Potomac River Year in Review: Algae and Primary Production

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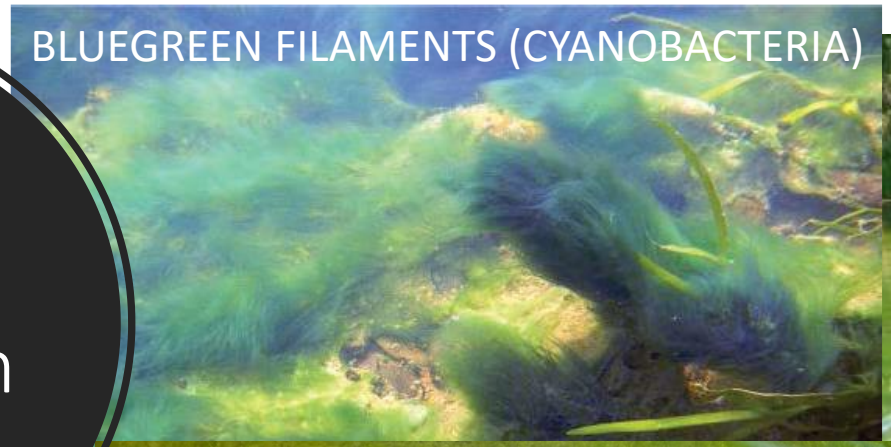
Claire Buchanan

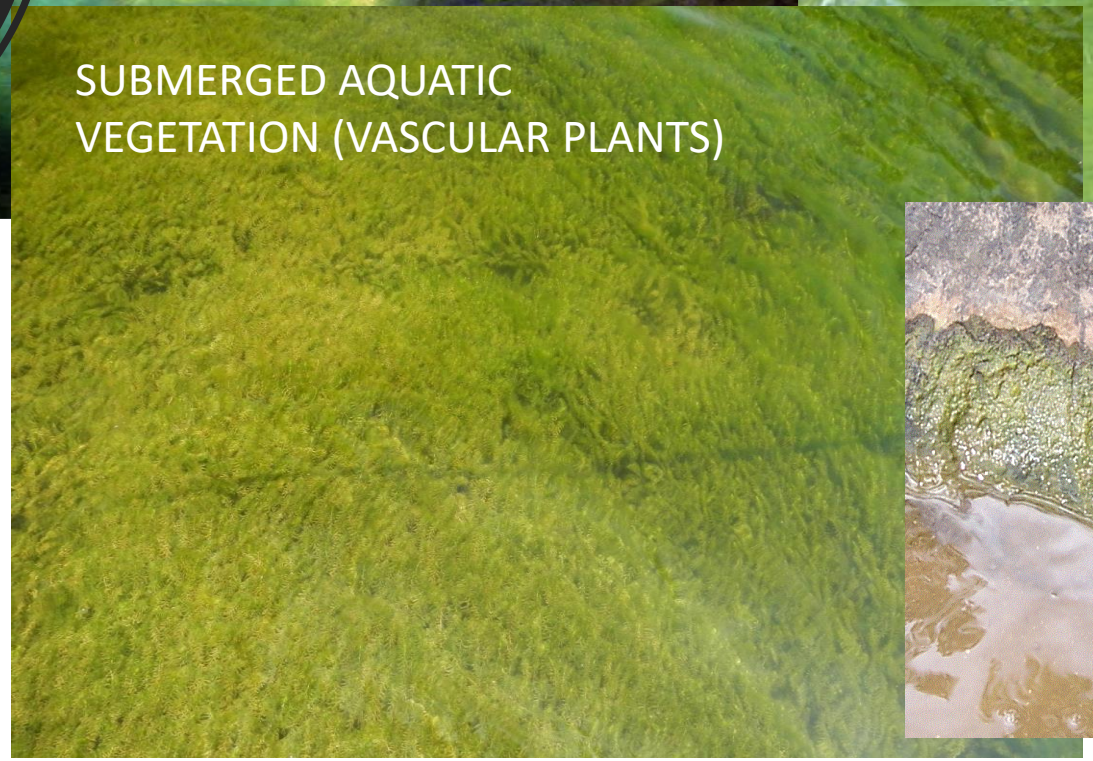
ICPRB Aquatic Habitats Presentation
For
Drinking Water Source Protection Partnership (DWSPP)
2/3/2022

Key Concepts

- *Biology/Ecology* of Primary Production
- Algae and *River Morphology*
- Algae and *Flow*
- *Considerations for 2021 and beyond*

Primary Production



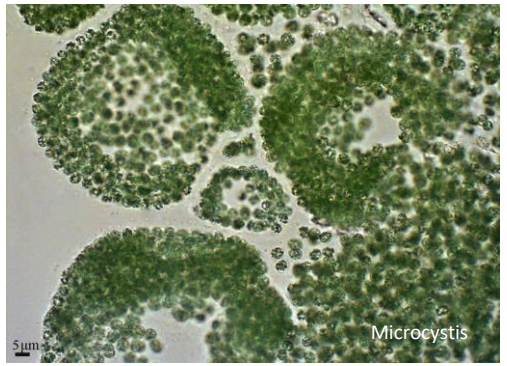


Primary Production

Planktonic Algae (free-floating)


WVDEP Ohio River

Planktothrix


Microcystis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River Continuum Concept

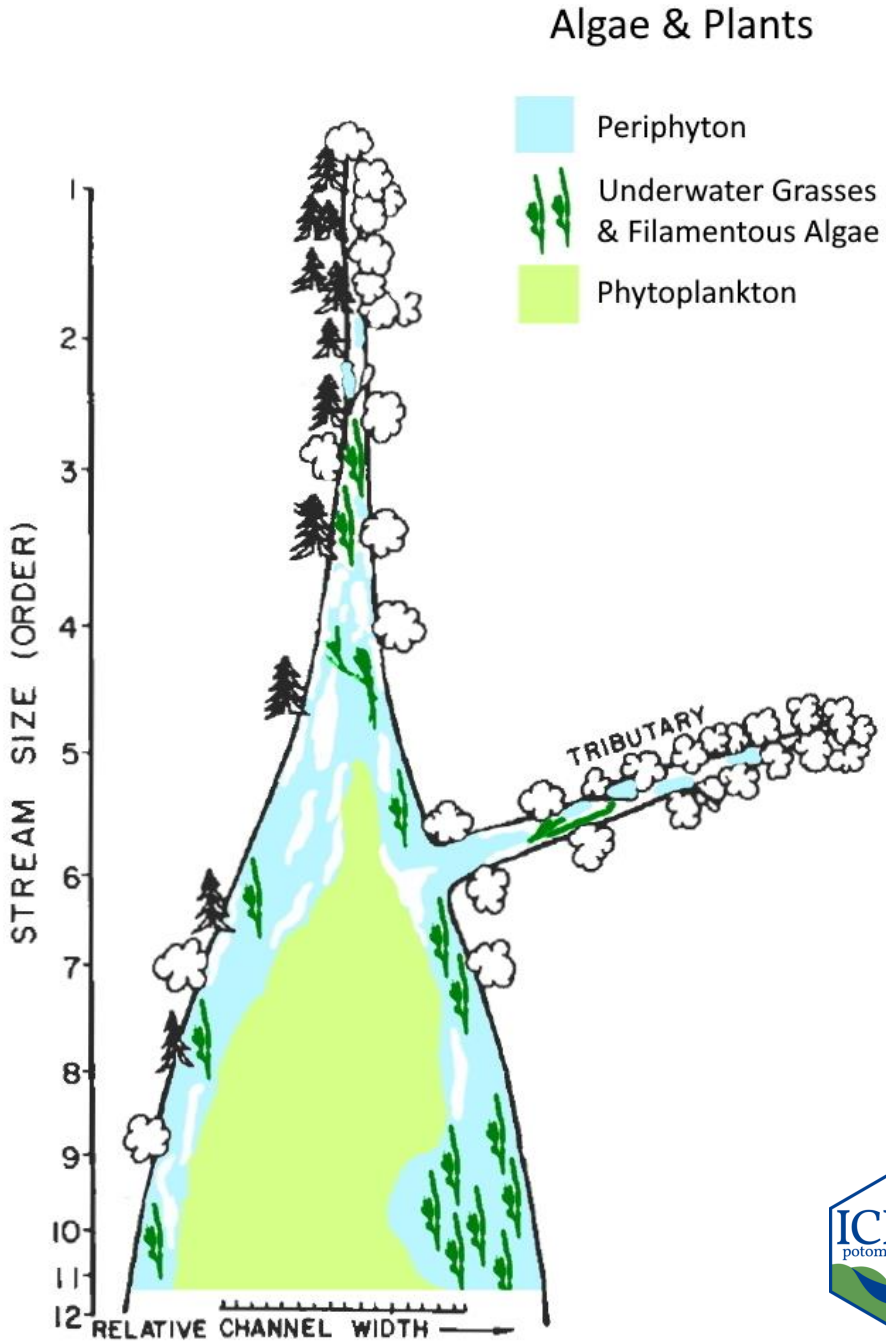
From Vannote et al. 1980. *The river continuum concept.* Can. J. Fish. Aquat. Sci. 37:130-137.

Seneca Creek before it joins the Potomac River →

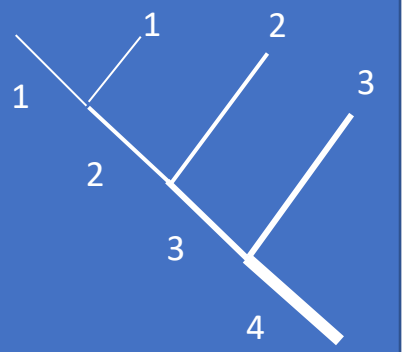
North and South Branches of Potomac River before they converge →

Shenandoah and Potomac rivers before they converge at Harpers Ferry →

Potomac River below Harpers Ferry, to Little Falls and estuary →



Stream Size (Order)



