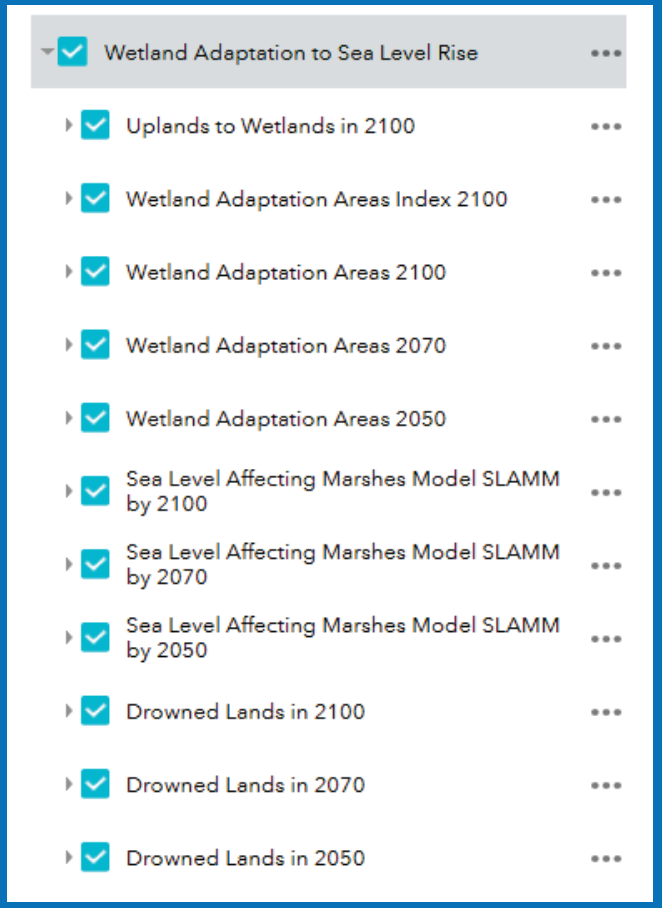




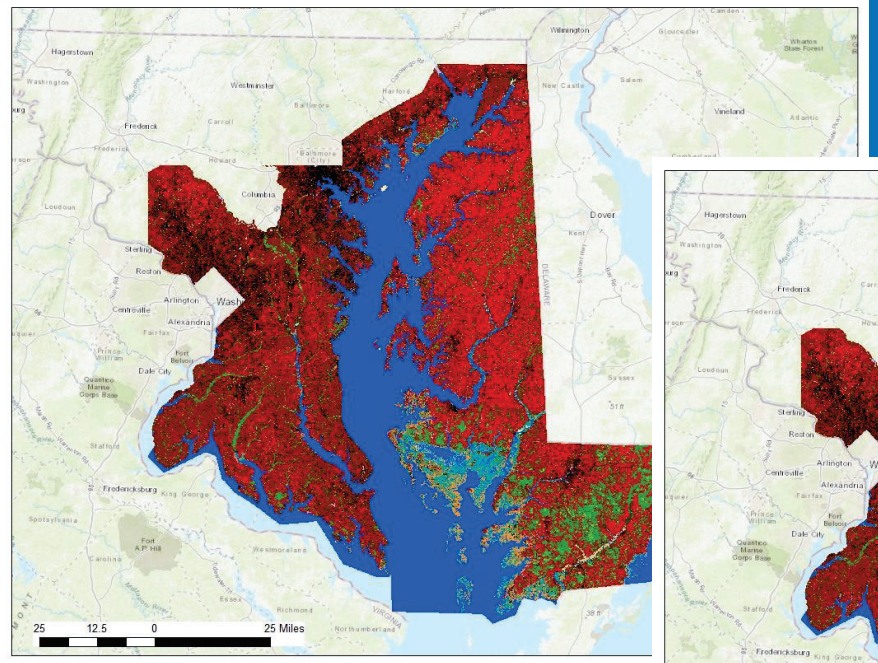
Data Layers on Coastal Atlas

New: Wetland Adaptation to Sea Level Rise

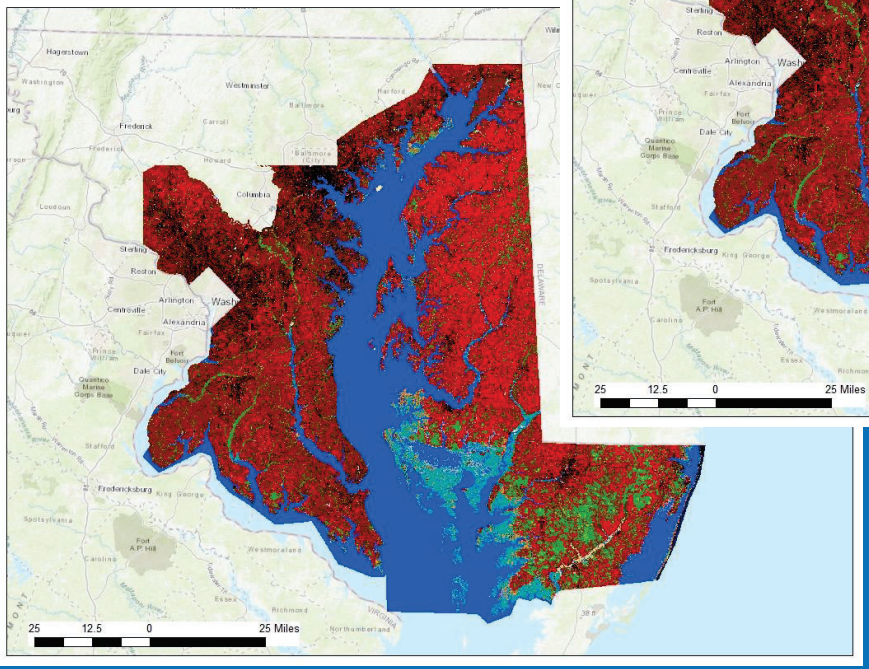
- New SLAMM data at 10m resolution
  - Sea-Level Affecting Marshes Model
- Able to distinguish between uplands that convert to wetlands and wetlands that remain wetlands
- Multiple timesteps means we can display the “corridor” for wetland migration
- 2050, 2070, & 2100
- SLR is the only stressor in model



