Microbial Transformations of Carbon, Nitrogen and Phosphorus in the Substrate of Constructed Wetland

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Introduction:

Constructed wetlands (CWs) are most often used for treating municipal waste water, especially in small towns and villages. Subsurface horizontal flow CWs planted with emersed vegetation (e.g. common reed – Phragmites australis) is the most common type of CW used in the Czech Republic.
CWs use natural wetland processes, especially interactive ones among vegetation, soil and microbial communities. They are very effective for decreasing organic pollution, while the effectiveness of nitrogen and phosphorus reduction is more variable.

The aim:

- Estimate the role of aerobic and anaerobic transformations of C, N, and P in the reed bed

Study site:

CW in South Bohemia, for 150 PE (person equivalent).
Ostrolovský Újezd: in operation since 1997

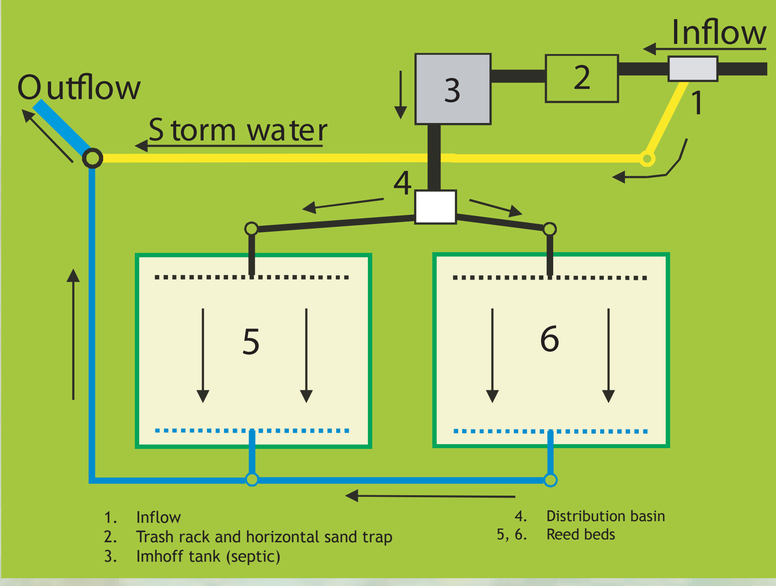
Sampling:

- Samples of substrate from both inflow and outflow zone
- 0—20cm rooting zone, 40—60cm gravel zone
- 7 day incubation under both aerobic and anaerobic conditions

All processes are expresses on the reed bed
- aerobic processes: 1cm surface layer and root surface
- anaerobic processes: gravel surface and pore water

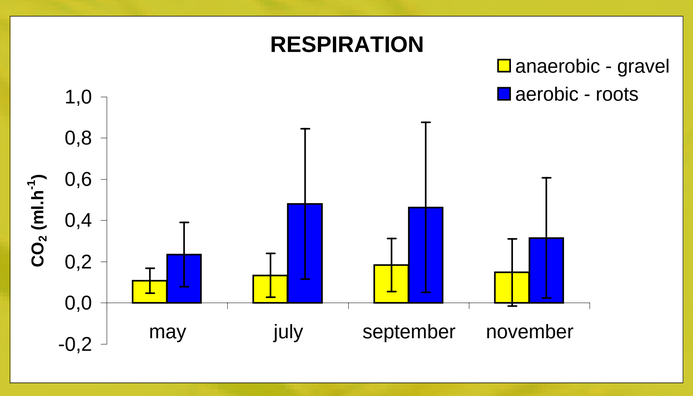
Inflow zone

Outflow zone

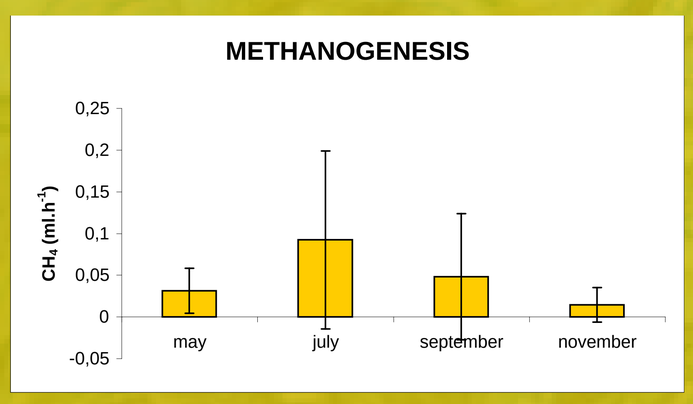


Gaseous products of microbial transformations:

C



Aerobic and anaerobic respiration
depends on DOC and SRP concentrations

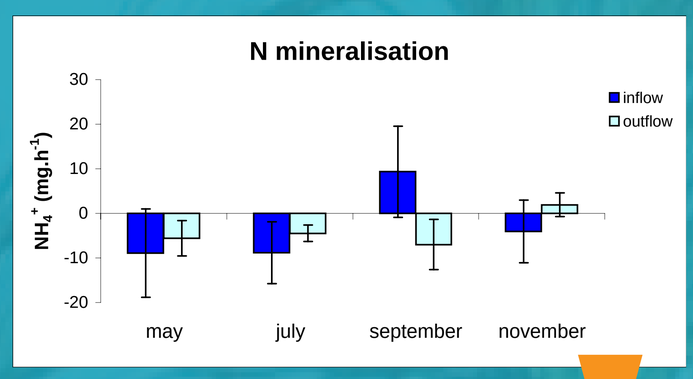


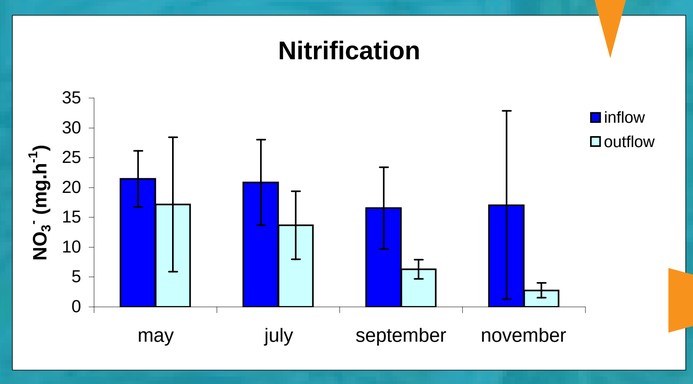
Methanogenesis depends on temperature and on DOC and SRP concentrations

Dissolved products of microbial transformations:

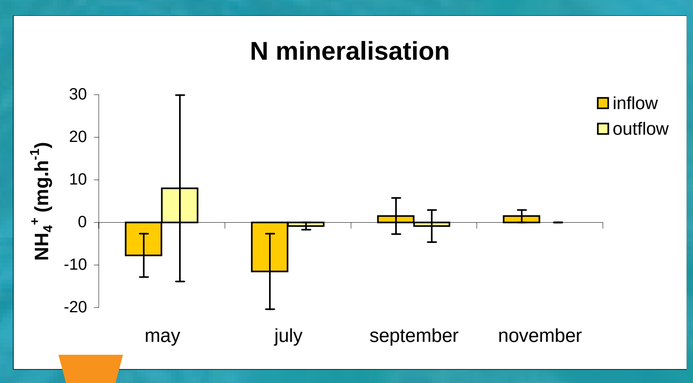
N

AEROBIC





ANAEROBIC

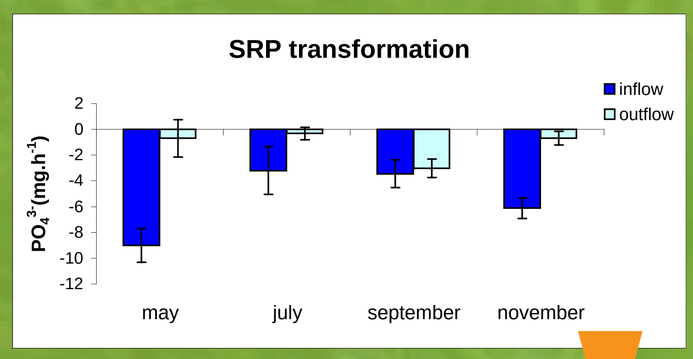


Mineralised N removal
No dependence found

Nitrification and N Mineralisation depend on NH_4^+ and SRP concentration
Mineralised N partly transformed in nitrification

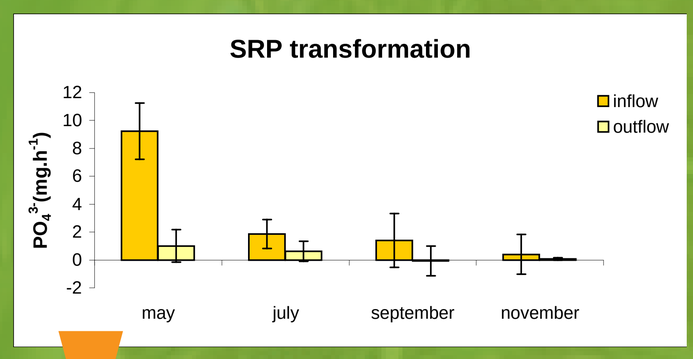
P

AEROBIC



Removal via chemical sorption
(max. -3,9 mg.h^{-1})
Possible removal via biological sorption
(max. -9 mg.hod^{-1})

ANAEROBIC



Releasing adsorped SRP

CONCLUSIONS:

- C, N and P:
  removal under aerobic conditions
  release under anaerobic conditions
- Aerobic processes: in the zone with roots
- Roots create aerobic conditions

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