WETLANDS: FILTERS, SINKS, SOURCES, TRANSFORMERS

SUMMARY

Different types of wetlands - the main determinant hydrology
Hydrology determines the sediment quality (level of anoxia)
Hydrology & sediment quality determine the type of vegetation

FEEDBACKS!

Plants evolved various adaptations for living in aquatic environment and flooded sediments
Hydrology, sediments and living organisms in wetlands all together determine the functions of wetlands

"Filters/Sinks/Source/Transformers" - important in connection with the role of wetlands in water quality improvement.
General belief is that wetlands are sinks but they may release twice as much P as terrestrial ecosystems
Most studies directed towards nitrogen, phosphorus and carbon.

Terminology:
Filter - any device in which a solid part is held and liquid passes through - this term should be restricted to the removal of suspended materials and solids from liquids
Sink - storage (net retention) of an element or a specific form of that element; input > output
Source - output > input for a particular element
Transformer - processes within a wetland ecosystem result in significant changes in the valence state of an element, change from inorganic form to organic forms or conversion from liquid phase to gaseous phase

Wetlands as filters - evidence from agricultural and urban runoff studies; values for removal of suspended solids range from 60 to 95 %
Riparian vegetation removed - erosion Buffer zones

Wetlands: sinks or sources for nutrients
- Inflow x outflow diagrams
time scale - year; growing season
**Wetlands as transformers** - analysis of biogeochemical cycles of N, P, and C to find out if a significant proportion of these elements is transformed prior to storage or export from wetland ecosystems

**IMPORTANCE OF PLANTS AND MICROORGANISMS**

**NITROGEN** - complex biogeochemical cycle with multiple biotic/abiotic transformations

- major pools: 1) total sediment N mostly org. 100-1000 g/m²
  2) total plants 10-80 g/m²
  3) inorganic N in sediments/water 1-5 g/m²

  - input: atmospheric deposition, N2 fixation, inflow
  - output: denitrification, volatilization, outflow

**PHOSPHORUS** - geochemical cycle

- major pools: 1) sediment litter compartment >95%
  2) plants 0.5-10 g/m²
  3) inorganic P in sediment/water 0.05-0.5 g/m²

  inorganic P transformations controlled by interactions of redox, pH, Fe, Al, and Ca minerals

  Storage of P in wetlands depends on:
  - microorganisms removal of DIP from water
  - plant removal
    - = **short term sink**
  - soil absorption by aluminum and iron minerals and incorporation of organic P into peat
    - = **long term sink**

  many wetlands source of total P !!

**CARBON**

- most carbon in vegetation and litter
- losses through respiration and stream flow

Important for global C budgets

**SULFUR** - little information, over 90% organic; transformations biologically mediated; SO4 from atmospheric deposition; many wetlands sinks (bogs); many transformers (H2S and organic S gases)
Conclusion: whether a wetland is a sink or source for a particular element depends on the type of wetland, the loading level, the season of the year, the flooded x droughtdown stage of a cycle.
Examples from different types of wetlands cannot be uniformly taken as typical for all wetlands.