Maryland Rivers & Streams 101

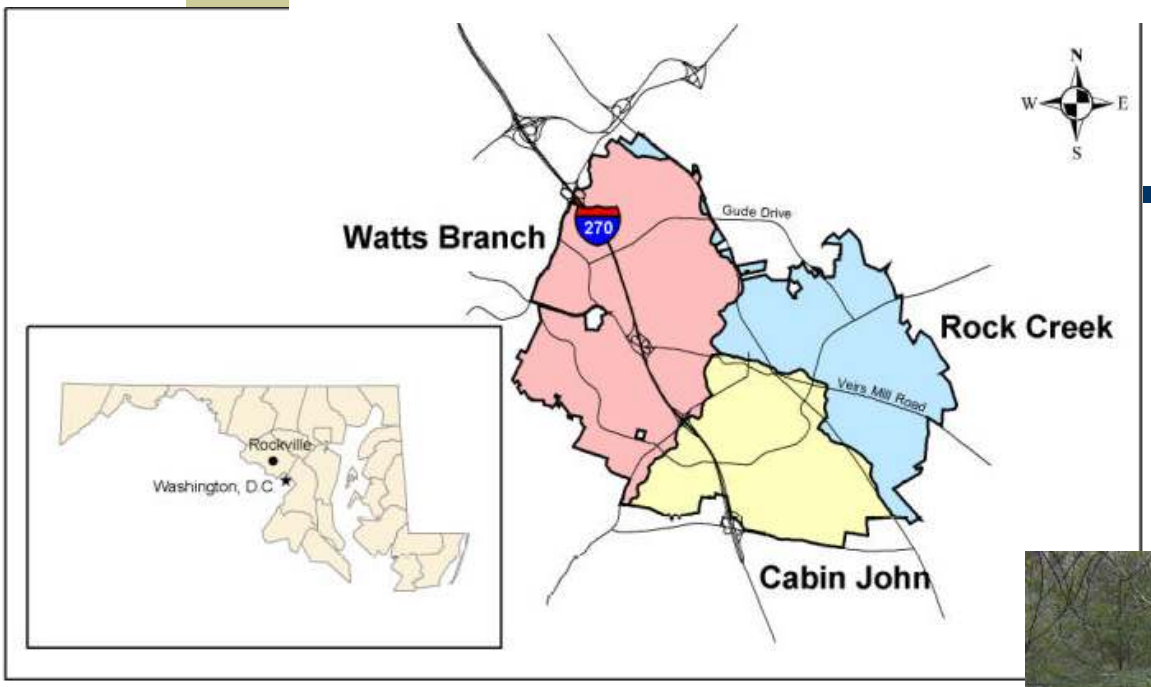
Imagine you are standing in a stream…

- How would you describe its appearance?
- What makes it look the way it does?
- Does the appearance change over time?
- How do the stream's physical characteristics influence the biota that live in it?

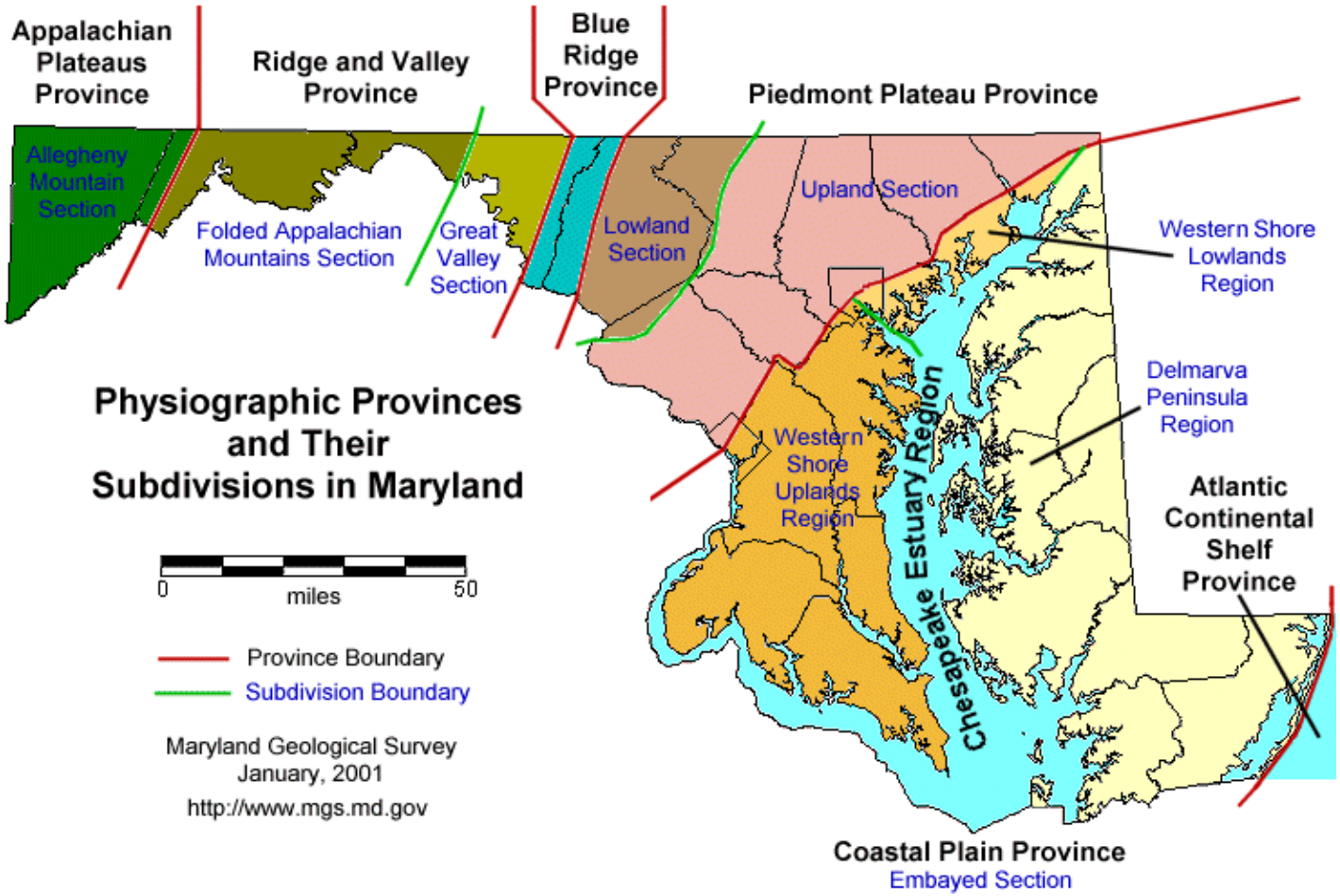
CONSIDER THE **REGIONAL** LANDSCAPE CONDITIONS