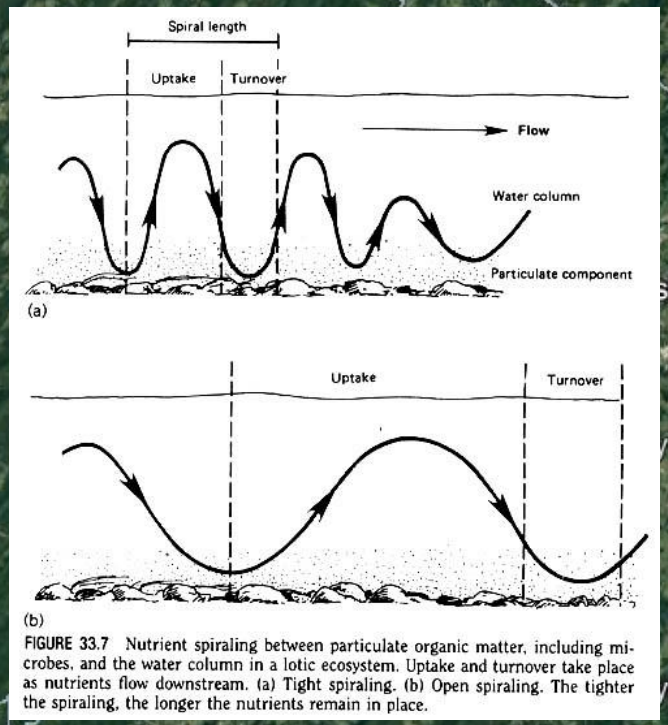
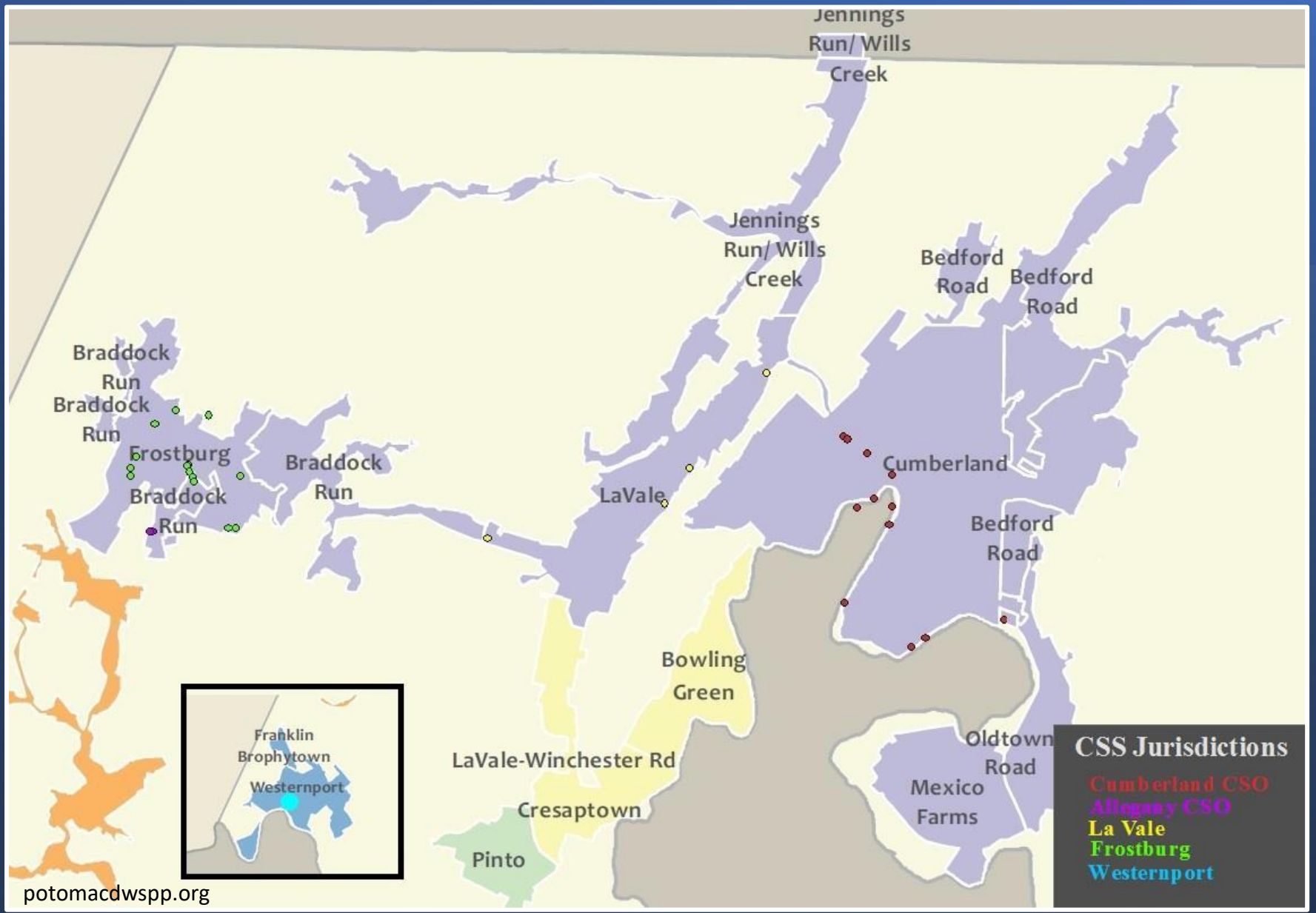


FIGURE 33.7 Nutrient spiraling between particulate organic matter, including microbes, and the water column in a lotic ecosystem. Uptake and turnover take place as nutrients flow downstream. (a) Tight spiraling. (b) Open spiraling. The tighter the spiraling, the longer the nutrients remain in place.

Jennings Randolph Lake and Dam

Dam Releases and Cumberland?

Excess Nutrients From Combined Sewer Overflows (CSOs)?

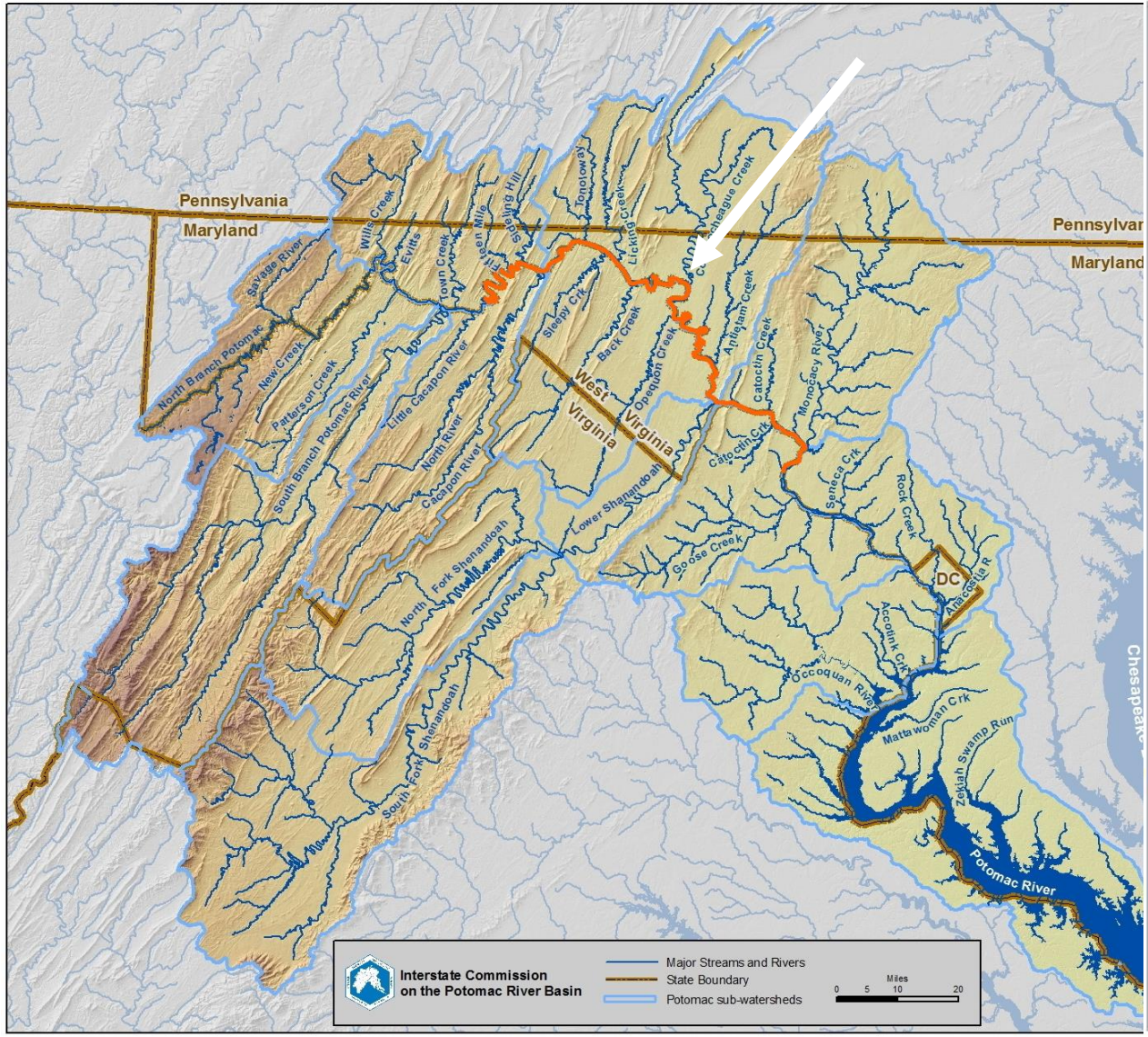


CSO Communities in Cumberland/Frostburg Area

Dam Releases and Cumberland?

Excess Nutrients From Combined Sewer Overflows (CSOs)?

Potomac at Williamsport MD



Planktothrix

Planktothrix rubescens

Scientific classification

Domain: Bacteria
Phylum: Cyanobacteria
Class: Cyanophyceae
Order: Oscillatoriales
Family: Microcoleaceae
Genus: ***Planktothrix***

Previously "*Oscillatoria*"

Range of *Planktothrix* Bloom Sightings in Potomac

Henesy, J., J. L. Wolny, J. E. Mullican, D. S. Rosales, J. S., Pitula, & J. W. Love. (2021). Identification of *Planktothrix* (Cyanobacteria) blooms and effects on the aquatic macroinvertebrate community in the non-tidal Potomac River, USA. Virginia Journal of Science, 72(1-2), 1-29. https://doi.org/10.25778/qva2-b268

