Examining Turbidity and Sediment Dynamics in the Chesapeake Bay

York River Basin

Chesapeake Bay Watershed in Virginia

Potomac

Rappahannock

Richmond

James

20 40 60 80

Kilometers

Sources: Esri, USGS, NOAA
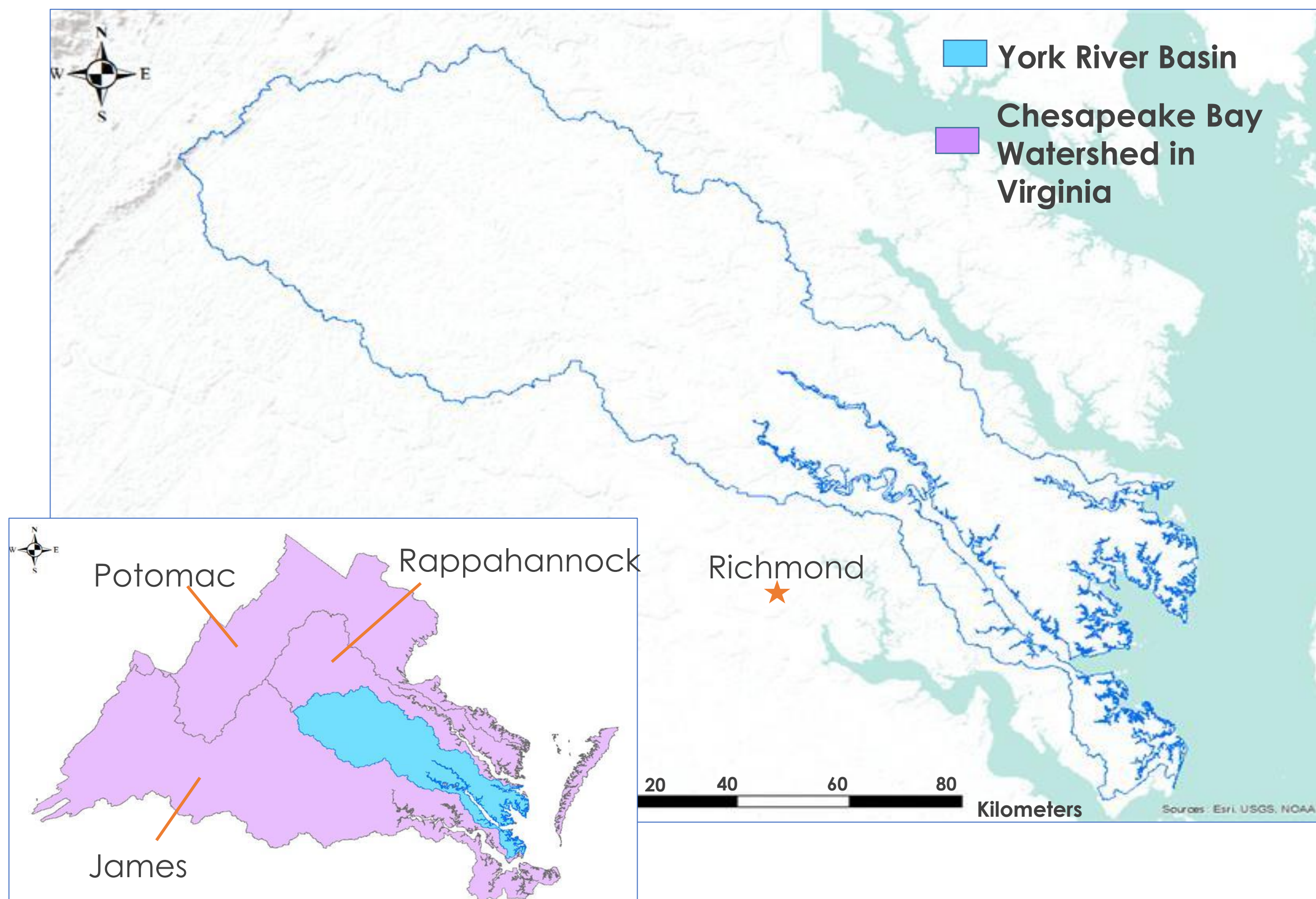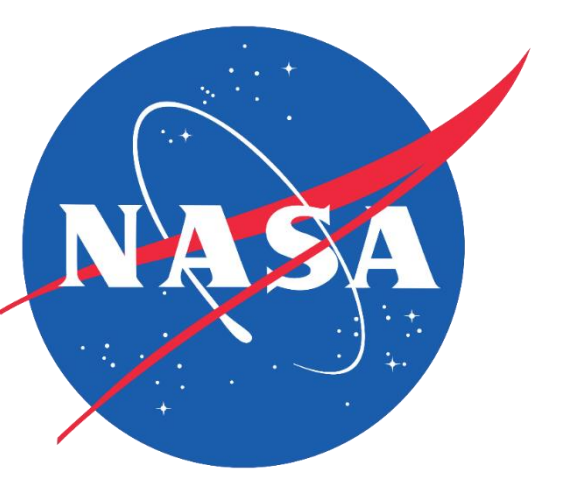
Did You Know?