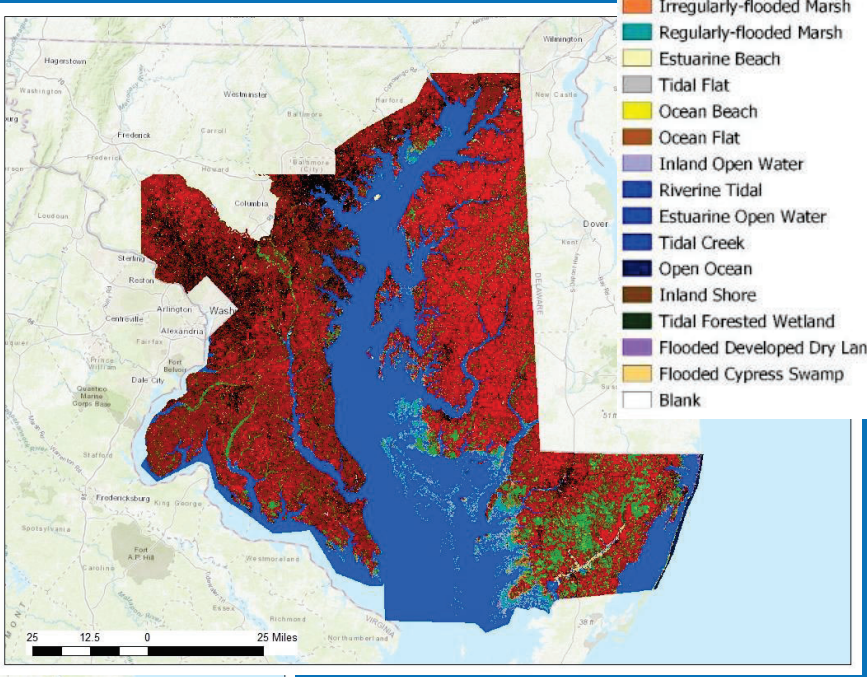
SLAMM Results for chosen scenario 2050, 2070, & 2100



2050



2070

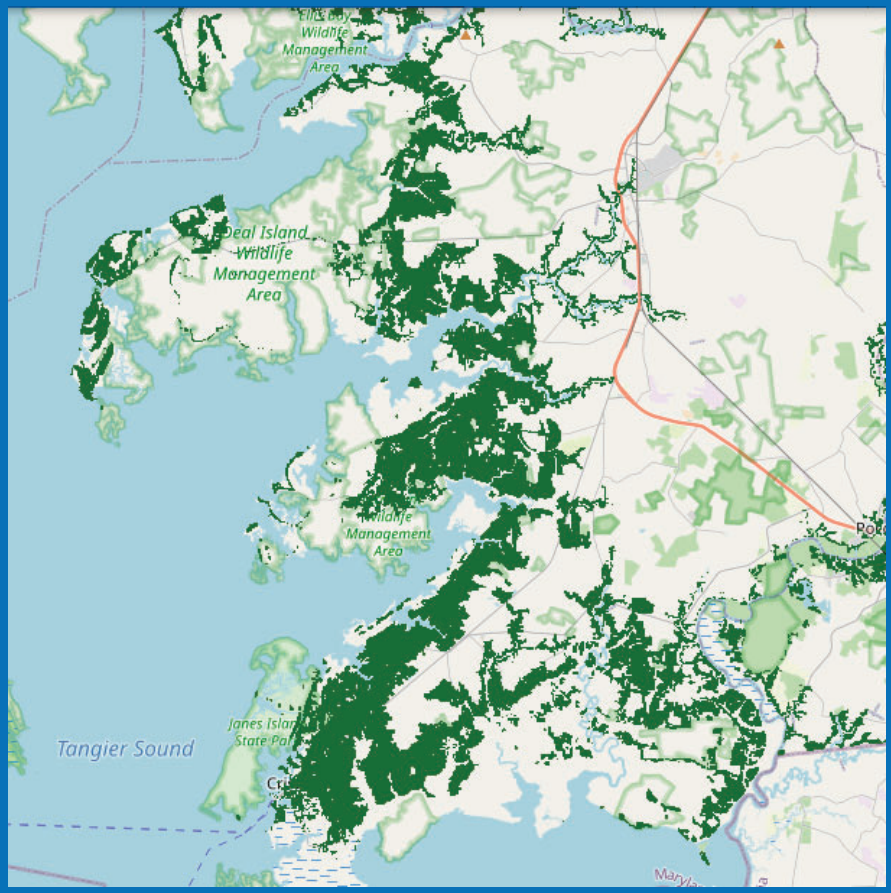


2100

Upland to Wetlands

NEW!

instances of wetland conversion under 4.03 feet of sea level rise (SLR), under a scenario of rising greenhouse gas emissions with a probability of at least 17%, using reported base sea levels in the year 2010



