Status and Trends work group
August 2, 2021
Renee Thompson
Maintaining Healthy Watersheds, interim indicator development

Healthy Watersheds Goal:

Potapsco Valley State Park
Photo by Will Parson

Goal: *Sustain state-identified healthy waters and watersheds recognized for their high quality and/or high ecological value*

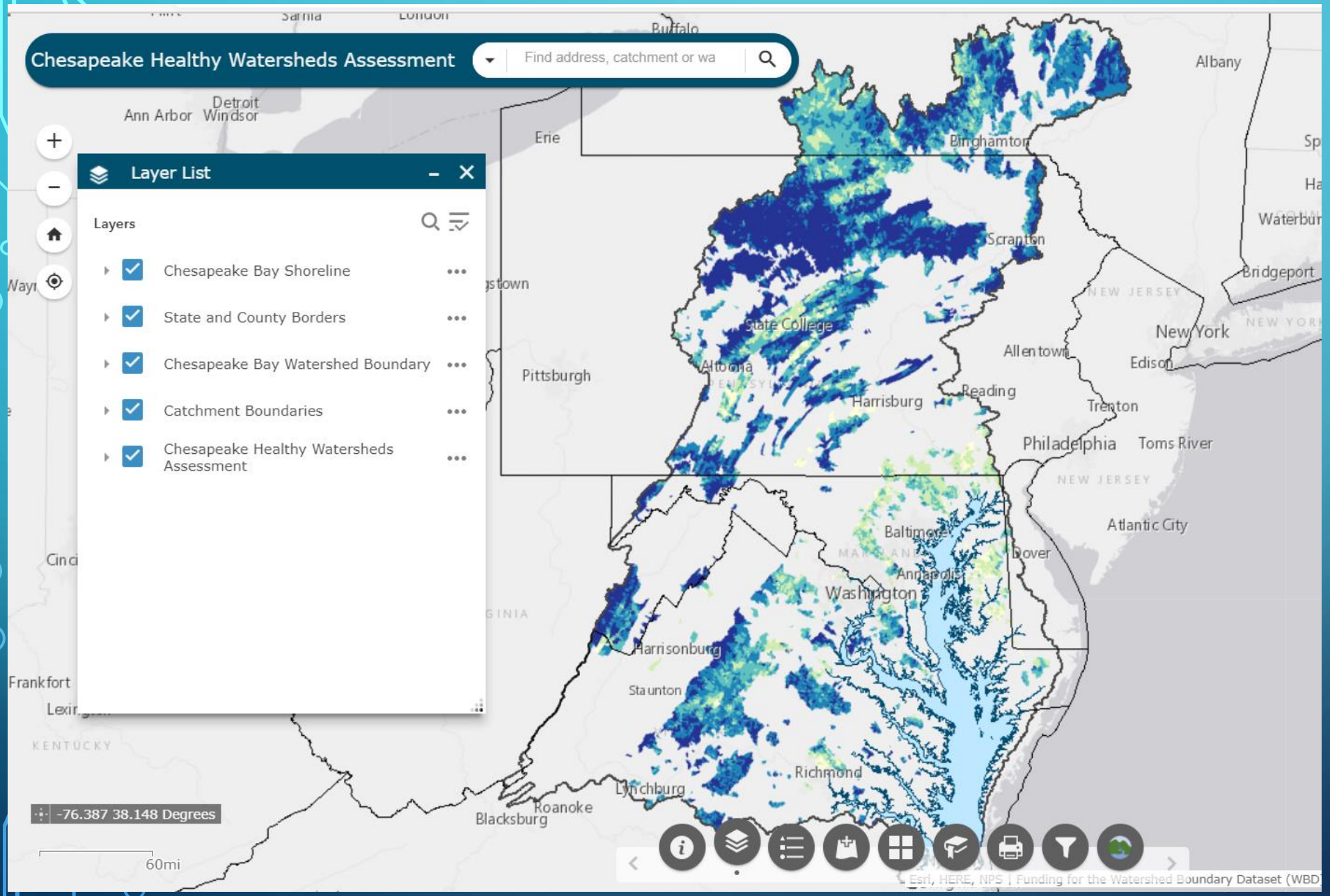
Outcome: *100 percent of state-identified healthy waters and watersheds remain healthy.*

HEALTHY WATERSHEDS, HEALTHY STREAMS

EPA defines a healthy watershed as one in which natural land cover supports:

- Dynamic hydrologic and geomorphic processes within their natural range of variation,
- Habitat of sufficient size and connectivity to support native aquatic and riparian species, and
- Physical and chemical water quality conditions able to support healthy biological communities.

Source: EPA, Healthy Watersheds Protection



CHESAPEAKE HEALTHY WATERSHEDS ASSESSMENT

CHESAPEAKE HEALTHY WATERSHEDS ASSESSMENT

- CONDITION METRICS

Landscape Condition

Subindex score:

Metric values

- % Natural Land Cover (Ws)*
- **% Forest in Riparian Zone (Ws)**
- Population Density (Ws)
- **Housing Unit Density (Ws)**
- Mining Density (Ws)
- **% Managed Turf Grass in Hydrologically Connected Zone (Ws)***
- **Historic Forest Loss (Ws)**

Hydrology

Subindex score:

Metric values

- % Agriculture on Hydric Soil (Ws)
- **% Forest (Ws)***
- % Forest Remaining (Ws)
- % Wetlands Remaining (Ws)
- % Imperviousness Cover (Ws)*
- Road Stream Crossing Density (Ws)
- **% Wetlands (Ws)***

Habitat

Subindex Score:

Metric values

- National Fish Habitat Partnership (NFHP) Habitat Condition Index (Catchment)
- **% Natural Connectivity (Catchment)**
  - **Habitat Condition Index – Local**
  - **Habitat Condition Index – Network**
  - **Habitat Condition Index – Cumulative**

Geomorphology

Subindex Score:

Metric values

- Dam Density (Ws)
- % Vulnerable Geology (Ws)
- Road Density in Riparian Zone (Ws)
- % Impervious in Riparian Zone (Ws)*

Water Quality

Subindex score:

Metric values

- **% of Stream Length Impaired (Catchment)**
- **Estimated Nitrogen Load from SPARROW Model (lbs/acre/yr) (Ws)**
- **Nitrogen, Phosphorus, and Sediment Load from Chesapeake Bay Model, by Sector (Ws)**

Biological Condition

Subindex score:

