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U.S. Geological Survey science on the status, trends, and assessments of stream health conditions within the Chesapeake Bay watershed

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Chesapeake Bay Program's Stream Health Workgroup
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U.S. Department of the Interior
U.S. Geological Survey

USGS Status & Trends publication

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- Used USGS Non-Tidal Network as foundation for study design
- Added additional indicators describing stream health
- Compiled data inventories and harmonized datasets
- Selected approaches for computing status and trends
- Reported general patterns across stream health indicators

STRESSORS

- Stream temperature
- Hydro-morphology
- Salinity
- Nutrients
- Toxic contaminants
- Flow regime

LIVING RESOURCES

- Fish communities
- Benthic Macroinvertebrate communities

Boyle, L.J., Austin, S.H., Cashman, M.J., Clifton, Z.J., Clune, J.W., Colgin, J.E., Elliott, K.E.M., Fanelli, R.M., Foss, E.P., Hitt, N.P., Hittle, E.A., Howe, C.M., Majcher, E.H., Maloney, K.O., Mason, C.A., Metes, M.J., Moyer, D.L., Needham, T.P., Rogers, K.M., Thompson, J.J., Yang, G., and Zimmerman, T.M., 2025, Tracking status and trends in seven key indicators of river and stream condition in the Chesapeake Bay watershed: U.S. Geological Survey Scientific Investigations Report 2025–5072, 104 p., https://doi.org/10.3133/sir20255072

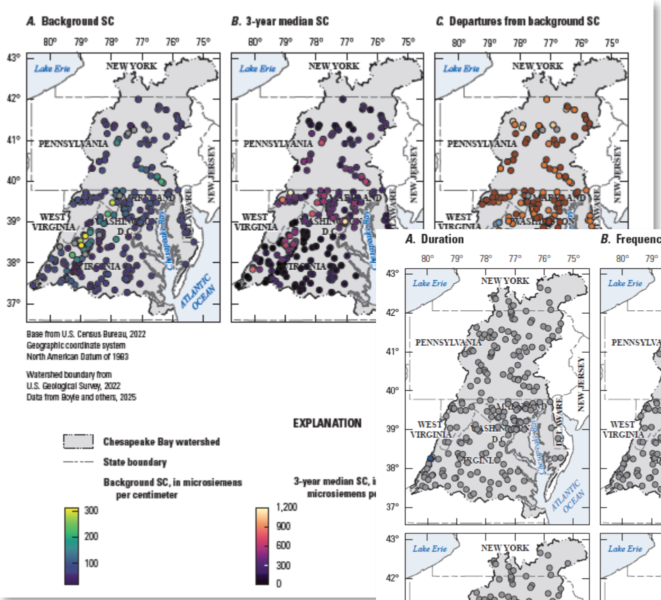
Data Compilations

USGS science for a changing world

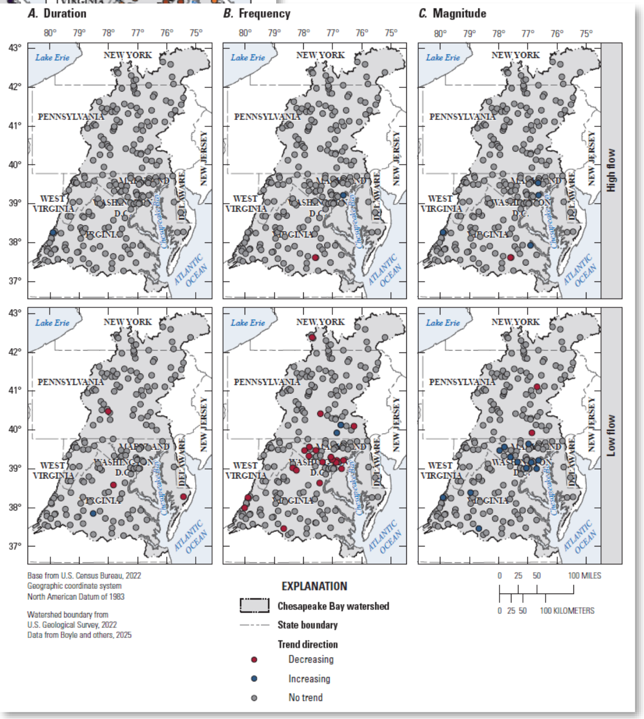
- **Macroinvertebrate data** – ICPRB data archive, Smith, Z., C. Buchanan, and A. Nagel. 2017
  - NHD links - Boyle, L.J., and Maloney, K.O., 2024, Attribution of benthic macroinvertebrate sampling data to NHDPlus V2 and NHDPlus HR catchments within the Chesapeake Bay Watershed: U.S. Geological Survey data release, https://doi.org/10.5066/P9X6JDHN
- **Fish data** - Krause, K.P., and Maloney, K.O., 2021, Community metrics from inter-agency compilation of inland fish sampling data within the Chesapeake Bay Watershed: U.S. Geological Survey data release, https://doi.org/10.5066/P9D6JU4X
  - NHD links - Boyle, L.J., Krause, K.P., Walker, R.H., Gressler, B.P., Young, J.A., and Maloney, K.O., 2024, Attribution of fish sampling data to NHDPlus HR catchments within the Chesapeake Bay Watershed: U.S. Geological Survey data release, https://doi.org/10.5066/P9ZVO70A
- **Habitat data** - Chesapeake Bay Data Hub, https://datahub.chesapeakebay.net/
  - NHD links - Boyle, L.J., Cashman, M.J., and Maloney, K.O., 2024, Attribution of stream habitat assessment data to NHDPlus V2 and NHDPlus HR catchments within the Chesapeake Bay Watershed: U.S. Geological Survey data release, https://doi.org/10.5066/P1F2COKK
- **Salinity data** - Fanelli, R.M., Sekellick, A.J., and Hamilton, W.B., 2023, Compilation of multi-agency specific conductance observations for streams within the Chesapeake Bay watershed, U.S. Geological Survey data release, https://doi.org/10.5066/P98O2HQJ
- **Temperature data** - Clune, J.W., Colgin, J.E., and Zimmerman, T.M., 2023, Compilation of multi-agency water temperature observations for streams within the Chesapeake Bay watershed: U.S. Geological Survey Data Release, https://doi.org/10.5066/P92SHG66
- **Nutrient data** - Mason, C.A., Colgin, J.E., Webber, J.S., and Soroka, A.M., 2025, Nitrogen, phosphorus, and suspended-sediment loads and trends measured at the Chesapeake Bay Nontidal Network stations: Water years 1985-2023: U.S. Geological Survey data release, https://doi.org/10.5066/P13P4TWR
- **Toxic contaminant data** - Banks, B.D., Needham, T.P., Dugan, C.M., Foss, E.P., and Majcher, E.H., 2022, Priority toxic contaminant metadata inventory and associated total polychlorinated biphenyls concentration data: U.S. Geological Survey data release, https://doi.org/10.5066/P9R78SQ6

USGS Status & Trends publication

Salinity status



Flow trends

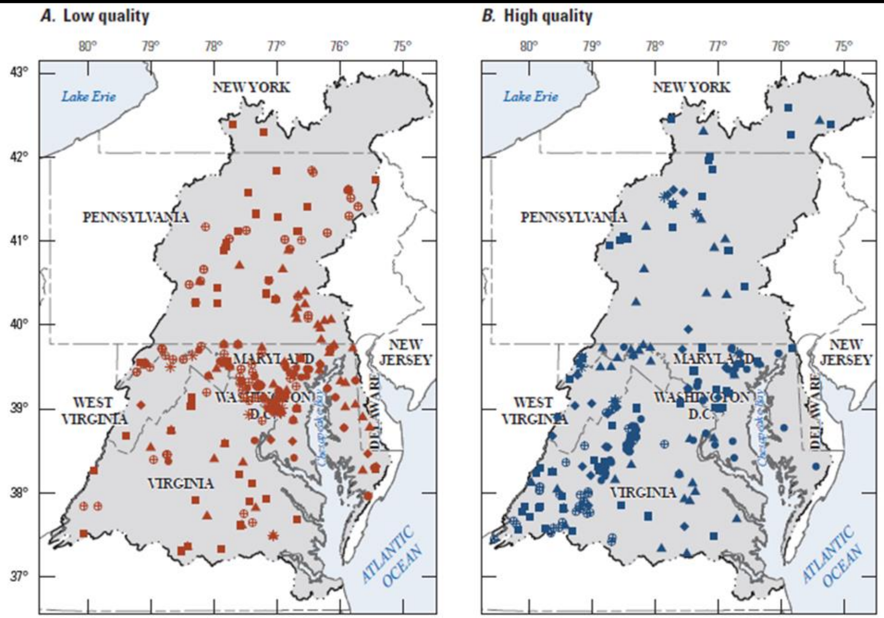


Anthropogenic land use as potential driver of stream health

Indicator	Metric	Relationship at significance value of p≤0.05		
		Developed	Agriculture	Forest
Nutrients and sediment	Suspended sediment concentration, mg/L	None	None	Negative
	Total nitrogen concentration, mg/L	None	Positive	Negative
	Total phosphorus concentration, mg/L	Positive	Positive	Negative
Temperature	Temperature, °C	Positive	None	Negative
Salinity	3-year median annual SC value, µS/cm	Positive	Positive	Negative
Streamflow	Low-flow magnitude, $(ft^3/s)/mi^2$	Positive	Positive	Negative
	Low-flow frequency	Positive	None	None
	Low-flow duration, days	None	None	None
	High-flow magnitude, $(ft^3/s)/mi^2$	None	Negative	Positive
	High-flow frequency	Positive	Negative	Negative
	High-flow duration, days	Negative	Negative	Positive
Hydromorphology	Bank stability	Negative	None	Positive
	Bank vegetative protection	Negative	None	Positive
	Channel alteration	None	None	None
	Embeddedness	Negative	None	Positive
	Epifaunal substrate	Negative	None	Positive
	Channel streamflow status	Negative	None	Positive
	Frequency of riffles	None	None	None
	Sediment deposition	Negative	Negative	Positive
	Velocity and depth combinations	None	Positive	None
Biological assemblages	Chessie BIBI	Negative	None	Positive
	Percentage EPT-H	Negative	None	Positive
	MMI	None	None	None
	Percentage nontolerant individuals	None	Negative	None

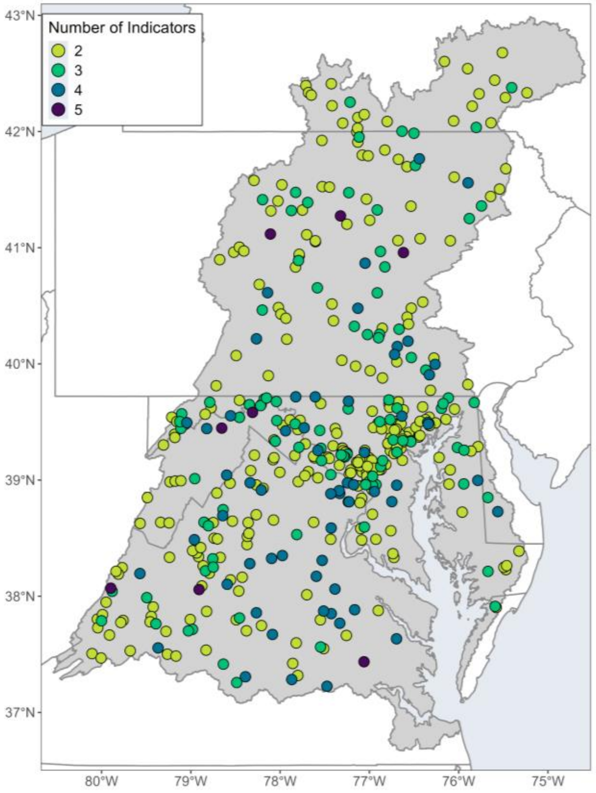
Boyle, L.J., Austin, S.H., Cashman, M.J., Clifton, Z.J., Clune, J.W., Colgin, J.E., Elliott, K.E.M., Fanelli, R.M., Foss, E.P., Hitt, N.P., Hittle, E.A., Howe, C.M., Majcher, E.H., Maloney, K.O., Mason, C.A., Metes, M.J., Moyer, D.L., Needham, T.P., Rogers, K.M., Thompson, J.J., Yang, G., and Zimmerman, T.M., 2025, Tracking status and trends in seven key indicators of river and stream condition in the Chesapeake Bay watershed: U.S. Geological Survey Scientific Investigations Report 2025–5072, 104 p., https://doi.org/10.3133/sir20255072

Key takeaways and challenges



Takeaways:

- Trends vary greatly by indicator and location – Some sites show improvement, but many are degrading over time.
- Trends consistently indicated degrading conditions around the Washington D.C. and Baltimore areas
- Degrading trends and poor status associated with developed landcover for all indicators



Challenges:

- Temporal variability – indicators differ in frequency and data coverage
- Spatial bias – sites unevenly spread across the watershed and concentrated near urban areas
- Limited overlap– no site in the watershed has data available for all indicators

Boyle, L.J., Austin, S.H., Cashman, M.J., Clifton, Z.J., Clune, J.W., Colgin, J.E., Elliott, K.E.M., Fanelli, R.M., Foss, E.P., Hitt, N.P., Hittle, E.A., Howe, C.M., Majcher, E.H., Maloney, K.O., Mason, C.A., Metes, M.J., Moyer, D.L., Needham, T.P., Rogers, K.M., Thompson, J.J., Yang, G., and Zimmerman, T.M., 2025, Tracking status and trends in seven key indicators of river and stream condition in the Chesapeake Bay watershed: U.S. Geological Survey Scientific Investigations Report 2025–5072, 104 p., https://doi.org/10.3133/sir20255072

Current work

Goal: Synthesizing results for a holistic view of stream health

Steps:

- Gather additional data to increase spatial and temporal coverage for all indicators
- Determine smallest spatial scales at which all indicators overlap
- Identify existing ecologically relevant thresholds or criteria to contextualize results as indicating good or poor stream health
- Determine common drivers within and across indicators
- Develop products to communicate results and display multi-indicator stream health across the watershed

Lindsey Boyle, Rosemary Fanelli, Marissa Cassell, Zach Clifton, Doug Moyer

Status data

Status = Mean or median of 2015-17 metric values for each indicator

Indicator	Site Count	Metric	Ecological Benchmark
Total Nitrogen	117	TN concentration (mg/L)	EPA National Rivers and Streams Assessment (NRSA) benchmarks for the Conterminous United States
Total Phosphorus	116	TP concentration (mg/L)	EPA National Rivers and Streams Assessment (NRSA) benchmarks for the Conterminous United States
Suspended Sediment	126	Suspended sediment concentration (mg/L)	
Salinity	461	Specific Conductance	Predicted background salinity
Temperature	112	Mean continuous stream temperature (C)	Predicted critical thermal maximum of sensitive fish taxa
Streamflow	389	Richard Barker Flashiness Index, 7 day low flow	
Habitat	157	epifaunal substrate score (EPA Rapid Habitat Assessment)	EPA Rapid Habitat Assessment Score categories
Macroinvertebrates	274	Chessie BIBI score, %EPT-H	Chessie BIBI categories
Fish	82	EPA MMI, % Sensitive individuals	EPA MMI categories

