

Building with nature in wetlands: Plants accelerate soil forming processes of newly deposited fine sediments

Dekker, Stefan; Saaltink, Remon; de Boer, Hugo; Barciela Rial, Maria; van Kessel, Thijs; Griffioen, Jasper; Winterwerp, Han; Wassen, Martin

Publication date

2018

Document Version

Final published version

Citation (APA)

Dekker, S., Saaltink, R., de Boer, H., Barciela Rial, M., van Kessel, T., Griffioen, J., Winterwerp, H., & Wassen, M. (2018). *Building with nature in wetlands: Plants accelerate soil forming processes of newly deposited fine sediments*. Abstract from EGU General Assembly 2018, Vienna, Austria.

Important note

To cite this publication, please use the final published version (if applicable).
Please check the document version above.

Copyright

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

Takedown policy

Please contact us and provide details if you believe this document breaches copyrights.
We will remove access to the work immediately and investigate your claim.



Building with nature in wetlands: Plants accelerate soil forming processes of newly deposited fine sediments

Stefan Dekker (1,2), Remon Saaltink (1), Hugo de Boer (1), Maria Barciela Rial (3), Thijs van Kessel (4), Jasper Griffioen (5,1), Han Winterwerp (4), and Martin Wassen (1)

(1) Utrecht University, Environmental Sciences, Copernicus Institute of Sustainable Development, Utrecht, Netherlands (s.c.dekker@uu.nl), (2) Faculty of Management, Science and Technology, Open University, Heerlen, The Netherlands, (3) Environmental Fluid Mechanics, Delft University of Technology, Delft, The Netherlands., (4) Deltares, Delft, The Netherlands, (5) TNO Geological Survey of the Netherlands, Princetonlaan 6, The Netherlands.

The MarkerWadden building with nature project is a new dynamic and bio-diverse wetland system that will cover 10.000 ha. It is being developed with the deposition of fine sediments in the Markermeer lake (the Netherlands). Problematic is that the process of sediment consolidation and soil forming in the MarkerWadden wetland takes several years. Consolidation may be speed up by technological solutions such as horizontal drainage, however, these measures are invasive and often degrade the natural value of the system. Our current research therefore focusses on exploring alternative approaches that use natural processes, rather than technological solutions, to speed up the sediment consolidation process.

Plants are excellent examples of ecological engineers as they directly interact with the physical components in the sediment and contribute to the natural value of the system. In this research we therefore explored how plants and physical processes effect sediment consolidation and soil forming processes. Specifically, we aim to understand via which mechanisms the fast-growing perennial wetland species *Phragmites australis* expedite drainage in soft cohesive sediment, and to which extent this process promotes consolidation.

In a controlled climate room, we conducted column experiments with fixed water level. We measured the dynamics of pore pressures at 10 cm depth intervals during a 129-day period in a column with and without plants. Water loss via evaporation and transpiration was measured by water loss from Mariotte bottles and the photosynthetic processes were measured with a LICOR photosynthesis system.

Our results show that *Phragmites australis* effectively lowered pore pressure between 20-40 cm below the water table and dynamically influenced the pore pressure during day and night times. As a result of this plant activity, the sediments developed into more permeable soils, by increasing the hydraulic conductivity on average from $1.04\text{E-}9 \text{ m.s-}1$ ($\pm 7.49\text{E-}11$) in the unplanted column to $2.85 \text{E-}9 \text{ m.s-}1$ ($\pm 9.78\text{E-}11$). In the 129 day period, evapotranspiration increased to $7 \text{ mm.day-}1$ with a rooting depth to 85 cm.

These results provide crucial information needed for predictive modelling of plants as ecological engineers to speed up soil forming processes in the newly constructed wetlands in the Netherlands.