Metric values

- **Outlet Aquatic Condition Score (Catchment)**

CHWA VISUALIZATION DOWNLOAD / ANALYSIS

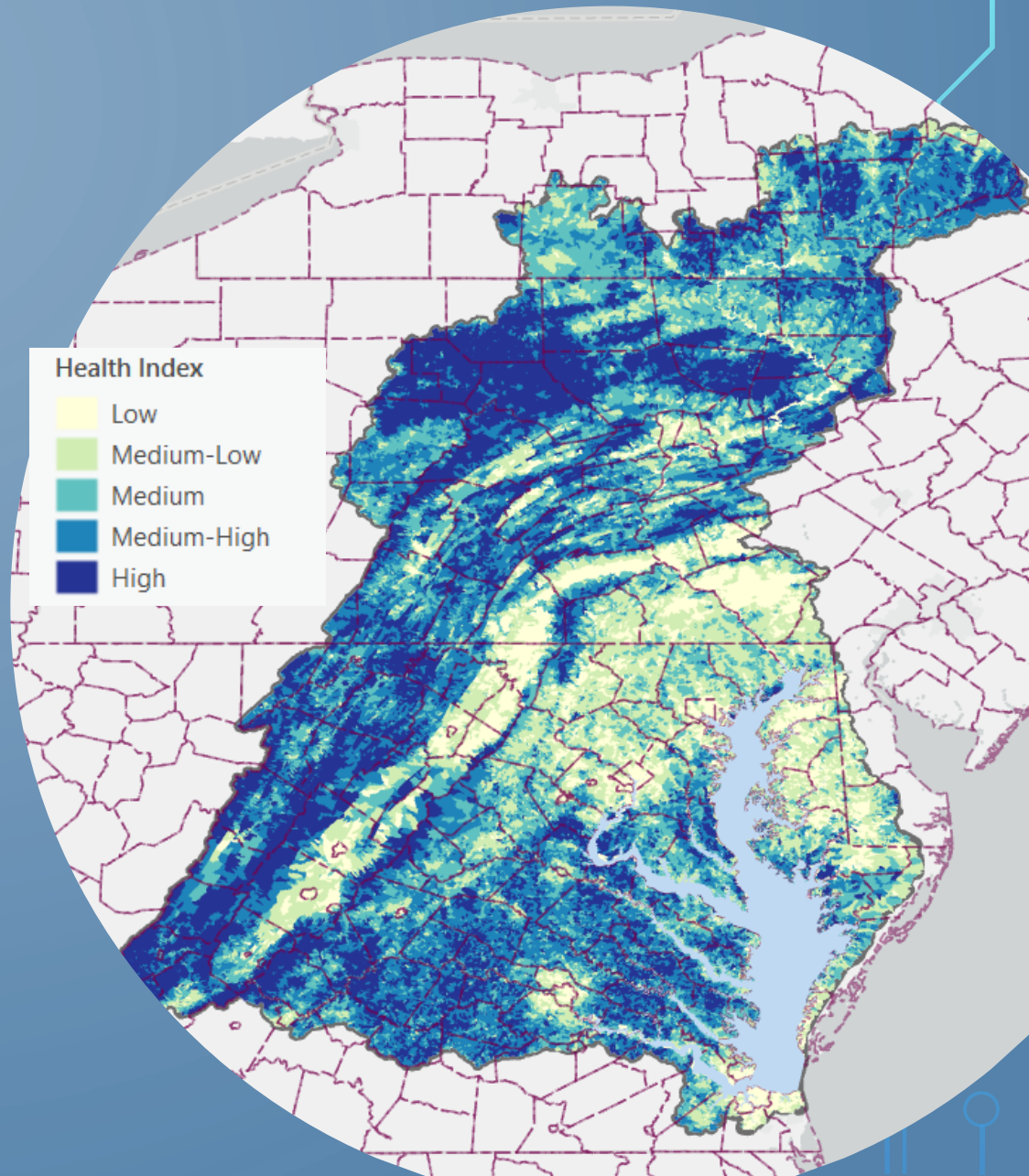
Data needs to be made available through

- Chesapeake Bay Open Data Portal http://data-chesbay.opendata.arcgis.com/)
- Audience
  - State and Local governments
  - watershed groups
  - Land Trusts

EPA Support, Innovate, Inc. (FY 2020)

Analysis and Visualization

- user-friendly
- Facilitates exploration
- Easy access to data
- variety of scales, from regional to statewide to local
- Statistics such as rankings and percentiles (either Baywide or by state) or comparisons of local catchment



CHESAPEAKE HEALTHY WATERSHEDS ASSESSMENT

VULNERABILITY METRICS

Land Use Change

Metric values

- % Increase in Development (Catchment)
- Recent Forest Loss (Ws)
- % Protected Lands (Ws)

Wildfire

Metric value

- % Wildland Urban Interface (Ws)

Water Use

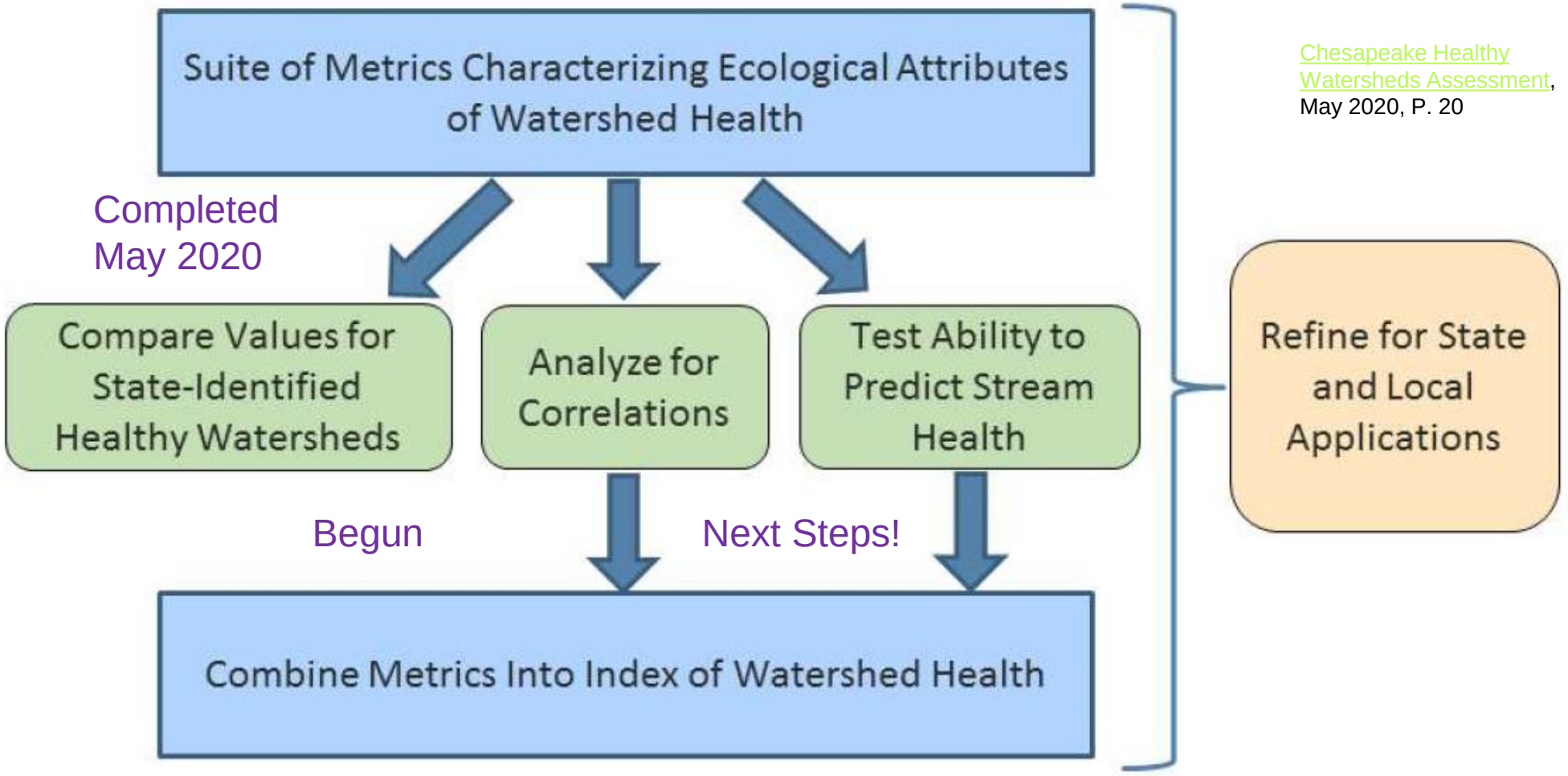
Metric values

- Agricultural Water Use (Catchment)
- Domestic Water Use (Catchment)
- Industrial Water Use (Catchment)