Site specific and HUC status

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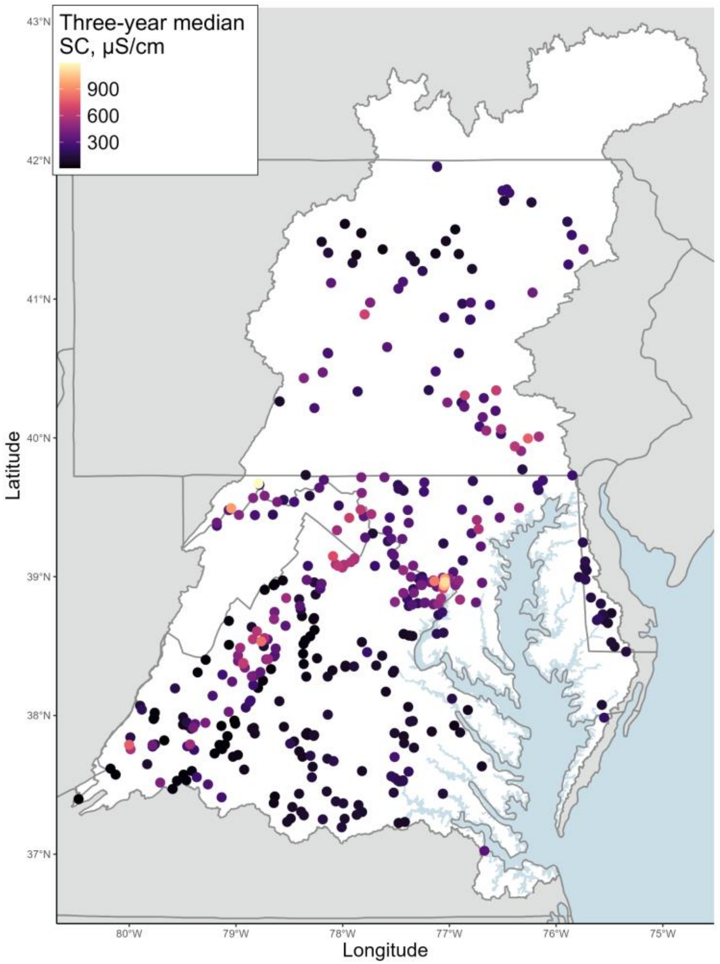
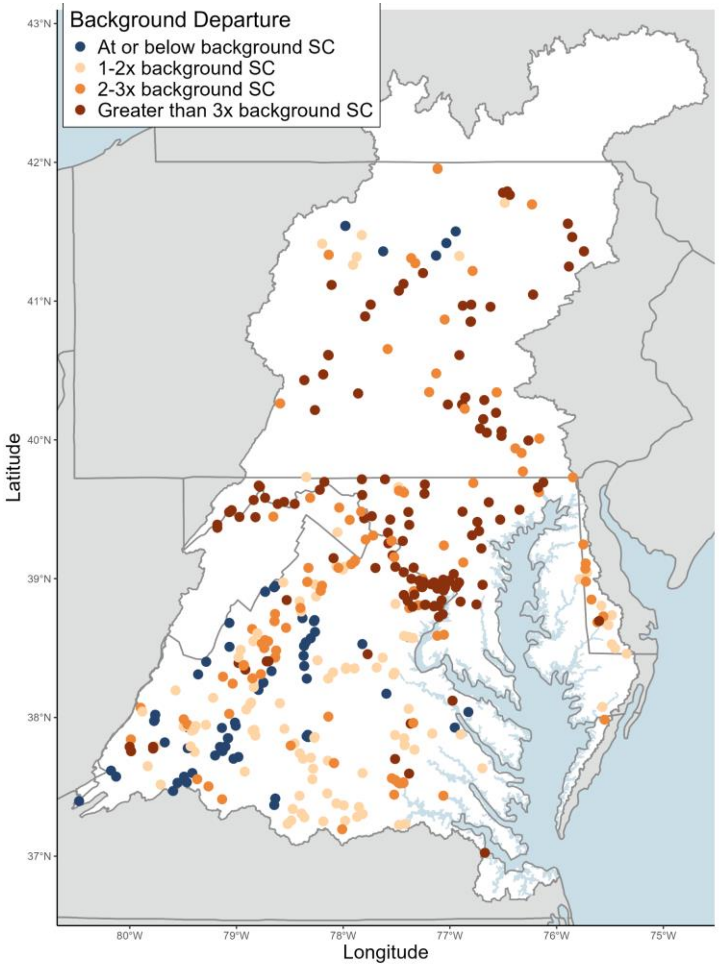
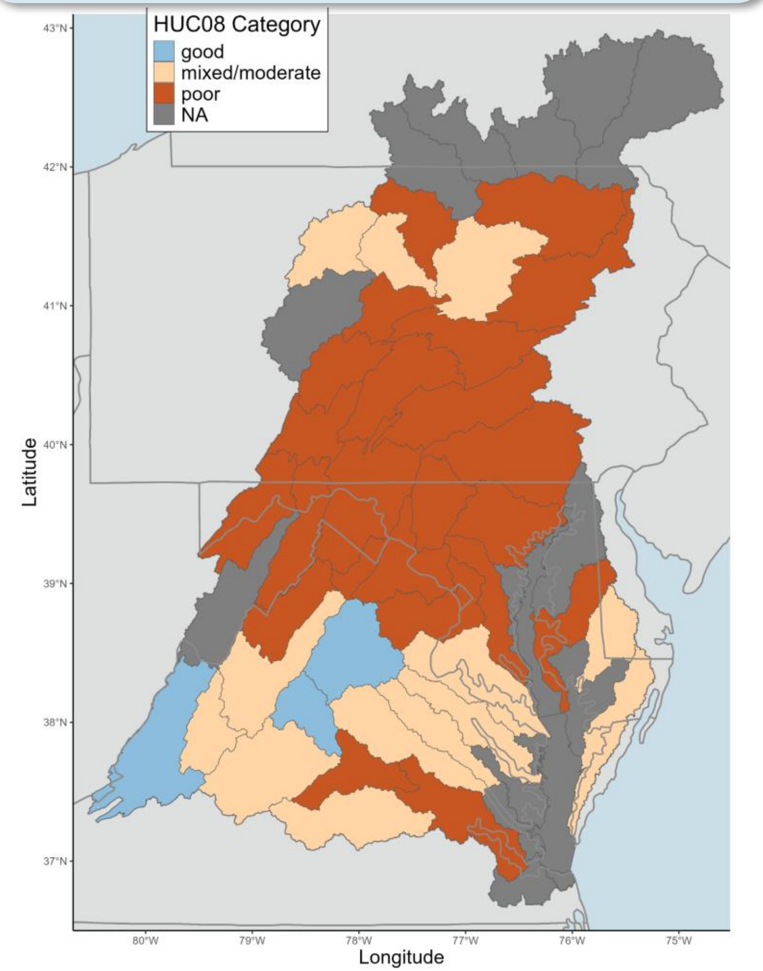
Compute indicator metrics
Salinity: Three year median specific conductance

Assess site conditions
Compare metric values to ecological benchmarks (Predicted background SC)

Categorize HUC08s
Score HUC08 based on if 50% or more of the status sites indicate "good" or "poor" condition





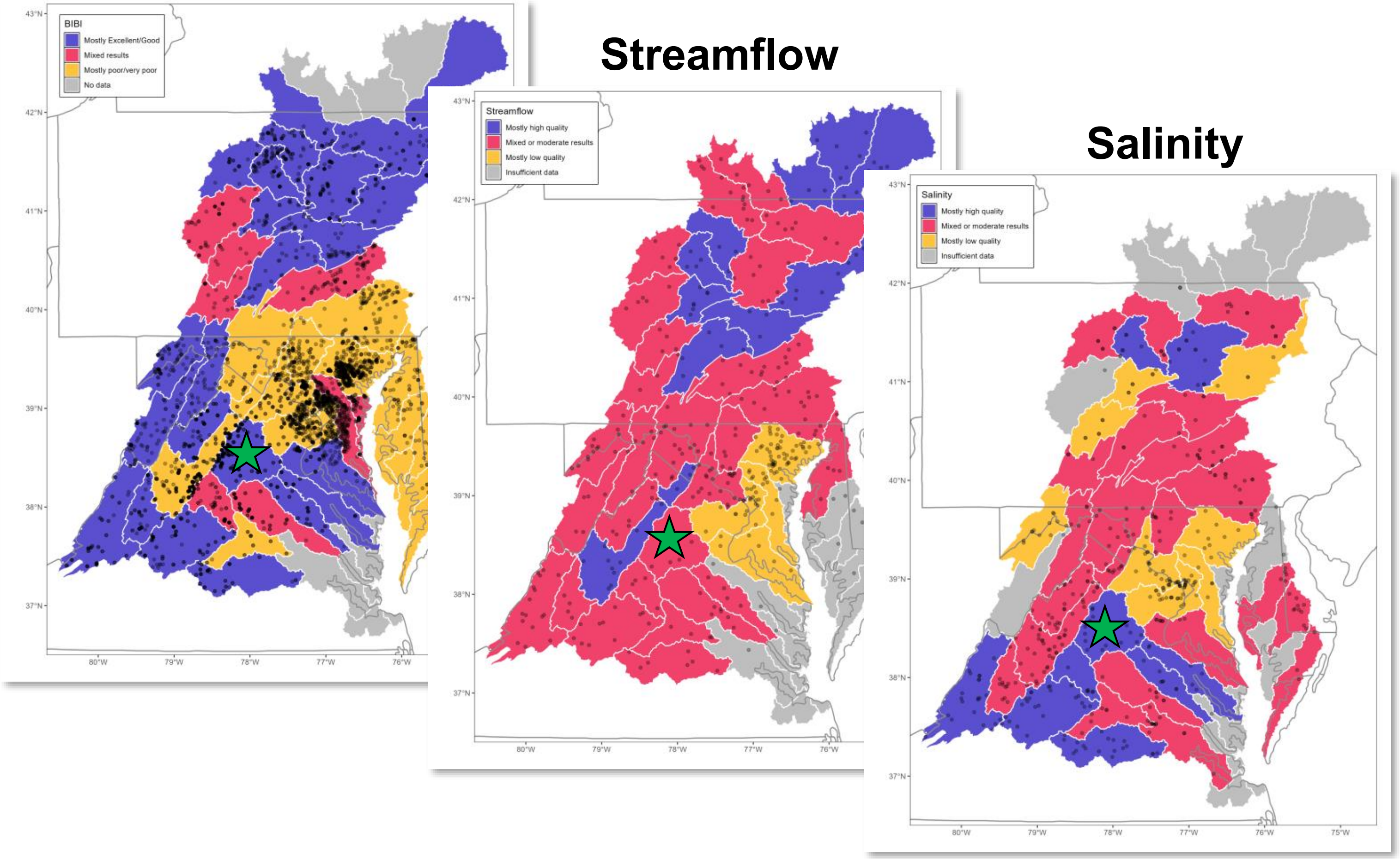


HUC-scale synthesis

Benthic IBI

Streamflow

Salinity



Report on **number of sites in HUC** with indicator data, the **percentage of sites** with high/low-quality conditions, and **data gaps**

Stream Health report for Rapidan-Upper Rappahannock

- **Biology:** Most sites had BIBI scores in Excellent/Good or Fair categories
- **Habitat:** Almost half of the sites had low levels of embeddedness
- **Salinity:** Most sites had salinity levels at or around background
- **Flow:** All sites had moderately elevated flashiness
- **Nutrients:** Not enough information (n < 3 sites)

Next Steps: Data Visualization

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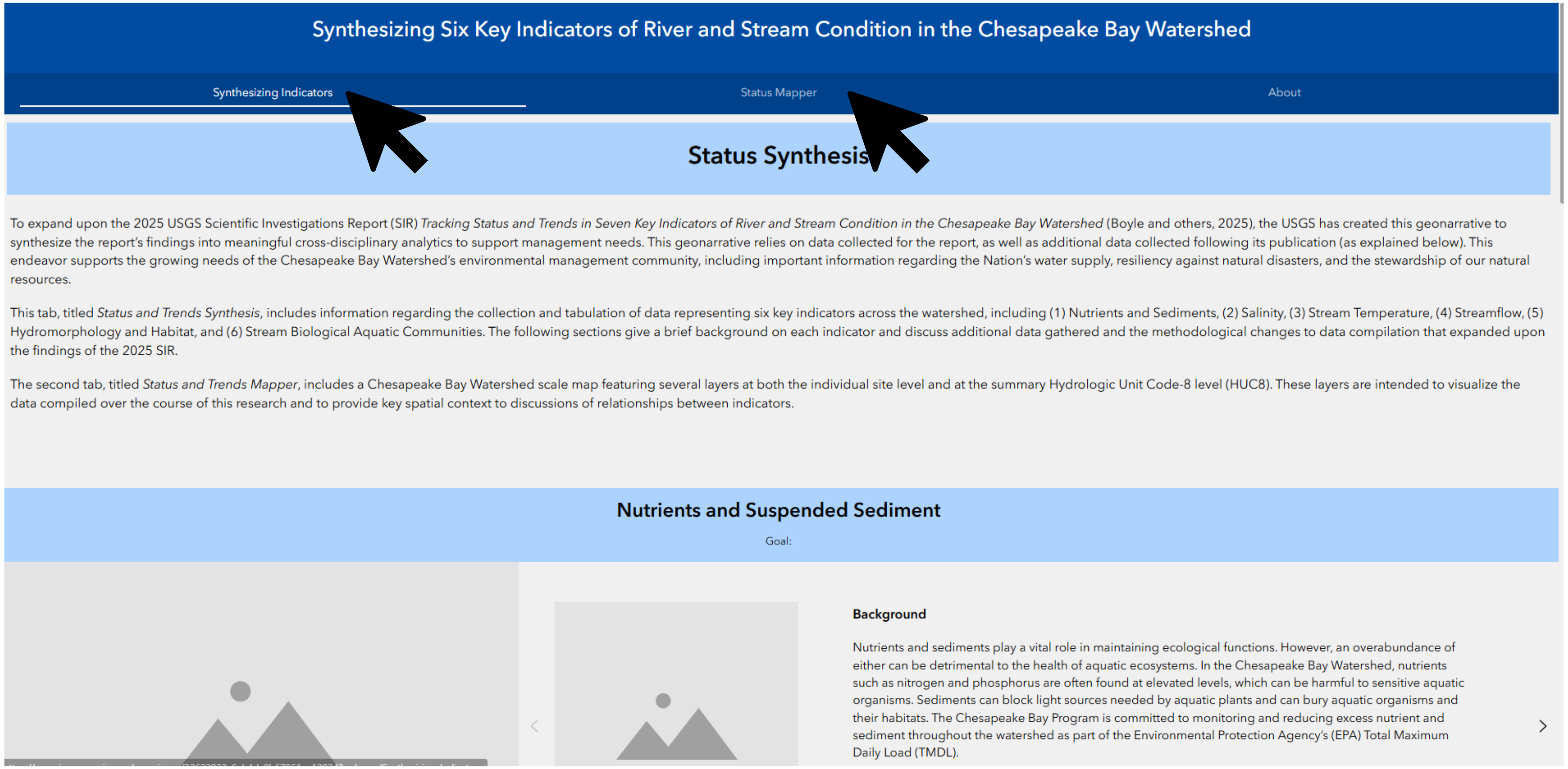
- Tool for collaborators to view:
  - Background information
  - Methods
  - Site Specific Status Results
  - HUC Status Results
  - Resources and References



Next Steps: Data Visualization

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Layers

- Macroinvertebrates
  - Macroinvertebrate Status
  - Macroinvertebrate Raw Values - Percent EPT Minus H
  - invertebrate HUC Status
- Salinity
- Fish
- Streamflow
- Stream Temperature
- Habitat
- Suspended Sediment
- Total Nitrogen
- Total Phosphorus
- Chesapeake Bay Watershed

