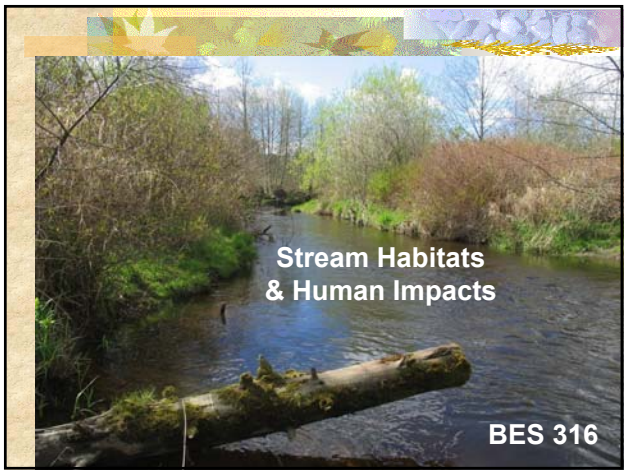
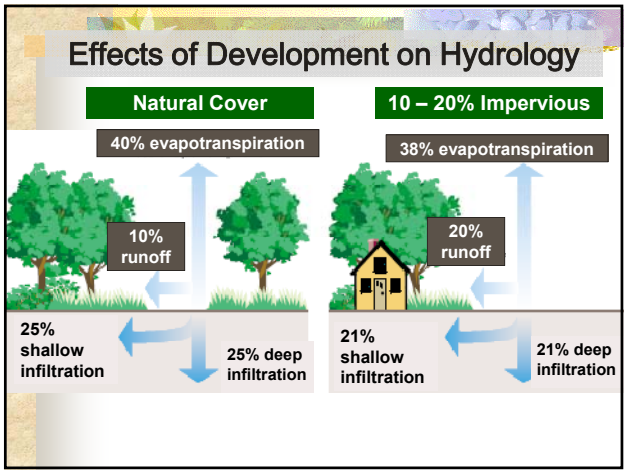


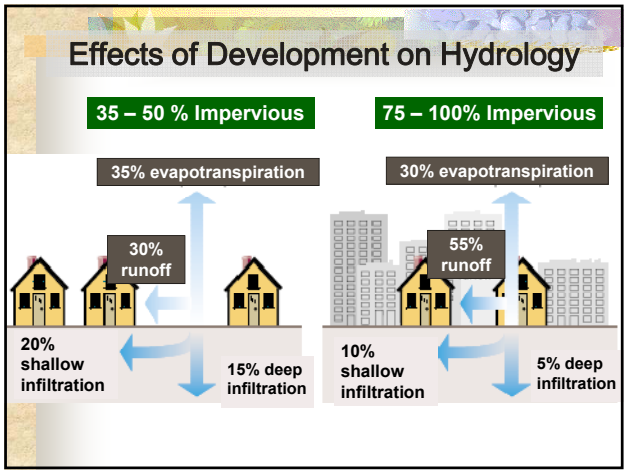
Human Impacts on Stream Ecosystems

- Changes in hydrology
- Changes in water quality
- Changes in stream morphology
- Changes in stream ecology

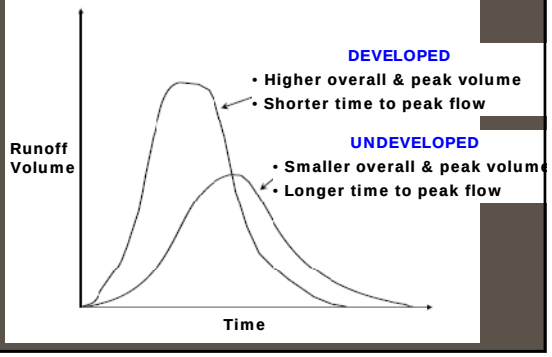
Urban / suburban development

Impervious Surface





Hydrologic Response to Development



WHAT DOES THIS MEAN???

