Monitoring Human Impacts on Water Quality

CSS 496

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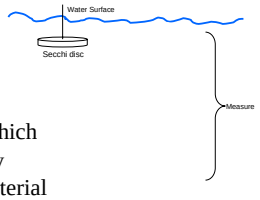
Physical Indicators to Monitor Water Quality



- Temperature
  - regulator of natural processes
- Turbidity -- degree to which water clarity is reduced by suspended & collodial material
- Sedimentation -- soil, sand & rock particles that are transported by moving water

Measure depth at which Secchi disc just disappears

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Chemical Indicators to Monitor Water Quality

- pH a measure of H+ ion activity
- range 0 to 14, where 7 = neutral
  - Important -- every aquatic organism has a specific pH tolerance. At pH 5.5 aquatic insects utilized by trout begin to disappear
- **Alkalinity** -- a measure of water's ability to absorb acid (buffering capacity).
  - Alkalinity goes to 0 before lake pH starts dropping-- indicates a lake's susceptibility to acid precip.
  - Minimum for aquatic life -- 20mg/l (as $CaCO_3$)

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Chemical Indicators to Monitor Water Quality

- **Conductivity** -- measure of water's capacity to transfer an electrical current -- relates to ion concentrations.
- **Nitrogen & phosphorus** compounds -- limit or enhance plant growth
- **N & P** usually high in Spring following runoff, decline as they are absorbed by plants
- Soil erosion & feces are prime sources of nutrients

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Chemical Indicators to Monitor Water Quality

- Dissolved Oxygen (DO)
  - cold water fish start dying at O_2 concentrations below 6mg/l
- Biological Oxygen Demand (BOD)
  - amount of O_2 required by bacteria to decompose organic matter

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Biological Indicators to Monitor Water Quality

- Macroinvertebrates
- Aquatic plants
- Phytoplankton & Zooplankton
- Pathological indicators
  - Fecal coliform (FC)
  - Fecal streptococci (FS) – FC/FS
  - Giardia lamblia

Biological Indicators to Monitor Water Quality

Macroinvertebrates

- Inhabit specific aquatic niches
- Concentrate minerals in exoskeleton
- Impacts they respond to:
  - Acid precipitation -- (decreased abundance)
  - Heavy metals -- (decreased abundance)
  - Vegetation trampling along streambanks -- (increased abundance)
  - Nutrient loading -- (increased abundance)

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Biological Indicators to Monitor Water Quality

Aquatic benthic plants

- Impacts they respond to:
  - Nutrient input from livestock, packstock, or human feces -- (increased abundance)
  - Nutrient input from soil erosion -- (increased abundance)
- Easy to sample & they respond quickly to change
  - but may be hard to pinpoint source of nutrients

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Biological Indicators to Monitor Water Quality

Phytoplankton & Zooplankton

- Impacts they respond to:
  - Nutrient input from feces & soil erosion -- (increased abundance)
  - Toxic chemicals from mining or contaminated precipitation -- (decreased abundance)
  - Phytoplankton appear to be more valuable indicators than zooplankton

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Biological Indicators to Monitor Water Quality

Pathological (fecal coliform & fecal streptococci)

- Impacts they respond to:
  - Fecal contamination from humans & other mammals, birds & reptiles
- FC (humans)/FS (animals) Ratio >4:1=human, <0.7:1=nonhuman
- FC/FS ratios only valid for first 24 hrs after contamination
- Grand Teton NP has ecoli identified from every mammal species using DNA research

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Biological Indicators to Monitor Water Quality

Pathological (fecal coliform & fecal streptococci)

- May concentrate in bottom sediments
- Care required to avoid contaminating samples
- Storing and transporting samples may be difficult
- May be more useful to study in areas with specific problems or concerns

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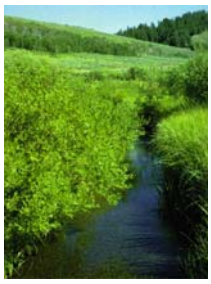
Monitoring stream conditions



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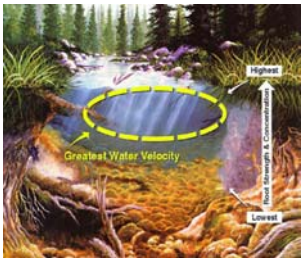
Measurements



- Canopy closure (% overstory closure w/densiometer)
- Overhangs/undercuts %
- LOD (large organic debris > 10cm)
- Cobble embededness (avg. % diameter of rocks over 4.5cm above & below fine substrate)

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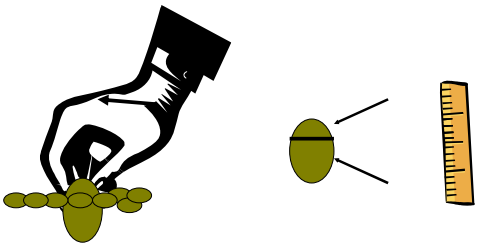
Cobble embeddedness



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Water Quality Summary

- Water quality is a major concern, but not a prevalent impact from human use in wildland areas.
- In warm lakes & streams excessive plant production can quickly alter BOD & species composition of aquatic organisms.
- Human fecal contamination is rare.
- Turbidity is undesirable to users & may signify other problems in the watershed.

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