Macroinvertebrates

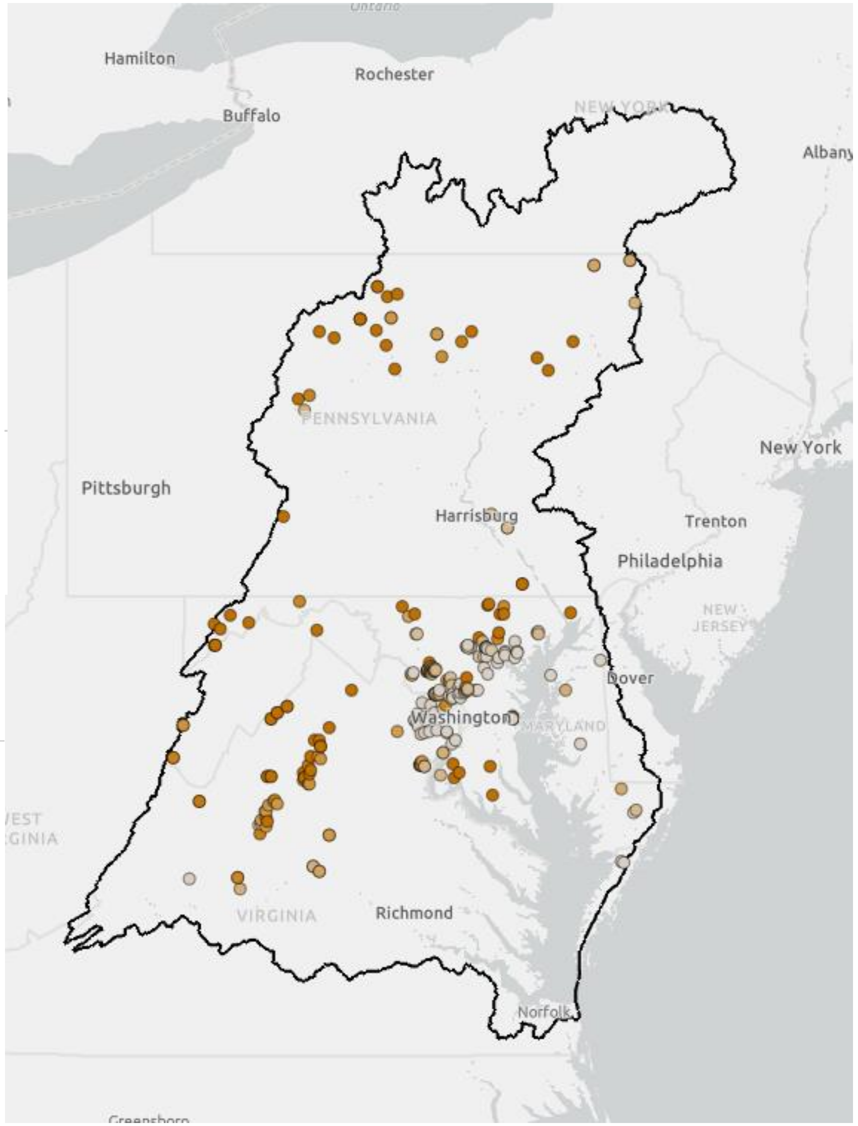
Macroinvertebrate Status

- Very Poor
- Poor
- Fair
- Good
- Excellent

Macroinvertebrate HUC Status

- Good
- Mixed/Moderate
- Poor
- Not Available

Chesapeake Bay Watershed



Next Steps: Data Visualization

Layers

- Macroinvertebrates (checked)
  - Macroinvertebrate Status (checked)
  - ...nvertebrate Raw Values - Percent E... ...inus H
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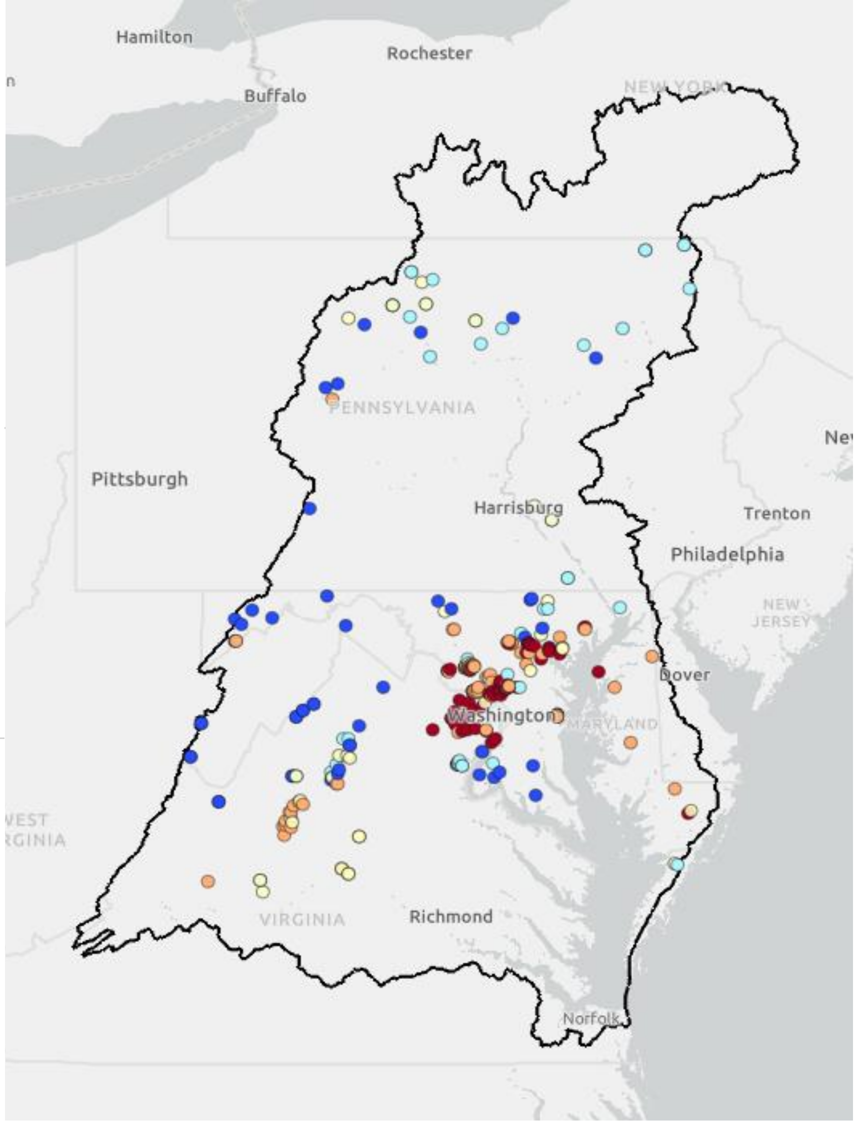

Next Steps: Data Visualization

USGS science for a changing world

Layers

- [x] Macroinvertebrates
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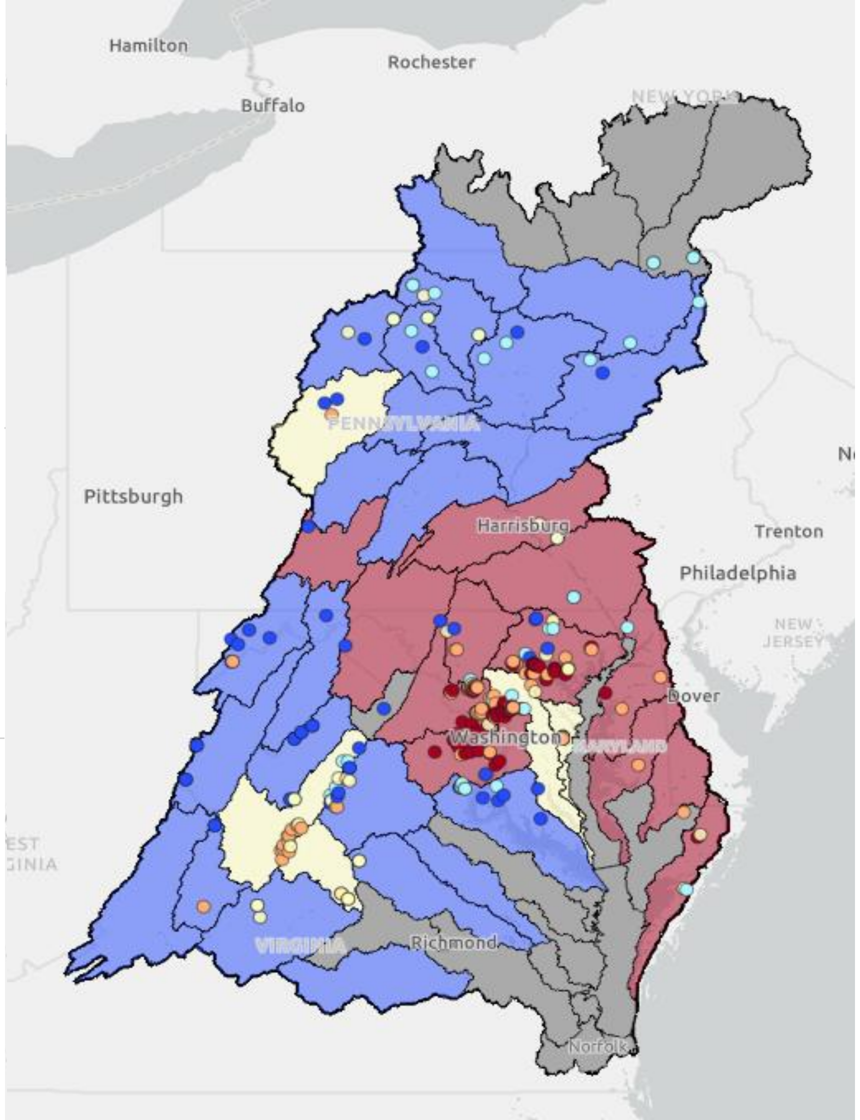

Next Steps: Data Visualization

USGS science for a changing world

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  - Salinity Status
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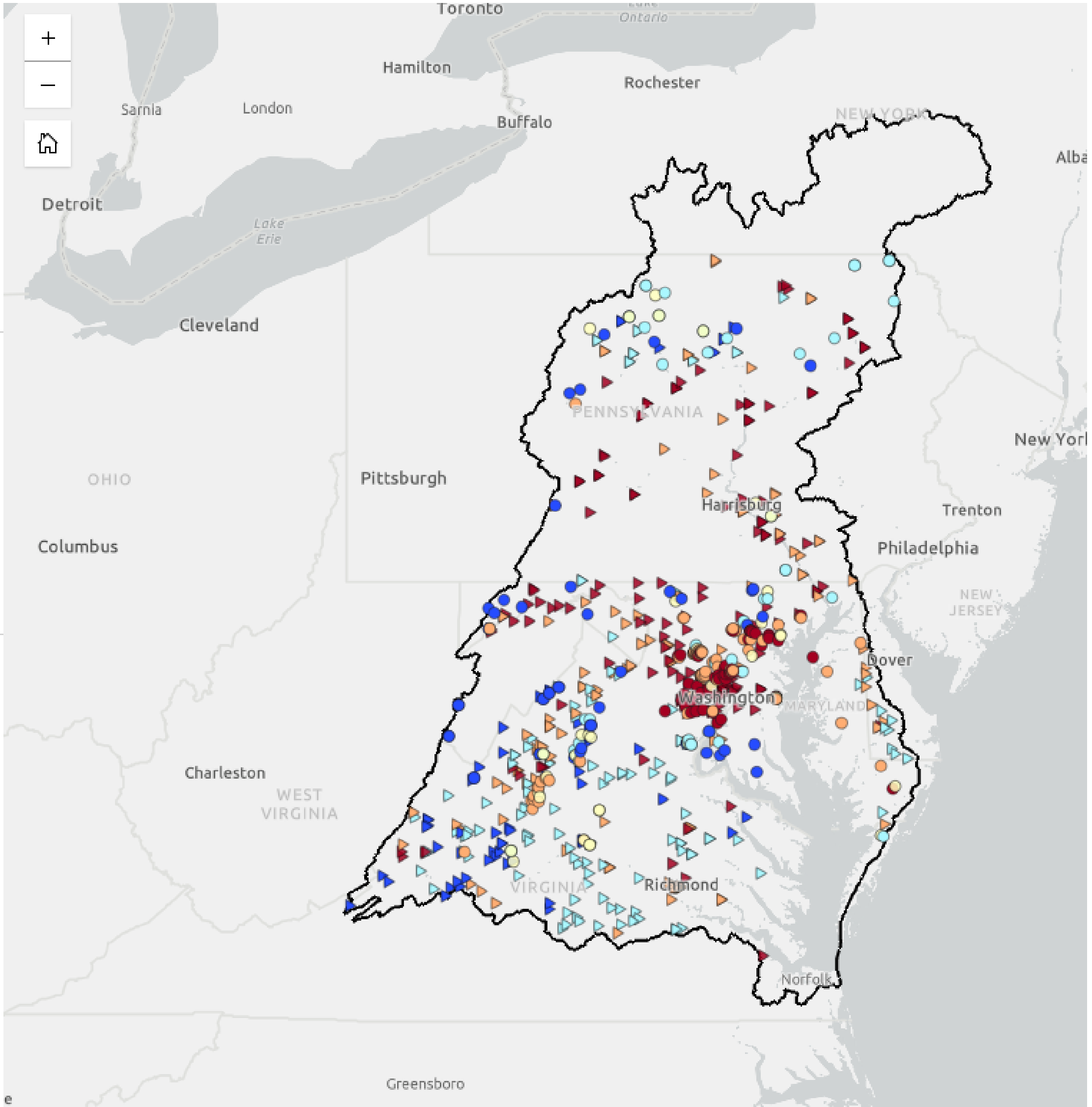
Salinity

Salinity Status

- Greater than 3x background SC
- 2-3x background SC
- 1-2x background SC
- At or below background SC