Climate Change

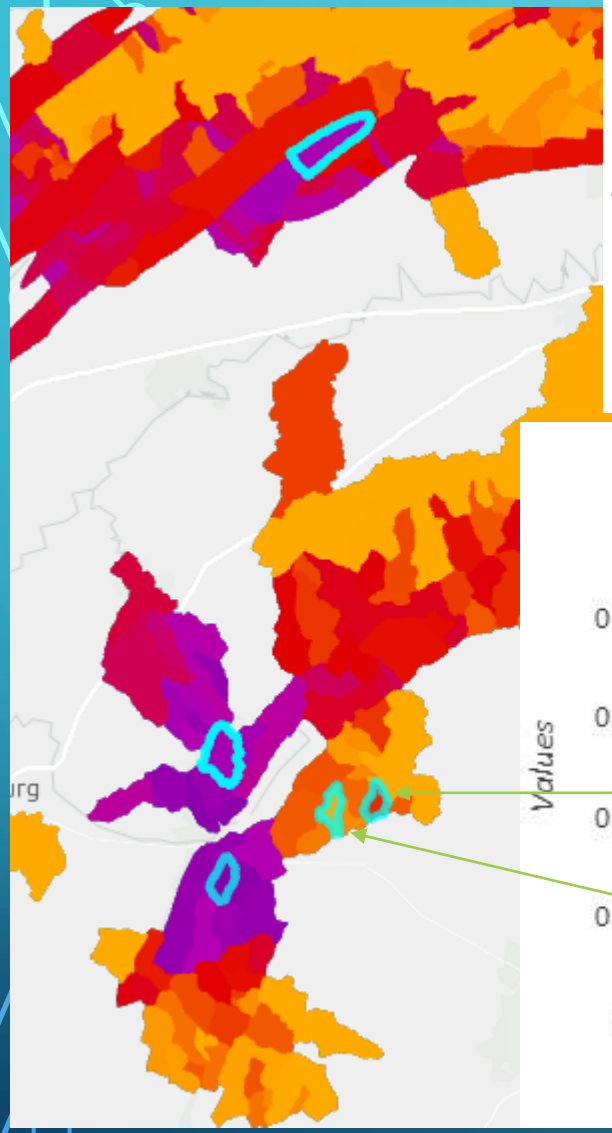
Metric values

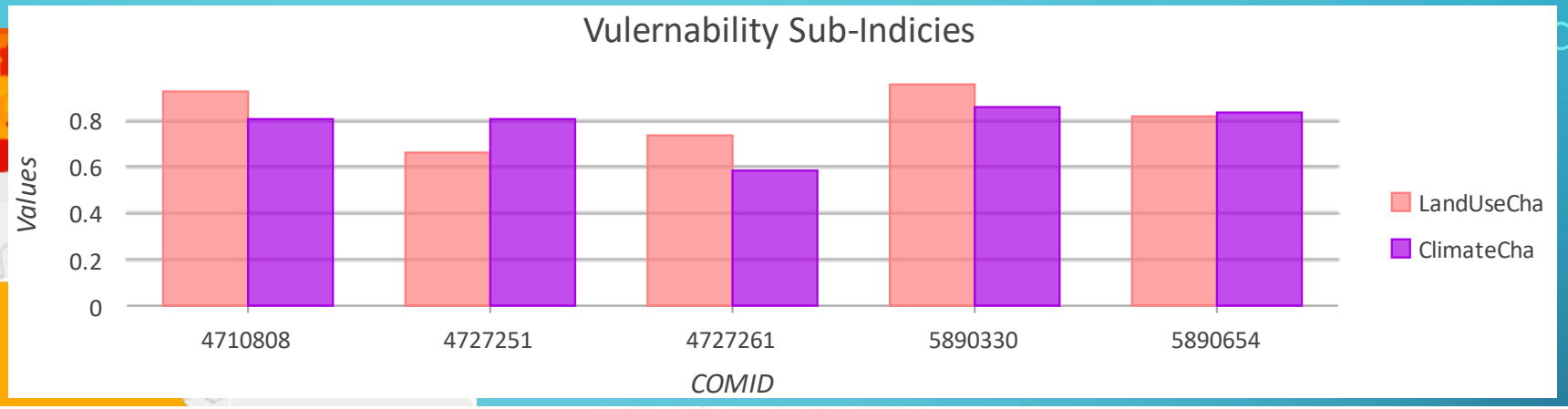
- Brook Trout Occurrence – current (Catchment)
- Change in Probability of Brook Trout Occurrence with 6 C Temperature change (Catchment)
- NALCC Climate Stress Indicator (Catchment)

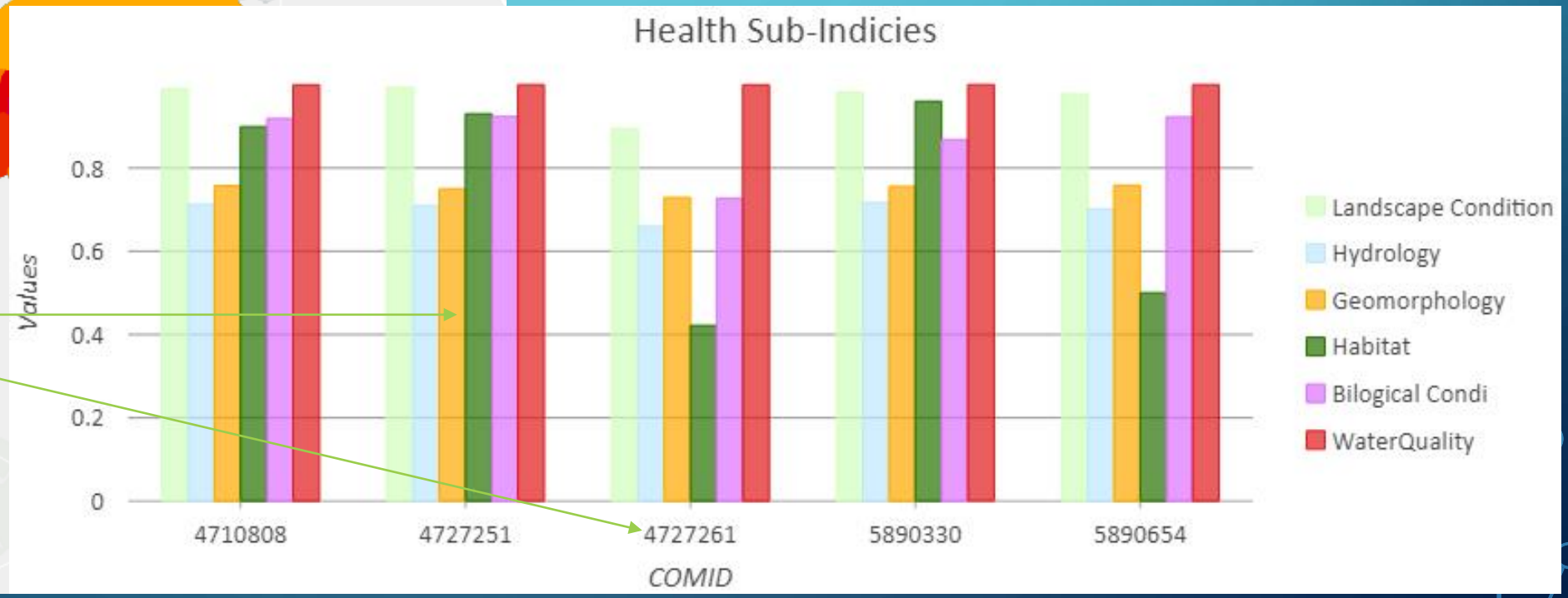


Chesapeake Healthy Watersheds Assessment, May 2020, P. 20

Figure 10: Exploration and refinement of metrics of watershed health. While initial analyses have been completed, additional investigations and refinement are proposed as future steps for the CHWA.

