Abatement costs of climate friendly peatland management options: case study results for two German peatland regions

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Keywords*

Peatland management, Climate mitigation, Abatement costs, Linear programming farm model

Topics*

Environmental Sustainability and Economics of Climate Change, Farm Production and Supply Analysis, Agricultural and Rural Policy, Mathematical Programming Methods in Agricultural Economics

Problem Statement

Peatlands constitute the most efficient terrestrial ecosystem for carbon storage. Due to the wet conditions found in peatlands (precipitation and high ground or surface water tables), plant decomposition is slowed so that plant growth exceeds decay. As a consequence, peat accumulates and stores organic matter, meaning carbon. However, when peatlands are drained for agriculture, they change from a carbon sink to a greenhouse gas source, as the organic matter is decomposed. In Germany, peatlands drained for agriculture cause more than 40 Mio. T CO_2 equiv. per year. This accounts for about 7% of total emissions in Germany and 40% of emissions from agriculture.

Since peatlands have a high mitigation potential, they are becoming increasingly important for EU agricultural policy and Germany's national mitigation efforts. With the LULUCF Regulation (EU) 2018/841, all emissions and removals from land use, land use change and forestry, including cropland and grassland management on organic soils, have to be reported and accounted towards the mitigation target for the land use sector. The German Federal Government emphasizes in its Climate Protection Program 2030 that peat soil protection should be promoted more strongly. The aim of the Federal Government and the Federal States is to reduce emissions from drained peatlands by 5 Mio. T CO_2 equiv. per year until 2030.

Research Question(s) and Objectives

Our work investigates, which agricultural business models are possible when part of a farm's drained grassland is converted to more climate friendly extensive use with higher water levels (target level in summer of approximately 10-30 cm below ground) or when it is fully rewetted so that it cannot be used for conventional agriculture anymore. We calculate how this will change the farm's income situation and thus how high farmers' expectations for financial compensation will at least be, so that they voluntarily implement peatland protection measures.

Methods

We apply an adapted version of the farm management model Farm Boss. Farm Boss is a linear programming model based on an extensive database allowing a detailed coverage of technologies regarding costs, labor and products. The adapted version provides for a differentiation between mineral and organic soils and for different intensities of grassland use, for example with regard to fertilizer application and forage quantity and quality. With Farm Boss, we simulate not only the change in the contribution margin of areas that are in extensive wet use or fully rewetted, but also adaptation reactions throughout the whole farm such as intensification of grassland, different crop rotations or changes in livestock.

Data

We interviewed typical farmers in two German peatland regions with very different agricultural structures: firstly, the Rhinluch in Brandenburg (6 interviews) with mainly large (Ø 2000 ha) mixed farms; secondly, the Eider Treene Sorge area in Schleswig-Holstein (9 interviews) with smaller farms (Ø 150 ha) that are predominantly grassland based. In both regions, the farms represent a gradient of intensively, moderately and extensively used grassland. The interviews comprised mainly closed-ended questions to determine the type of farms (e.g. size, production target), the equipment (e.g. stables, labor) and agronomic indicators (e.g. milk yield, number of cuts, harvest yields).

In addition, we carried out grassland monitoring at various sites to estimate forage quality and quantity at different water levels and intensities of grassland use. Data on CO_2 emissions at different water levels we took from literature and German emission accounting.

Results and conclusion

Results show farm level effects of increasing wet use or full rewetting of peatland areas for three different farm types per region. This includes especially the associated loss of fodder quantity and quality and its consequences such as reduction in animal stock. In monetary terms, we calculated shadow prices of each additional ha of the farms' grassland that is in wet use or fully rewetted. Shadow prices reflect changes in revenues and variables costs. We differentiated between a short-term perspective when farmers operate with their current machinery and a long-term perspective, when machinery is depreciated and all machinery-related costs are variable. Results further include the corresponding greenhouse gas abatement costs (€/T CO_2 equiv.) reflecting assumptions on soil emission for different water levels and land use categories.

Finally, we conclude with the reasons for the wide range of shadow prices and abatement costs and cluster the farm types. In addition, we explain differences in the abatement costs of wet use and full rewetting.