Saline constructed wetlands may accommodate biodiversity demands under climate change in coastal areas

H.J. de Lange & M.P.C.P. Paulissen

Background

- Natural saline wetlands occur in settings ranging from coastal salt marshes to estuarine tidal marshes, shallow lagoons and mangrove swamps. Wetlands are nature's water purifiers: filtering water, regulating flow to allow sedimentation and removing nutrients and other pollutants.
- Constructed wetlands utilize the ecosystem service of wetlands as water purifier and are used worldwide to purify a wide range of waste water sources, from freshwater, brackish and saline sources.
- Natural or constructed wetlands can serve as a link between the large variety of needs and functions in an urbanized delta, such as nature, agriculture, recreation, water storage, and water purification.

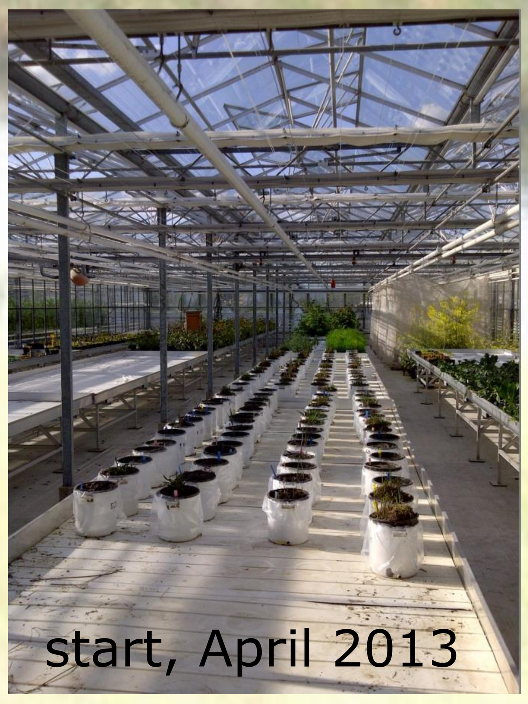
Objectives

- To compare the nutrient removal efficiency of three salt tolerant plant species in a greenhouse experiment.

- To investigate the potential of saline constructed wetlands in temperate deltas (such as the Netherlands), integrating biodiversity and nature functions with nutrient removal from point or diffuse sources.

Greenhouse experiment

We performed a greenhouse experiment, using three plant species, common in temperate coastal wetlands. During the experiment we followed nutrient removal from the water, after 9 weeks we measured nutrient uptake in shoot and root biomass. We used two salinity levels (low = 1/10 seawater; high = 1/3 seawater) and one nutrient level (15 mg N/L and 2.5 mg P/L).



start, April 2013

end, July 2013

Aster

Spartina

Bolboschoenus

Nutrient storage in plants

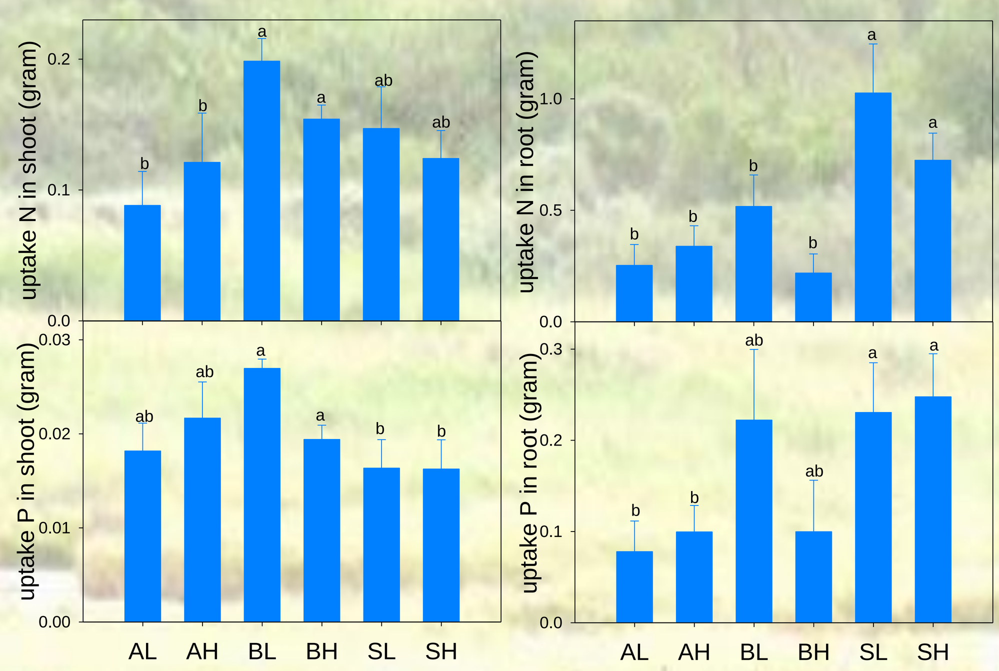


Figure 1. Uptake of N (upper panels) and P (lower panels) in aboveground plant biomass (left side panels) and belowground biomass (right side panels), average ± 1 SE (n=6). Letters indicate homogeneous groups (ANOVA followed by post-hoc LSD test). Treatments are abbreviated as follows: A = Aster, B = Bolboschoenus, S = Spartina; L = low salinity, H = high salinity.

Spartina and *Bolboschoenus* had the highest nutrient removal from the water, *Bolboschoenus* had the highest nutrient uptake. If a location is more saline, *Aster* is better suited, and for locations with large tidal influence, *Spartina* is the best choice.

Choosing the optimal species

LOW		HIGH
Aster	uptake nutrients from water	*Bolboschoenus* *Spartina*
Aster *Spartina*	nutrient storage in plant	*Bolboschoenus*
Aster	aboveground biomass production	*Bolboschoenus* *Spartina*
Bolboschoenus *Spartina*	salinity tolerance	*Aster*
Bolboschoenus *Aster*	hydraulic tolerance	*Spartina*

Implications for society

- The three species differ in nutrient removal from water, and in storage in shoots or roots.
- Depending on the local conditions (salinity and hydraulics), the optimal species can be chosen.
- Saline constructed wetlands can be well suited to remove nutrients from waste water coming from point sources and diffuse sources.
- Saline constructed wetlands can be incorporated in the transition zone from salt to freshwater, where a variety of functions can be integrated.
- Integrating functions can provide a significant contribution to a sustainable delta management.

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Alterra
P.O. Box 47, 6700 AA Wageningen
Contact: marieke.delange@wur.nl
T + 31 (0)317 48 57 84
www.wageningenUR.nl/Alterra