More runoff in a shorter amount of time

Effects of higher, flashier flows

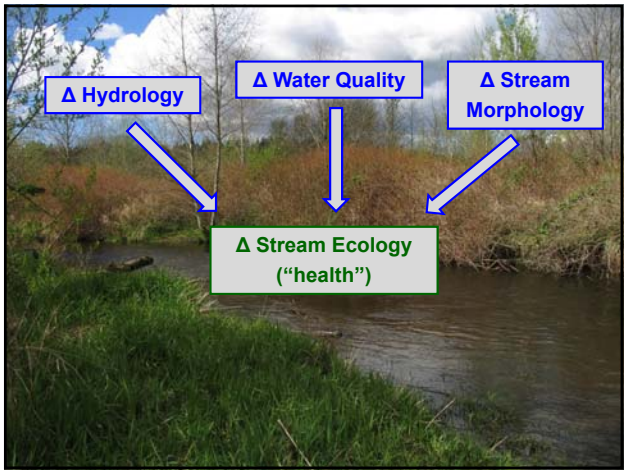
- Flooding
- Stream bank erosion
- Stream channel widening and deepening
- Lower base flows
- Sedimentation
- More pollutant inputs





Changes to Water Quality

- Temperature
- pH
- Dissolved oxygen
- Nutrients (N, P, etc.)
- Turbidity
- Pathogens
- Heavy metals
- Petroleum-based compounds



Biological Integrity

"the ability to support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity and functional organization comparable to those of natural habitats within a region"

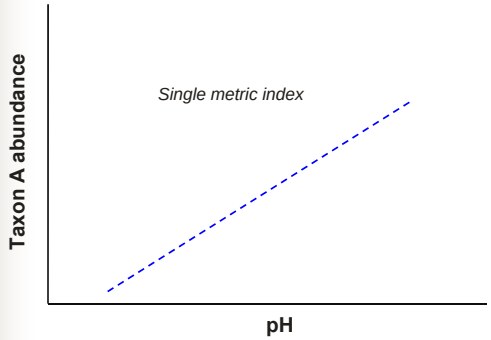
Karr 1981

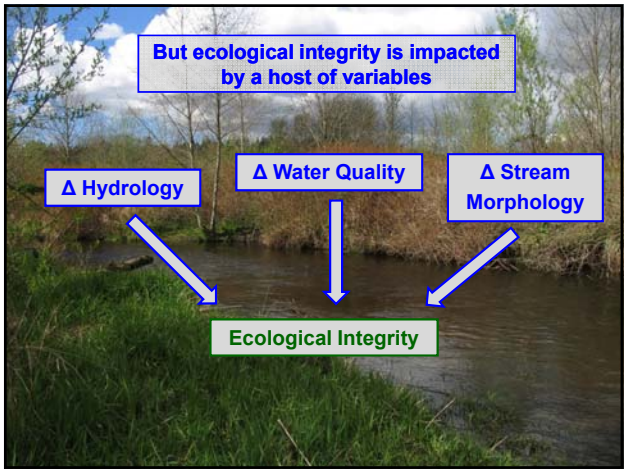
How to measure Biological Integrity ?

Figure 9. Almost any biological attribute can be measured, but only certain attributes provide reliable signals of biological condition and therefore merit integration into a multimetric index.

Karr & Chu1999

Single metrics may be useful for single types of impacts

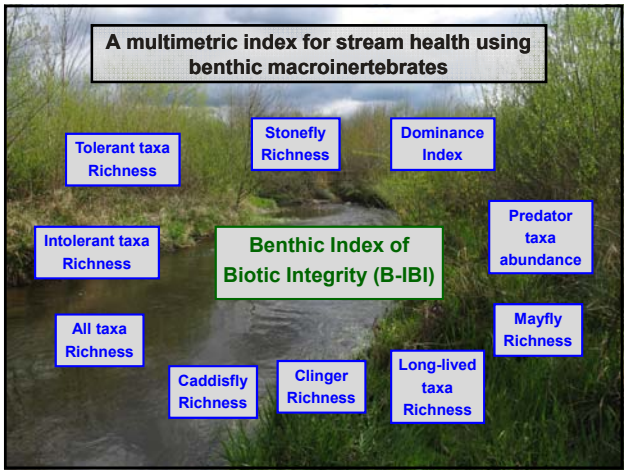




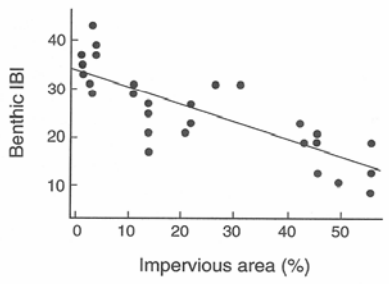
A Multimetric index incorporates

- Responses of organisms to different environmental changes
- Responses of different ecological functions & dimensions of biological systems