Chesapeake Bay Watershed



Next Steps: Data Visualization

USGS science for a changing world

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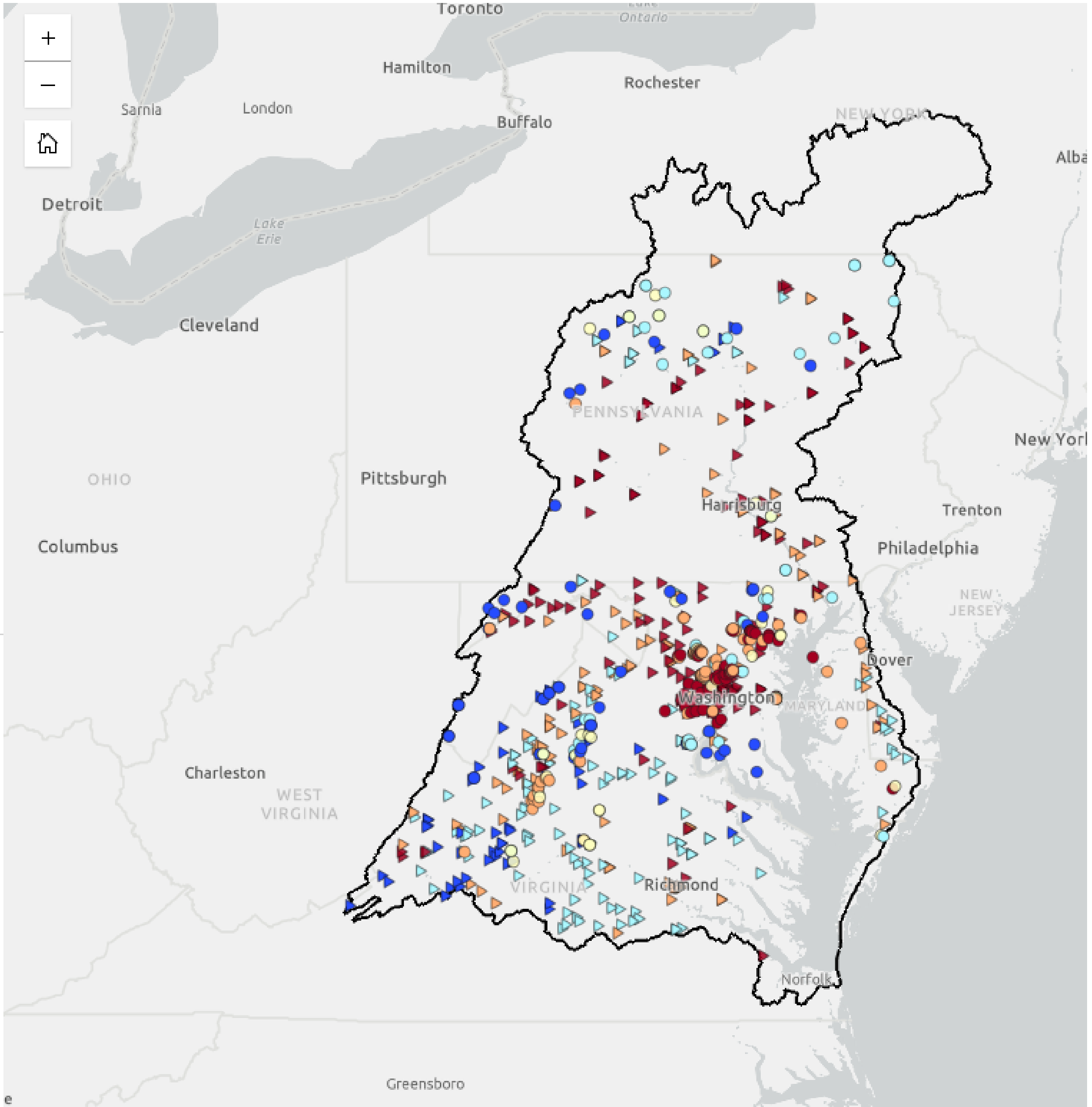

Next Steps: Data Visualization

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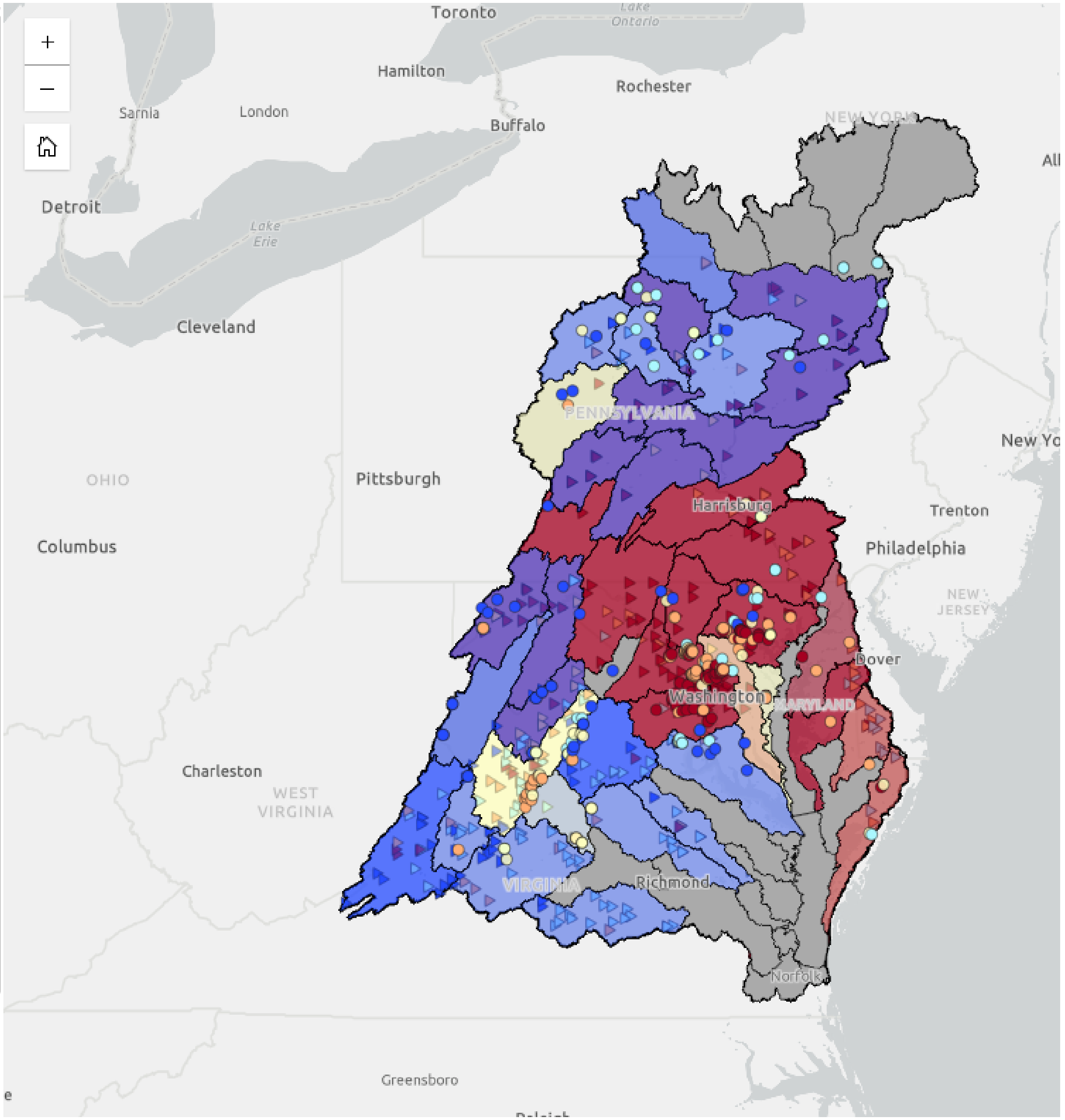
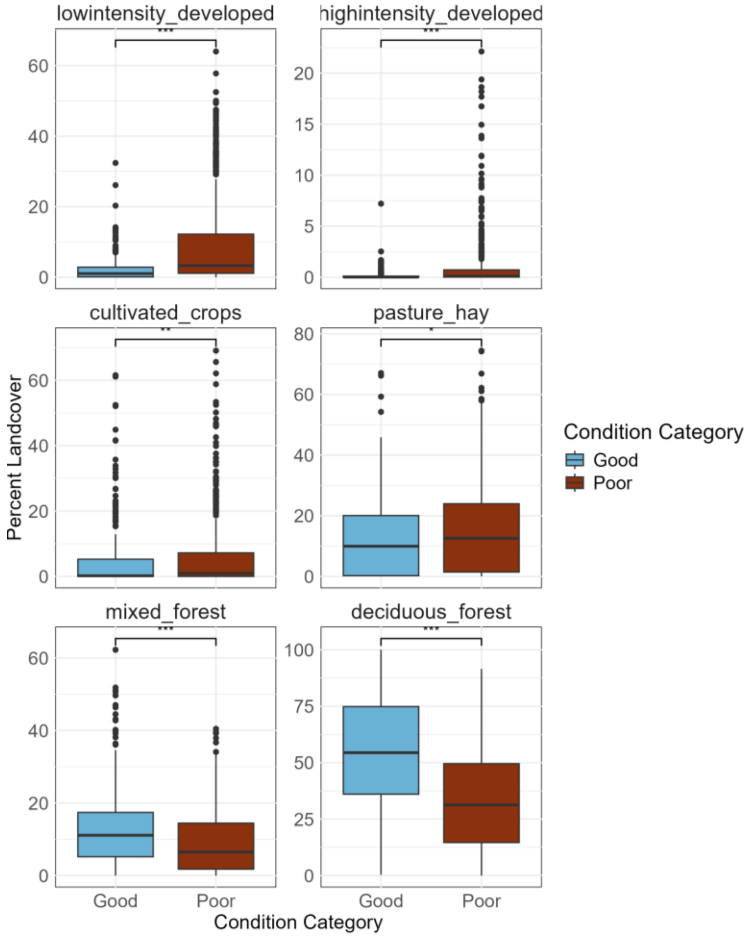


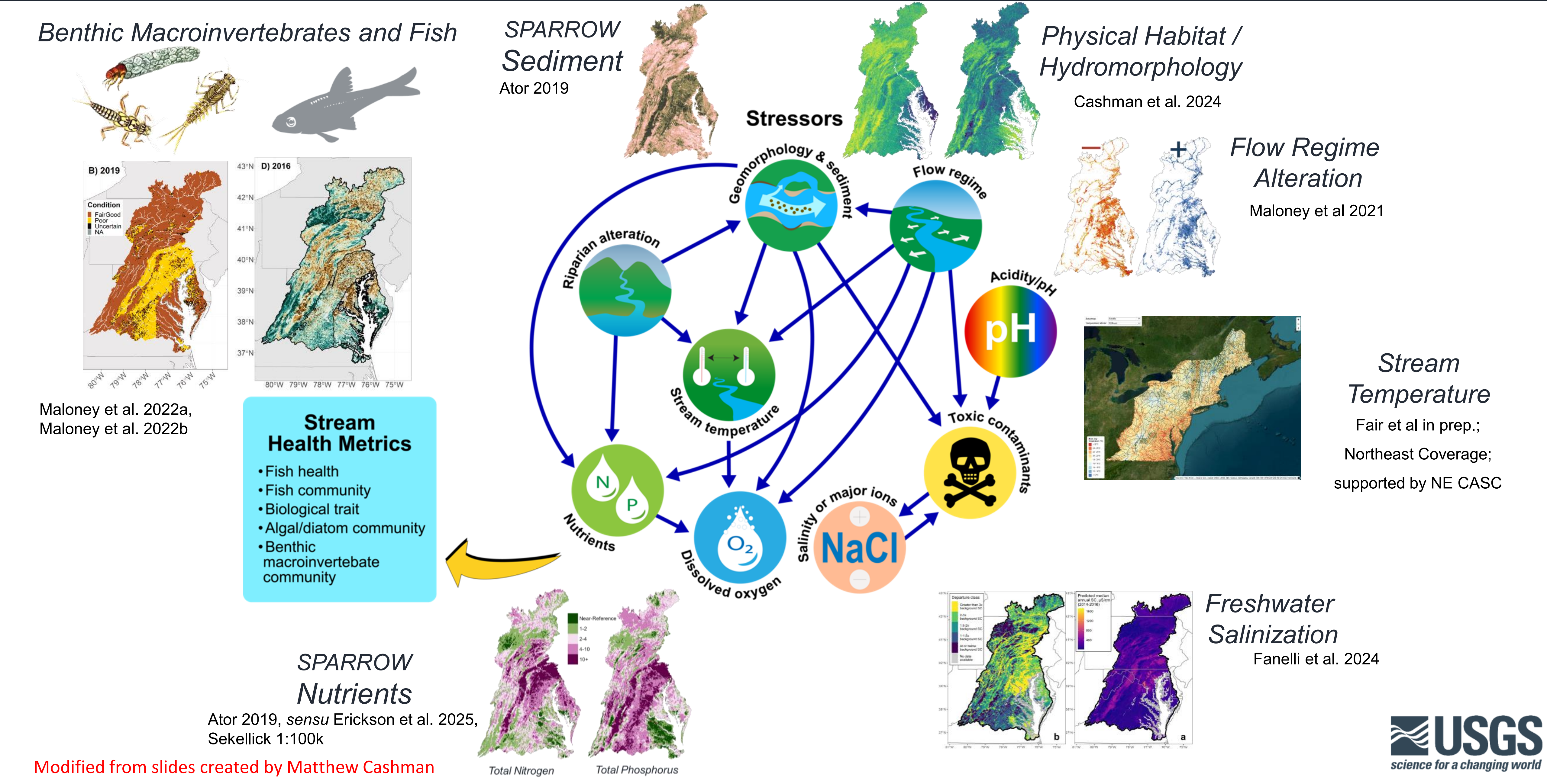
Looking Forward: Explore common drivers and network gaps

- **Explore common drivers:**
  - Compare watershed characteristics across multiple stream health indicators in sites with good or poor condition

- **Determine network gaps:**
  - Quantify spatial and temporal gaps in the indicator networks
  - Quantify representativeness of current network
  - Investigate over/underrepresented landcovers and stream sizes
  - Identify areas where additional monitoring sites would most benefit indicator networks



USGS Assessments – consistent watershed evaluations



USGS Assessments – consistent watershed evaluations

Goal: To develop consistent map scale (1:24,000) predictions for streams and rivers across the watershed

Response data:

- Physical habitat, salinity, benthic macroinvertebrates, fish, sediment (2025/6)
- Stream temperature, stream channel morphology, nutrients, flow (2026/7)
- Data were from the USGS Status and Trends efforts

Stream Network

- NHDPlus HR 1:24,000 map scale

Predictors

- ChesBay 24k (Gressler et al. 2024 a,b,c,d), > 7,000 summarized at local catchment, downstream and upstream drainages.
- Static predictors – geology, soils, dams
- Time-variant predictors – NLCD LULC (1985-2023), Daymet climate (1980-2023)

Modeling

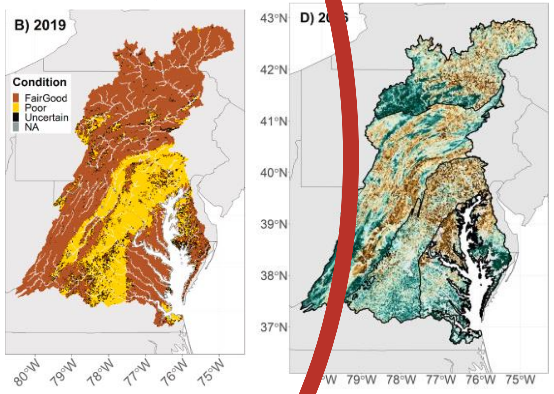
- Paired each of the observed samples with a NHDPlus HR catchment by nhdplusid
- Reduced the >7,000 predictors to uncorrelated ones mechanistically and/or partner of interest
- Many options but mostly using machine learning (Random Forests)

Data visualization

- Current geonarrative (chesapeakeassessments), moving to the ecosheds platform (EcoSHEDS | USGS)