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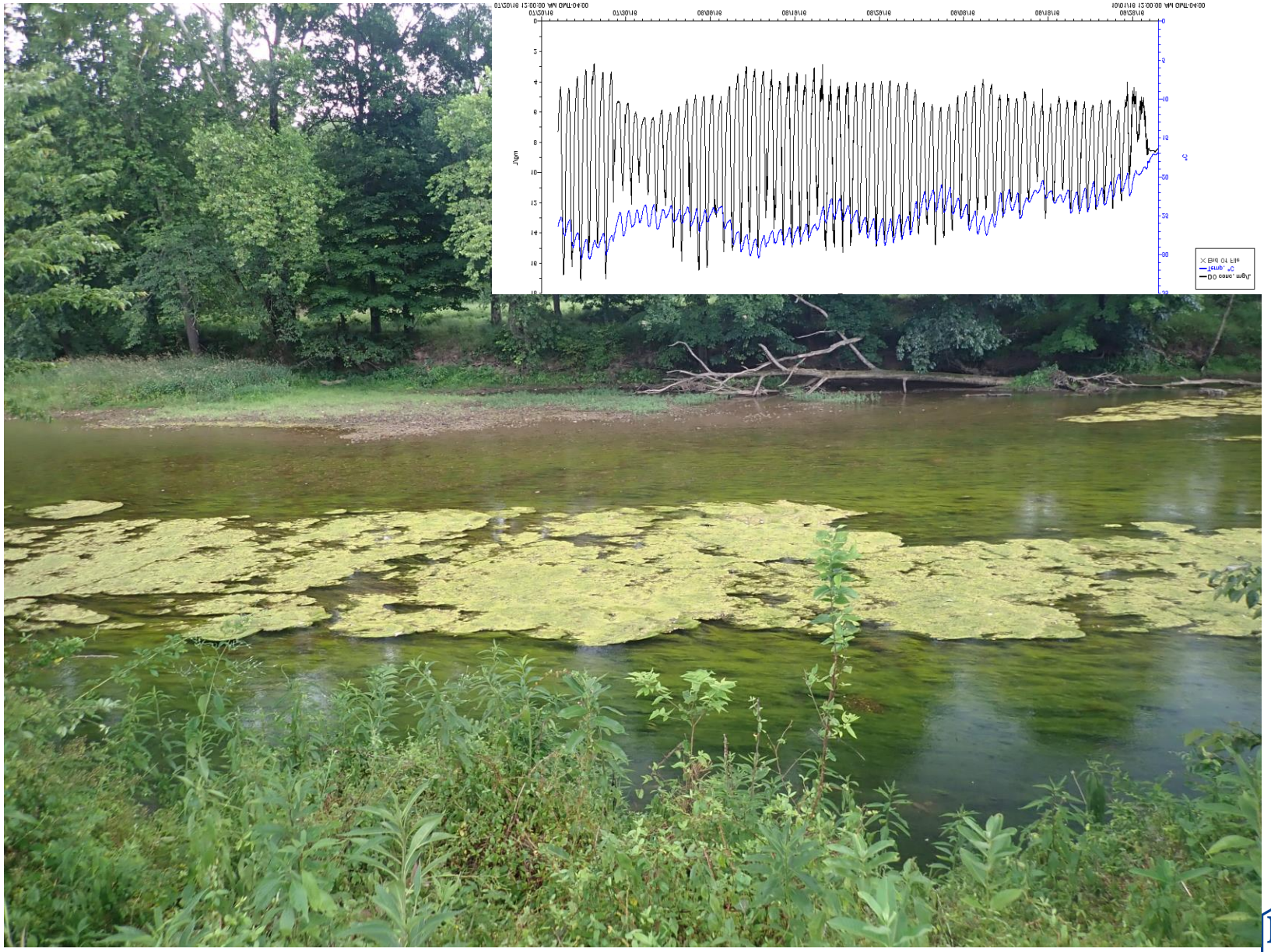
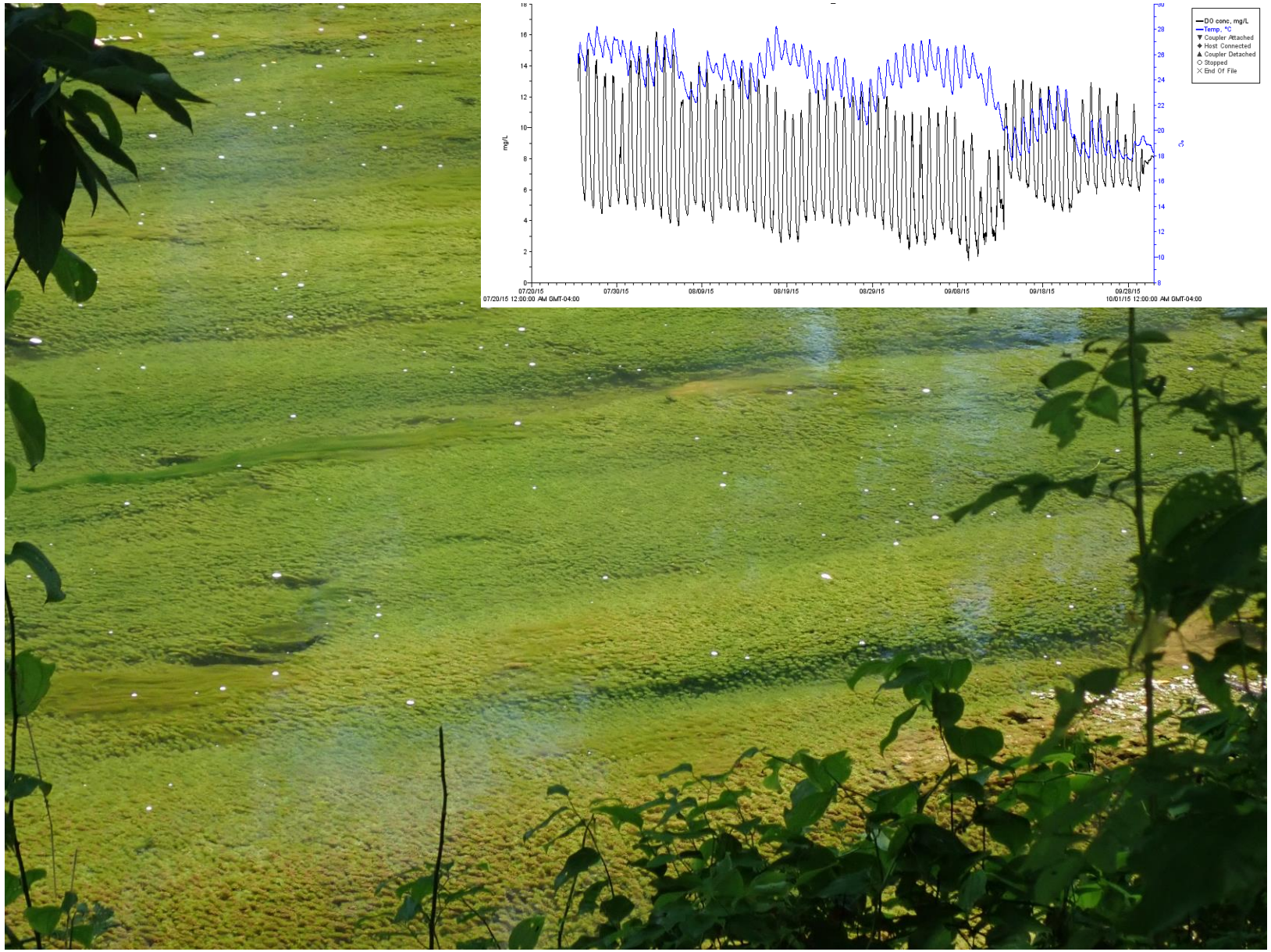
Cacapon River: Significance of Flow