The Chesapeake Bay is the largest estuary in the U.S. It covers a total area of **11,600 sq km.**

The fishing and shellfish industries generate **billions of dollars** annually.

The Bay could accumulate a predicted amount of **$130 billion** yearly in its restored state.

Aquatic grasses are vital to the Bay's ecosystems. They **filter sediment**, create habitats, and provide protection from flooding.
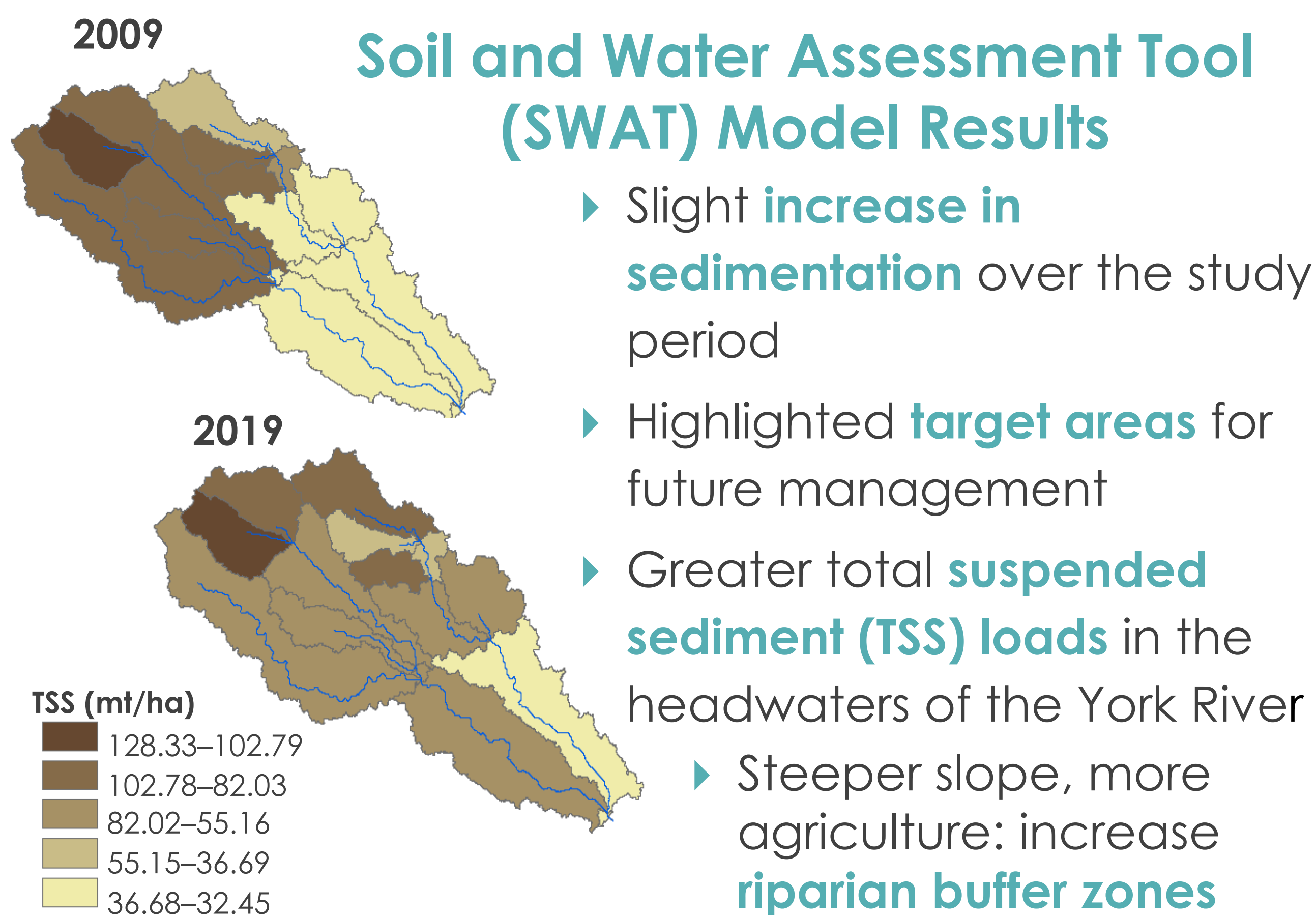
Earth Observations