Wetland Adaptation Areas

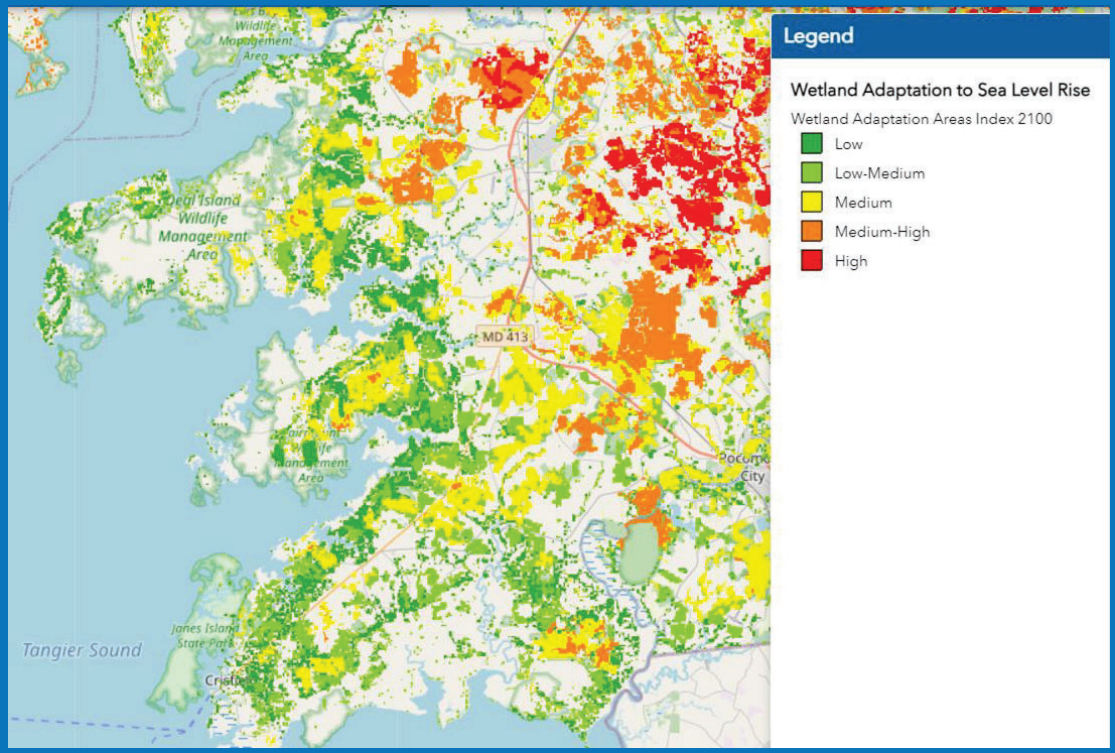
NEW!

Dataset visualizes the areas projected to be wetlands in 2050, 2070, and 2100 (both upland conversion and persistent wetlands)

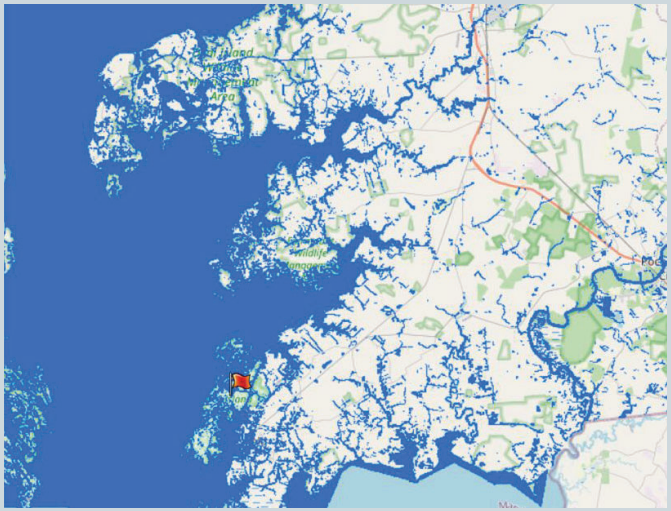
- 2050 represents a rise of 1.37ft
- 2070 represents a rise of 2.32ft
- 2100 represents a rise of 4.03ft

WAA Index 2100

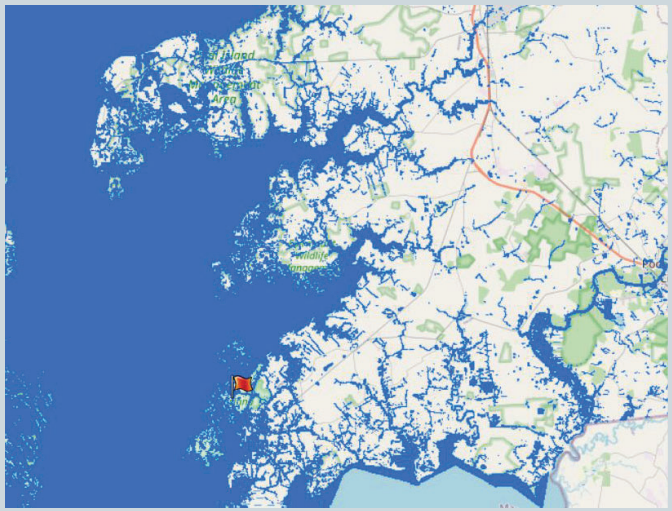
- Ranks future wetlands by their potential for providing high quality habitat
- Conservation criteria include:
  - areas that may support future wetland migration
  - wildlife habitat and corridors
  - high priority terrestrial living resources
  - vulnerable wetland habitat
  - suitable hydric soils for wetland establishment