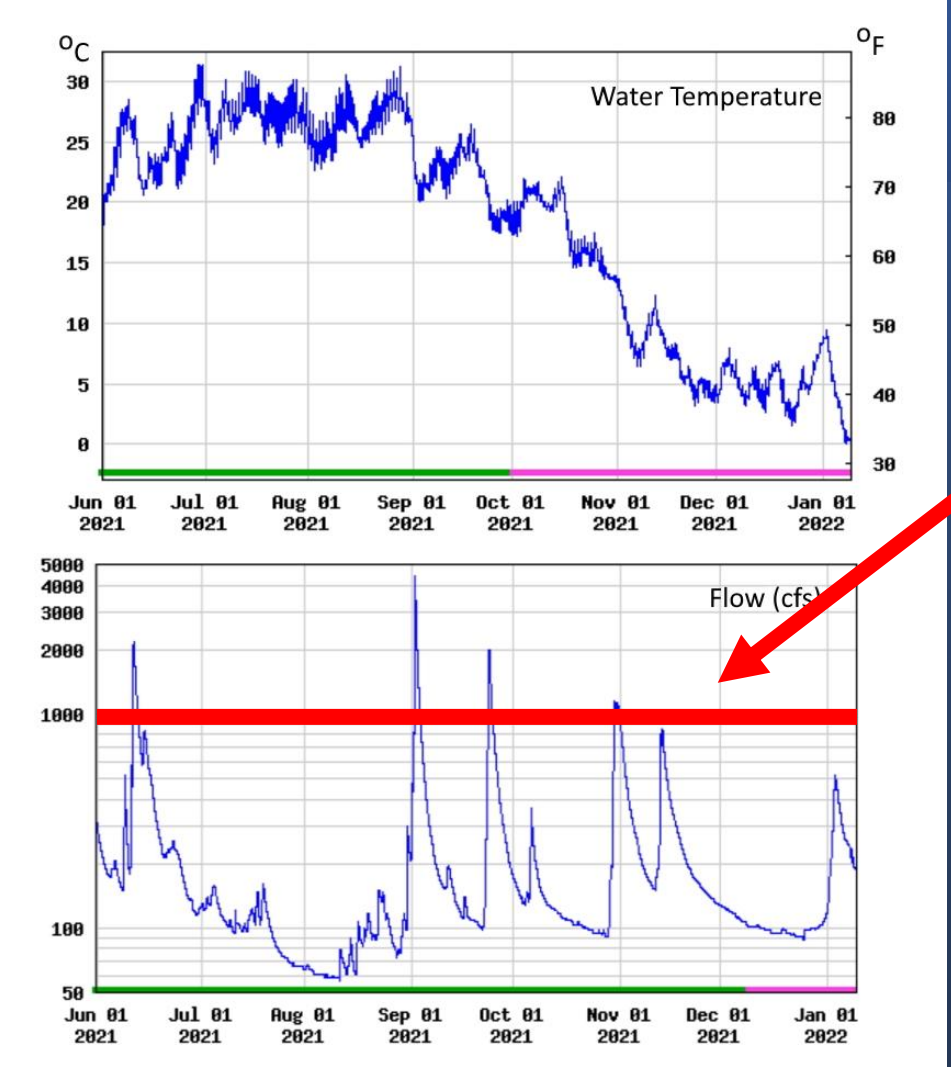


Cacapon River: Significance of Flow

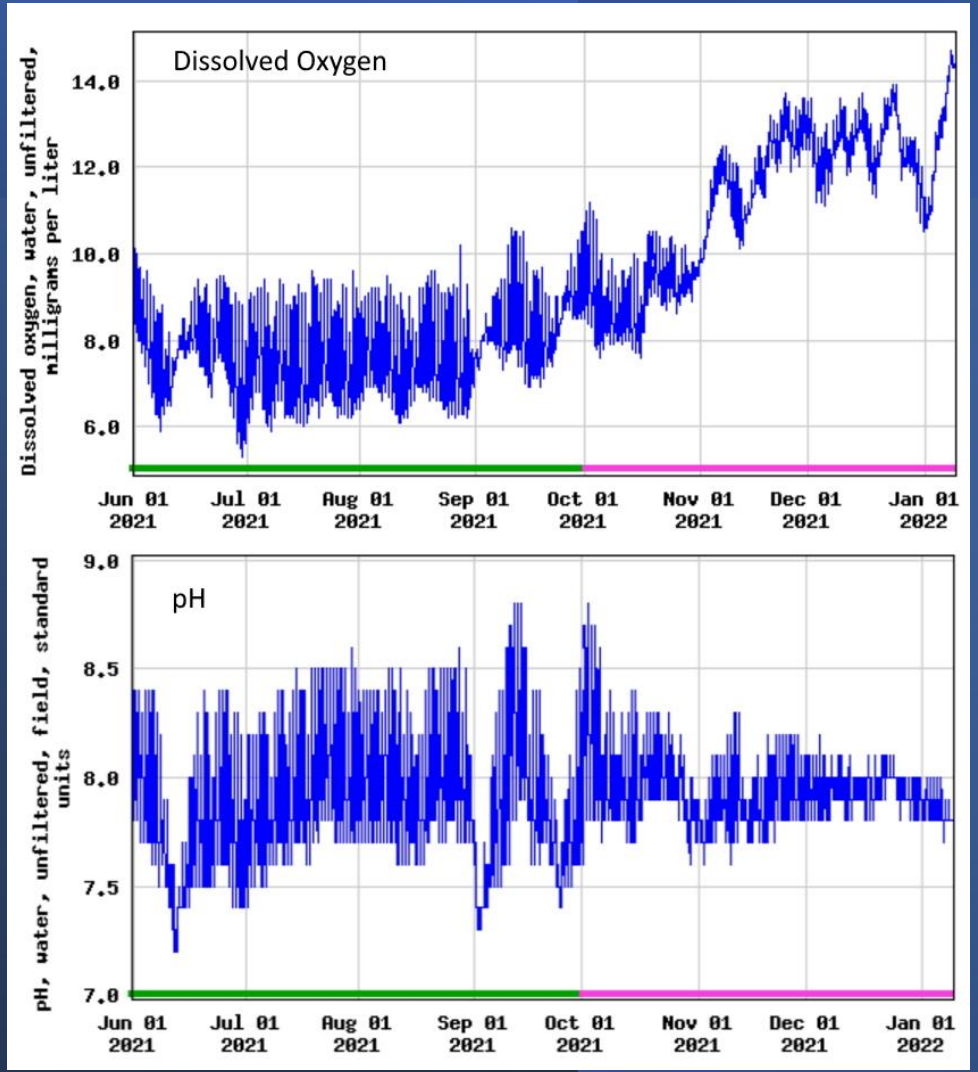


USGS 01611500 Cacapon River Near Great Cacapon WV (2021)

Hot, Low-Flow July and August



Highly Productive



https://www.potomacriver.org/focus-areas/aquatic-life/benthic-algae/

Nort
Shen
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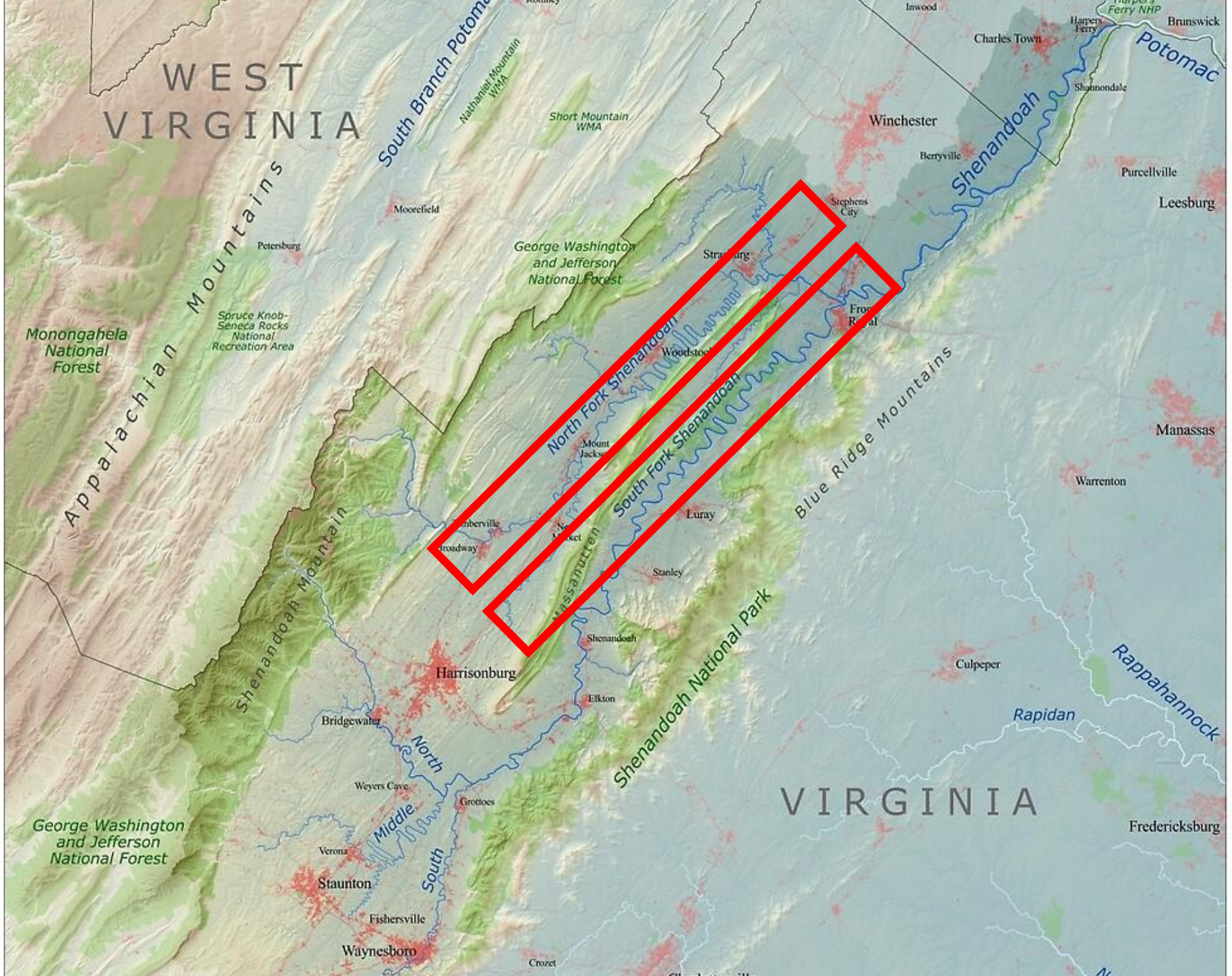

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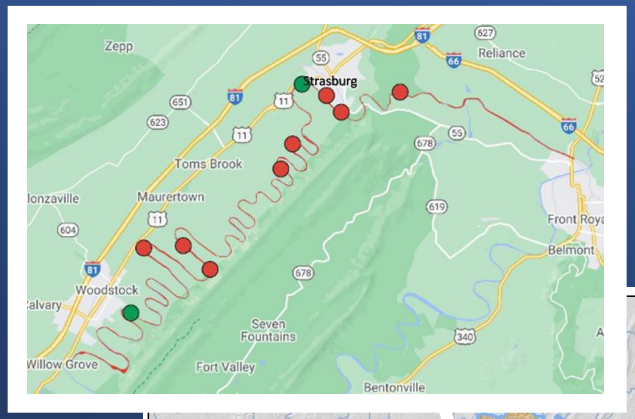
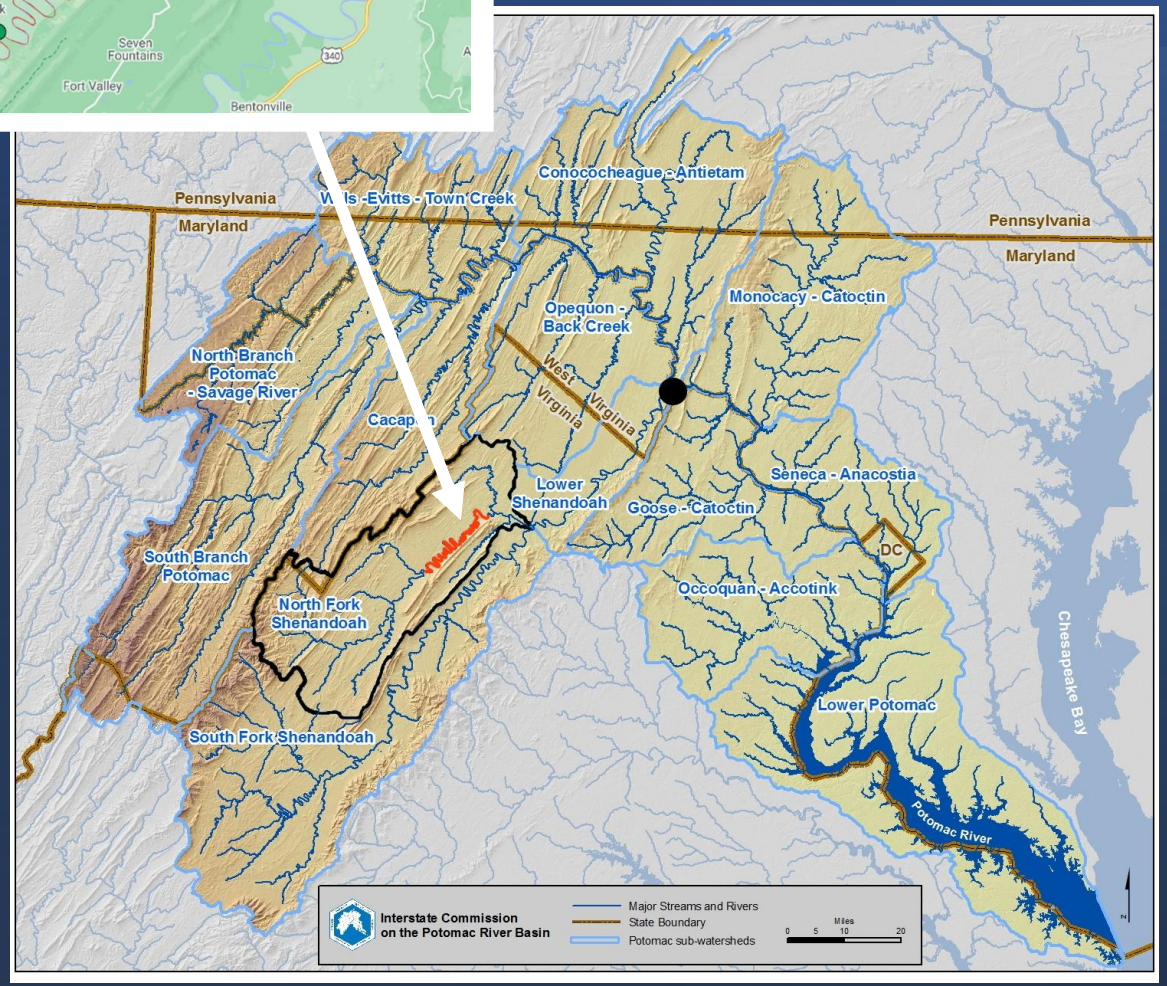
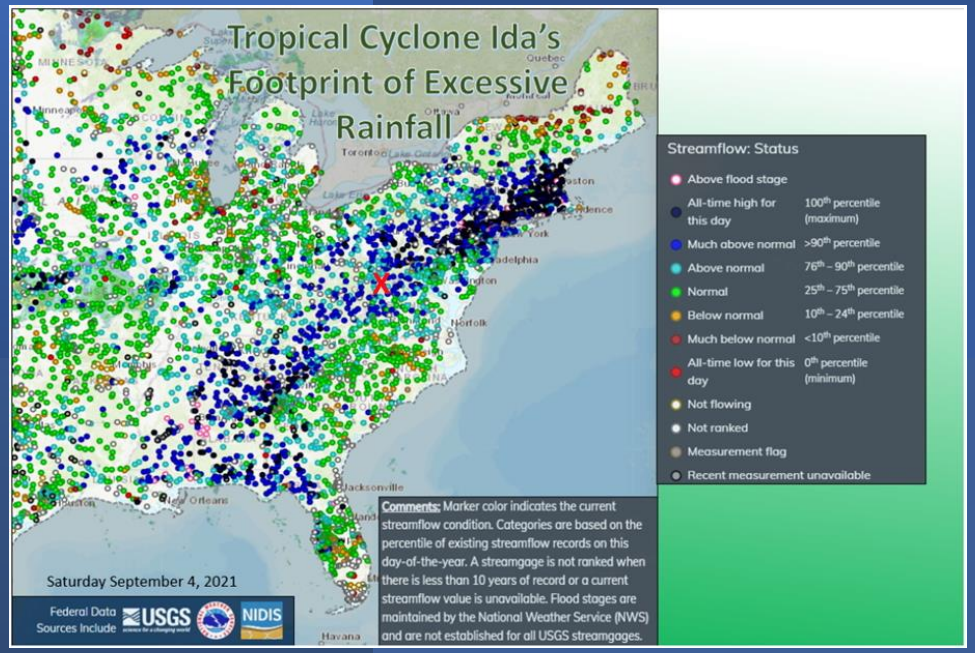
North Fork Shenandoah River