Landsat 8 OLI

Sentinel-2 MSI

Landsat 5 TM

**Landsat 7** ETM+

GPM IMERG

Methodology

SWAT	▸ Land cover + weather + soil + digital elevation model ▸ Annual sedimentation 2009-2019
ORCAA	▸ Google Earth Engine (GEE) JavaScript API analysis ▸ Monthly median turbidity from 2009-2019 using the Normalized Difference Turbidity Index (NDTI)
Results	▸ Analyze sediment and turbidity dynamics ▸ Compare to precipitation levels

Sediment and Precipitation 2009–2019

Monthly Precipitation (mm) — Monthly Sediment (t/ha) ★ Hurricane/Tropical Storm

Soil and Water Assessment Tool (SWAT) Model Results

2009

2019

TSS (mt/ha)
- 128.33–102.79
- 102.78–82.03
- 82.02–55.16
- 55.15–36.69
- 36.68–32.45

▸ Slight **increase in sedimentation** over the study period

▸ Highlighted **target areas** for future management

▸ Greater total **suspended sediment (TSS) loads** in the headwaters of the York River

  ▸ Steeper slope, more agriculture: increase **riparian buffer zones**

Optical Reef & Coastal Area Assessment (ORCAA) Tool Results

Normalized Difference Turbidity Index

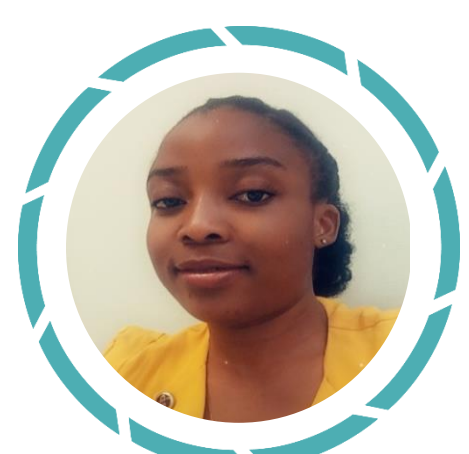-0.5   0

January 2009 Turbidity Levels

January 2019 Turbidity Levels
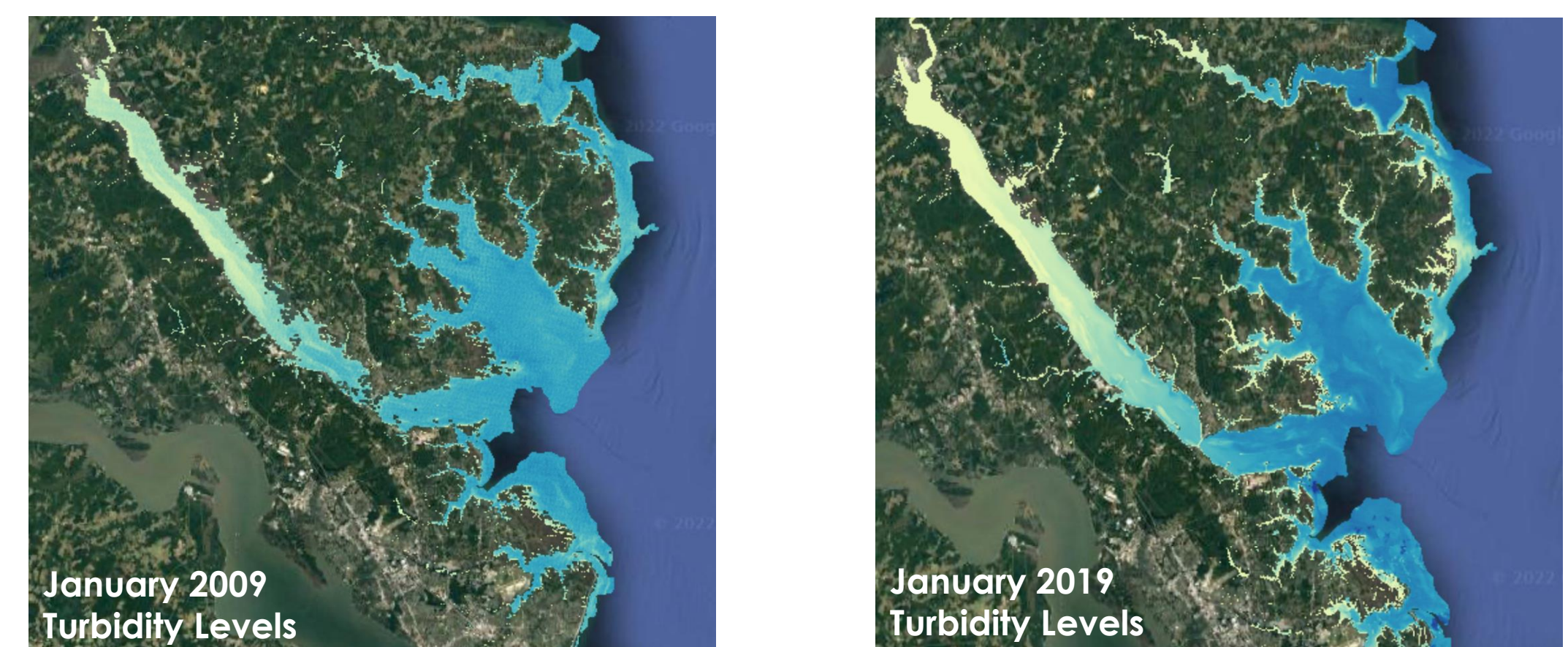
> Greater sediment levels **threaten water quality**, increasing the need for management techniques like **riparian buffers**

Acknowledgements

The team would like to thank everyone for their support towards the completion of this project.

▸ **Fellow** - Caroline Williams (DEVELOP PUP)

▸ **Partners** - Amanda Shaver (VA DEQ), Carl Friedrichs (CBNERR), Merrie Beth Neely (CEOS COAST), Steve Greb (GEO AquaWatch)

▸ **Science Advisors** - Dr. Kenton Ross (NASA LaRC), Dr. Venkataraman Lakshmi (UVA)

▸ **Special thanks** - Prakrut Kansara, Duc Tran

This material contains modified Copernicus Sentinel data (2009-2019), processed by ESA.

Team Members

Katherine Hahn (Project Lead)

Julia Atayi

Julia Portmann

Abigail Sgan

Chesapeake Bay Water Resources

DEVELOP