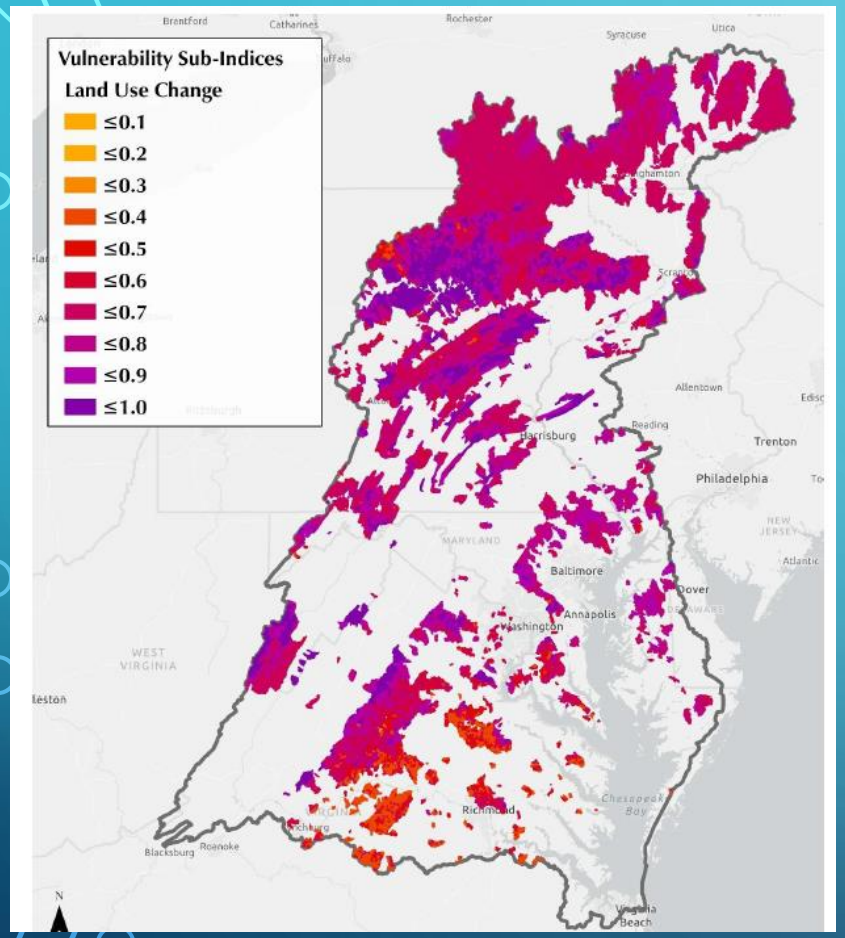


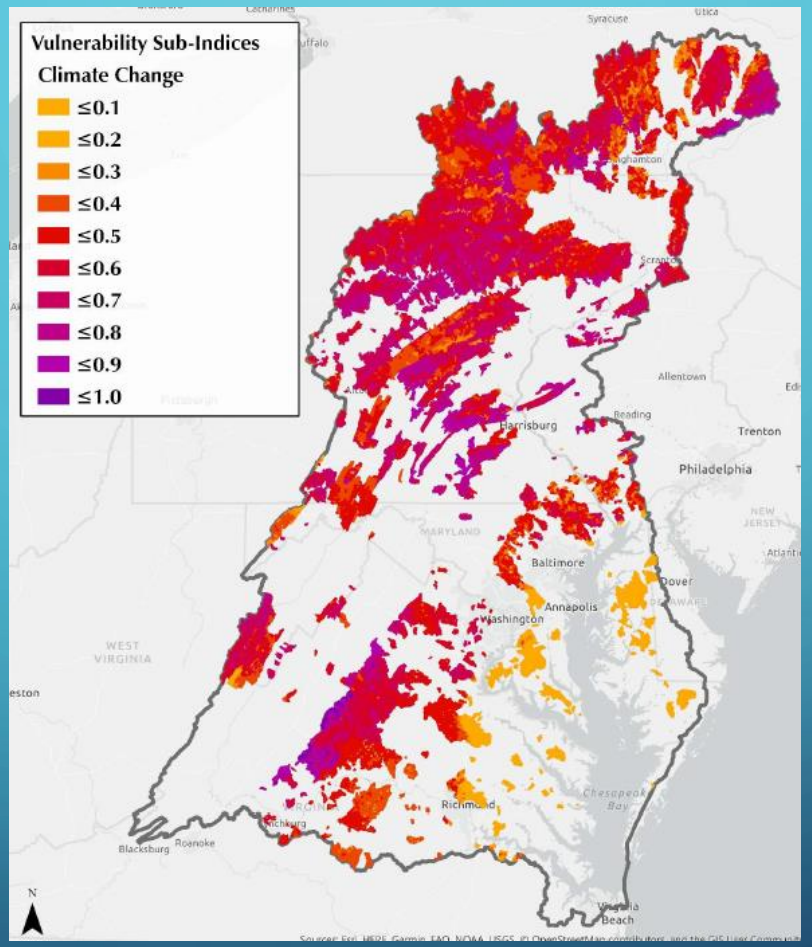

Vulernability Sub-Indicies
Values
0.8
0.6
0.4
0.2
0
4710808
4727251
4727261
5890330
5890654
COMID
LandUseCha
ClimateCha


Health Sub-Indicies
Values
0.8
0.6
0.4
0.2
0
4710808
4727251
4727261
5890330
5890654
COMID
Landscape Condition
Hydrology
Geomorphology
Habitat
Bilogical Condi
WaterQuality