Metric Type	Individual	Population	Community	Ecosystem	Landscape
Richness	X	X	X	X	
Tolerance or intolerance		X	X		
Trophic structure			X	X	X
Individual health	X				



B-IBI response to urbanization in Puget Sound area



Karr & Chu1999

Benthic Macroinvertebrates

Heptageniidae sp.
(Mayfly larva)

Hydropsyche sp.
(Caddisfly larva)

Perlodidae sp.
(Stonefly larva)

Benthic Macroinvertebrates

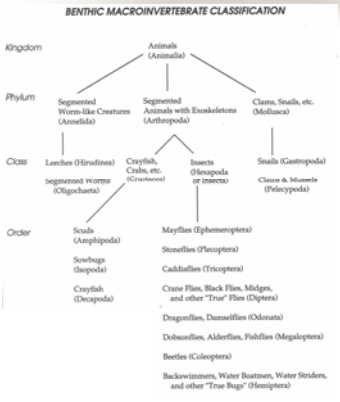
(bottom-dwelling) (animals w/o backbones visible to naked eye)

Heptageniidae sp.
(Mayfly larva)

Hydropsyche sp.
(Caddisfly larva)

Perlodidae sp.
(Stonefly larva)

Benthic Macroinvertebrates



from your reading

Benthic Macroinvertebrates

(bottom-dwelling) (animals w/o backbones visible to naked eye)

Heptageniidae sp.
(Mayfly larva)

Hydropsyche sp.
(Caddisfly larva)

Perlodidae sp.
(Stonefly larva)

Why do we use them for biological monitoring ?

Benthic Macroinvertebrates as Indicators

- Limited migration patterns–good indicators of localized conditions and site-specific impacts
- Broad range of habitat requirements and sensitivities to pollution

- Important component of aquatic food webs
- Integrate effects of human impacts
- "Easy" to sample and identify

General Patterns of Pollution Tolerance

Least tolerant → **Most tolerant**

Stoneflies

require high DO, clear water, rocky cobble substrate

Midges & Leeches

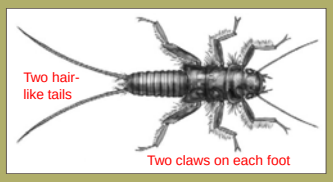
contain hemoglobin, tolerate lower DO, prefer soft substrate, less sensitive to toxins

Common Benthic Macroinvertebrates

Stoneflies (*Plecoptera*)

Low tolerance to pollution

Perlidae



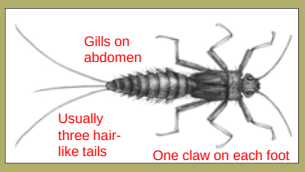
Perlodidae

Common Benthic Macroinvertebrates

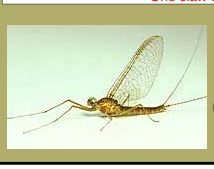
Mayflies (*Ephemeroptera*)

Vary in pollution tolerance; many low to moderate tolerance

Ephemerellidae



Baetidae



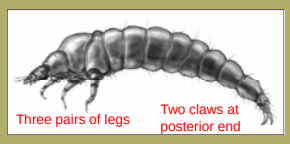
(Adult)

Common Benthic Macroinvertebrates

Caddisflies (*Trichoptera*)

Vary in pollution tolerance; many low to moderate tolerance

Hydropsychidae



Philopotamidae

(Adult)