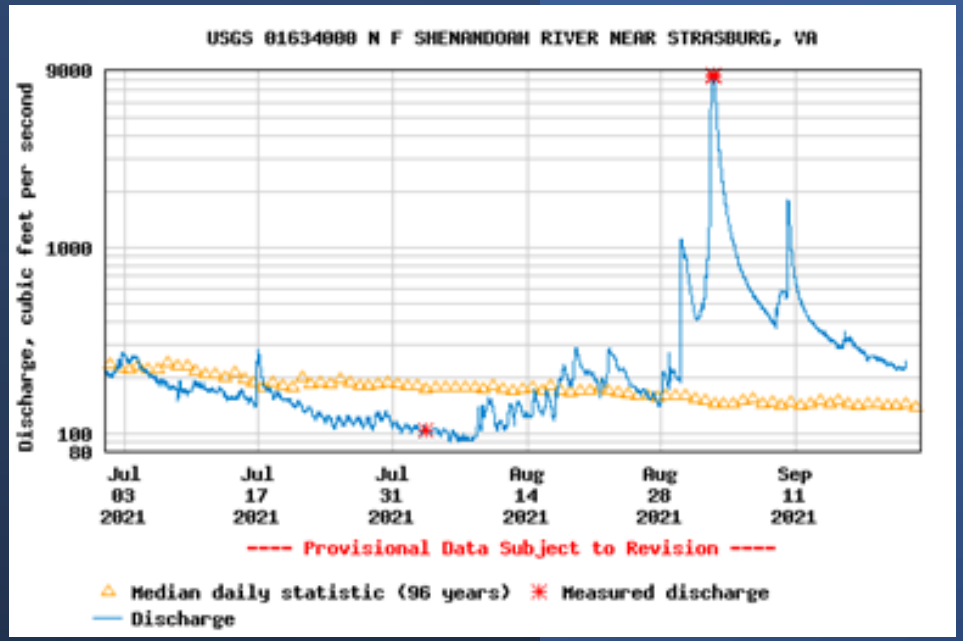
Friends of the Shenandoah River

Benthic Algal Bloom at Strasburg Park, VA









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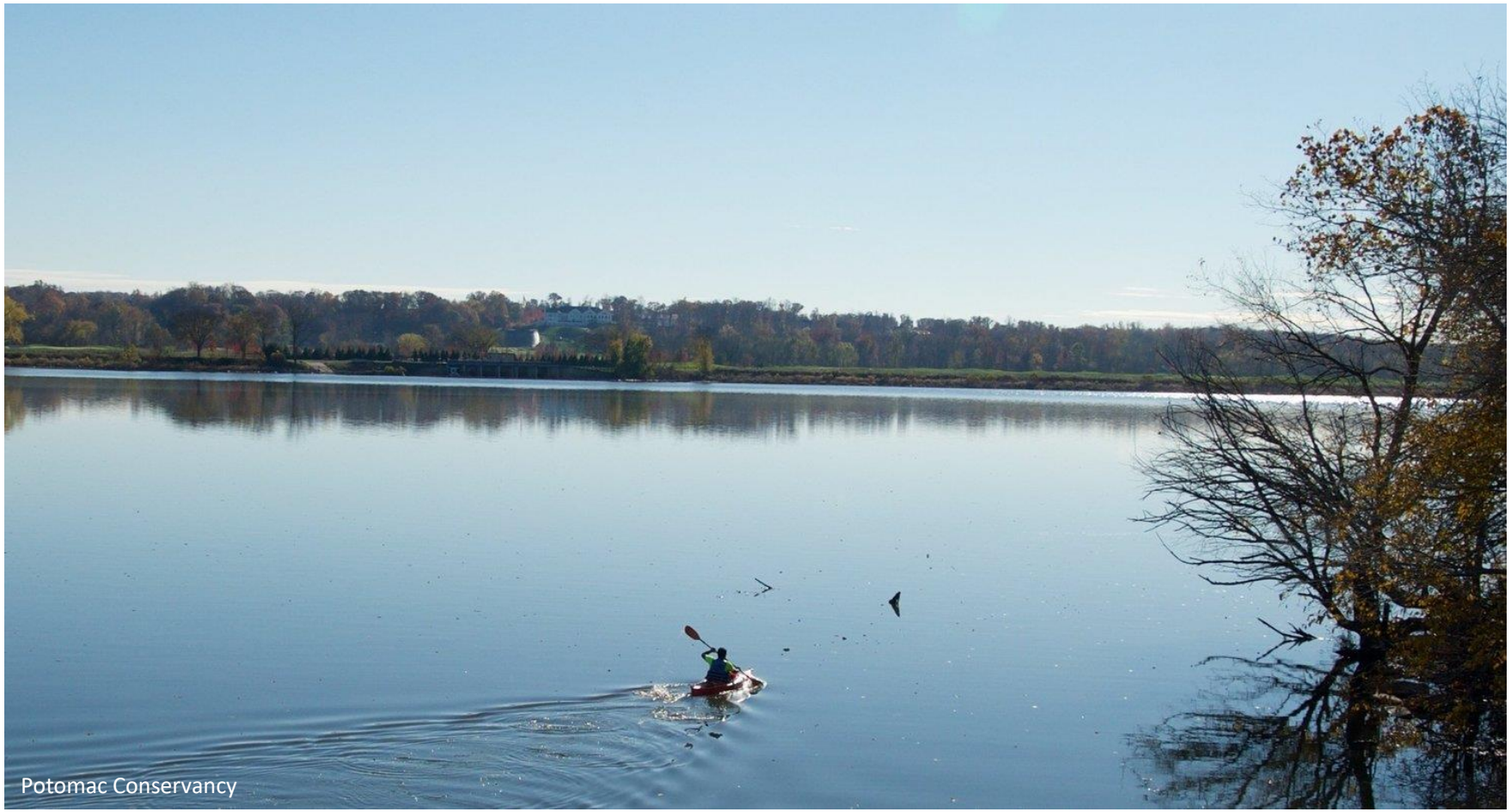
TS Ida’s very high flows diluted the HABs to non-detectable levels before they reached the Potomac mainstem.

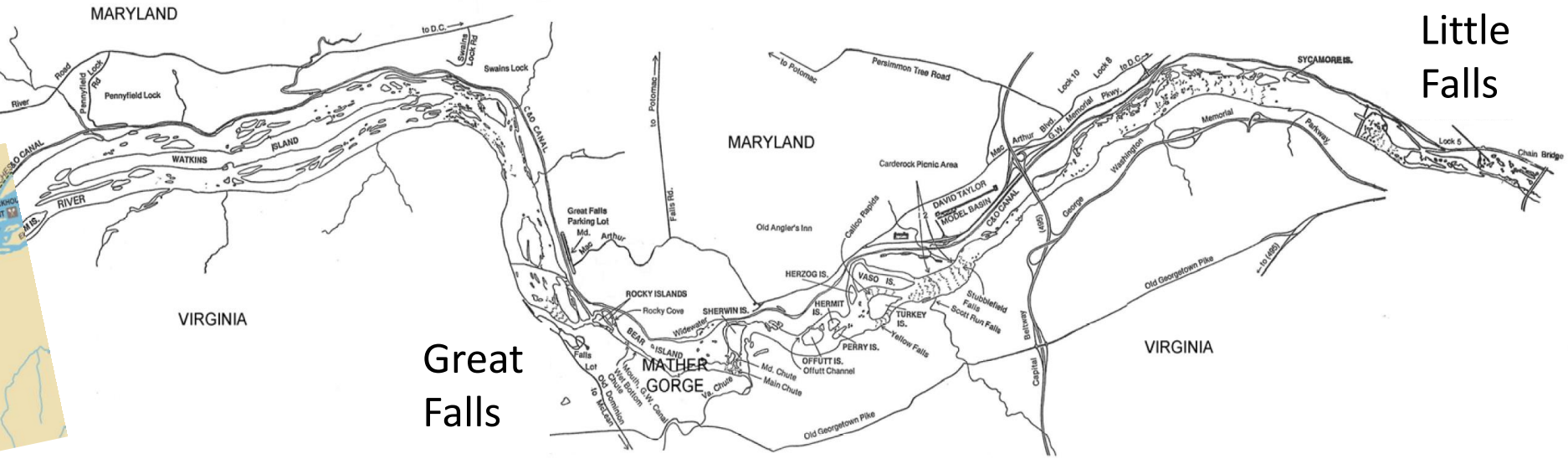
Report: https://www.potomacriver.org/publications/