- Is the land mountainous, hilly, or flat?
- How did the dominant landscape conditions develop and how do they influence the appearance of stream channels in the area?
- What types of geologic materials are present in the area? How do they influence the appearance of stream channels?

Regional Geology



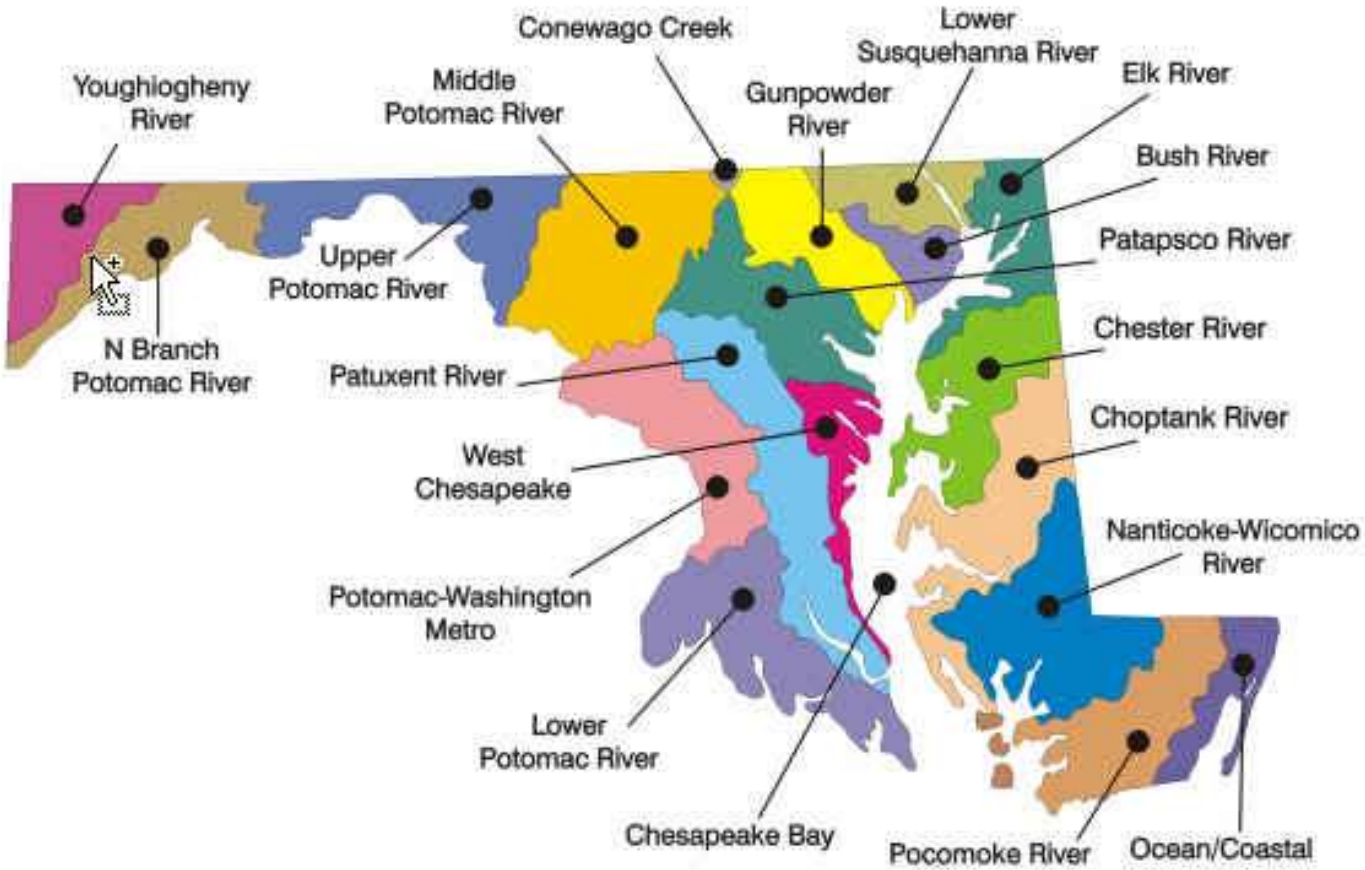
Topography


Appalachian Plateaus Province
Ridge and Valley Province
Blue Ridge Province
Piedmont Plateau Province
Allegheny Mountain Section
Folded Appalachian Mountains Section
Great Valley Section
Lowland Section
Upland Section
Western Shore Lowlands Region
Delmarva Peninsula Region
Western Shore Uplands Region
Chesapeake Estuary Region
Atlantic Continental Shelf Province
Coastal Plain Province
Embayed Section
Physiographic Provinces and Their Subdivisions in Maryland
0
miles
50
Province Boundary
Subdivision Boundary
Maryland Geological Survey
January, 2001
http://www.mgs.md.gov