Common Benthic Macroinvertebrates

Vary in pollution tolerance; many very tolerant

Damselflies and Dragonflies *(Odonata)*

Dobsonflies, Alderflies and Fishflies *(Megaloptera)*

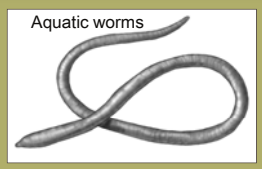
Low to moderate pollution tolerance

Beetles *(Coleoptera)*

Moderate pollution tolerance

Common Benthic Macroinvertebrates

VERY Tolerant of Pollution



Often in sediments; tolerate low O_2

Often under rocks or in detritus; tolerate warm water & low O_2

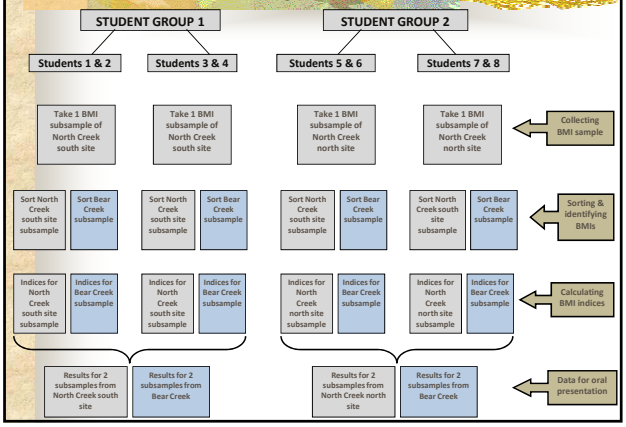
Tuesday, May 18

- Collection of BMIs from North Creek (on campus)
- Sample preservation

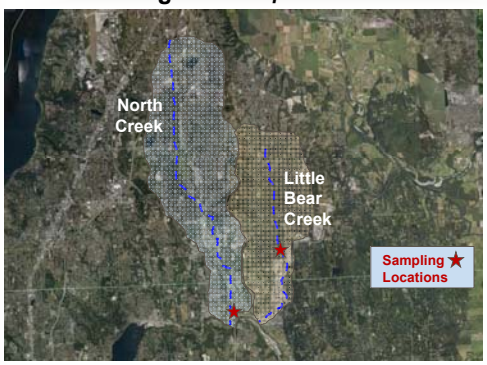
Thursday, May 20

- Sorting, identifying, and counting BMI samples from North Creek & Little Bear Creek
- Calculating BMI indices

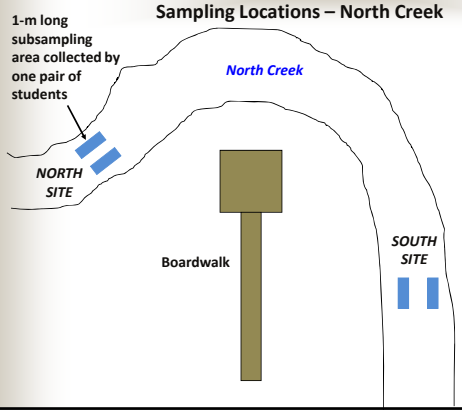
Experimental Design – *from May 20 handout*



Experimental Design – *a comparison of 2 watersheds*



Sampling Locations – North Creek



Sampling and sorting procedures – review lab handouts

Be prepared to get WET, VERY WET on Tuesday!

<u>Products</u>: oral presentations next Tuesday (May 25)

Group presentations preferred but individual presentations possible.

Acknowledgements

- Murdoch and Cheo (1999)
- Karr and Chu (1999)
- Adopt-a-Stream (2009) Georgia Adopt-a-Stream Biological Training. *http://aesl.ces.uga.edu/aascd/Manuals_etc/Presentations/Bio_color.ppt*
- Chaffee, C (2007) Macroinvertebrates and Bioassessment: Using Biological Indicators to Measure Stream Health. University of Rhode Island, Cooperative Extension. *http://www.ririvers.org/wsp/Presentations/Class%203/Macroinvertibrates-Bioassessment.ppt*
- Audubon Naturalist Society (2008) GreenKids Stream Study. *http://www.audubonnaturalist.org/images2/greenkids/lessonplans/streamstudypptgr4v2.ppt*