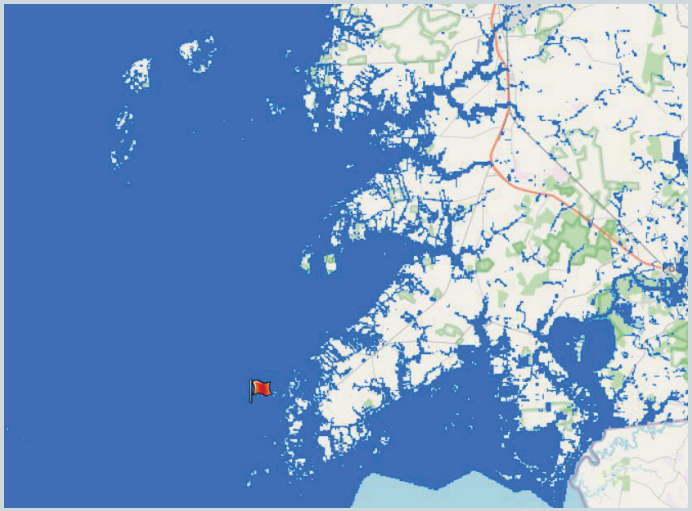
Drowned Lands



2050



2070

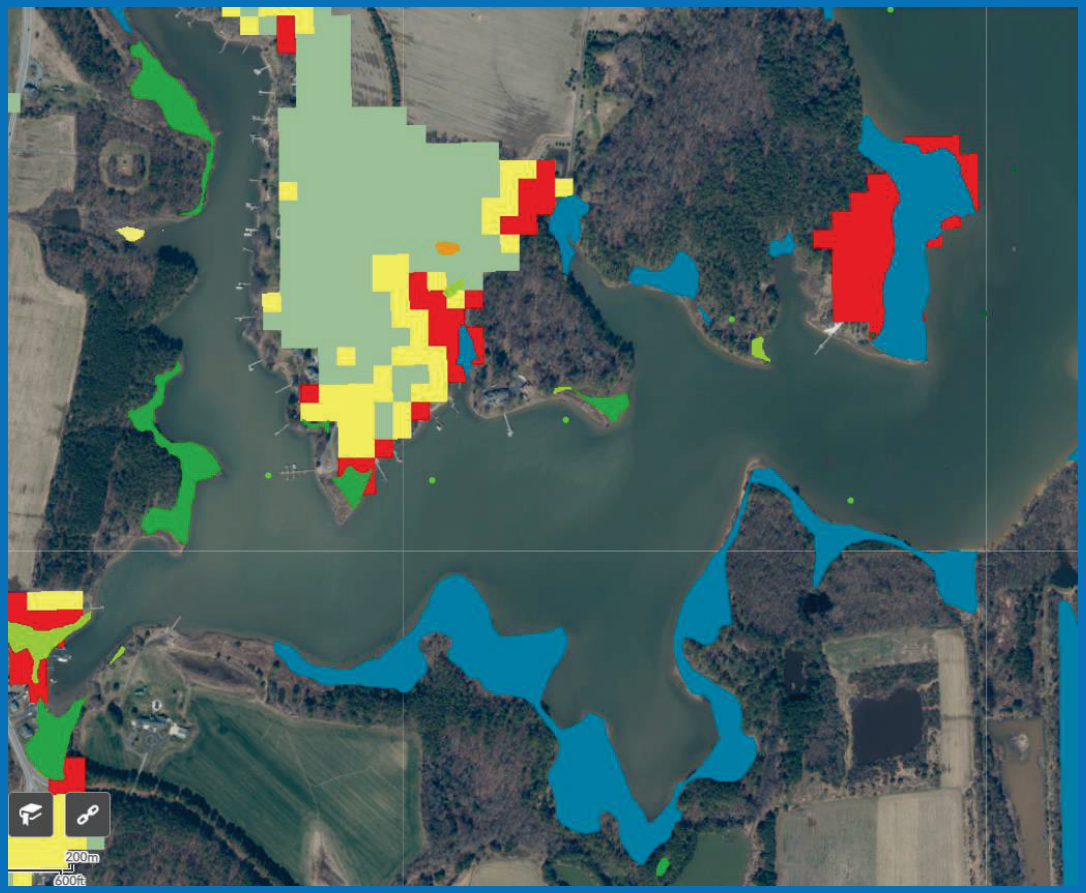


2100

1.37ft

2.32ft

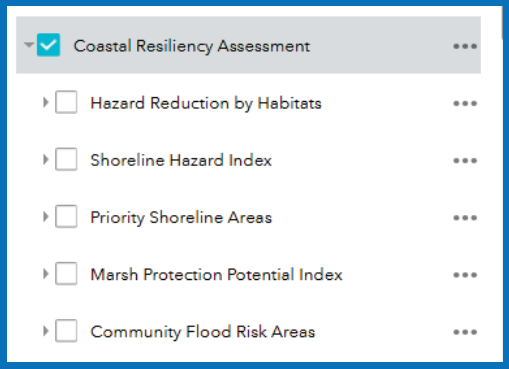
Coastal Resiliency Assessment