USGS Assessments – benthic macroinvertebrates

Benthic Macroinvertebrates and Fish

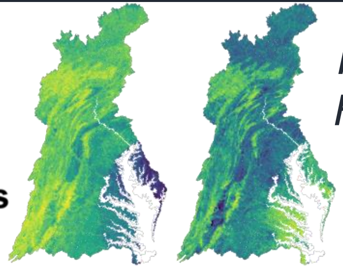


Maloney et al. 2022a,
Maloney et al. 2022b

Stream Health Metrics

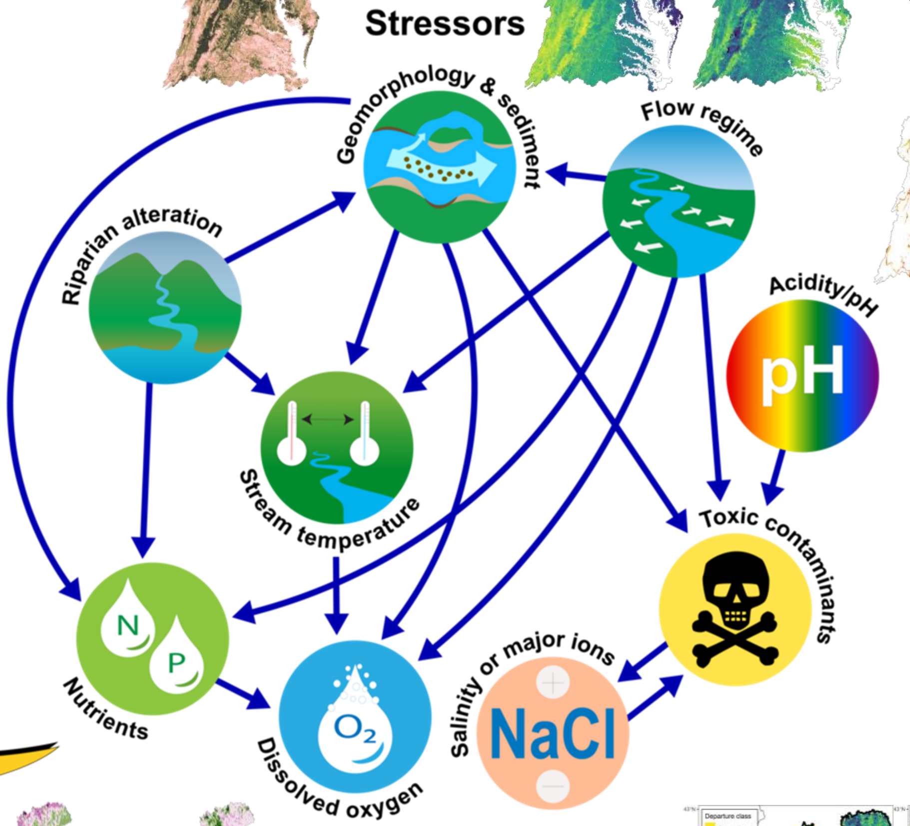
- Fish health
- Fish community
- Biological trait
- Algal/diatom community
- Benthic macroinvertebate community

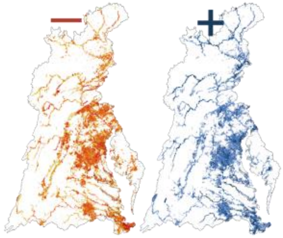
SPARROW
Sediment
Ator 2019



Physical Habitat / Hydromorphology

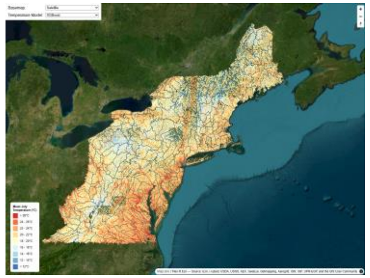
Cashman et al. 2024





Flow Regime Alteration

Maloney et al 2021



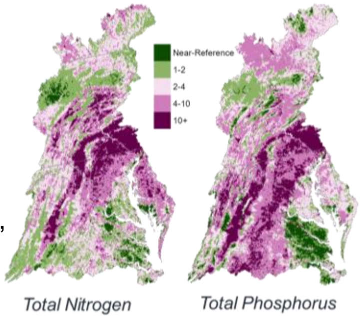
Stream Temperature

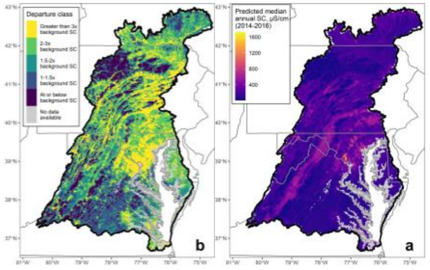
Fair et al in prep.;

Northeast Coverage;

supported by NE CASC

SPARROW
Nutrients
Ator 2019, *sensu* Erickson et al. 2025,
Sekellick 1:100k





Freshwater Salinization
Fanelli et al. 2024

Modified from slides created by Matthew Cashman

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Benthic Macroinvertebrates

Data:

- Data were from the Chessie BIBI effort of the ICPRB
- A total of 29,009 samples of which 5,943 passed our QA/QC

Response metrics

- Raw Chesapeake basin-wide index of biotic integrity for stream macroinvertebrates (BIBI_raw)
- Percent of the assemblage that have the clinger trait (%Clingers)
- Percent of the assemblage that were Ephemeroptera, Plecoptera and Trichoptera less Trichoptera Hydropsychidae family (%EPT-H)
- Percent that were Percent Ephemeroptera (%Ephem)

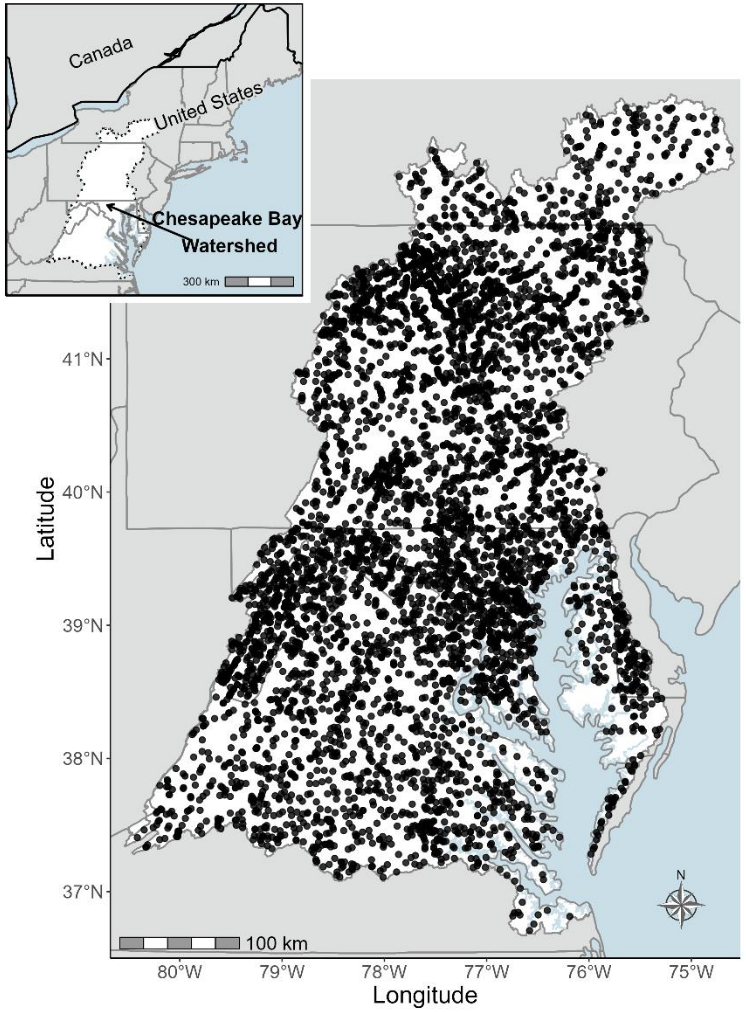
Predictors

- 89 uncorrelated predictors – NLCD LULC, topography, time varying climate (e.g., month of sample, month of and prior to sample)

Modeling

- Random forest machine learning (Ranger and tuneRanger R packages) with 80/20 training/test split

Chessie BIBI Points



Model Results

Measures

- Raw Chesapeake basin-wide index of biotic integrity for stream macroinvertebrates (BIBI_raw)
- Percent of the assemblage that have the clinger trait (%Clingers)
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- Percent that were Percent Ephemeroptera (%Ephem)

Response abbreviation	Test Dataset		
	MSE	RMSE	R squared
BIBI_raw	403.9	20.1	0.47
%Clingers	376.5	19.4	0.50
%EPT-H	292.9	17.1	0.59
%Ephem	197.3	14	0.49

Top five important variables

BIBI_raw	%Clingers	%EPT-H	%Ephem
Upstream watershed slope (mean)	Upstream elevation (mean)	Upstream elevation (mean)	Upstream elevation (mean)
Upstream impervious (%)	Upstream deciduous forest (%)	Upstream impervious (%)	Upstream watershed slope (mean)
Local watershed slope (mean)	Upstream impervious (%)	Local watershed slope (mean)	Local watershed slope (mean)
Upstream mixed forest (%)	Upstream average hydraulic conductivity	Upstream deciduous forest (%)	Upstream impervious (%)
Local impervious (%)	Upstream 3 to 10 inch rock fragments (%)	Upstream average max air temp (M0-1)	Upstream average max air temp (M0-1)

Prediction to all NHDPlus HR stream reaches - Trends

Trends in predictions 1985-2023

Methods

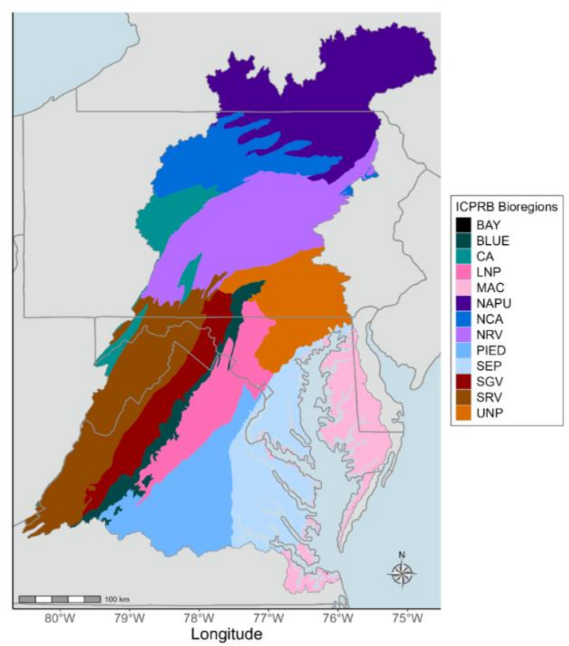
- Predict each response for 360,893 small reaches across the CBW for each year 1985-2023 with the tuned random forest models
- Trends for each stream were then calculated with Mann Kendall and Thien Sen slopes

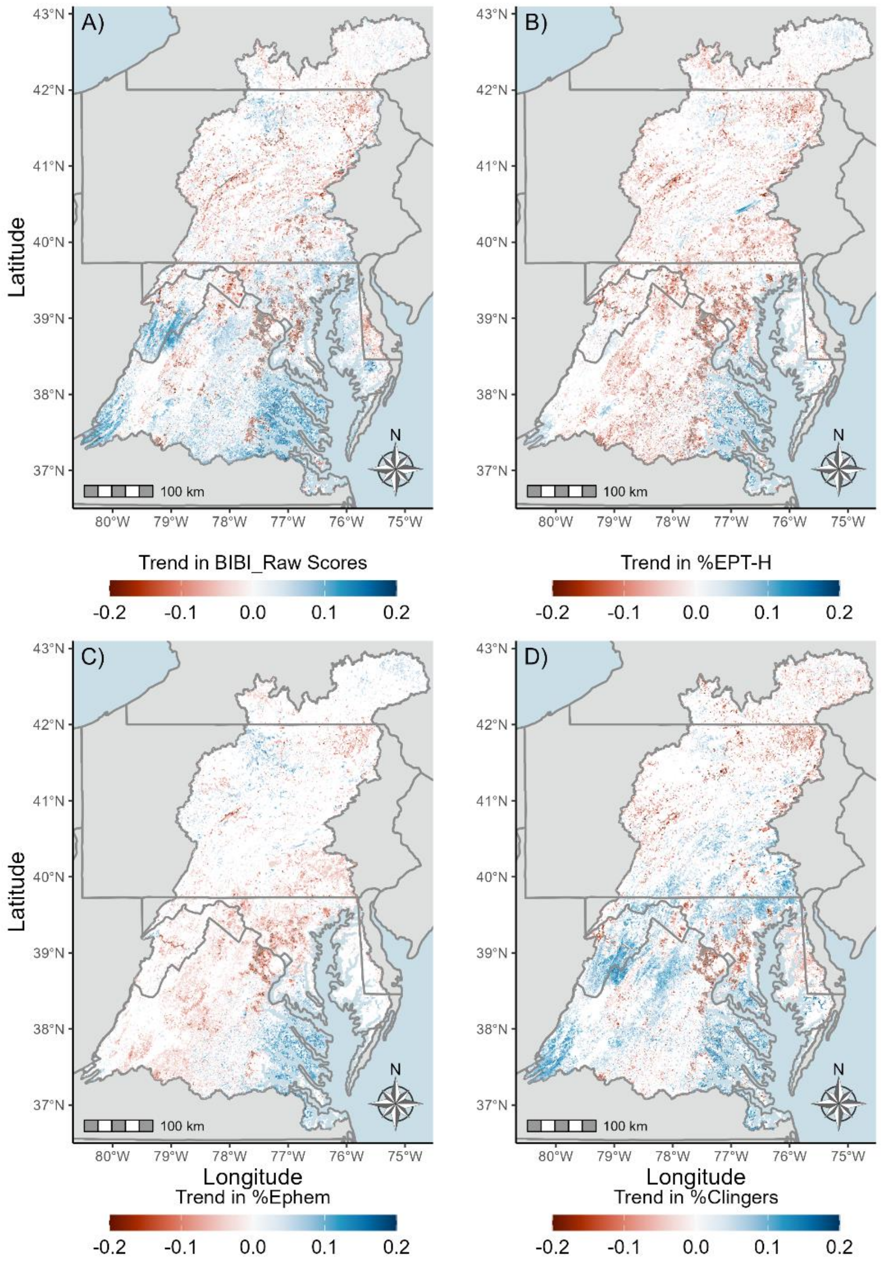
Prediction to all NHDPlus HR stream reaches - Trends

Trends in predictions 1985-2023

Results

- All four metrics showed strong negative trends around the Washington D.C. and Baltimore Maryland metropolitan region
- BIBI_raw and %Clingers had positive trends (improved conditions) for many streams in the Southeastern Plains, Southern Great Valley and Southern Ridge and Valley bioregions and negative trends (declining conditions) for many streams in the northern portion of the watershed





- %EPT-H and %Ephem showed widespread negative trends for all bioregions except the SEP across the 39-year period

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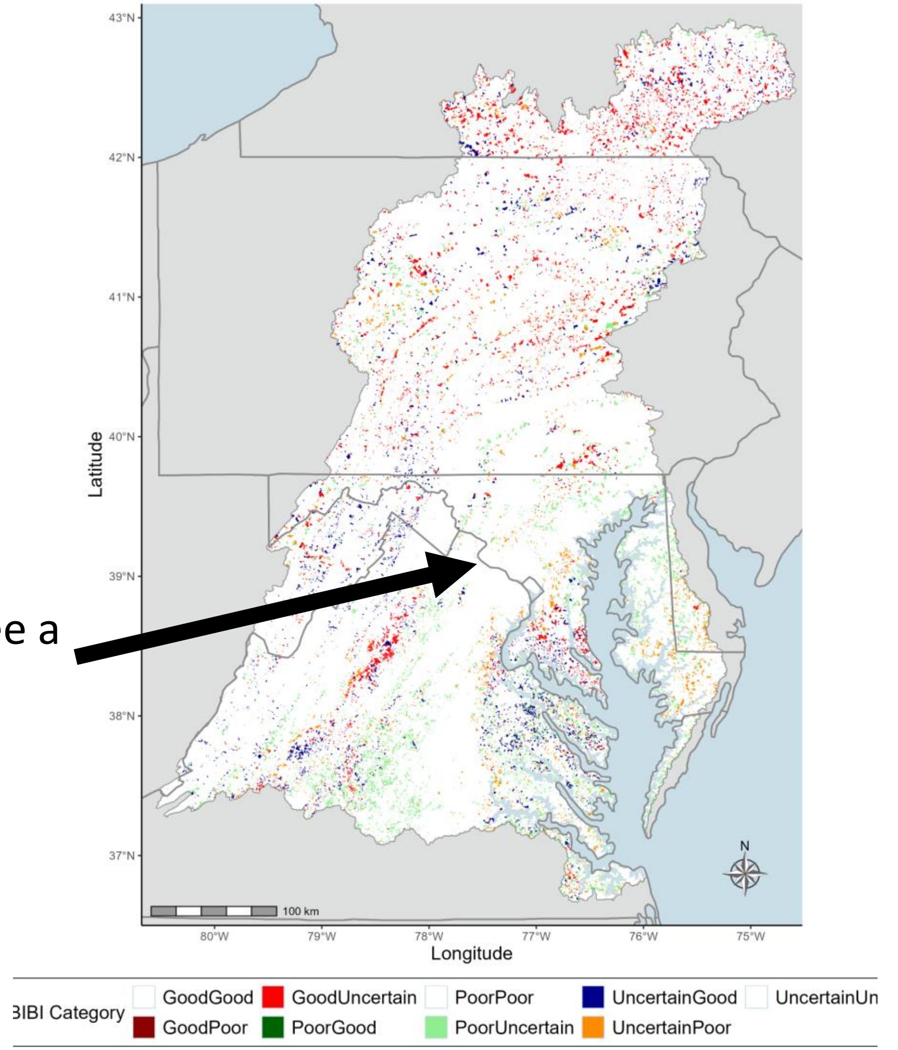
Prediction to all NHDPlus HR stream reaches – Chessie BIBI

Predictions – 3 category Chessie BIBI

- Converted raw scores in the 3 categories of Poor, Uncertain (Fair) and Good using Chessie BIBI developed cutoffs for each stream and year 1985 and 2023
- Examined change in these 3 categories between 1985 and 2023 to identify areas that have experienced change in conditions over the 39 years
- We did not see the expected change near the Washington D.C./Baltimore area

3 category model change 1985 to 2023



Why do we not see a change here?