LAND USE CHANGE AND CLIMATE CHANGE

VULNERABILITY METRICS





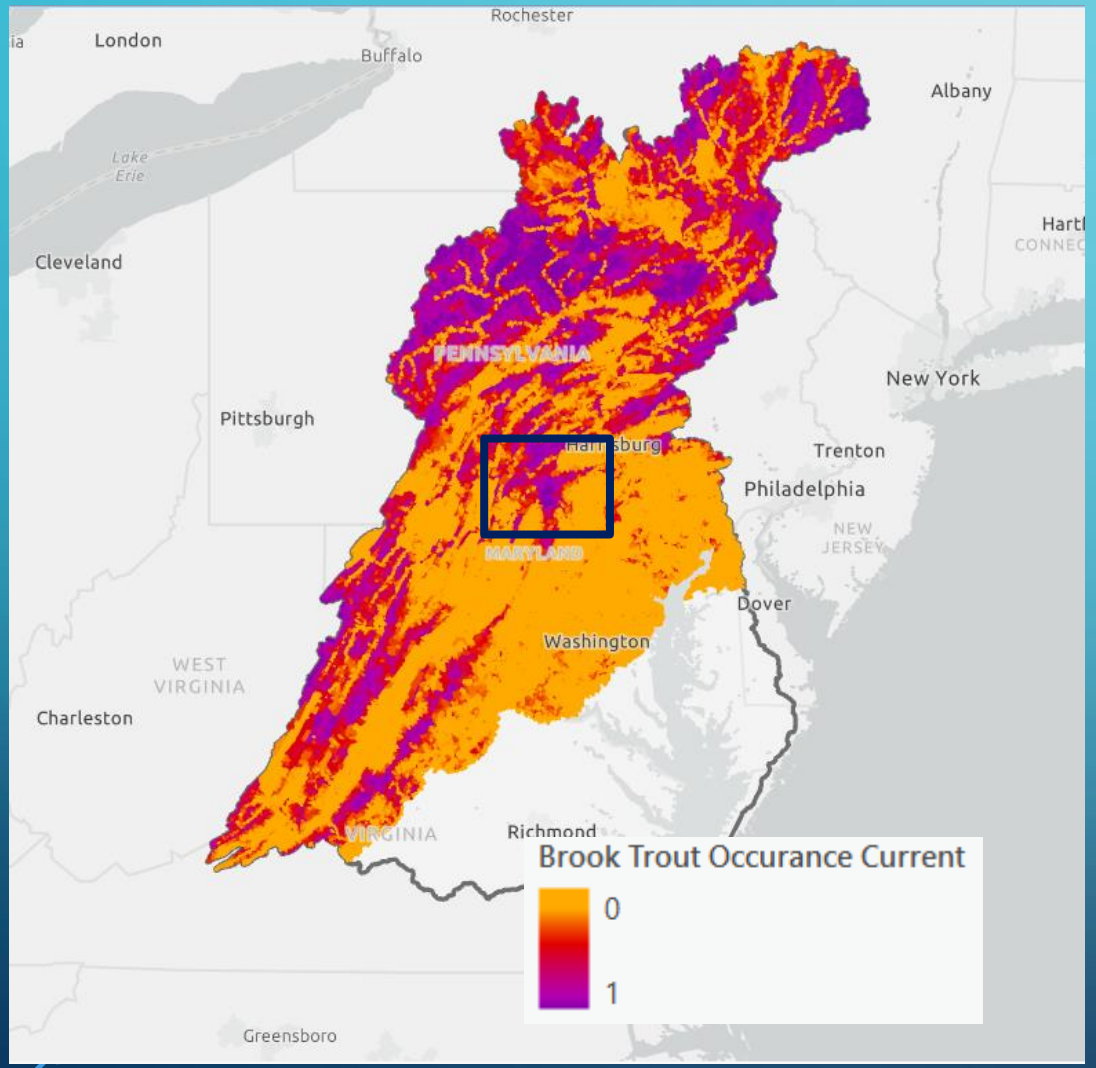
Chesapeake Bay State-Identified Healthy Watersheds

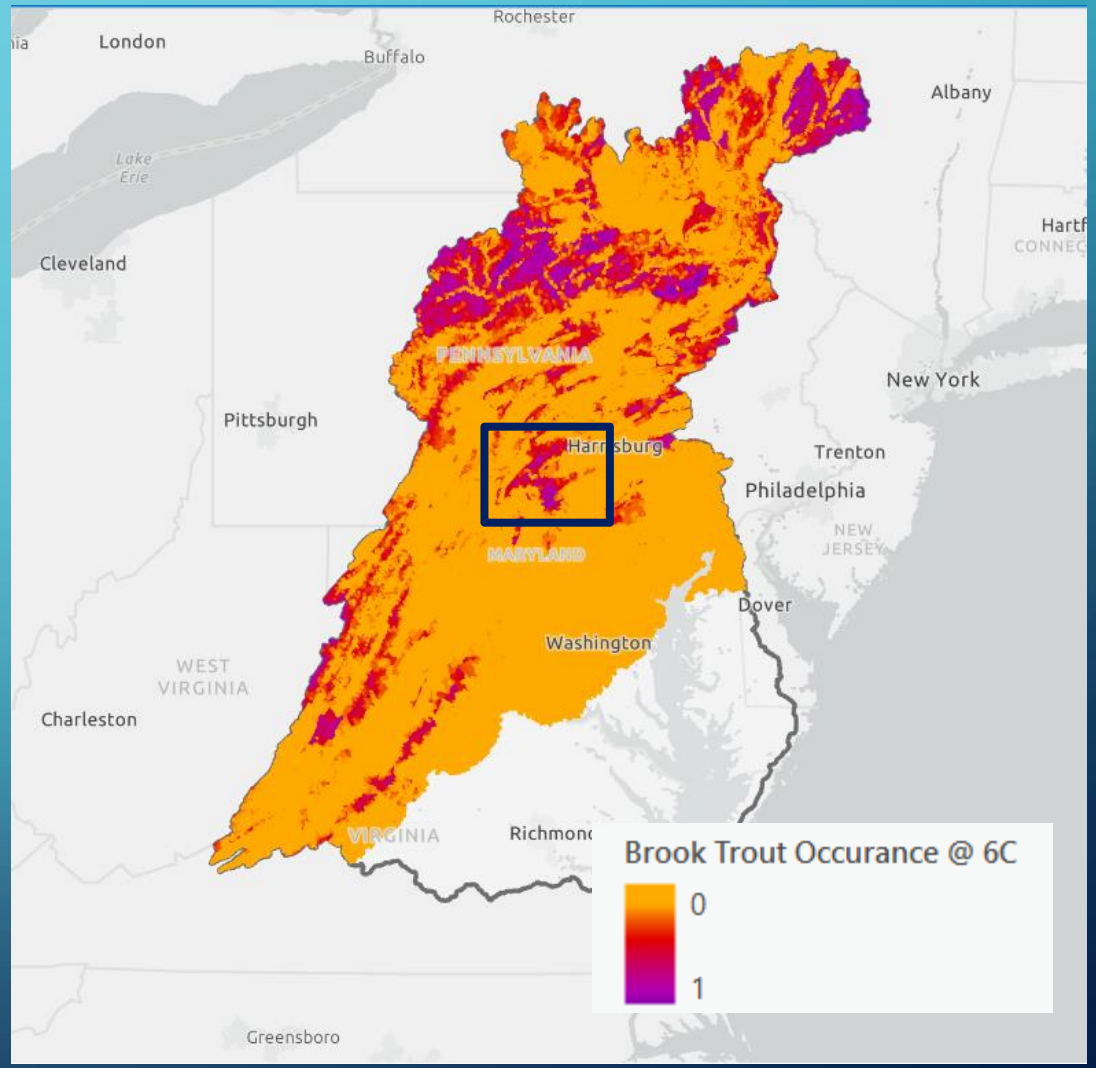
0 25 50 100 Kilometers

0 25 50 100 Miles

TETRA TECH

CURRENT BROOK TROUT VS. BROOK TROUT 6 DEG C. INCREASE





ADDITIONAL MANAGEMENT APPLICATIONS OF THE CHESAPEAKE AND MARYLAND HWAS INCLUDE:

Coordination with CBP's Fish Habitat Assessments

Source water protection (drinking water)

Engagement with local governments to inform land use decisions

Assessing landscape factors affecting fish habitat in non-tidal and tidal watersheds

Identifying areas of brook trout populations susceptible to climate shifts

Examining/quantifying stressors affecting stream health (not just in healthy watersheds)

