ERASMUS Soil & Water

Protokoll Montag 17.09.2012

Hana Santruckova Introduction in the topic of the IP „Soil & Water“:

Soil-Water-Interactions

water retention capacity of soil: water doesn't evaporate in the hemisphere or flows back to the groundwater, it is available for plants and organisms

water availability and saturation:

- water is unavailable for plants: wilting.
- water availability over field capacity: plants suffer of oxygen absence
- optimum: between wilting point and field capacity

pores within and between aggregates: living space for soil organisms

- texture of the soil is important
- bacteria need much less space (pores) than plants

soil and aluminum:

- acid rain dissolves Al^{3+} away of stones -> more Al^{3+} content in soil
- fast formation of $Al(OH)_3$ -> irreversible
- $Al(OH)_3$is toxic for organisms -> inactivation of PO_{4-}, no more available for organisms
- soil is a natural $Al(OH)_3$ source for lake sediment

11:00-12:30 Kazda Basic introductions to Soil-Water-Relations:

Soil-Water-Relations, Nitrogen cycle

soil contains:

- particles of different shape and size

-> gravel: >2 mm; sand: 2 - 0,063 mm; silt: 0,063 – 0,002 mm; clay: <0,002 mm

- minerals in solution, air in gas shape, water in liquid shape

- solved nutrients (nitrate, NO^{3-}, Ca, K, Mg)

soil has negative charge, and thus binds nutrients: NO^{3-}, Ca^{2+}, K^+, Mg^{2+}

making nitrogen available for soil, 2 possibilities:

1) through high temperature combustion: NO_x ->NO^{3-}. going into the soil

2) NH_3 -> NH_4^+ ->going into the soil -> through nitrification: NO_3^- and release of $2H^+$

NO^{3-} goes to groundwater, denitrification follows: N_2O and N_2 are established through NO^3.

N_2O is bad for climate, N_2 goes to the atmosphere and is recycled in the cycles mentioned above

consequences of gaining protons: Al^{3+} is getting released and reaches the groundwater

<u>soil-water status as a function of pressure:</u>

3 different conditions of soil:

- saturation: flooded condition

- field capacity: soil moisture 2-3 days after a rain or irrigation, is the amount of water that can be

held in soil before gravity will begin to drain the soil

- wilting point: plant will not recover after dry status, is a condition where the soil moisture is at low level where a plant can’t uptake any water.

suction pressure head (cm of water):

- that means, when soil is getting dryer, water remains in small capillary -> potential is getting more negative

Ψ is water potential and a measure of water availability in soil

Ψ (osmoses): osmotic solutes in plant and in water

Ψ (matrix): difference of particles

-> Ψ = Ψ (matrix) + Ψ (osmoses)

data in soil: Ψ

- saturation: 0
- field capacity: -340
- wilting point: < -15000

<u>soil texture and available water:</u>

- the bigger the particles in soil, the higher is the gap between each particle
- sand has lowest porosity, field capacity and thus low wilting point
-.clay has highest porosity, field capacity and highest wilting point
- available water storage capacity is between field capacity and permanent wilting point

<u>plant under declining water supply:</u>

- texture is very important for the availability of water
- problems for plant to get water: water has to go through cell membrane, water movement trough the texture
- water uptake w; water movement Sr; root surface A
- root water potential has to be lower than water potential of the soil

$w = A*((\Psi soil - \Psi root) / \Sigma r)$

14:00-15:00 Wanner

Soil biology – definitions and overview

Organismic components of the soil

Soil organisms as decomposers

importance of soil organisms:

- bio-indicators
- important for soil functioning
- informative for reconstruction of habitats

soil is important…

- habitat and basis for organisms (including man!)
- regulates water and nutrient cycle
- archive for natural and cultural history
- source of raw materials, mineral resources

soil animals: location

- mainly restricted to the upper soil layers containing organic matter
- „edaphon“: all soil inhabiting organisms
- epigeic/ epedaphic: organisms restricted to the soil surface
- anecic/ hemiedaphic: organisms moving between soil and soil surface
- endogeic/ euedaphic: organisms living in the soil

Microfauna: protozoa, nematodes

mesofauna: insects, mites

megafauna: mice, earthworms

soil nematoda: very resistant through their cuticle

earthworms: specialized on buffer/alkali soil on buffered (neutral pH) soil

-.functions of earthworms: turbation and aeration of soil

potworms: specialized on acid soil

15:00-16:00 Kask/Krasnov Seminar: „Predominant role of water in regulating soil and microbial respiration and their responses to climate change in a semiarid grassland“

definition: Soil respiration is an ecosystem process that releases carbon dioxide from soil via root

respiration, microbial decomposition of litter and soil organic matter, and fauna respiration.

sources of soil respiration: root respiration, decomposition of litter, microbial respiration in rhizosphere, oxidation of soil organic matter

importance of soil respiration:

- the second largest C exchange pathway between the atmosphere and terrestrial ecosystems
- sensitive to alterations of temperature and precipitation/water availability

temperature and precipitation:

- effect direct autotrophic and heterotrophic respiratory
- effect indirect the changing of soil temperature, soil water availability and supply of C substrate

conclusions:

- Increased precipitation stimulated soil respiration, microbial biomass and respiration
- Observations indicate that increased precipitation is relatively a much stronger driving factor than warming in arid and semiarid regions
- The temperate steppe in the arid and semiarid regions of northern China may act as a net C source under climate warming