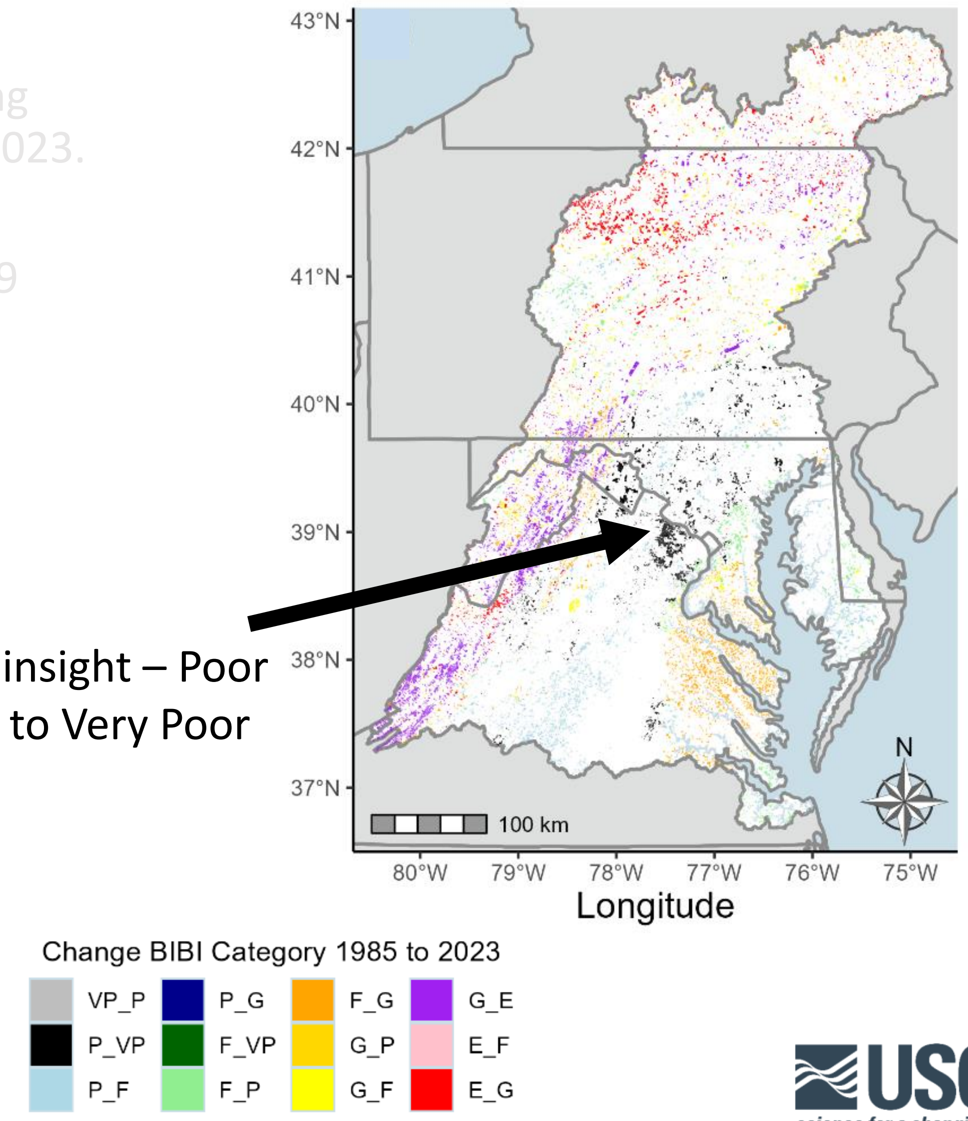
Prediction to all NHDPlus HR stream reaches – Chessie BIBI

Predictions – 5 category Chessie BIBI

- Converted raw scores in the 3 categories of Poor, Fair and Good using Chessie BIBI developed cutoffs for each stream and year 1985 and 2023.
- Examined change in these 3 categories between 1985 and 2023 to identify area that have experienced change in conditions over the 39 years.
- We do not see the expected change near the Washington D.C./Baltimore area.
- Looking at the 5 categories reveals an explanation!

5 category raw score model change 1985 to 2023

Some insight – Poor went to Very Poor



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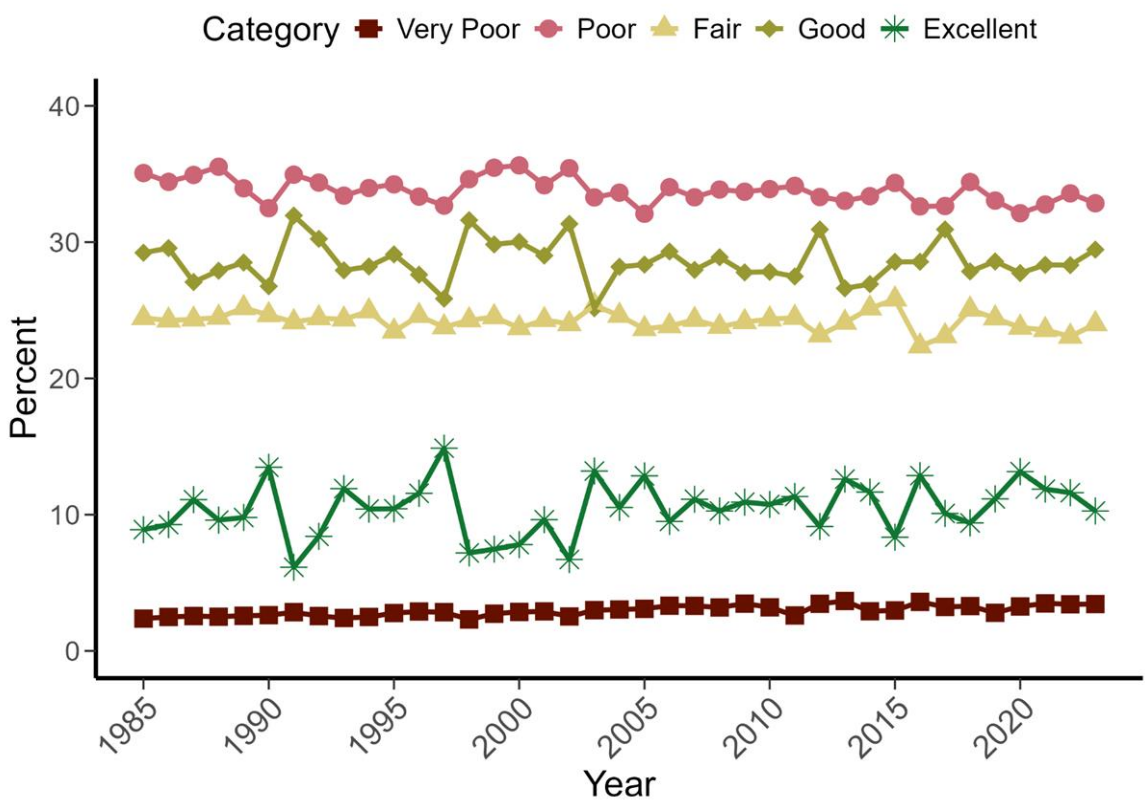
Prediction to all NHDPlus HR stream reaches – Chessie BIBI

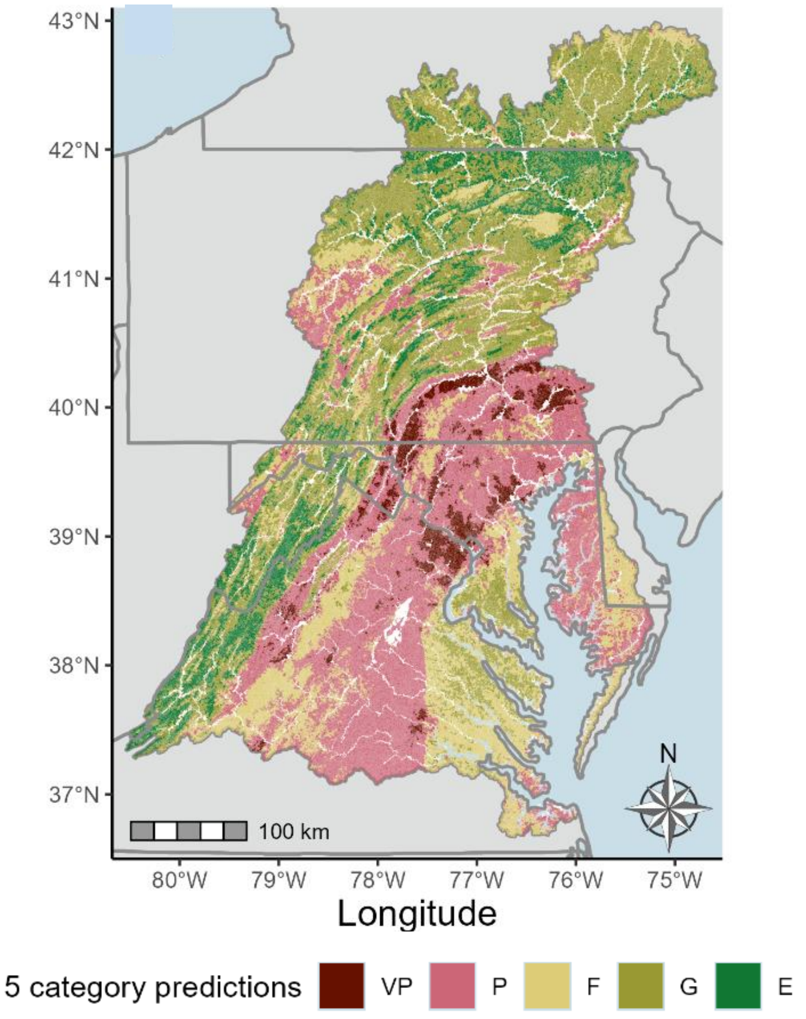
Percentage of the watershed total stream length

- Very Poor, Poor and Fair conditions showed consistent patterns across years with Very Poor increasing (2.4%, 3.4%), Poor decreasing (35.1%, 32.9%) and Fair decreasing (24.4%, 24.0%) between 1985 and 2023
- Good and Excellent conditions were much more variable but appeared to mirror each other suggesting these two categories often switched within a year



Year	%FGE
1985	62.6
2008	63.0
2015	62.7
2023	63.7

5 Category Predictions for 2023



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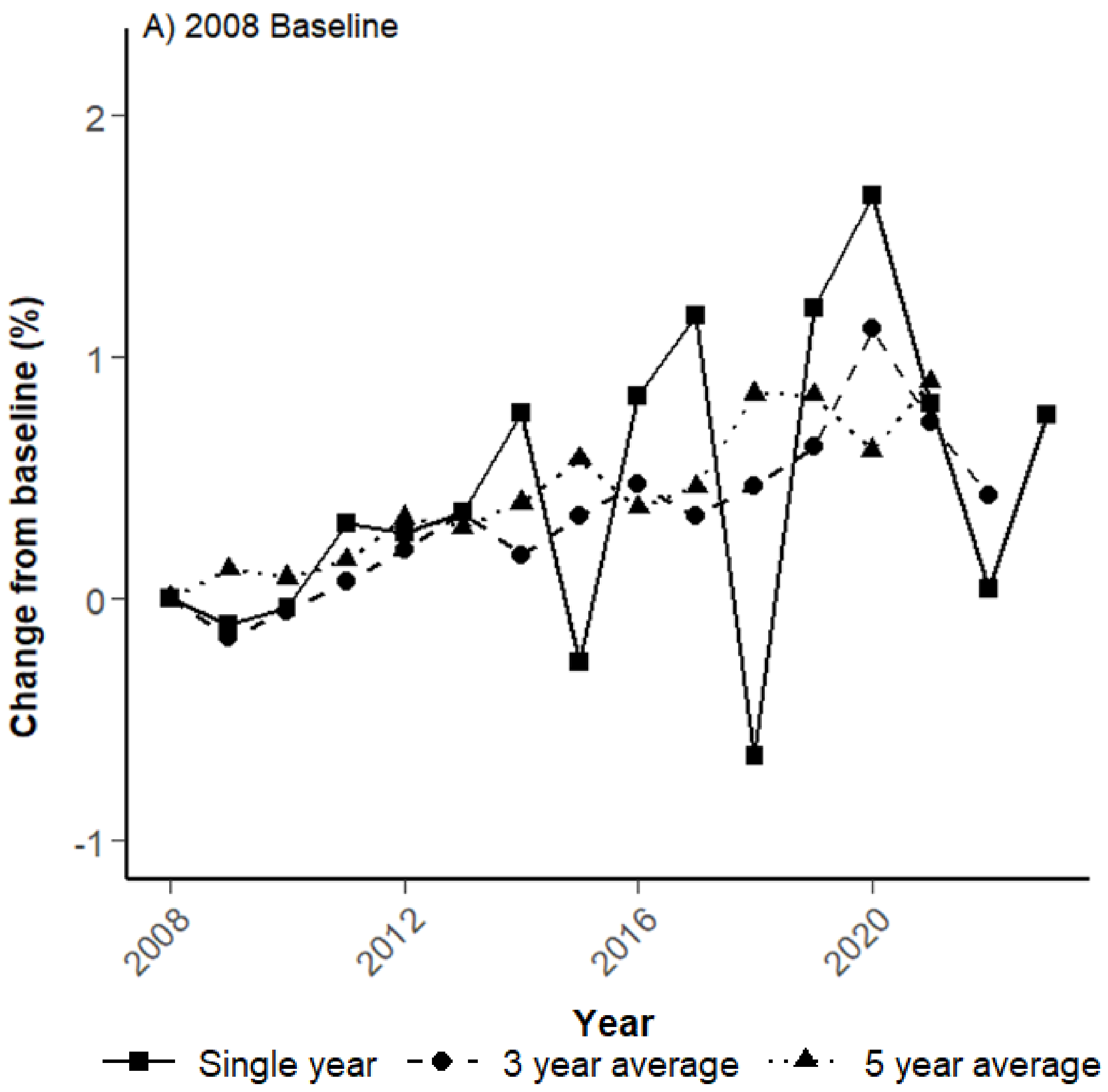
Prediction to all NHDPlus HR stream reaches – Chessie BIBI