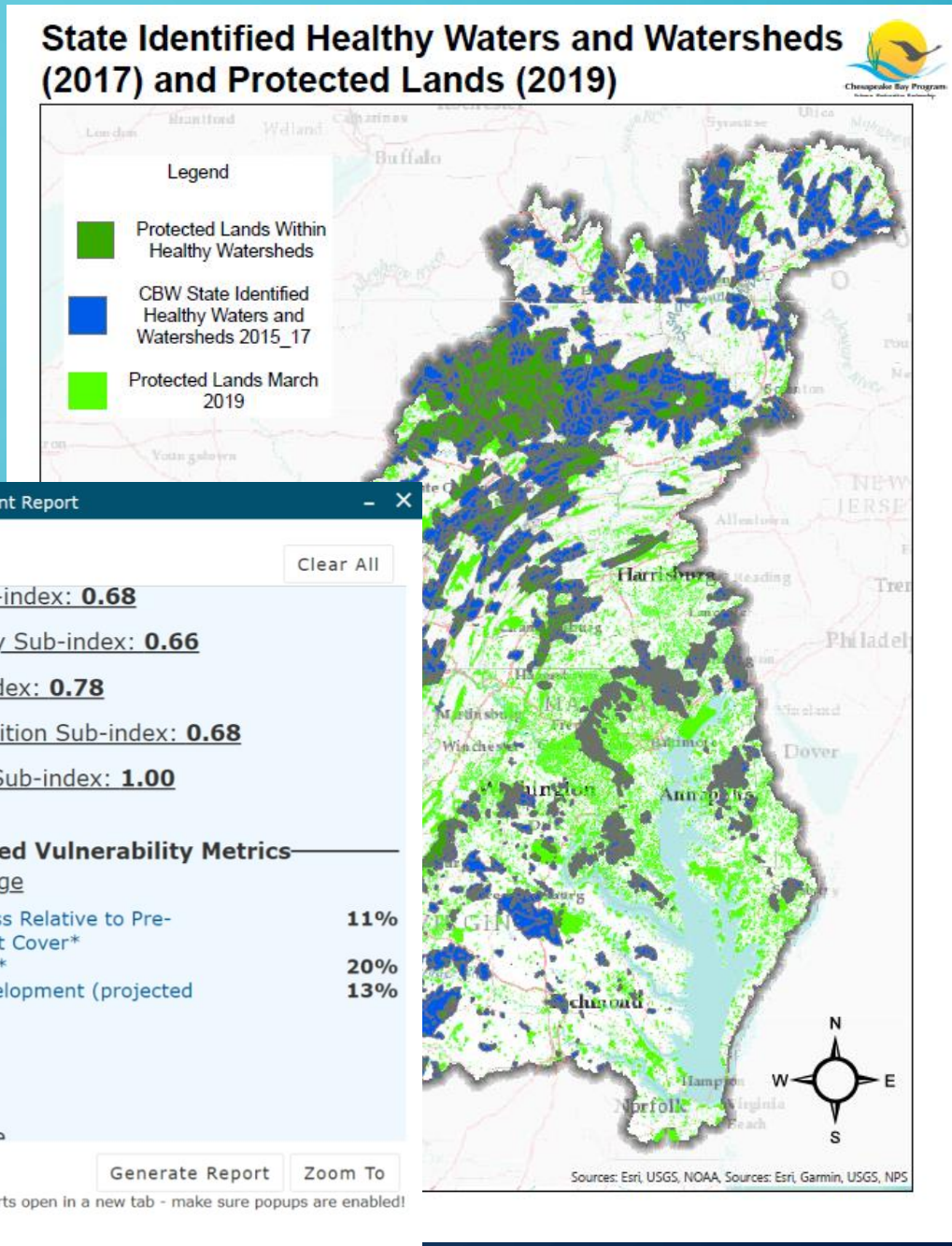
Supporting land trusts and other organizations managing protected lands

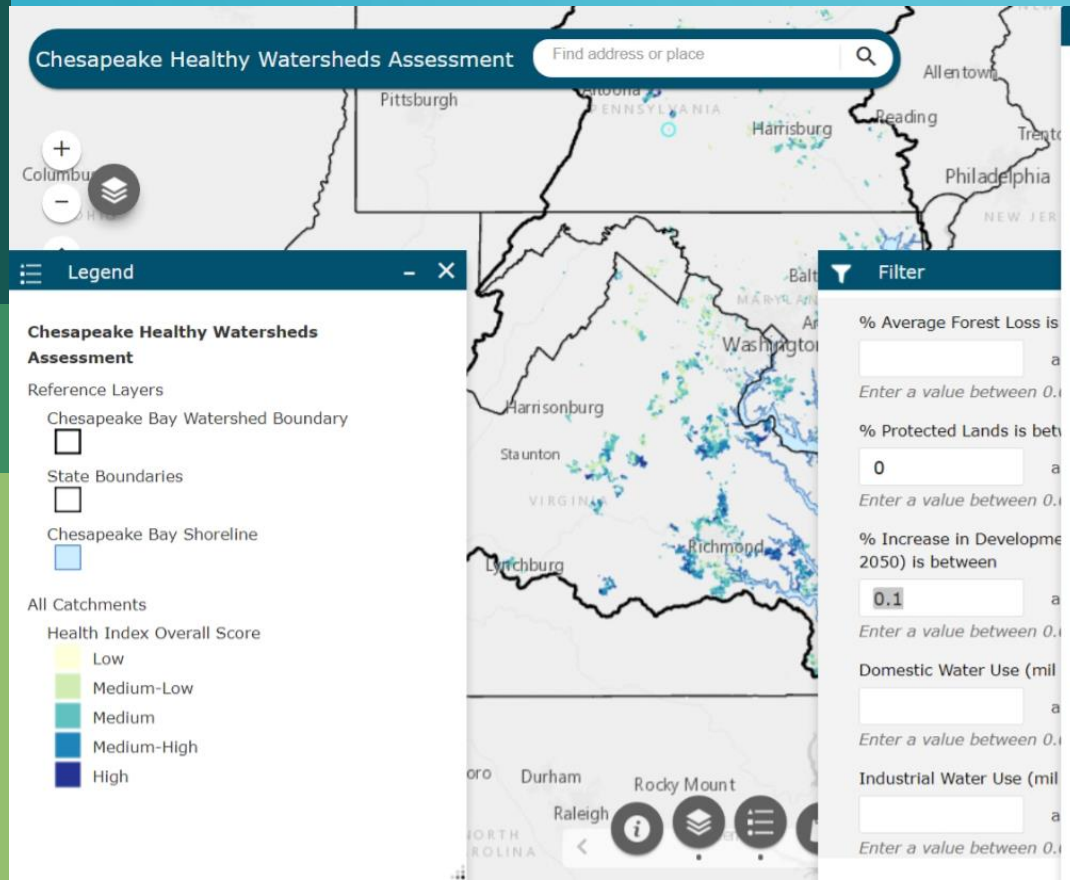
POTENTIAL INTERIM INDICATORS

- Proportion of state identified HW that are not protected and under threat of development. / Pristine watersheds vulnerable to land use change
- Presence of brooktrout despite changing climate conditions/ Brook trout watersheds resilient to climate change (conservation potential)/signal of "sustained"
- DEIJ – watershed health and vulnerability as related to high risk, underserved, low income or percent non-white.

Interim Indicators

Prioritize protection (Action 1.3)





CHESAPEAKE BAY ENVIRONMENTAL JUSTICE AND EQUIT
WHAT CAN YOU DO WITH THE INFORMATION?