THEN, CONSIDER LOCAL CONDITIONS IN THE **WATERSHED**

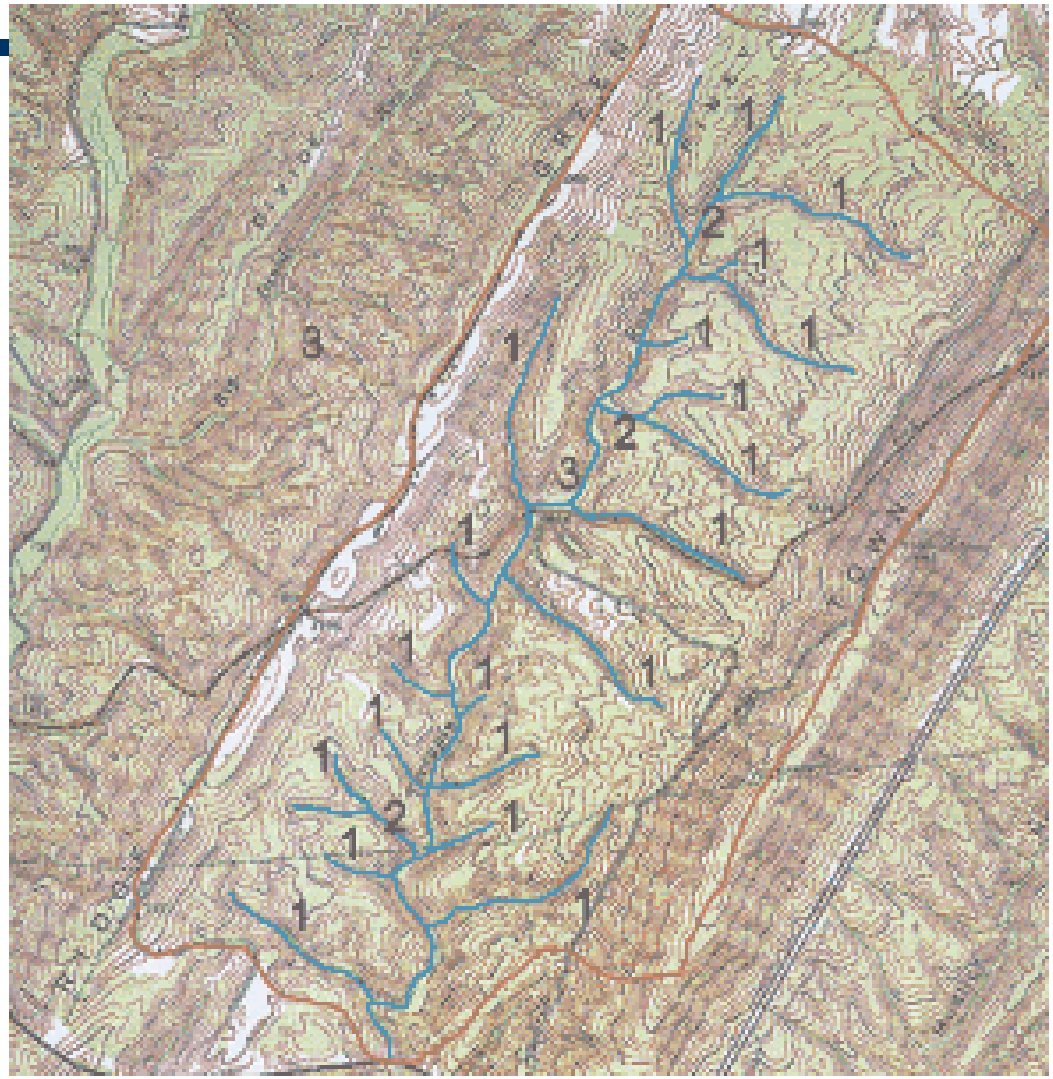
- Where is the stream located in the watershed? Is it at the top or bottom?
- Is the land draining to the stream channel developed, agricultural, or forested?
- What are the local geologic conditions and soil types?

Maryland's River Basins



The Drainage Network

Streams can be described from an aerial view in terms of the drainage network. These networks can take on different patterns depending on topography, geology, and land cover.The numbers indicate the order of the stream segments in the red outlined watersheds.



1
1
2
1
1
1
2
1
3
1
2
1
1
1
1
1

Land Use Effects

Before

Construction:

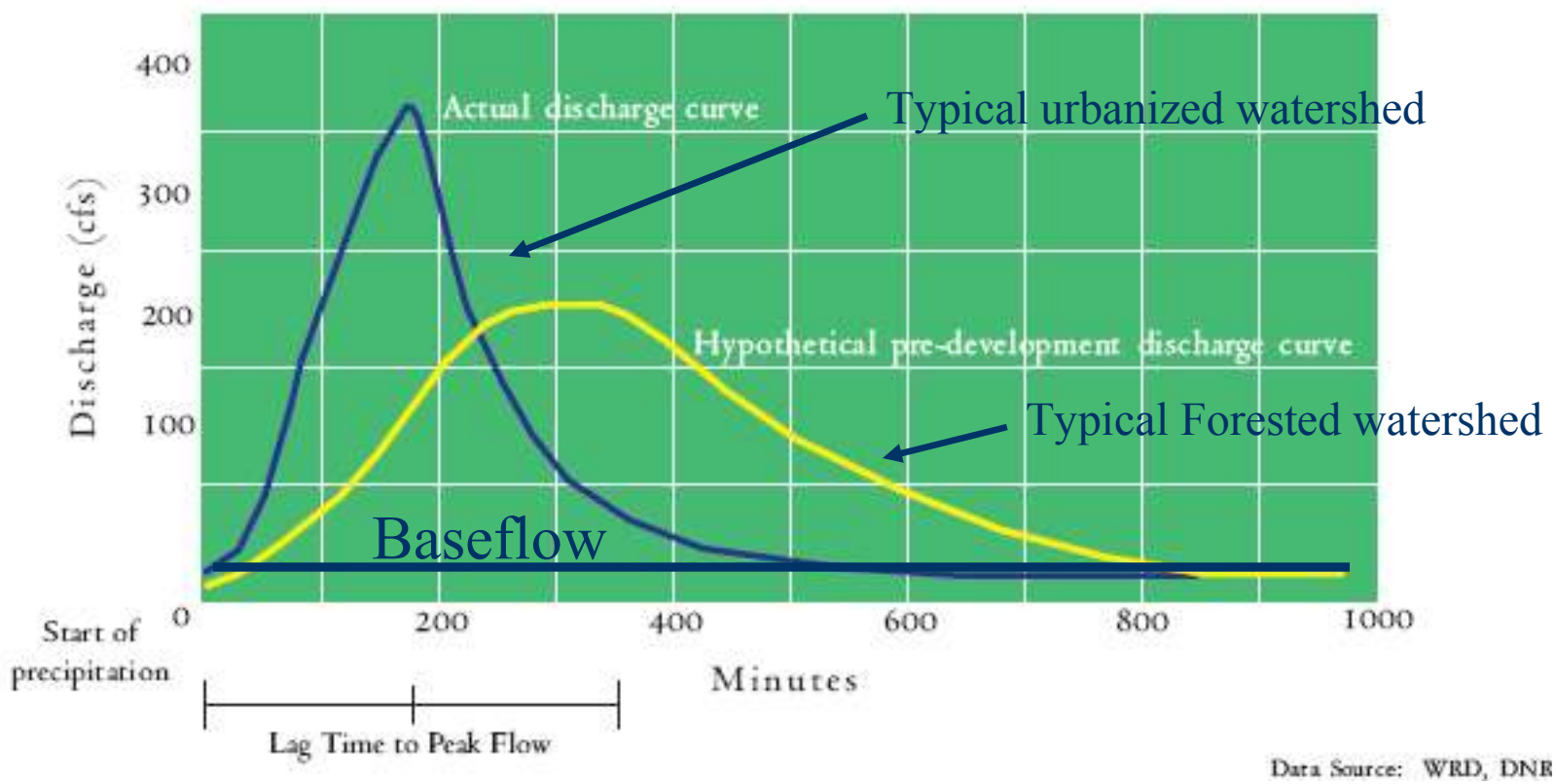
Channelized & eroding banks.

After

Construction:

Bank stabilization with grading and sod mats.

How much water makes it to the stream?



THEN, CONSIDER THE SPECIFIC CHANNEL **REACH**

- Is the channel meandering?
- Is the stream channel wide and shallow, or narrow and deep?
- Does the land adjacent to the stream have trees, grasses, or urban infrastructure?