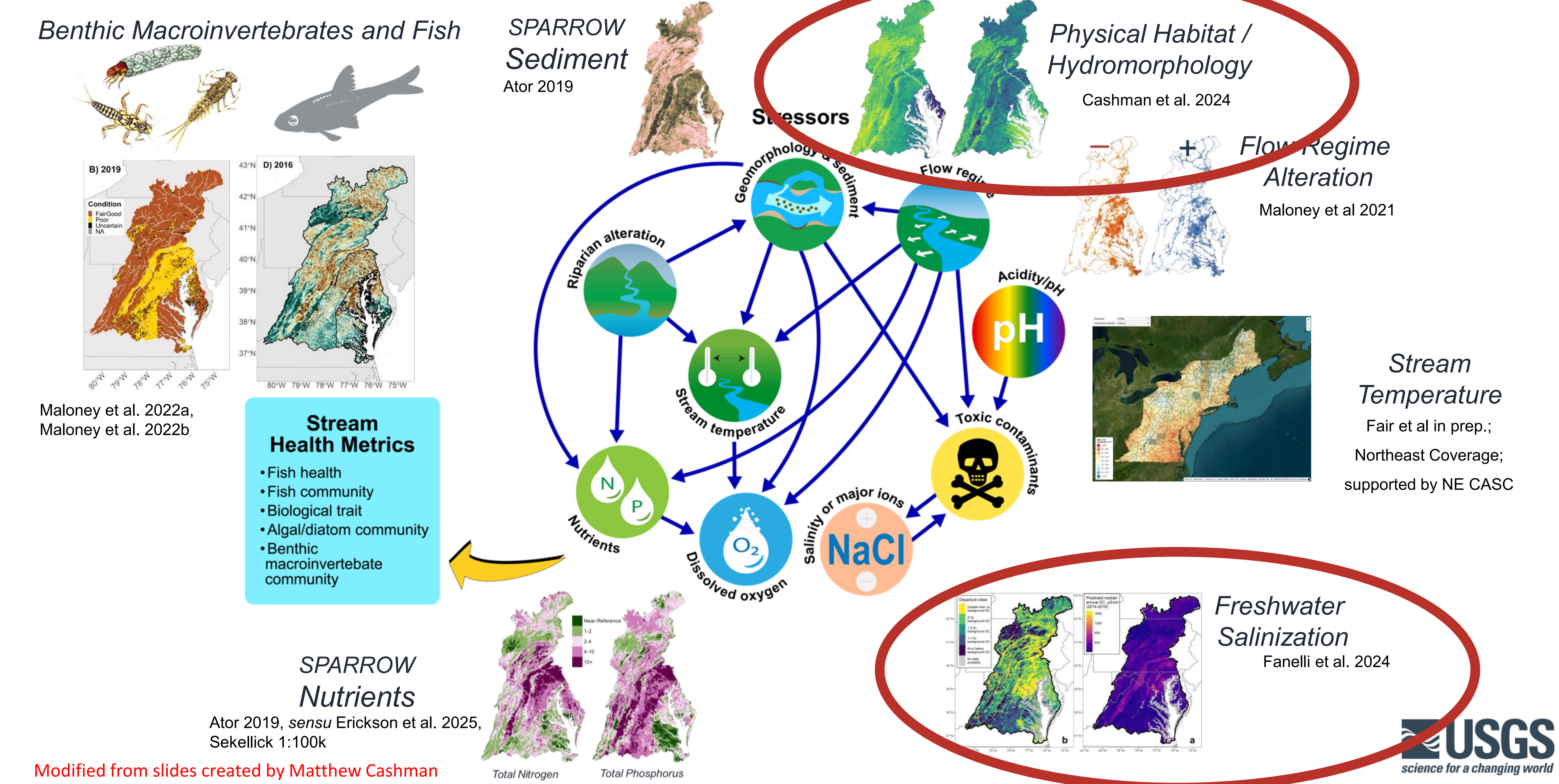
Change in percentage of the watershed stream length as Fair, Good or Excellent from 2008 baseline

- If only look at single year, the maximum change occurred in 2020 (1.7%) and minimum occurred in 2018 (-0.65%) but year-to-year changes were highly variable
- If look at 3-year average, the maximum change occurred in 2020 (1.1%) and minimum change occurred in 2009 (-0.2%) year-to-year changes were more stable
- If look at 5-year average, the maximum change occurred in 2021 (0.9%) and minimum change occurred in 2010 (0.1%) year-to-year changes were more stable



24k model contact: Kelly Maloney, kmaloney@usgs.gov

USGS Assessments – Physical Habitat & Salinity



Modified from slides created by Matthew Cashman

Salinity Lindsey Boyle and Rosemary Fanelli

Data:

- Compilation of multi-agency specific conductance observations for streams within the Chesapeake Bay watershed https://doi.org/10.5066/P98O2HQJ

Response metric:

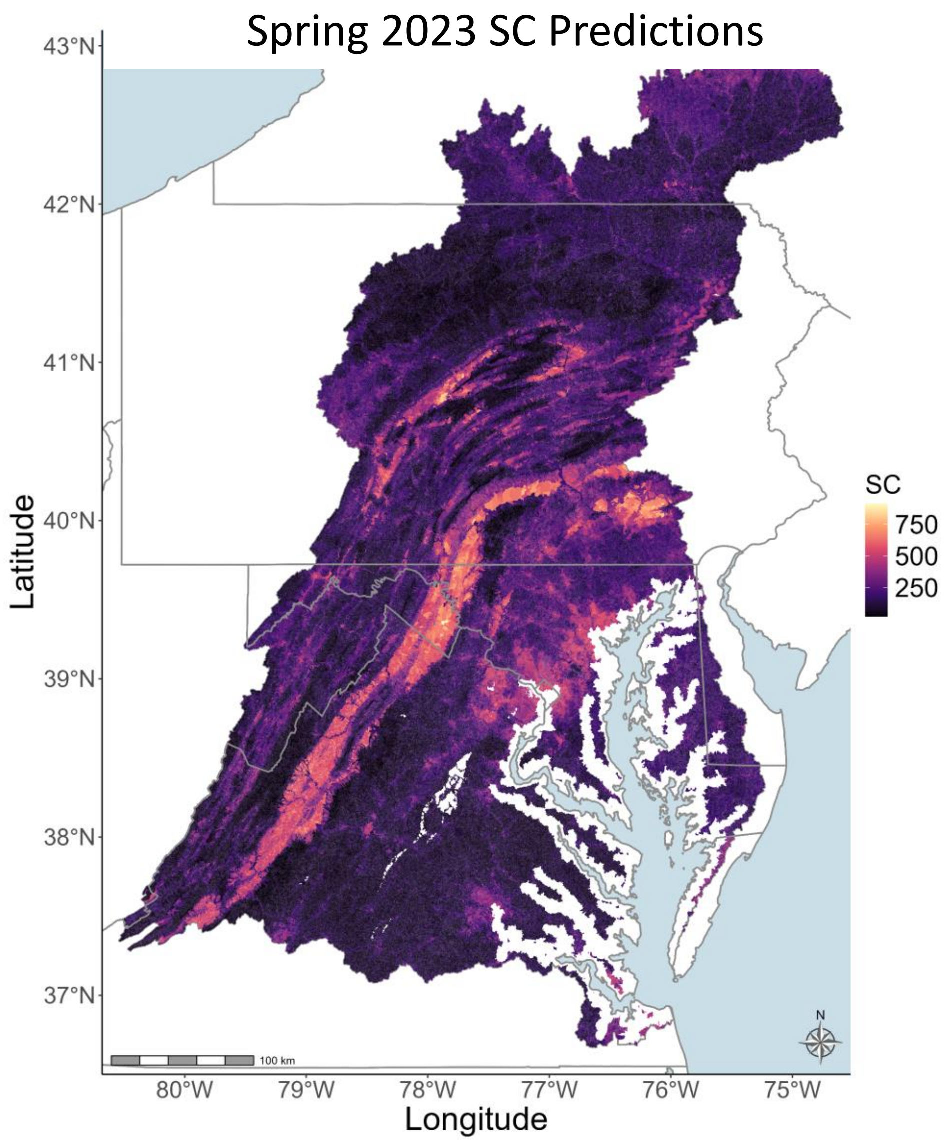
- Seasonal median specific conductance (SC)
  - Spring (March-May),
  - Summer (June-August),
  - Fall (September-November),
  - Winter (December-February)

Predictors

- 43 predictors including
  - Static predictors – geology, soils, dams, stream-road crossings, wwtps
  - NLCD LULC 1985-2023
  - 3, 6, 12 month antecedent precipitation, snow water equivalent, temperature

Modeling

- Created 4 separate random forest models trained on seasonal median SC to predict stream specific conductance for each season from 1985-2023



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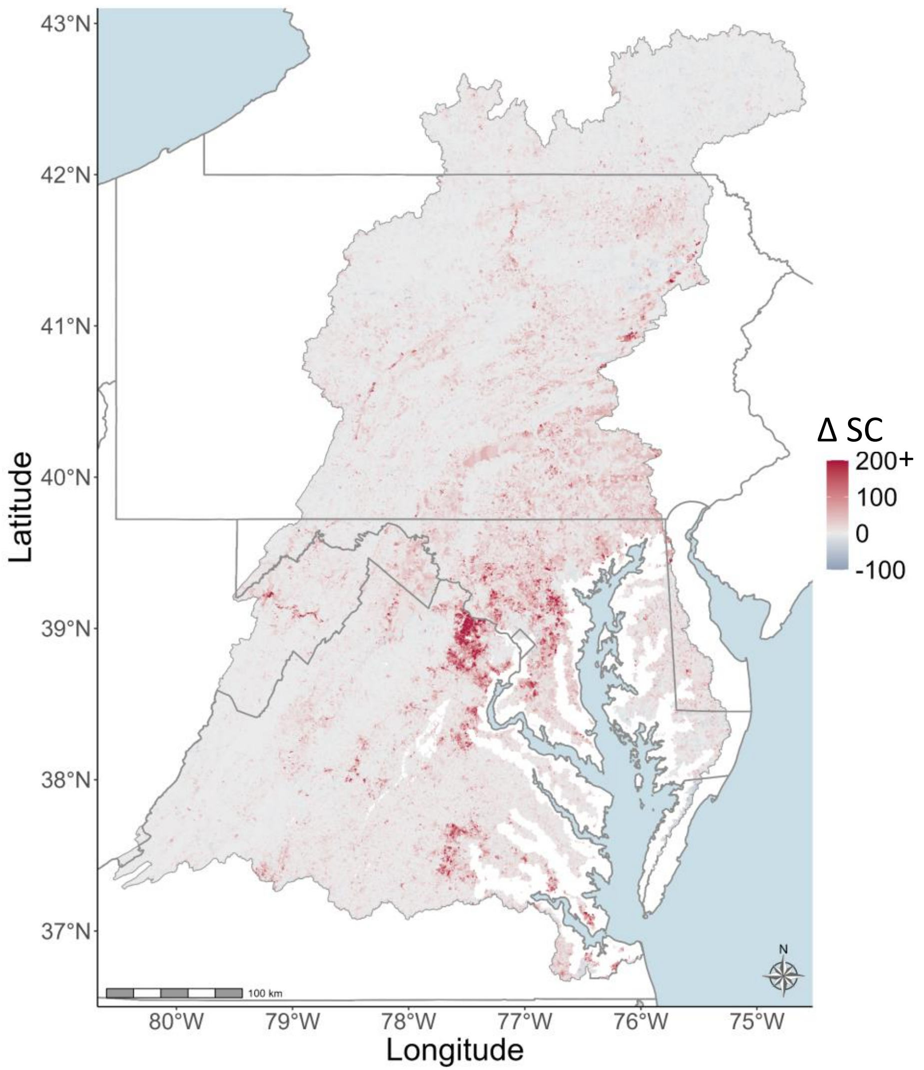
Salinity Lindsey Boyle and Rosemary Fanelli

Key Takeaways:

- Impervious surface and CaO lithology most important predictors
- Majority of catchments 1-3x above predicted natural salinity, and increasing in SC concentration over time
- Little change in salinity concentration from 1985-2023 for the majority of the watershed. Salinity increasing near the Washington D.C. and Baltimore metropolitan areas

Change in SC Spring 1985-2023



24k model contact: Lindsey Boyle, lboyle@usgs.gov

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Physical Habitat

Marina Metes, Matthew Cashman, Zachary Clifton

Data:

- 12,770 monitoring stations with a total of 15,664 observations between 1999 - 2019

Response metrics:

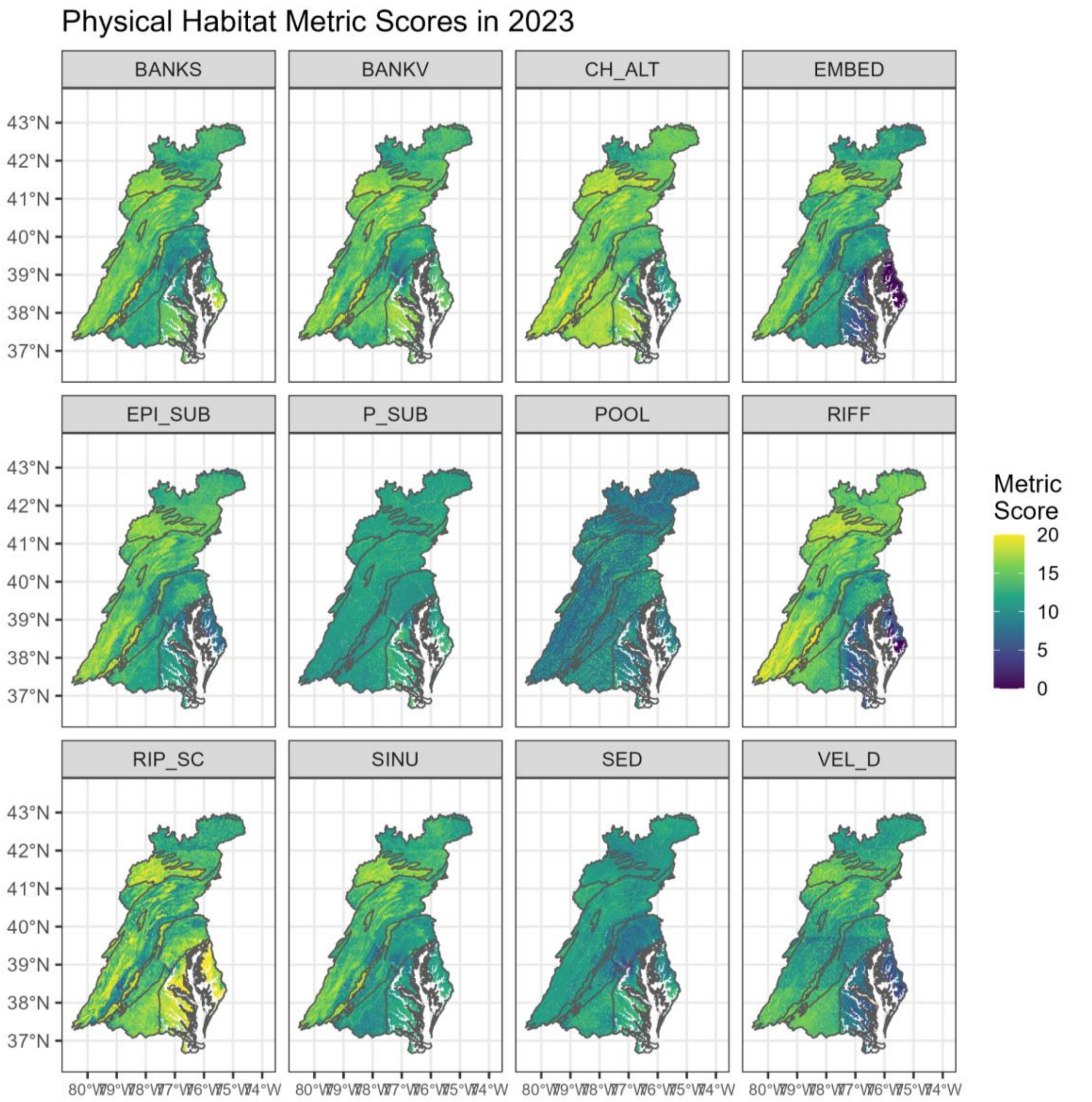
- 12 habitat metrics – bank stability, bank vegetative protection, channel alteration, embeddedness, epifaunal substrate and available cover, pool substrate characterization, pool variability, riffle frequency, riparian score, channel sinuosity, sediment deposition, velocity/depth combinations
- Grouped into two main components using PCA: metrics that capture (1) bed conditions channel heterogeneity at mesohabitat and microhabitat scales, and metrics that cover (2) riparian corridor and channel stability