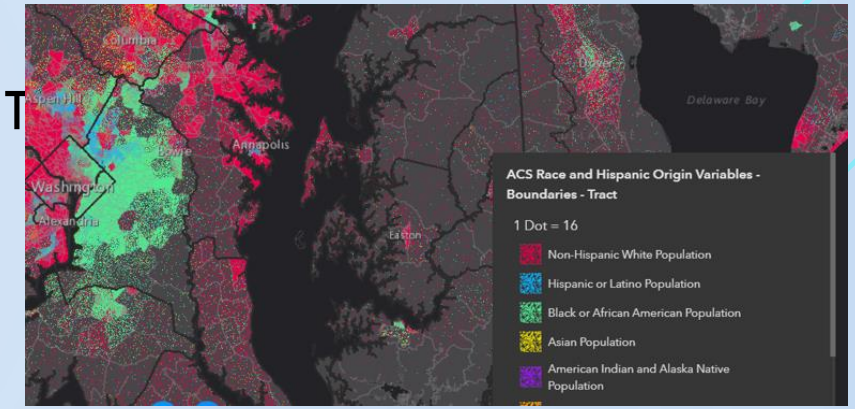
Contains Demographic, Environmental Programmatic content

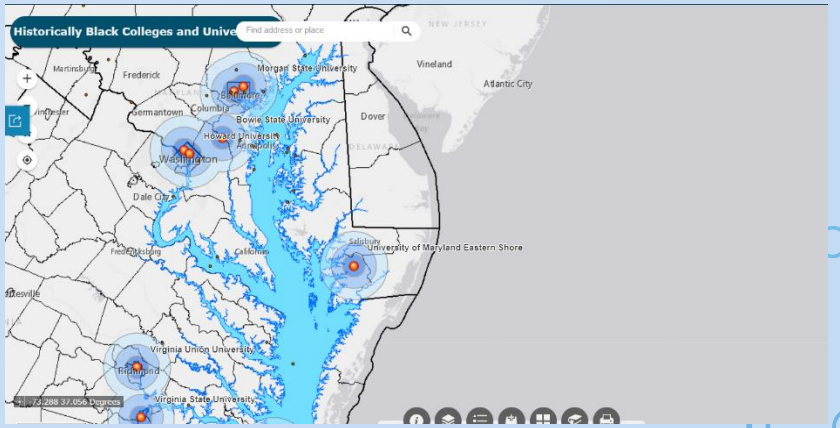
Examples of application include:

- Locate Historically Black Colleges and Understand where and what types of conservation and restoration projects have been funded in underrepresented communities.

- Understand the geographic distribution of underrepresented populations within the Chesapeake Bay Watershed

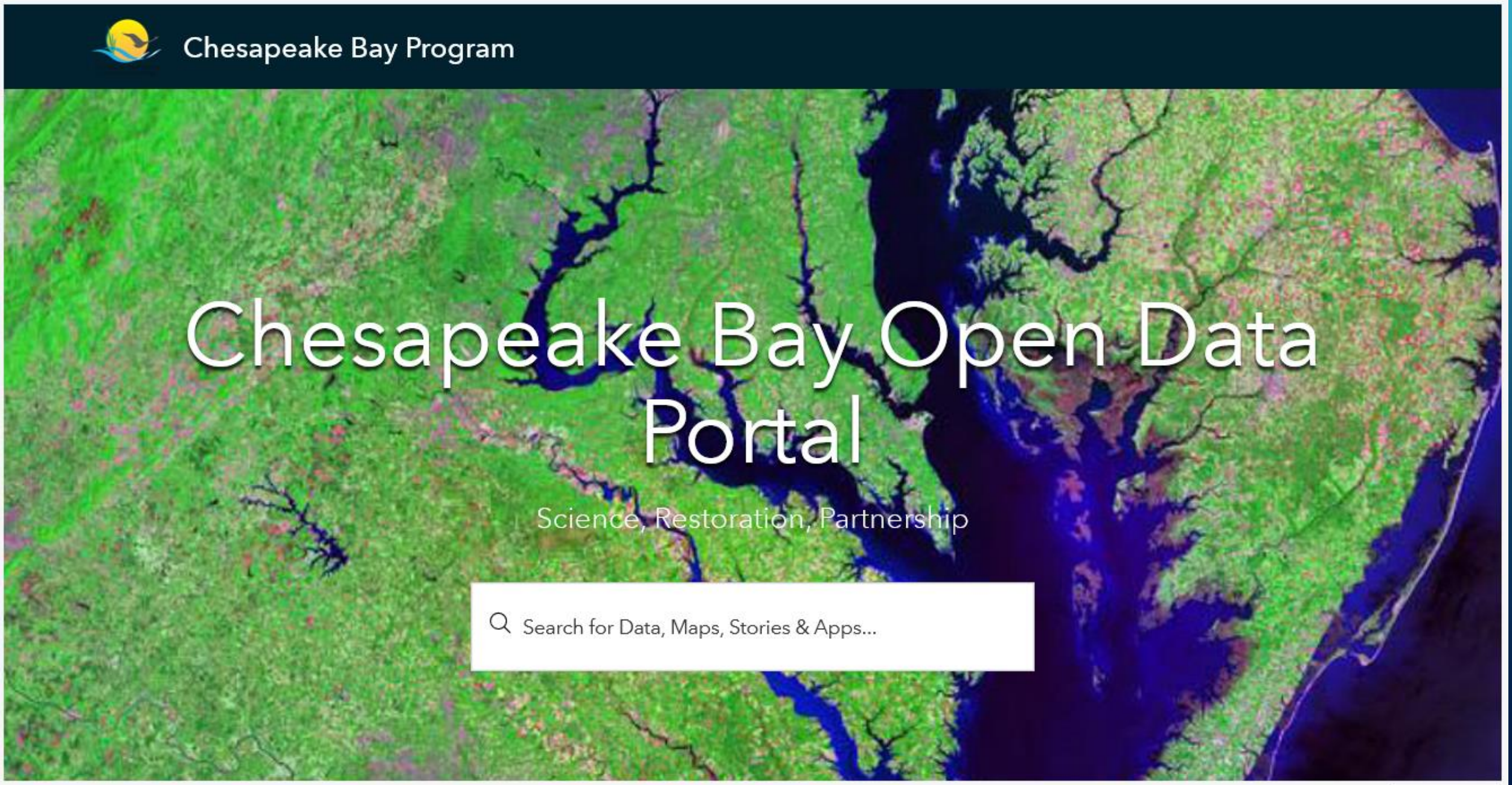
- Identify locations where environmental justice issues may be of particular concern