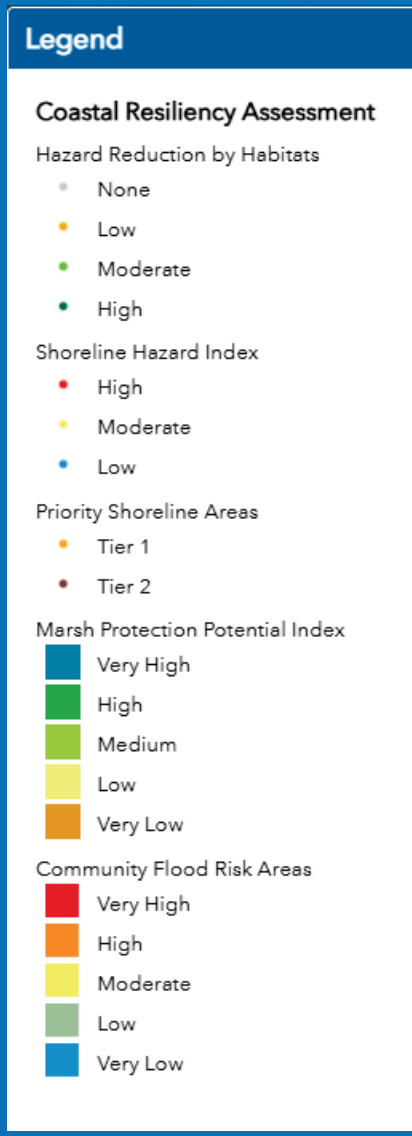


2016

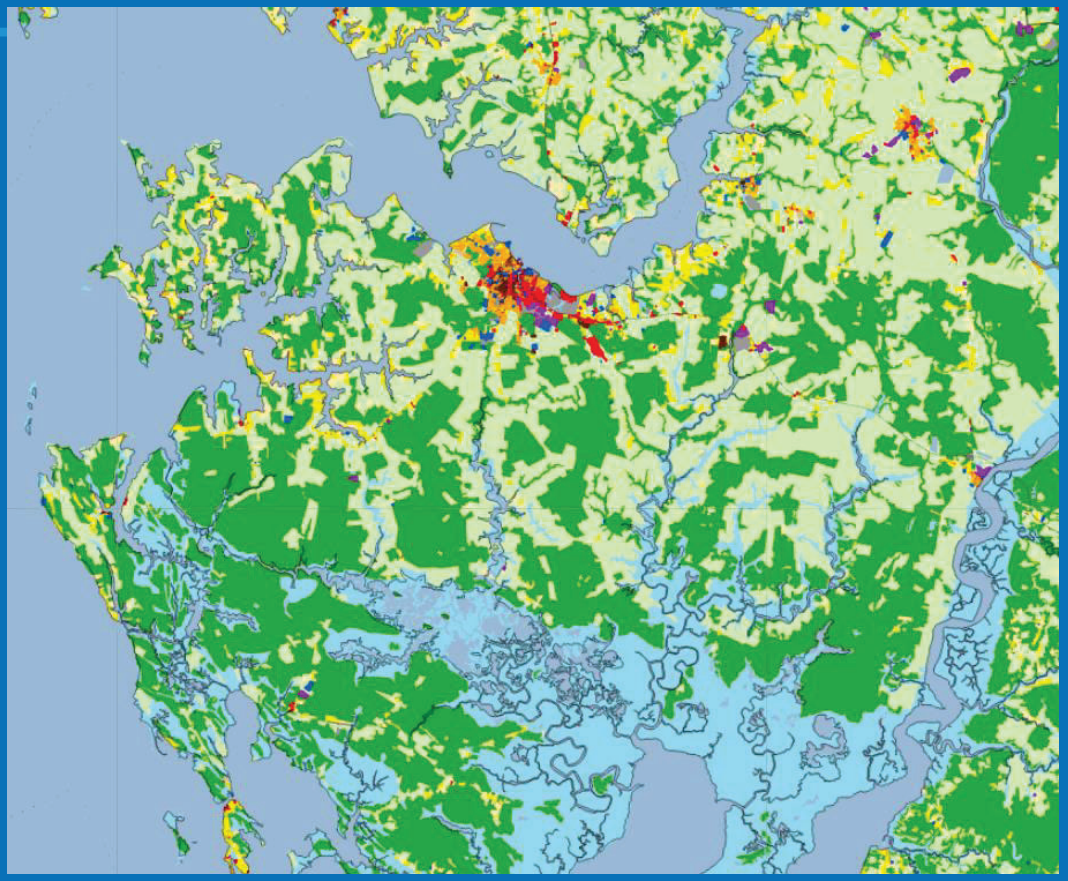
DNR & TNC

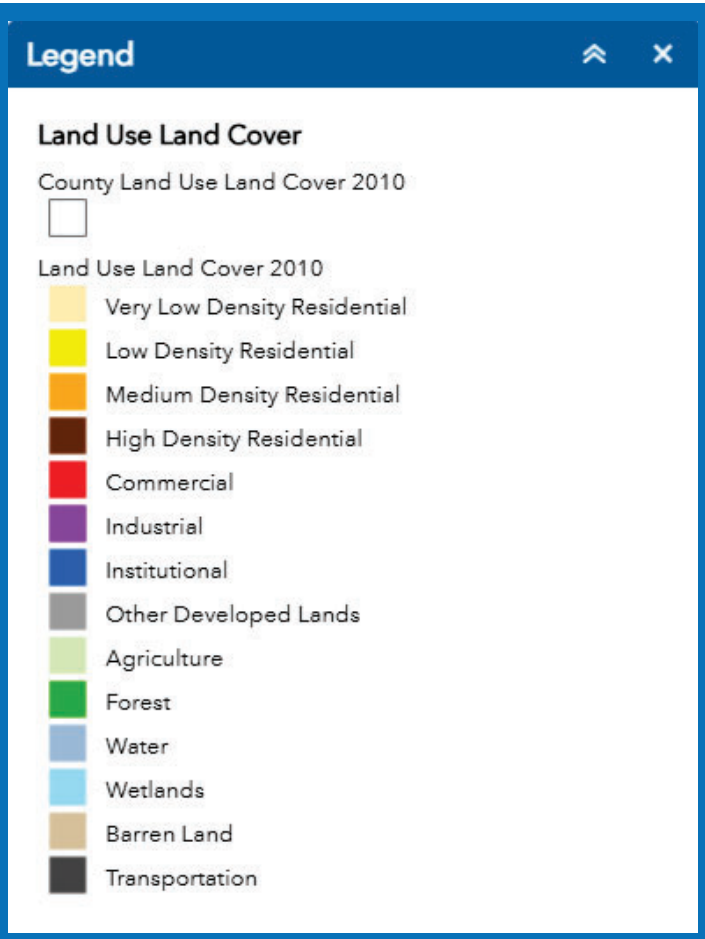
ID restoration priority & potential conservations areas