Potomac River Below Harpers Ferry



Seneca Pool

Seneca Pool



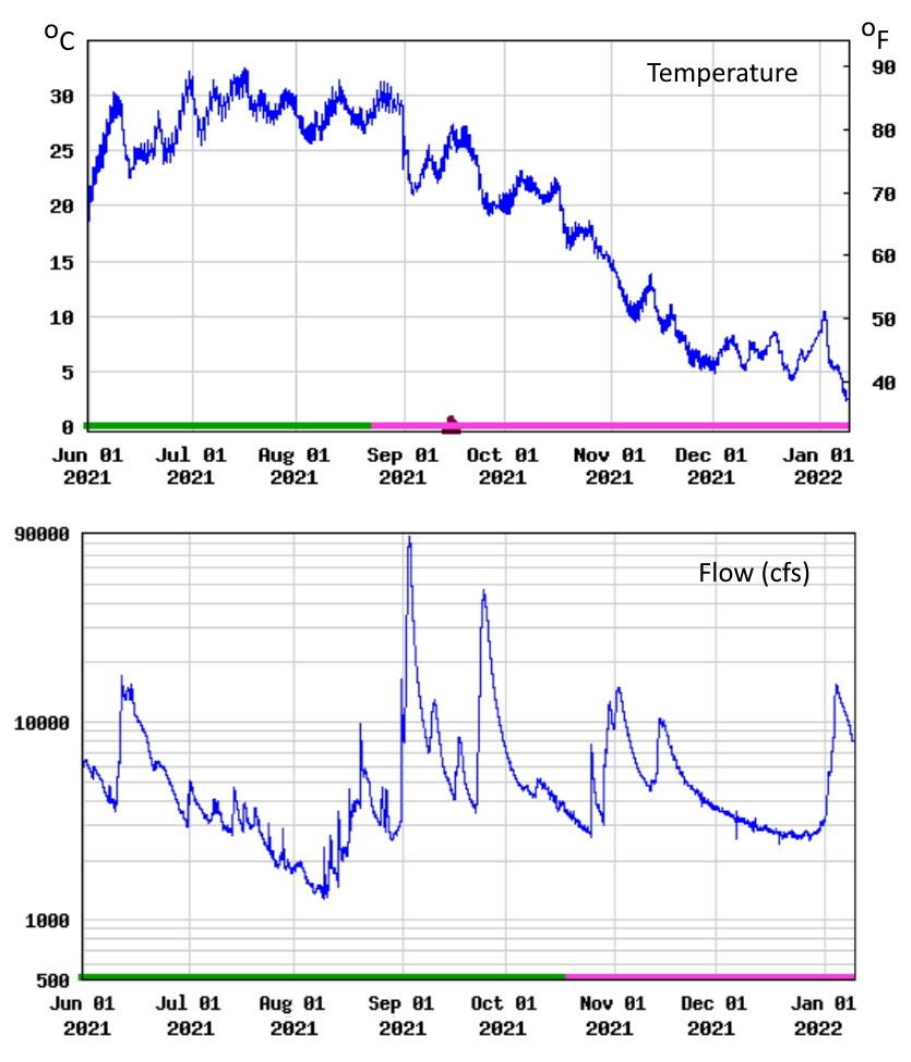
Great Falls

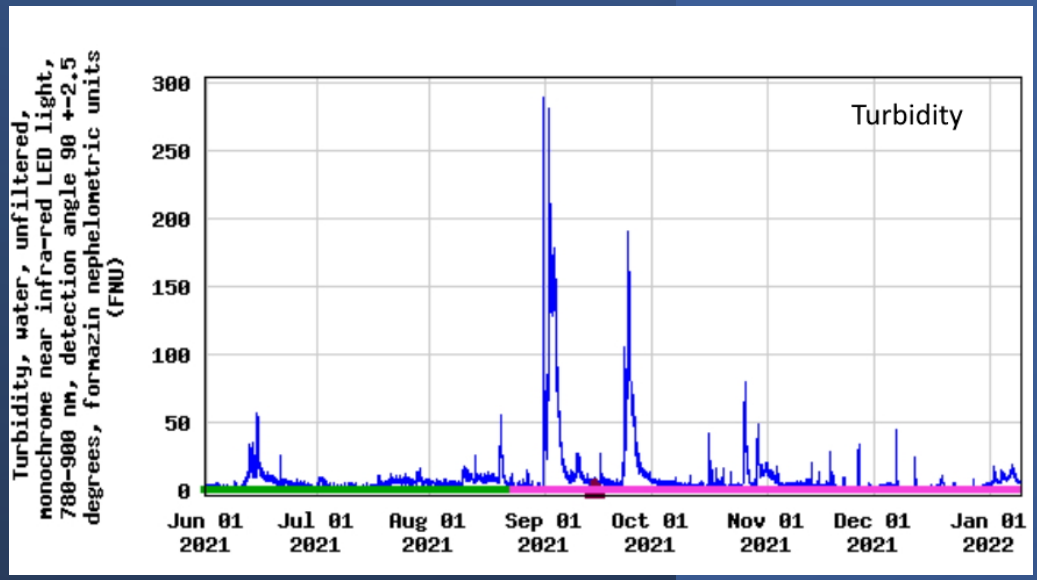
Little Falls

FLOW

Hot, Low-Flow, Generally Clear Conditions in July and August

USGS 01646500 Potomac River Little Falls

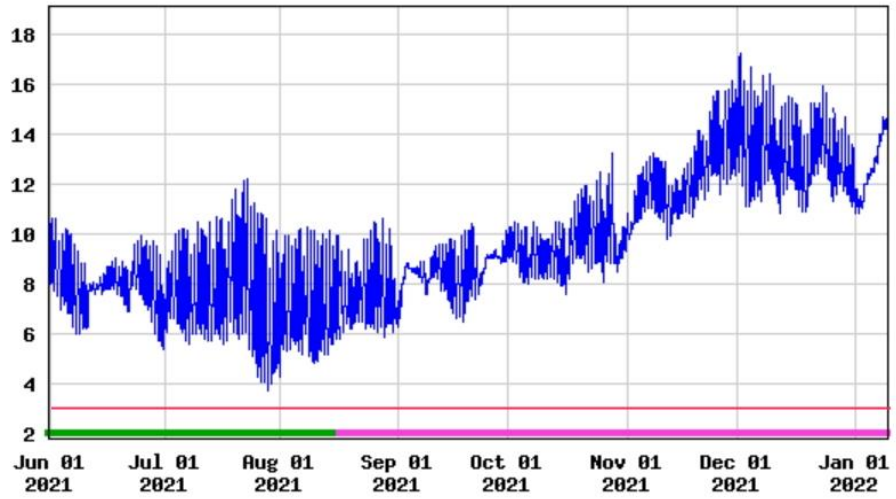




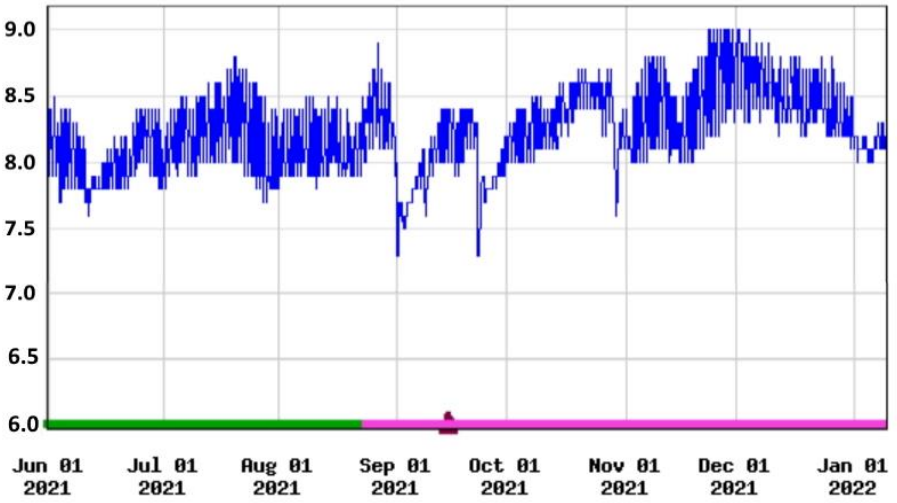
… and Highly Productive Below Harpers Ferry

Point of Rocks

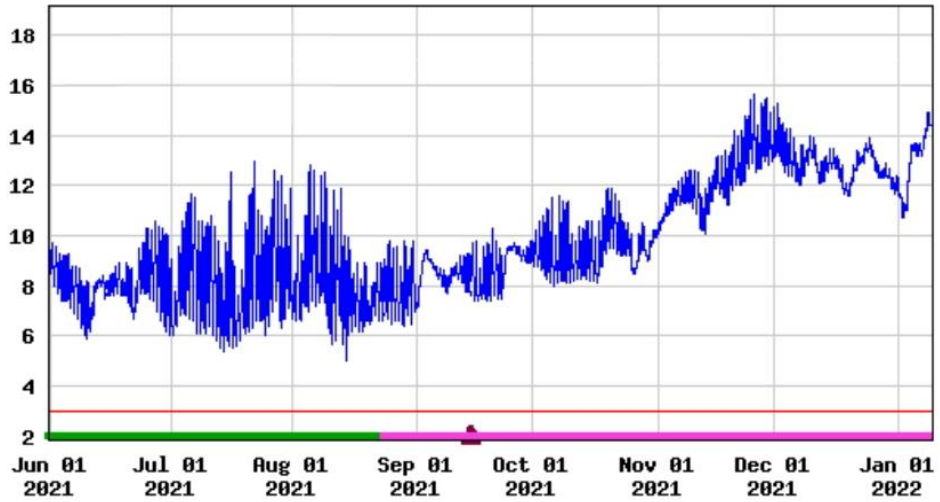
Dissolved oxygen, water, unfiltered, milligrams per liter

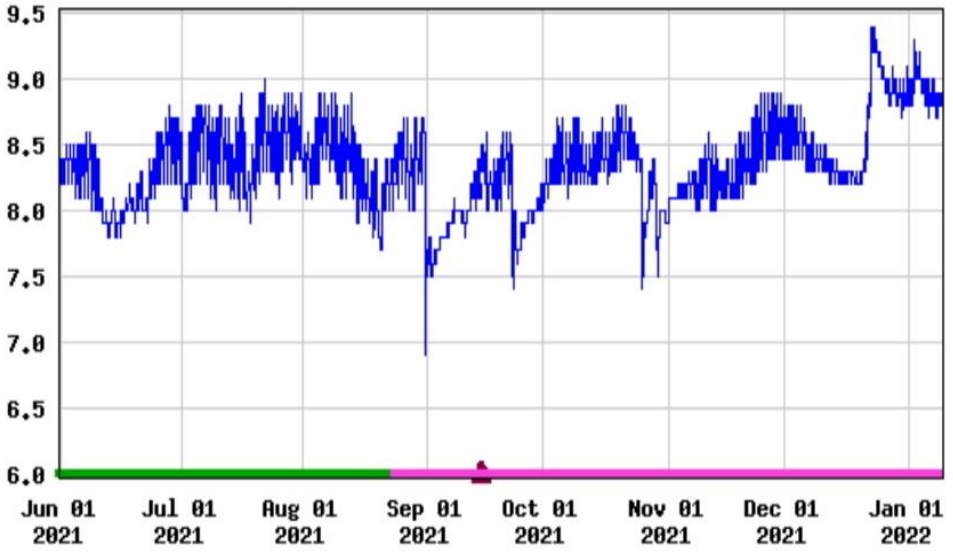


pH, water, unfiltered, field, standard units



Little Falls





Dozen Most Common Occurring Taxa

Washington Aqueduct Intake
2019 – 2021

Summer Dominant 2021

"Bluegreens" (Cyanophyta)