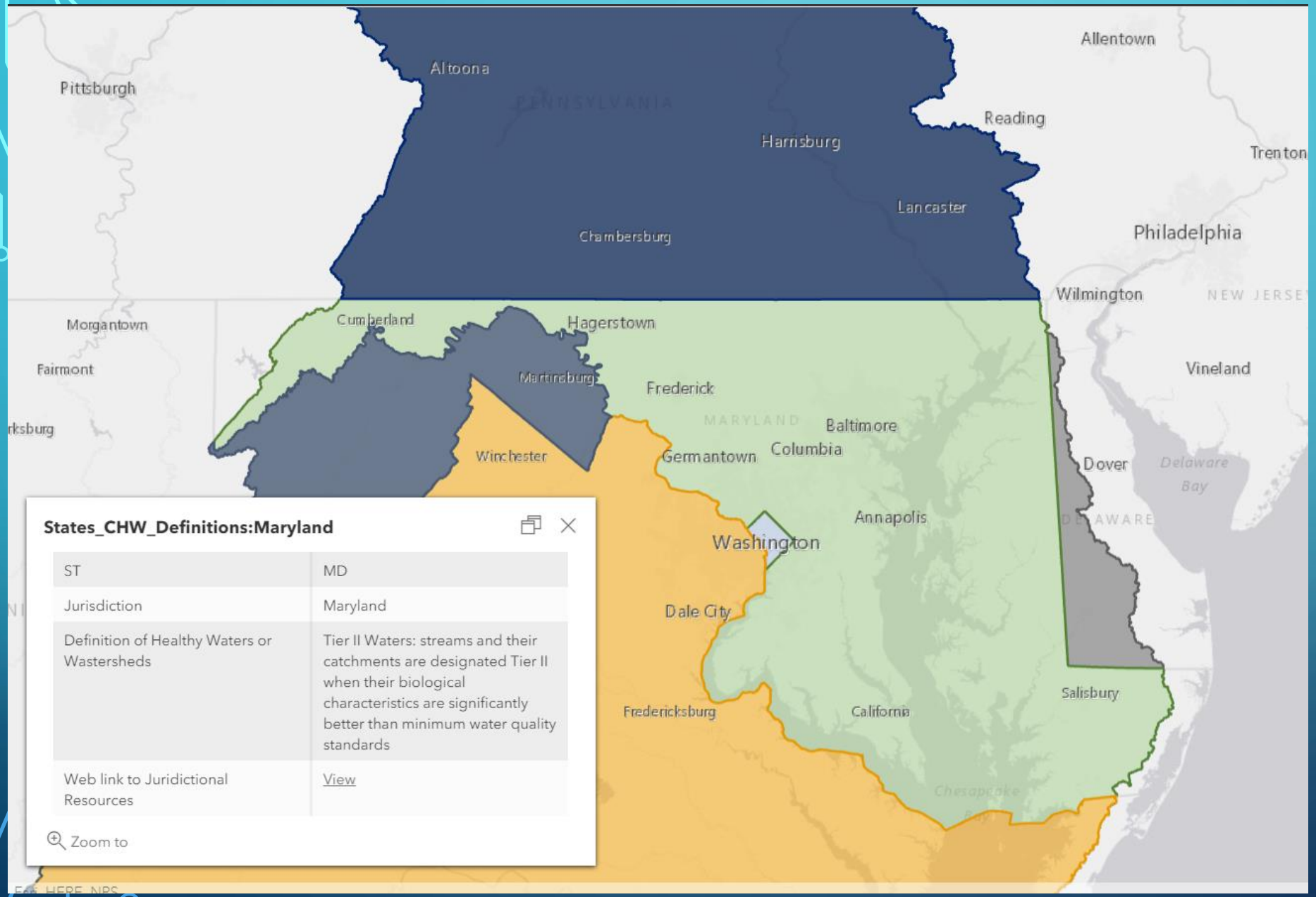


Renee Thompson, Geographer
Lower-Mississippi Gulf WSC, USGS,
Chesapeake Bay Program, MD
Coordinator Maintain Healthy Watersheds
Goal Implementation Team
Rthompso@chesapeakebay.net
Rthompson1@usgs.gov

Discussion


Chesapeake Bay Program
Chesapeake Bay Open Data Portal
Science, Restoration, Partnership
Search for Data, Maps, Stories & Apps...
Source: https://data-chesbay.opendata.arcgis.com/
Web Viewer Terms | Privacy & Cookies
Edit

MARYLAND HEALTHY WATERSHEDS ASSESSMENT



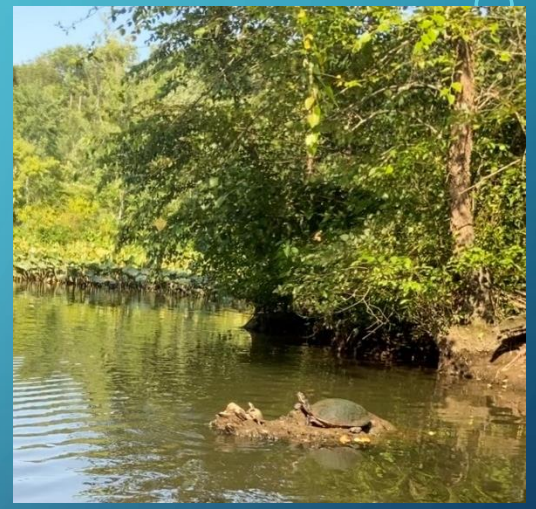
States_CHW_Definitions:Maryland

ST	MD
Jurisdiction	Maryland
Definition of Healthy Waters or Wastersheds	Tier II Waters: streams and their catchments are designated Tier II when their biological characteristics are significantly better than minimum water quality standards
Web link to Juridictional Resources	View

Zoom to

PURPOSE OF MARYLAND HWA

- Refine and customize the CHWA for application in Maryland
- Evaluate statistical relationships between landscape indicators and on-the-ground (*or better yet…in-the-stream!*) diagnostic measures of stream condition
- Develop approach that can be replicated in other jurisdictions using state, local, or regional data
- Provide Maryland with new tool to manage their heathy watersheds



APPLYING THE HWA IN MARYLAND

Providing data to support management decision-making, particularly for maintaining the health of watersheds

- Assess current watershed condition
- Track condition over time
- Provide early warning signs – vulnerability to degradation
- Identify resiliency – ability to sustain good watershed health in spite of stressors

PROCESS FOR DEVELOPING THE MD HWA

- Scientifically-based review of factors influencing MD streams
- Select candidate metrics
- Identify MD-specific data sources
- Review statistical approaches

- Gather source data
- Develop code (R, Python)
- Calculate and test metrics

- Evaluate predictive ability of landscape factors, related to measures of stream health

- Report
- Geodatabase
- Manual
- Video tutorial
- iMAP integration

Coordination with Core Team, Project Advisory Team, and GIT

INFLUENCERS OF WATERSHED HEALTH

---- POTENTIAL VULNERABILITY METRICS

Watershed Health

- Toxics
- Impervious surface (Hi res LC 2013)
- Riparian buffer - health
- Habitat condition (MBSS)
- Landscape surrogates (urban, impervious, ag)
  - Urban BMPs (MDE? data) – MS4 counties reports
  - Ag BMPs – Olivia D.

Vulnerability

- Land use change (urbanization, abandoned ag land, forest conversion or loss)
- Climate change data: temperature, flow, precipitation
- Climate change data: sea level rise, wetland migration
- Invasive pests (forest) – MD specific or regional?

DATASETS

- Stream temp
- Conductivity (EPA project, Susan Cormier) – predicted conductivity and departures from predicted
- Pesticide application summaries
- Climate resiliency (MDE)
- Wetland loss, vegetation departure (LANDFIRE)
- Phosphorus (EPA)
- Climate (precip, temp) and land use change – USGS Science Center data
- Invasive pests (Anne Hairston-Strang, DNR Forestry, may have data)
- Abandoned ag land – Peter Claggett
- Stream blockages (Jim Thompson, DNR, data on dams and other blockages)
- groundwater (MGS)
- County data (some more than others)

HWA – PROPOSED NEW METRICS FOR MD AND BEYOND

Non-coal and coal mining density, MD MDE

Active and Abandoned Mines, Chesapeake Conservancy, Conservation Innovation Center

% of stream miles in catchment that are entrenched (entr. Ratio <1.4)

% of stream miles in the catchment that are slightly to not entrenched (entr. Ratio >2.2)

Forest Habitat (Forest interior), P. Claggett USGS CBP

MBSS Stronghold Watersheds, MD DNR

BioNet (wildlife and rare species), MD iMAP

MBSS Physical Habitat Indicator, TBD incomplete data

Flow Alteration (Kelly Maloney, USGS Eastern Ecological Science Center, Leetown Research Laboratory)

PREVIOUS Nitrogen, Developed Land, Agriculture, Wastewater, Septic, and CSO), in Watershed (13 separate metrics)

PROPOSED USGS SPARROW sector specific loads (manure, fertilizer, urban wastewater, atmospheric, septic) for TN, TP, sed (incremental loads)