Moving Water

- Base Flow
- Bankfull Flow
- Flood Flow
- Energy Gradient (slope)
- Resistance

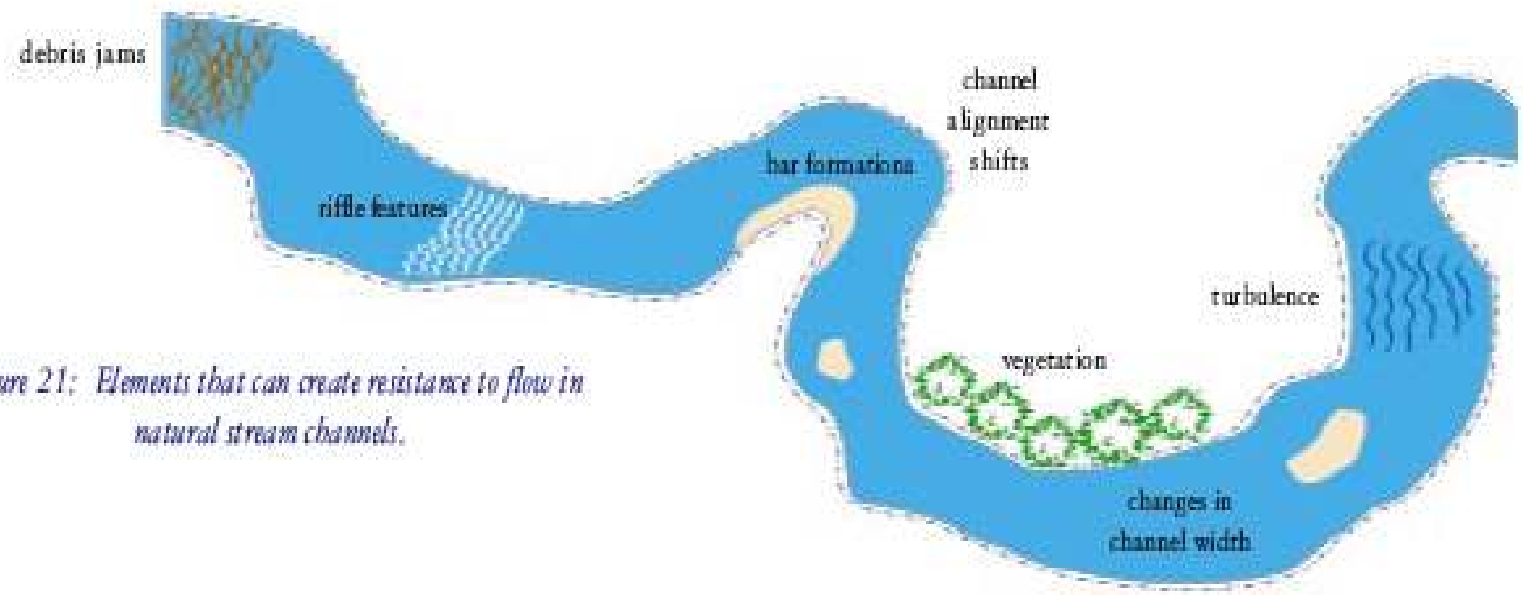


Figure 21: Elements that can create resistance to flow in natural stream channels.

Channel Changes

- Bank erosion on the outside of a meander bend is compensated by bank rebuilding on the inside of the bend.

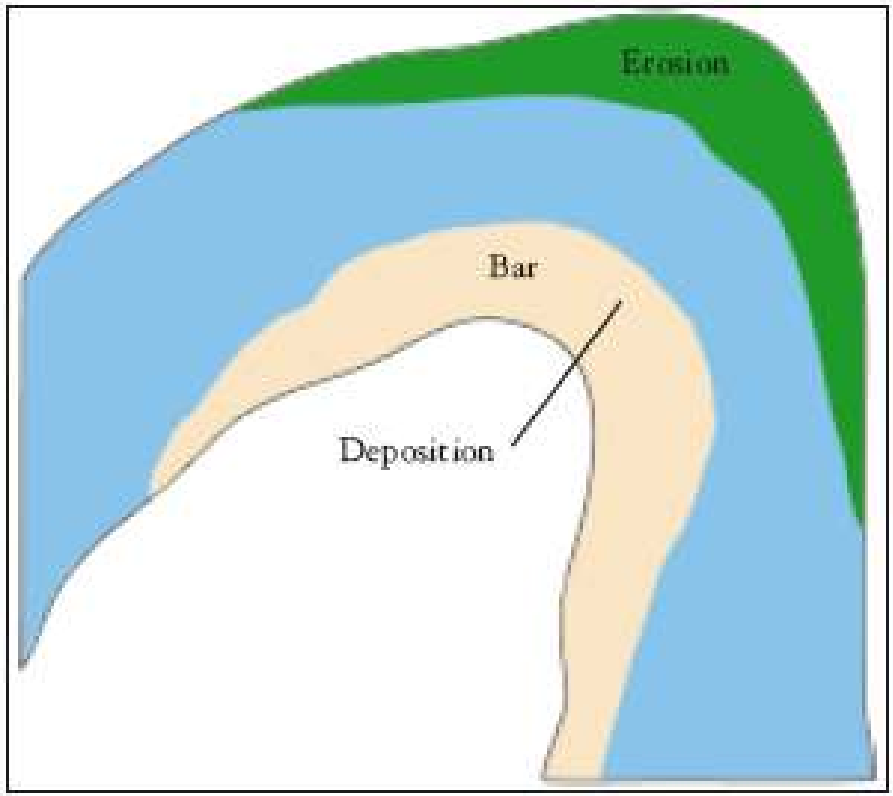


Figure 24: Lateral bank migration shown with erosion of the outside bend balanced by sediment deposition on the inside of the bend.

Sediment Movement

- The larger the mass, the more force required to move it.
- Sediments with more exposed surface area have more force from the water flow, which increases the chance of movement.
- Particle shape affects movement, rith round shapes being susceptible to rolling.
- Small particles surrounded by larger particles are more resistant to movement.
- Cohesion between particles increases resistance to the initiation of motion.

Riparian Zones

Provide:

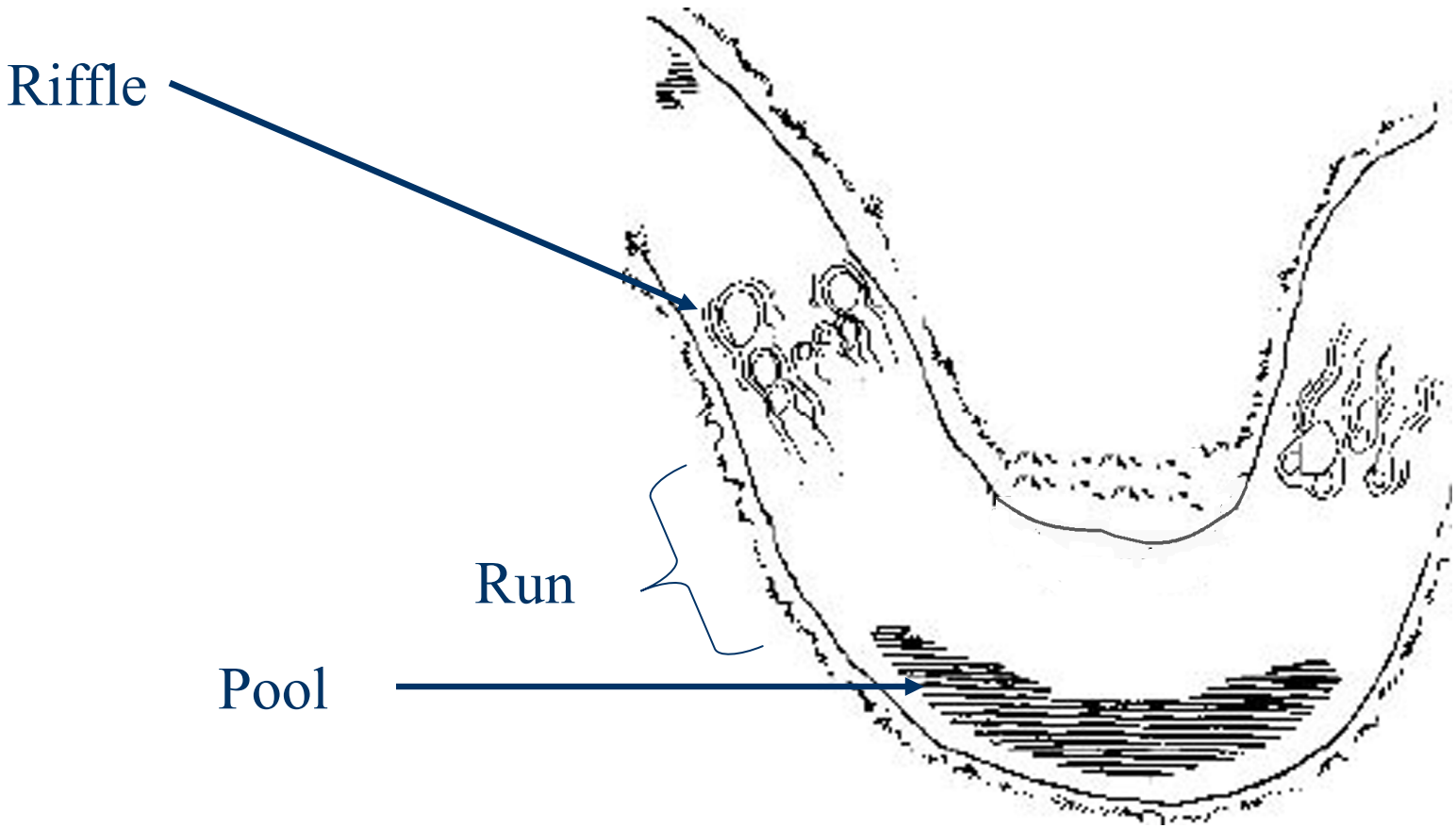
- Shading → lower water temperatures
- Sediment traps
- Mechanism to remove pollutants (excess nutrients)
- Stream bank structure → stabilization
- Leaf debris – the major source of energy for streams

Key to restoring the Chesapeake Bay!

THEN, FOCUS ON THE SPECIFIC STREAM **FEATURES**

- Is the stream rocky or sandy?
- How fast and in what direction is the water moving within the channel?
- What habitat elements are available for aquatic organisms?

Changes in Depth and Velocity



Biology and Habitat

Physical Habitat Variables…

Instream Habitat, Epifaunal Substrate, Velocity/Depth Diversity, Pool/Glide/Eddy Quality, Riffle/Run Quality, Embeddedness, Shading, Woody Debris/Rootwads, Bank Stability, Erosion Potential, Stream Gradient, Sinuosity, Stream Discharge

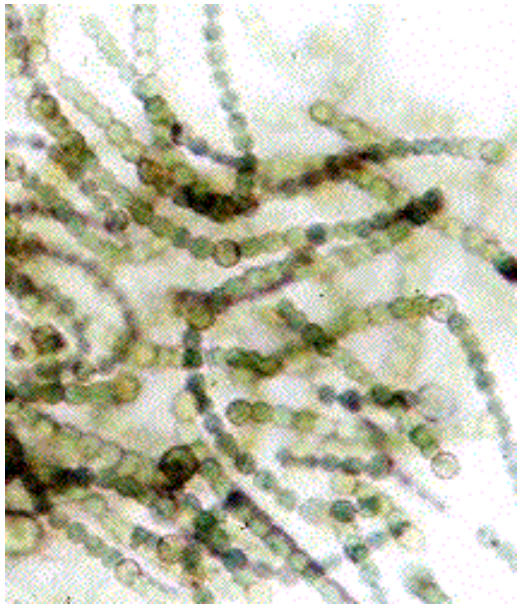
Water Chemistry Variables…

DO, Temperature, pH, Turbidity, ANC, Sulfate, Nitrate, Nitrite, Ammonia, Total Nitrogen (dissolved and particulate), Orthophosphate, Total Phosphorous (dissolved and particulate), Chloride, Conductivity, and DOC

Land Use Variables…

Riparian Buffer Width/Composition, Adjacent Land Use, Upstream Catchment Land Use, Altitude

