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Measures to reduce land subsidence and greenhouse gas emissions in peatlands: a Dutch case study

Tommy Wils[1,2], Jan van den Akker[2], Mandy Korff[1], Guido Bakema[2], Dries Hegger[3], Rudi Hessel[2], Mandy van den Ende[3], Martijn van Gils[4], and Daan Verstand[2]

[1]Delft University of Technology, Faculty of Civil Engineering and Geosciences, Geoscience & Engineering, Netherlands
[2]Wageningen Environmental Research, Wageningen University & Research, Droevendaalsesteeg 3, 6708 PB Wageningen, The Netherlands
[3]Copernicus Institute of Sustainable Development, Utrecht University, Princetonlaan 8a, 3584 CB Utrecht, The Netherlands
[4]School of Law, Utrecht University, Princetonlaan 8a, 3584 CB Utrecht, The Netherlands

Worldwide, peatlands suffer from land subsidence and greenhouse gas emissions due to artificial drainage inducing peat decomposition. Under anthropogenic climate change, these issues require measures to reduce the emission of greenhouse gases and protect low-lying areas from increasing flood risk. It is evident that tighter control of groundwater levels is required, both within existing agricultural systems and through the development of new agricultural systems suitable for farming under high groundwater levels or inundation. The complexity and value-laden nature of the issue warrants the development of a comprehensive overview of potential and side effects of measures. In this paper such an overview is synthesized based on a mixed-method approach for a special case, The Netherlands. The Dutch peatlands comprise extensive land areas in the low-lying west and north of The Netherlands. The case is exceptional as most of the these peatlands lie below sea level, sustain world-class intensive dairy farming and are subject to multiple other environmental, economic and societal challenges. Here, land subsidence increases flood risk, salt water intrusion and the costs of water management, particularly under global climate change. We review 27 technical measures and alternative land use options and synthesize evidence and insights for 15 effects. Technical measures allowing continuation of existing dairy farming provide relatively low-risk interventions, but will only reduce, not stop land subsidence and greenhouse gas emissions. Alternative land-use options, particularly paludiculture, are in a pioneering stage of development and can stop land subsidence. However, more research is required to reduce and control methane and nitrous oxide emissions during inundation required for crops such as (narrowleaf) cattail and azolla. Paludiculture can provide ecosystem services related to water management and nutrient status, as well as raw materials for a bio-based economy. Gradual transitions in space and time between farming and nature can be envisaged, providing incentives to diversify land use in the Dutch peatlands. This case study identifies key questions and provides valuable insights for peatland management worldwide. Reducing land subsidence and greenhouse gas emissions from peatlands is feasible, but requires thoughtful interventions that cautiously make and align trade-offs between various interests and uncertainties.