Land Use Land Cover





Parcel Boundaries

- Able to click on SDAT directly from attribute list

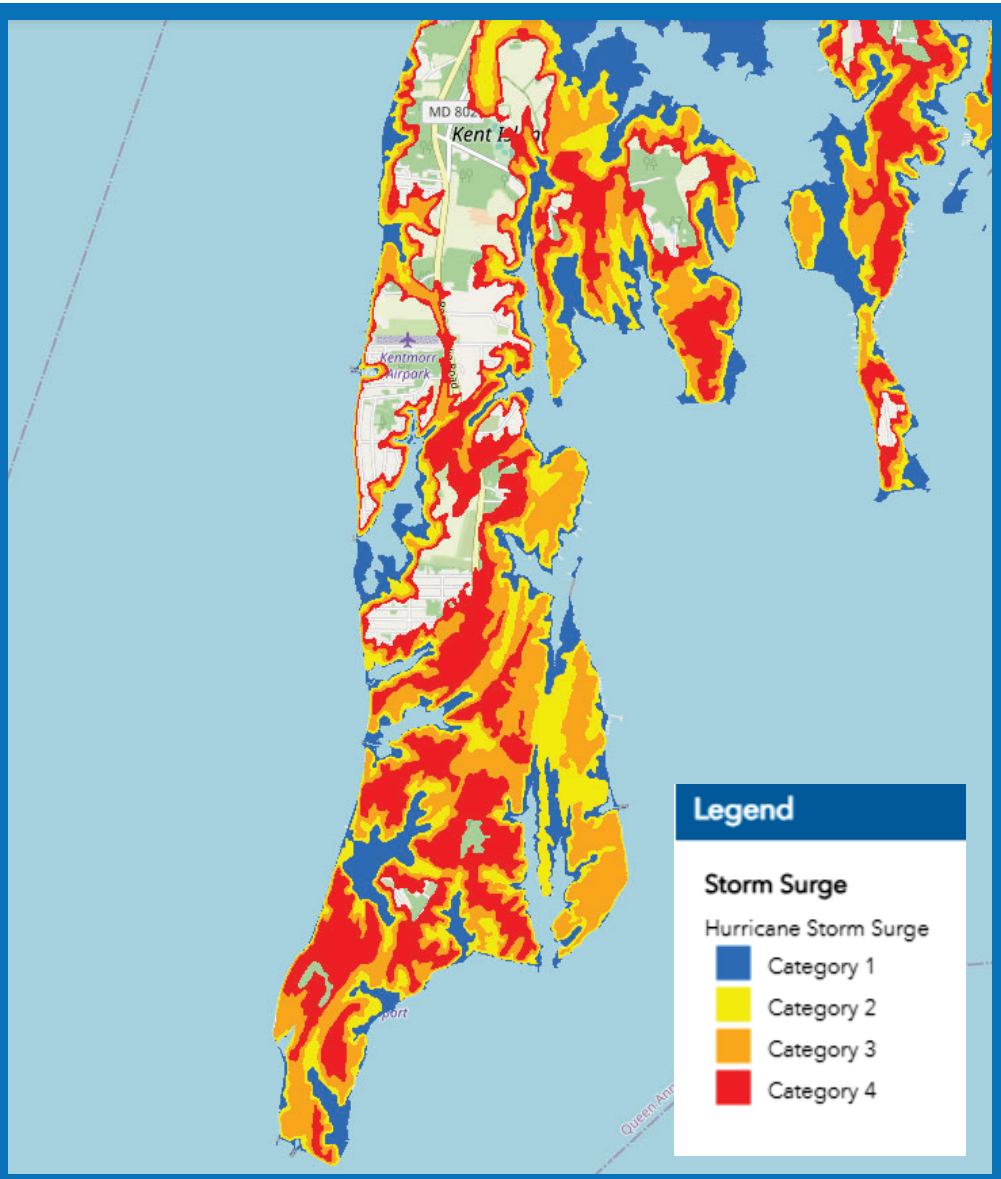
Parcel Boundaries

Options | Filter by map extent | Zoom to | Clear selection | Refresh

Jurisdiction Code	Address	City	Zipcode	Lot	Acres	SDAT URL	Census 2020 Census Tract	Census 2020 Block Grou
DORC	1710 GARDEN OF EDEN RD	CAMBRIDGE	21613		1.22	https://sdat.dat.maryland.g County=10&SearchType=A	24019970702	240199707022
DORC	1902 HORNS POINT RD	CAMBRIDGE	21613		152.90	https://sdat.dat.maryland.g County=10&SearchType=A	24019970702	240199707022
DORC	5930 HORNS POINT RD	CAMBRIDGE	21613		4.09	https://sdat.dat.maryland.g County=10&SearchType=A	24019970702	240199707022
DORC	5833 RICHARDSON RD	CAMBRIDGE	21613		0.50	https://sdat.dat.maryland.g County=10&SearchType=A	24019970702	240199707022

Storm Surge

- Areas at risk of storm-tide flooding from hurricanes
- 01/2016
- USACE used NWS model data
- Maximum of Maximums elevation
- Support hurricane emergency management planning activities



National Wetlands Inventory

National Wetlands Inventory - Version 2 (Newest)

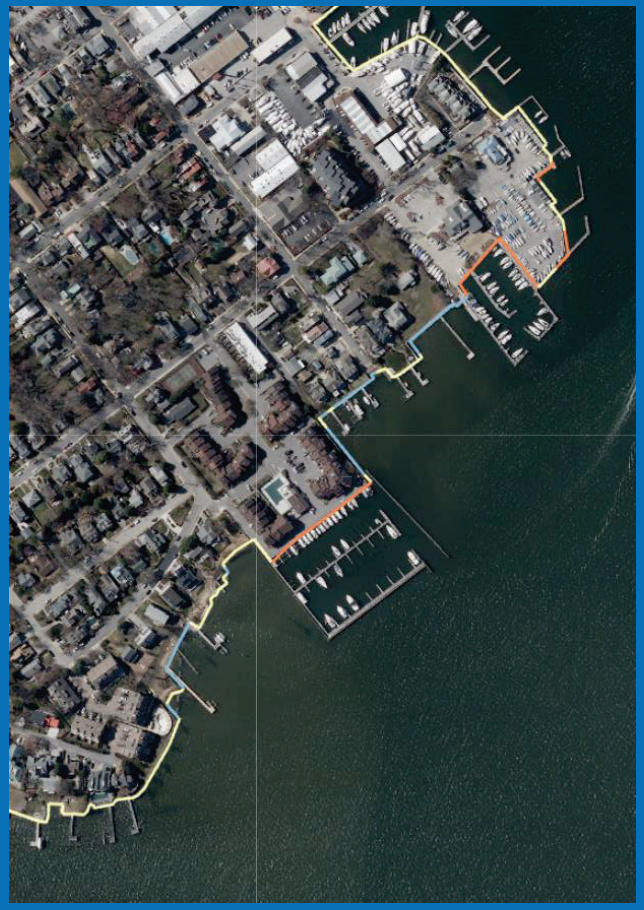
Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