The Microscopic Community

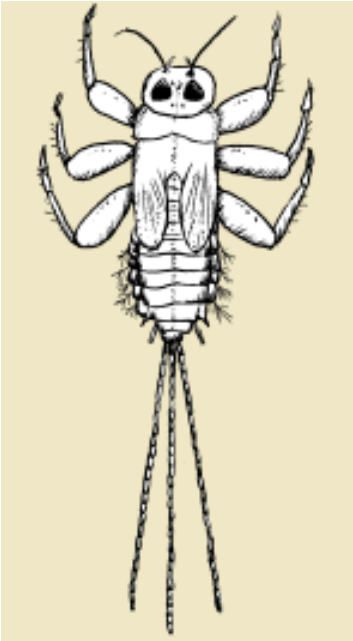


Cyanobacteria

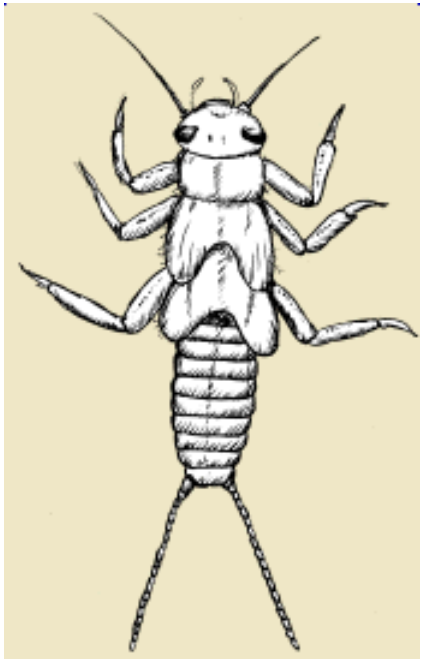
Algae

Diatom

The Macroscopic Community



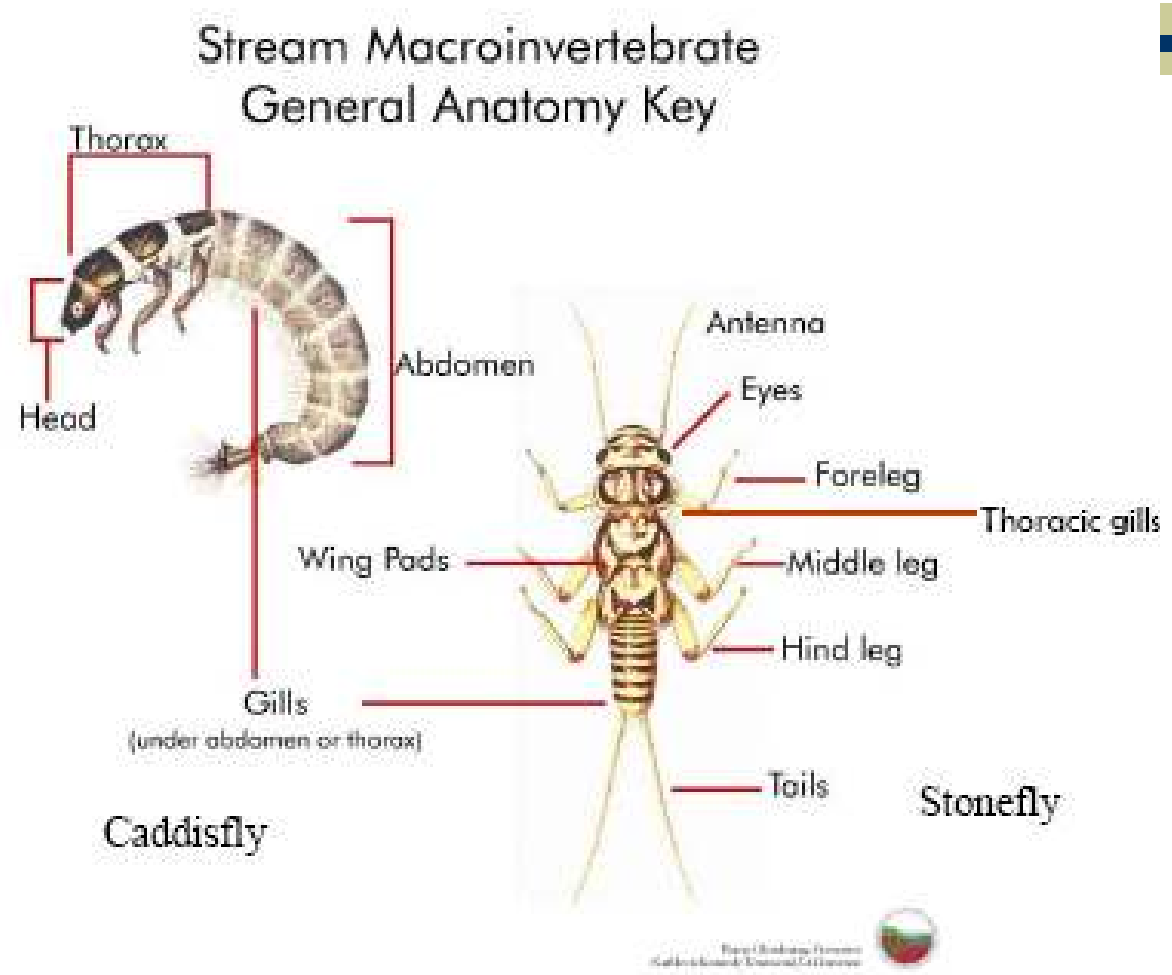
Mayfly: Order Ephemeroptera



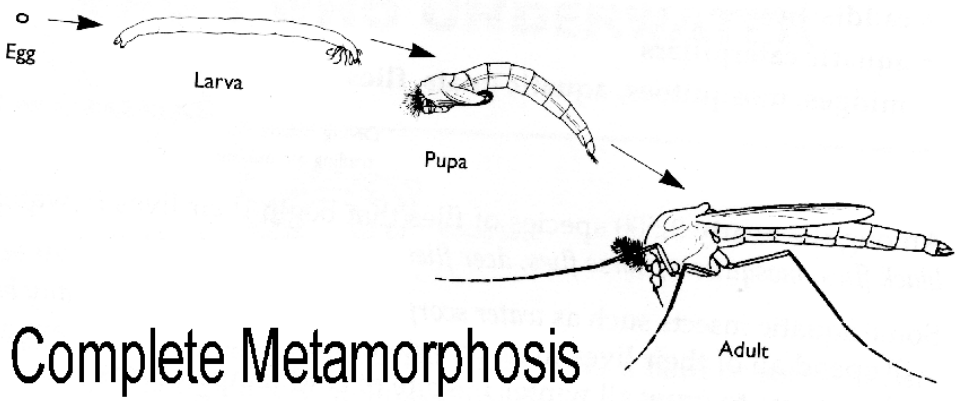
Stonefly: Order Plecoptera

Caddisfly: Order Trichoptera

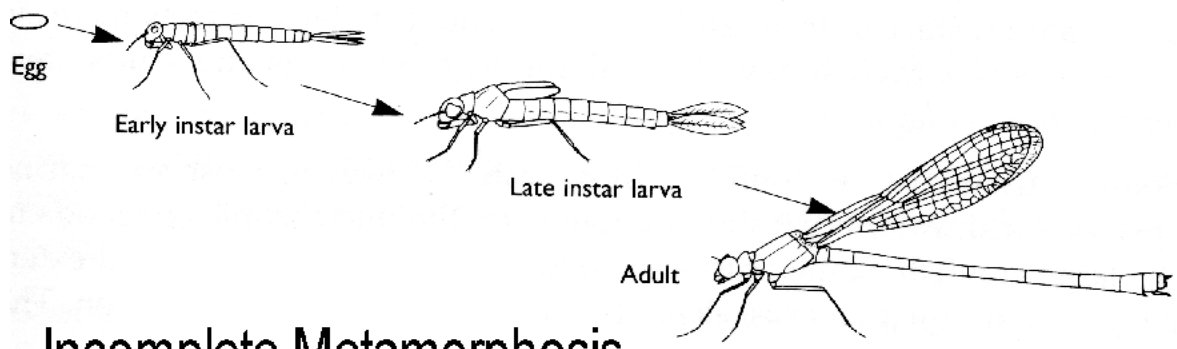
Insect Anatomy



Complete & Incomplete Metamorphosis



Complete Metamorphosis



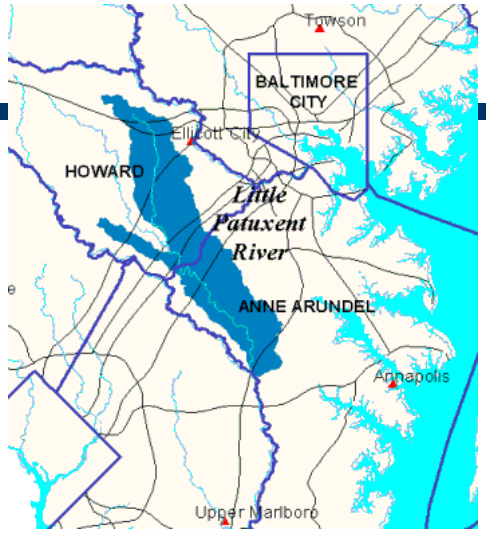
Incomplete Metamorphosis

Fish Communities

Water Chemistry

- Dissolved oxygen
- pH
- Temperature
- Turbidity
- Nitrates/Nitrites
- BOD

Maryland 8-Digit Watershed Code:	**02131105**
Tributary Basin:	**PATUXENT**



Population (1990 US Census)	
1990 Est. Population Density (Ppl per ac)	**1.62**

1994 Land Use (MdOP Data)	
Urban Acres	**32,337**
Agricultural Acres	**8,878**
Forest Acres	**24,537**
Wetland Acres	**11**
Barren Acres	**184**

Total Acres (non-water)	**65,947**

NON-TIDAL WETLAND REGULATORY ACTIONS

Authorizations by Type (since 1991)	
Letter of Authorization	**117**
Permit	**30**
Emergency Permit	**0**
Authorization to Proceed	**0**

Wetland Impact Data (since 1991)	
Acres of Permanent Loss	**-12.74**
Acres of Permitted Mitigation	**27.54**
Acres of Programmatic Gains	**2.75**
Acres of Other Gains	**3.46**

Net Gain/Loss	**21.01**