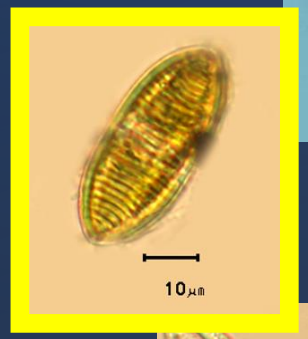
Oscillatoria (some renamed Planktothrix)

"Golden Algae" (Chrysophyta)

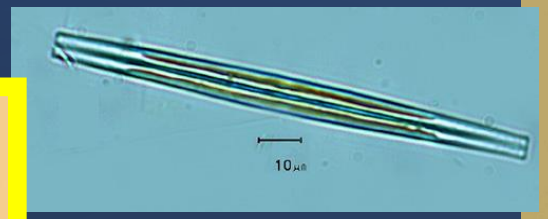
Chrysococcus

"Misc. Algae"

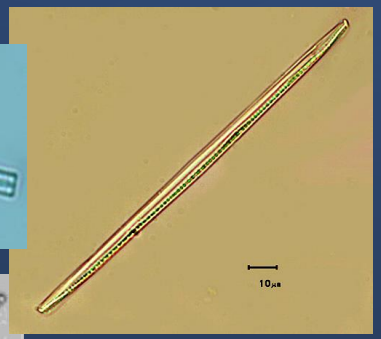
"Diatoms" (Bacillariophyceae)



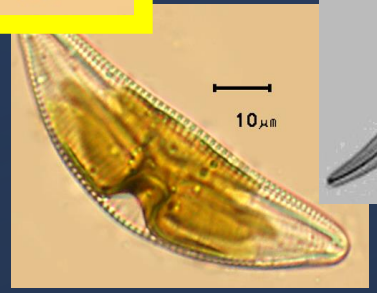
Diatoma



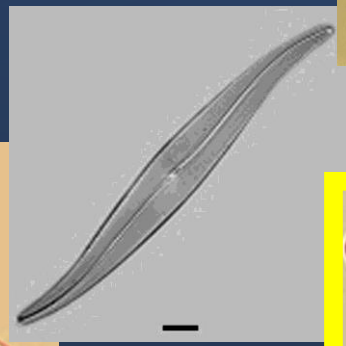
Synedra



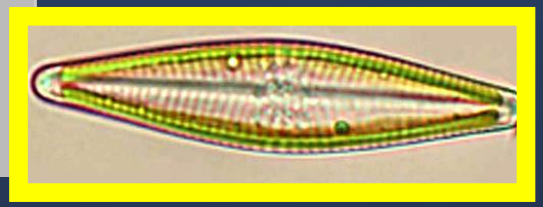
Nitzschia



Cymbella

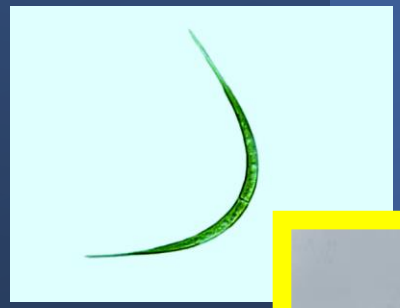


Gyrosigma



Navicula

"Greens" (Chlorophyta)



Ankistrodesmus

Ulothrix

Scenedesmus

Images: University of New Hampshire Center for Freshwater Biology

Dozen Most Common Occurring Taxa

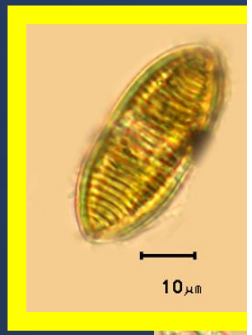
"Bluegreens" (Cyanophyta)

"Golden Algae" (Chrysophyta)

rysococcus

"Diaton

ophyta)



Diatoma

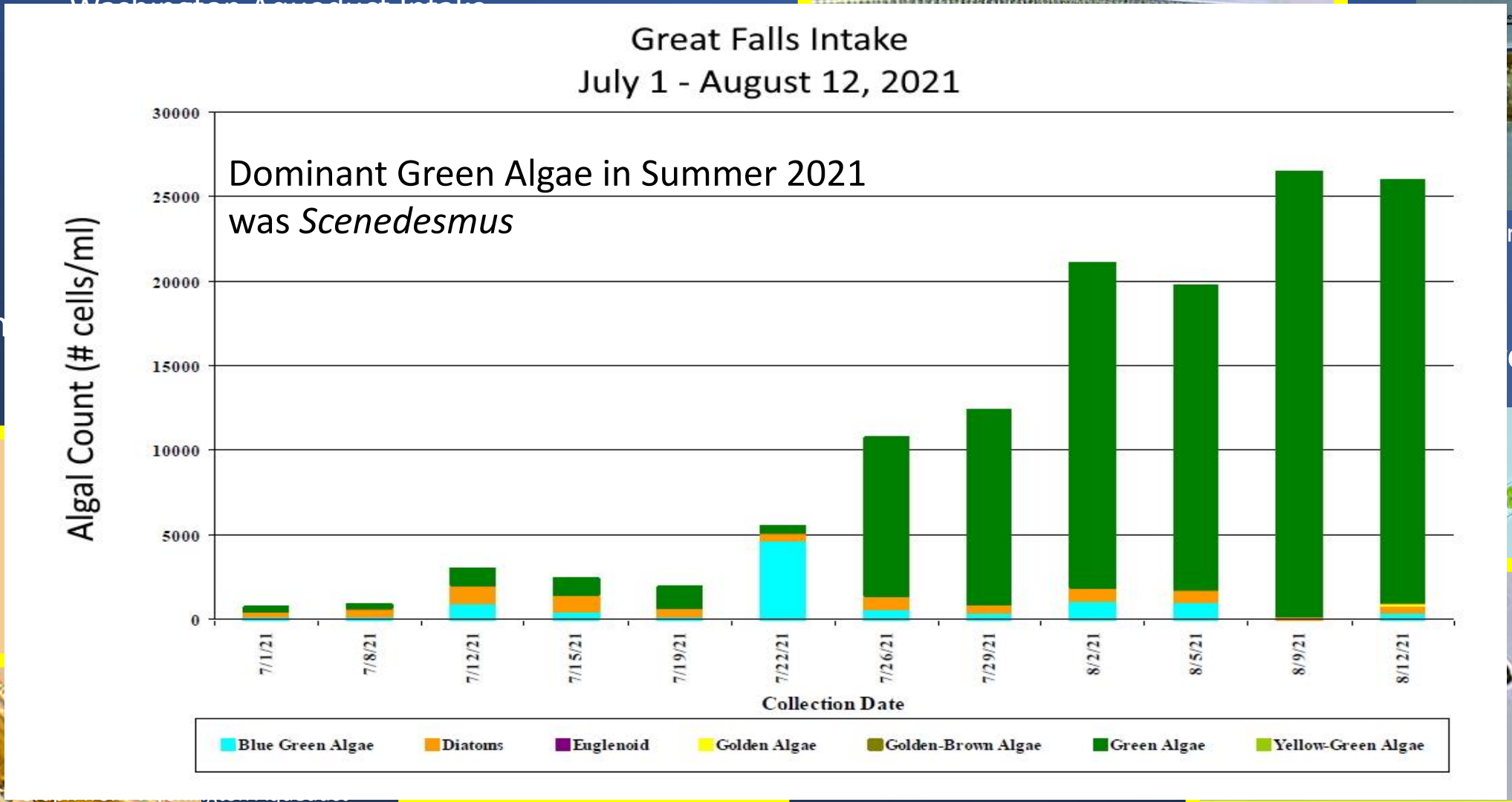
Ulothrix

Cymbella

Gyrosigma

Navicula

Scenedesmus



Images: University of New Hampshire Center for Freshwater Biology

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Wrap Up

Long Term Perspective

- Records of excess production go back at least 35 years in the Potomac and its tributaries
- Annual, seasonal, and spatial variability play a critical role in explaining distribution and abundance of algae
- Not all algae are toxic but algal blooms can be harmful
  - Bioindicators
  - Production as a symptom
- The Potomac is a nutrient enriched system

2021 Snapshot

- Hot, low-flow July and August – conditions ripe for algal blooms in rivers. Long residence times let cells accumulate.
- Recurring algae blooms in Potomac and Shenandoah will likely continue
- High productivity in Potomac below Harpers Ferry may continue to cause troubles for Washington area water suppliers in hot, dry summers if nutrients don't diminish.

Questions?