Zoom in to render

- USFWS

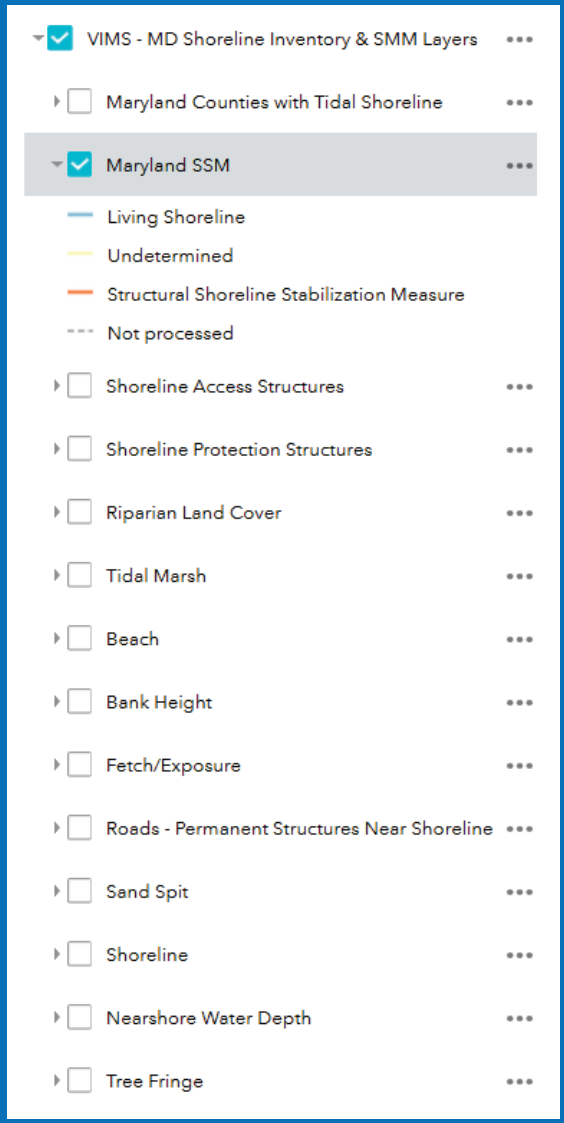
VIMS - Maryland SSM



Virginia Institute of Marine Science

MD Shoreline Stability Model - shows where shorelines may benefit from treatment for erosion control

2020-2023 county dependent)



Resources & Other Tools/Maps

Resources

Coastal Atlas: https://dnr.geodata.md.gov/CoastalAtlas/

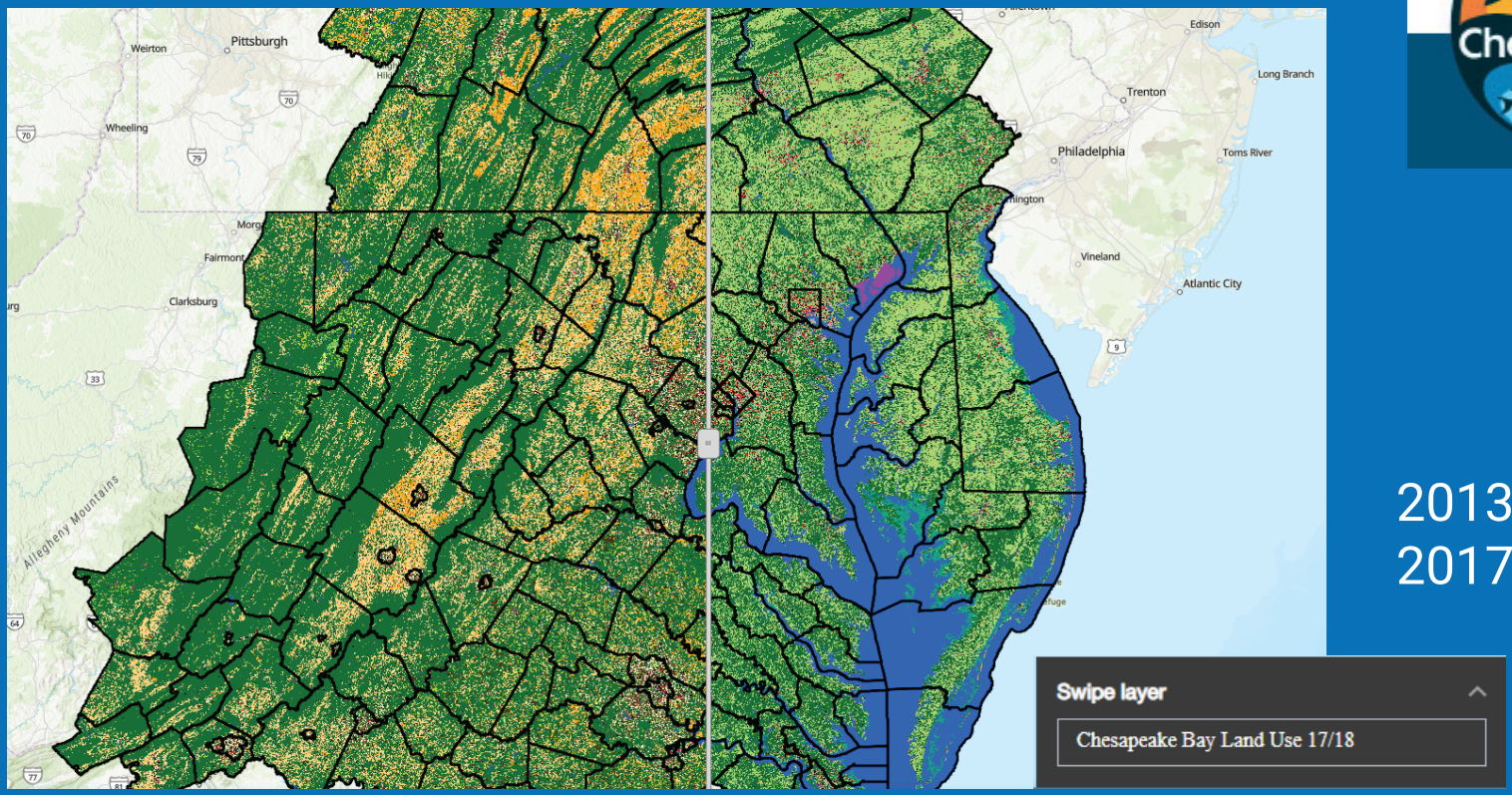
iMap Data Catalog: https://data.imap.maryland.gov/