Predictors

- 47 predictors (LULC, annual precip for observation year and 1 year prior, soil and lithology, basin elevation and stream gradient, ecoregion, dam and road/stream crossings, baseflow index, topographic wetness index

Modeling

- random forest models

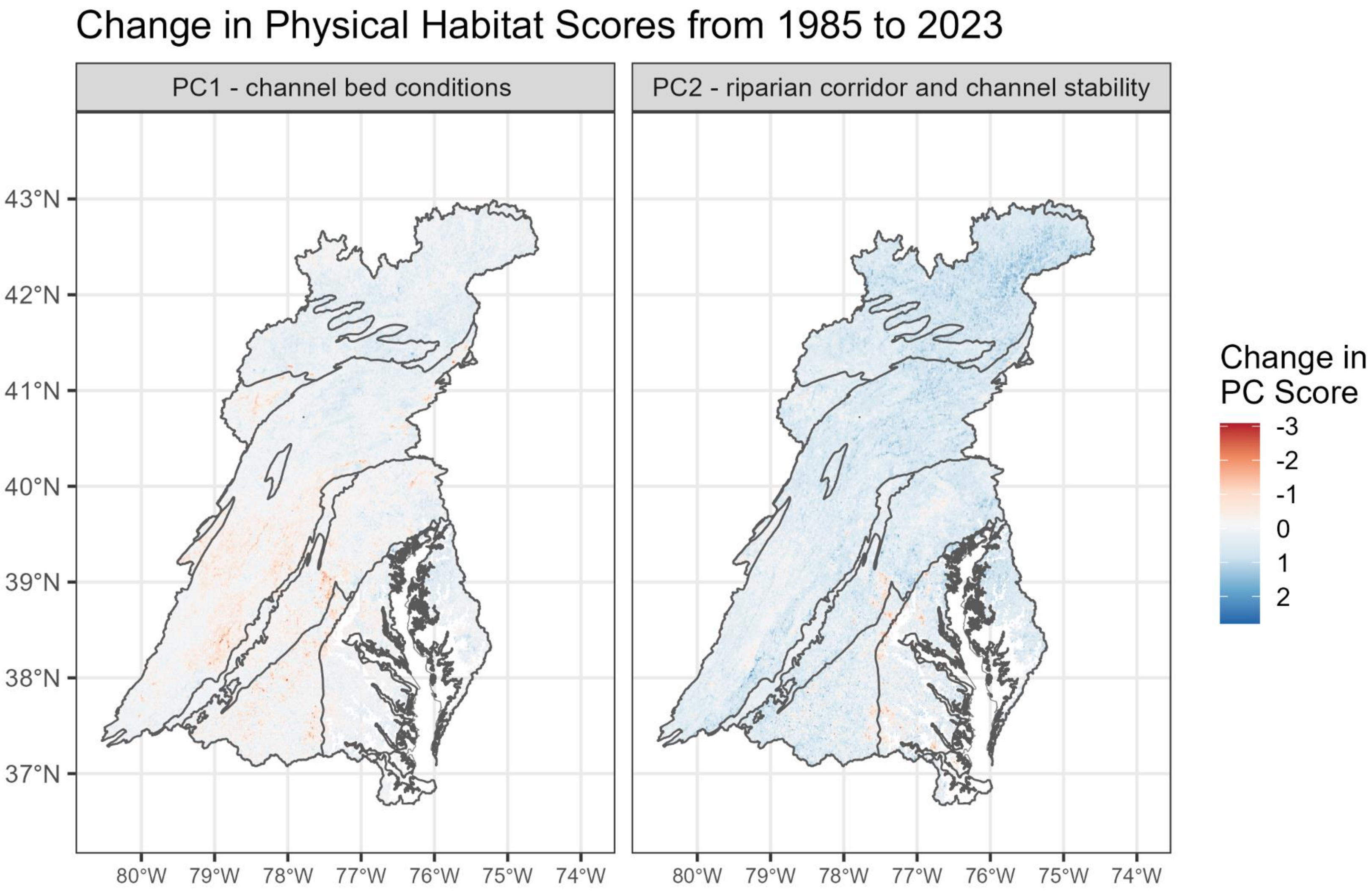


Physical Habitat

Marina Metes, Matthew Cashman, Zachary Clifton

Major take home point(s):

- The 1:24k scale physical habitat model provides an update to (1) scale, and (2) time series predictions, from an existing model at the 1:100k scale (Cashman et al., 2024)
- No huge shifts in scores
- Most areas of worsening conditions center around suburban areas of the I-95 corridor
- We haven't fully investigated the details yet, but one hypothesis is that these are areas of more recent urban development showing larger shifts to lower scores



24k model contact: Marina Metes, mmetes@usgs.gov

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Conclusions

Salinity

- Impervious surface and CaO lithology most important predictors
- Majority of catchments 1-3x above predicted natural salinity, and increasing in SC concentration over time

Physical Habitat

- No huge shifts in scores
- Most areas of worsening conditions center around suburban areas of the I-95 corridor

Benthic macroinvertebrates

- Trends showed decreases near Washington DC/Baltimore; BIBI_raw and %Clingers showed negative and positive trends across the CBW, %EPT-H and %Ephem showed widespread negative trends for all bioregions except the SEP
- Total stream length - model results suggest much variation and a maximum increase of 1.1–1.7% in 2020. Using 3 categories may be too coarse?

Where we are going

Additional indicators

- Fish, sediment, hydromorphology, stream temperature (1:24,000 scale)
- Flow, nutrients (1:100,000 scale)
- Mussels?

Effects of management practices and tying to existing impairment listings

Integrate Status, Trends and Assessments to provide more insight into watershed-wide stream conditions

Upload results from the existing geonarrative (chesapeakeassessments) to a single application (EcoSHEDS | USGS)

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Alignment with 2025 Chesapeake Bay Watershed Agreement

Thriving Habitat, Fisheries & Wildlife Goal

- Brook Trout Outcome
  - By 2040, increase brook trout occupancy by 1.5% (233 miles) in watersheds supporting healthy populations while achieving no net loss in other watersheds.
  - By 2040, reduce identified threats by 15% to increase brook trout resilience in watersheds supporting healthy populations.
- Fish Habitat Outcome
  - Improve the quality of nontidal fish habitat by continuing to assess the overall condition and suitability in the watershed to support healthy communities and inform effective restoration, conservation and management actions.
  - By 2040, improve 270 stream miles of waters impaired by acid mine drainage to continually increase available habitat supporting fish populations.
  - Develop comprehensive freshwater mussel conservation plans for 10 tributaries and implement key recommendations from at least five of these plans by 2040.
- Stream Health Outcome
  - Improve the health and the ecological integrity of at least an additional 4,340 (approximately 3%) nontidal stream miles every six years.

Clean Water Goal

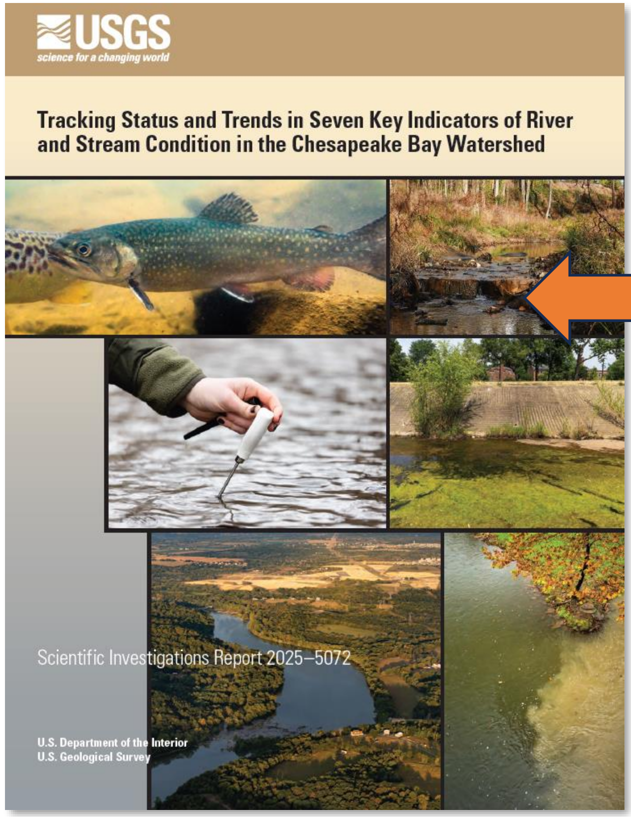
- Water Quality, Standards Attainment & Monitoring Outcome
  - Develop and expand partnership-approved approaches for assessing whether water quality criteria are being met for all designated uses

Healthy Landscapes Goal

- Adapting to Changing Environmental Conditions Outcome
  - By 2040, support at least seven sub-watershed areas with knowledge-sharing and technical assistance to identify adaptation options with a preference for nature-based solutions.
- Land Use Planning & Decision Support Outcome
  - Develop at least five use cases annually, informed by and provided at the county, watershed or municipal scale to inform land use planning and decisions and maintain the ecological integrity of watersheds supporting good stream health.

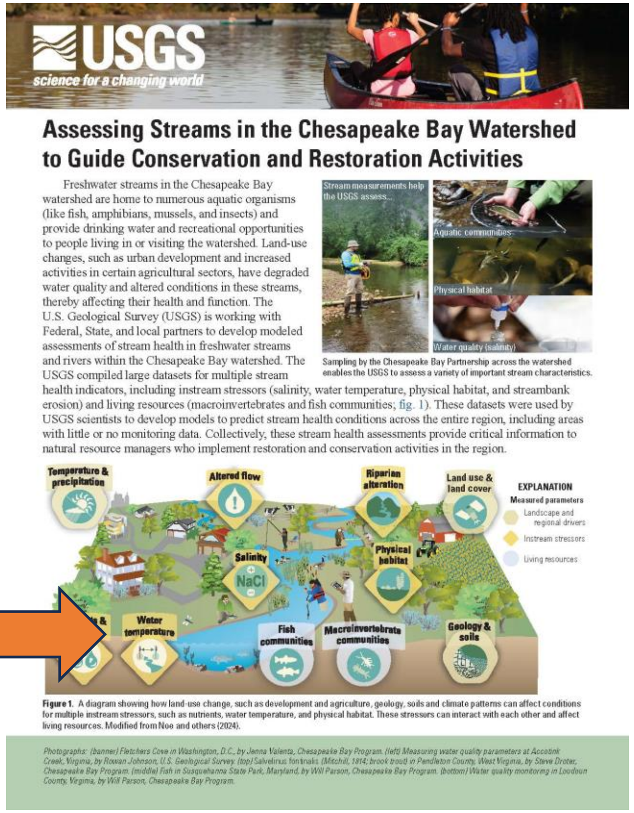
Thank you and Questions

New publications!



Boyle, L.J., Austin, S.H., Cashman, M.J., Clifton, Z.J., Clune, J.W., Colgin, J.E., Elliott, K.E.M., Fanelli, R.M., Foss, E.P., Hitt, N.P., Hittle, E.A., Howe, C.M., Majcher, E.H., Maloney, K.O., Mason, C.A., Metes, M.J., Moyer, D.L., Needham, T.P., Rogers, K.M., Thompson, J.J., Yang, G., and Zimmerman, T.M., 2025, Tracking status and trends in seven key indicators of river and stream condition in the Chesapeake Bay watershed: U.S. Geological Survey Scientific Investigations Report 2025–5072, 104 p., https://doi.org/10.3133/sir20255072.

Maloney, K.O., Fanelli, R.M., Cashman, M.J., Boyle, L.J., Gordon, S.E., Gressler, B.P., Katoski, M.P., Kiser, A.H., Metes, M.J., Noe, G.B., Sekellick, A.J., Sussman, A., and Young, J.A., 2025, Assessing streams in the Chesapeake Bay Watershed to guide conservation and restoration activities: U.S. Geological Survey Fact Sheet 2025–3056, 4 p., https://doi.org/10.3133/fs20253056.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Assessing Streams in the Chesapeake Bay Watershed to Guide Conservation and Restoration Activities

Freshwater streams in the Chesapeake Bay watershed are home to numerous aquatic organisms (like fish, amphibians, mussels, and insects) and provide drinking water and recreational opportunities to people living in or visiting the watershed. Land-use changes, such as urban development and increased activities in certain agricultural sectors, have degraded water quality and altered conditions in these streams, thereby affecting their health and function. The U.S. Geological Survey (USGS) is working with Federal, State, and local partners to develop modeled assessments of stream health in freshwater streams and rivers within the Chesapeake Bay watershed. The USGS compiled large datasets for multiple stream health indicators, including instream stressors (salinity, water temperature, physical habitat, and streambank erosion) and living resources (macroinvertebrates and fish communities; fig. 1). These datasets were used by USGS scientists to develop models to predict stream health conditions across the entire region, including areas with little or no monitoring data. Collectively, these stream health assessments provide critical information to natural resource managers who implement restoration and conservation activities in the region.

Sampling by the Chesapeake Bay Partnership across the watershed enables the USGS to assess a variety of important stream characteristics.

Figure 1. A diagram showing how land-use change, such as development and agriculture, geology, soils and climate patterns can affect conditions for multiple instream stressors, such as nutrients, water temperature, and physical habitat. These stressors can interact with each other and affect living resources. Modified from Noe and others (2024).

Photographs: (banner) Fletchers Cove in Washington, D.C., by Jenna Valenta, Chesapeake Bay Program. (left) Measuring water quality parameters at Accotink Creek, Virginia, by Rowan Johnson, U.S. Geological Survey. (top) Salvelinus fontinalis (Mitchill, 1814; brook trout) in Pendleton County, West Virginia, by Steve Droter, Chesapeake Bay Program. (middle) Fish in Susquehanna State Park, Maryland, by Will Parson, Chesapeake Bay Program. (bottom) Water quality monitoring in Loudoun County, Virginia, by Will Parson, Chesapeake Bay Program.

Want to learn more about USGS Status and Trends or Regional Assessments? Just email me (kmaloney@usgs.gov),Rosemary Fanelli (rfanelli@usgs.gov) or Lindsey Boyle (lboyle@usgs.gov).

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