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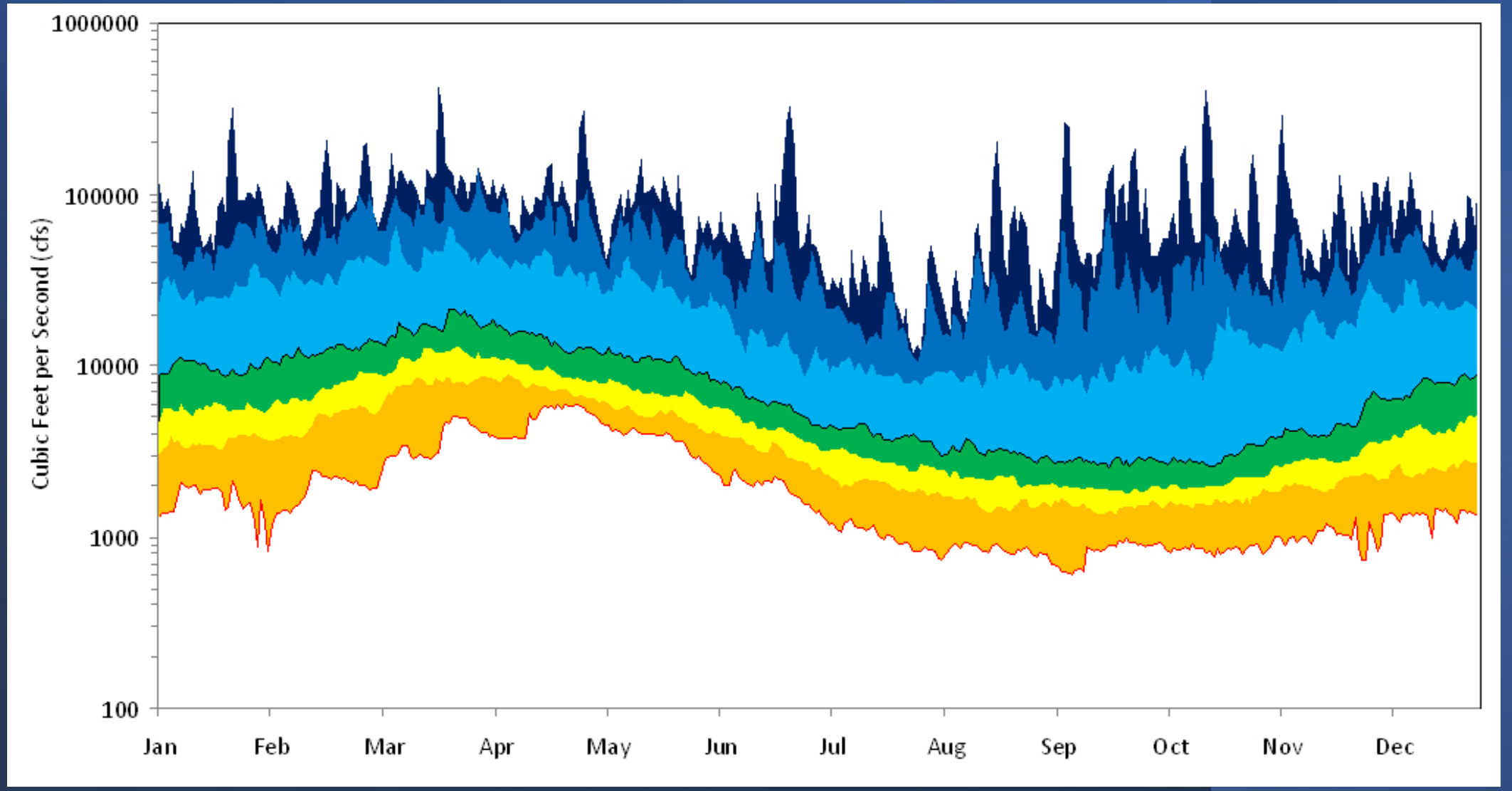
Extra Slides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Cubic Feet per Second (cfs)
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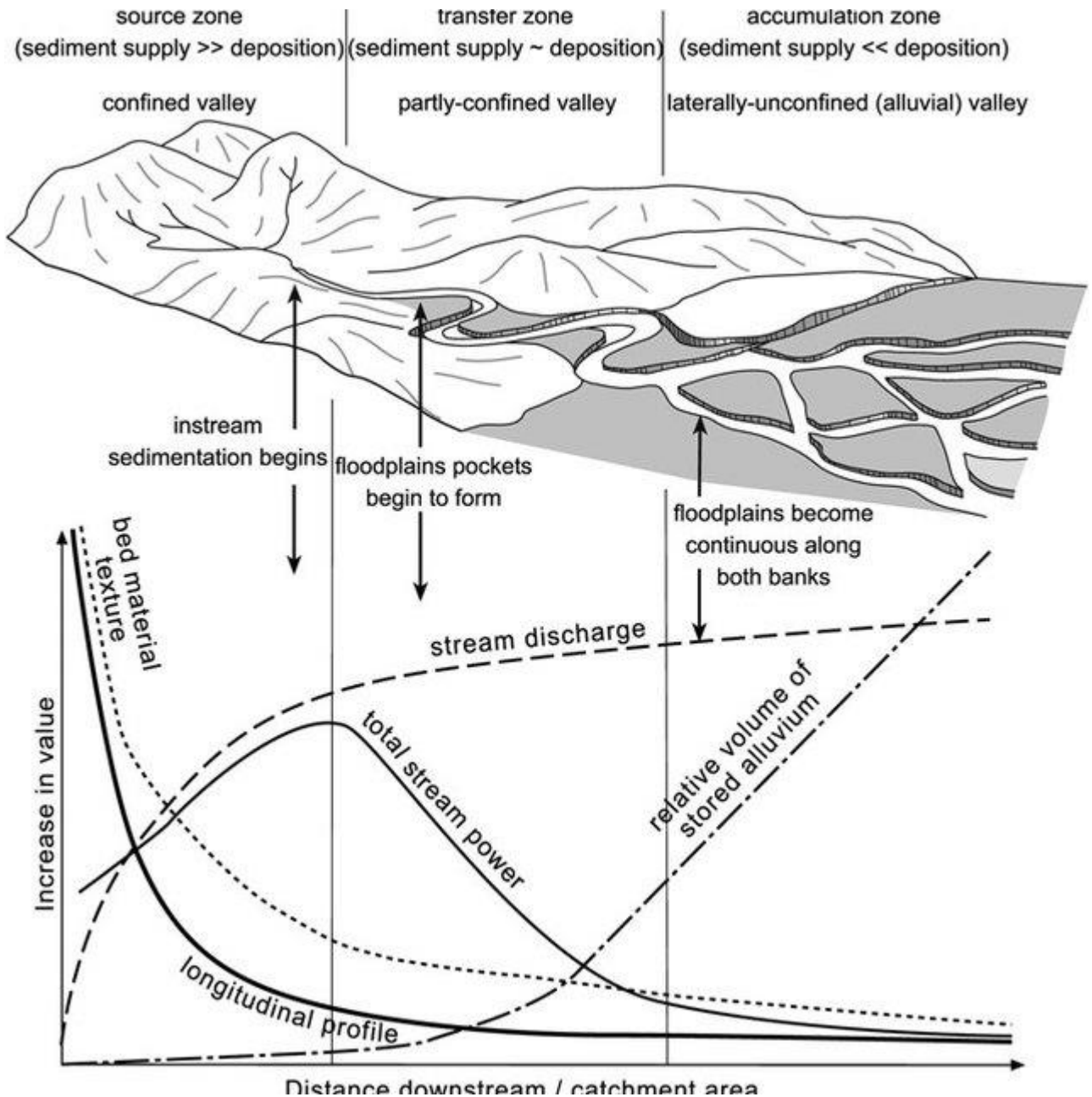


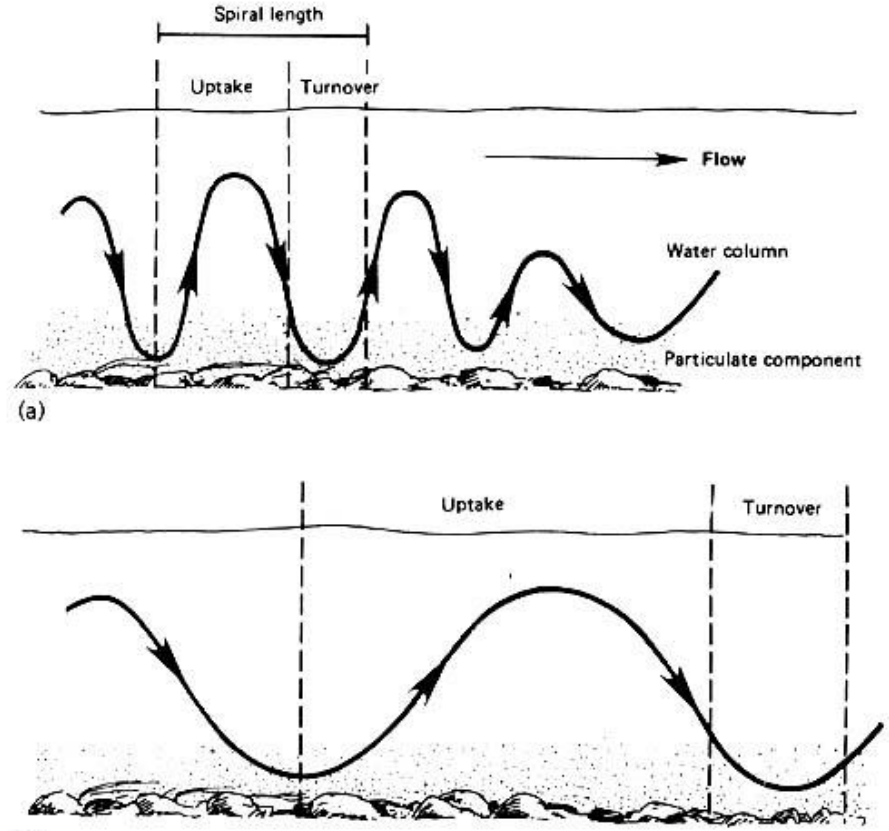
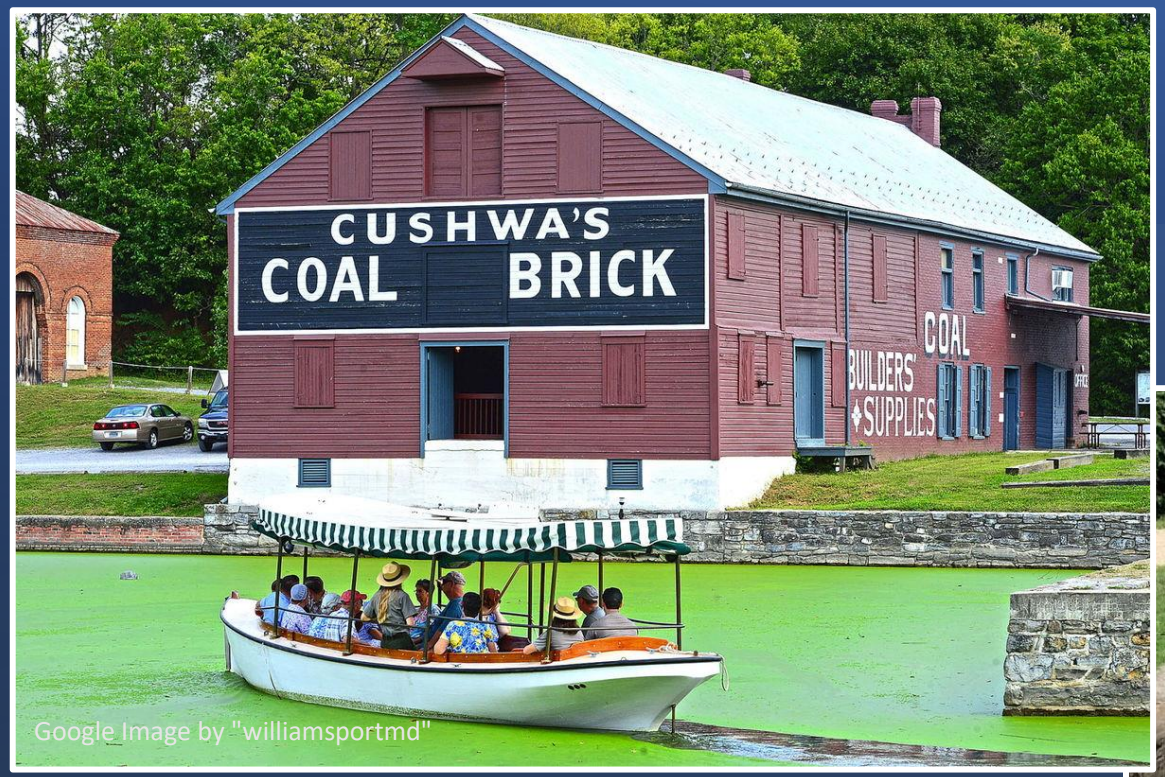


FIGURE 33.7 Nutrient spiraling between particulate organic matter, including microbes, and the water column in a lotic ecosystem. Uptake and turnover take place as nutrients flow downstream. (a) Tight spiraling. (b) Open spiraling. The tighter the spiraling, the longer the nutrients remain in place.

Primary Production Inoculated from C&O Canal?



Google Image by "williamsportmd"

July 2017

Willamsport, MD


Google Image by "Autumn Carter"

Sept 2021