WAA Story Map: QR Code

Coastal Atlas Guides:
https://dnr.maryland.gov/ccs/coastalatlas/Pages/guides.aspx

Coastal Atlas Contact: rachel.bacher@maryland.gov

Chesapeake Conservancy - LULC



2013/14
2017/18

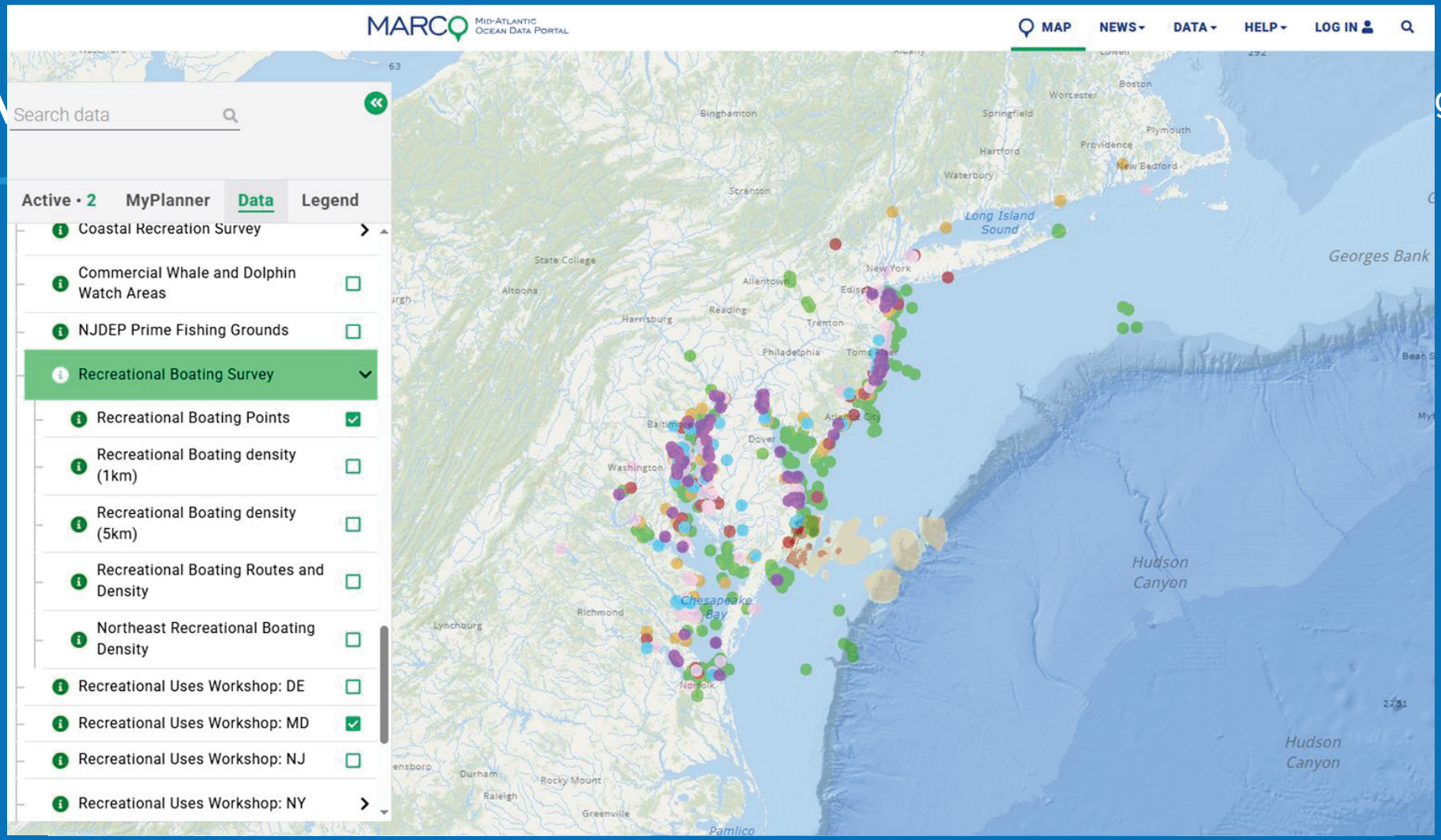
https://www.chesapeakeconservancy.org/projects/cbp-land-use-land-cover-data-project

NOAA Sea Level Rise Viewer

- Sea-Level Rise
- Local Scenarios
- Mapping Confidence
- Marsh Migration
- High Tide Flooding

https://coast.noaa.gov/slr/

N g/


MARCO
Mid-Atlantic Ocean Data Portal
MAP
NEWS
DATA
HELP
LOG IN
Search data
Active • 2
MyPlanner
Data
Legend
Coastal Recreation Survey
Commercial Whale and Dolphin Watch Areas
NJDEP Prime Fishing Grounds
Recreational Boating Survey
Recreational Boating Points
Recreational Boating density (1km)
Recreational Boating density (5km)
Recreational Boating Routes and Density
Northeast Recreational Boating Density
Recreational Uses Workshop: DE
Recreational Uses Workshop: MD
Recreational Uses Workshop: NJ
Recreational Uses Workshop: NY
Long Island Sound
Georges Bank
Hudson Canyon
Chesapeake Bay
Hudson Canyon
Pamlico

Thank you!

MARYLAND
DEPARTMENT OF
NATURAL RESOURCES