WATERSHED INDICATORS

Restoration Indicators	Indicator Value	Failed Indicator
Water Quality		
Monitored Nutrient Concentrations		
- eutrophication		
- habitat		
Modeled Nitrogen Loading Rate per ac. (lbs.)	14.14	Yes
Modeled Phosphorus Loading Rate per ac. (lbs.)	0.69	Yes
Aquatic Living Resources		
SAV Abundance		
SAV Habitat		
Tidal Benthic Index of Biotic Integrity		
Tidal Fish Index of Biotic Integrity		
Anadromous Fish Index		
Non-Tidal Benthic Index of Biotic Integrity	4.62	Yes
Non-Tidal Fish Index of Biotic Integrity	5.59	Yes
Non-Tidal Instream Habitat Index	4.87	Yes

Protection Indicators	Indicator Value	Select Indicator
Aquatic Living Resources		
Tidal Fish Index of Biotic Integrity		
Non-Tidal Instream Habitat Index	4.87	
Non-Tidal Fish Index of Biotic Integrity	5.59	
Imperiled Aquatic Species Indicator	9	Yes
Migratory Fish Spawning Area	0	
Anadromous Fish Index		
Wetland-Dependent Species	55.0	
Trout Spawning Area	0.0	
Fish Hatchery Water Supply		
Landscape Parameters		
% Headwater Streams occurring in Interior Forest	9	
Percent Watershed Forested	41	
Wildland Acres	0	
Number of Drinking Water Intakes	1	Yes
Wetlands Acres of Special Concern	862	

Sources

- Maryland Streams: Take a Closer Look

http://www.dnr.state.md.us/streams/pubs/md_streams_wrd.pdf

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MARYLAND
DEPARTMENT OF
NATURAL RESOURCES