Carbon Farming by Restoring Peatlands from the German Schleswig-Holstein's Agricultural Sector

Karl-Friedrich Boy, PhD[1,2], Luis M Peña-Lévano, PhD[1], Christian Henning, PhD[2]
*Presenting author: KBoy@ucdavis.edu

Abstract

This paper explores the potential for reducing CO_2 emissions in the German region of Schleswig-Holstein by restoring peatlands and setting-aside land. By implementing a carbon market with prices varying from $0 to $500 per ton CO_2 equivalent (tCO_2e). **While prices of $150-200/tCO$_2$e show an increase in set-aside areas by 20–50%, higher prices are necessary to reach the ambitious EU climate target.**

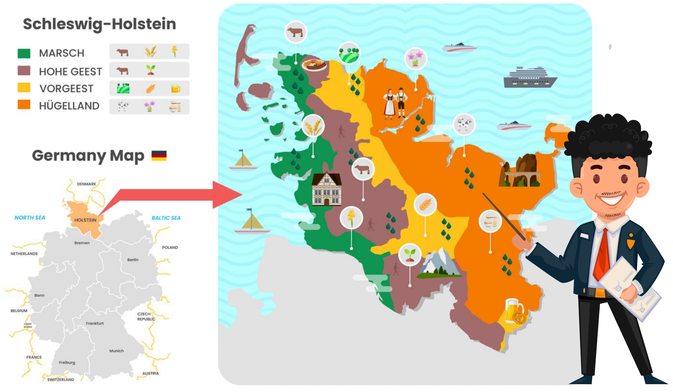
Why peatlands?

- Peatlands are wetlands that accumulate decomposed organic matter and capture atmospheric CO_2.
- Thus, peatlands are major carbon sinks that store more than half of the global carbon despite covering only 3% of the global land area.
- Historically, German agriculture has drained peatlands to expand its farmable area, releasing CO_2 stored in this land, making this action one of the largest contributors of GHG emissions.
- For this reason, the **German National Peatland Protection Strategy**[1] was enacted, aiming to protect 5,000 hectares annually by 2030

Research Objectives

Major Goal:
Understand under what conditions German farmers are willing to restore peatland by implementing a CO_2 trading market.

Area of study: Schleswig-Holstein (Northern Germany)



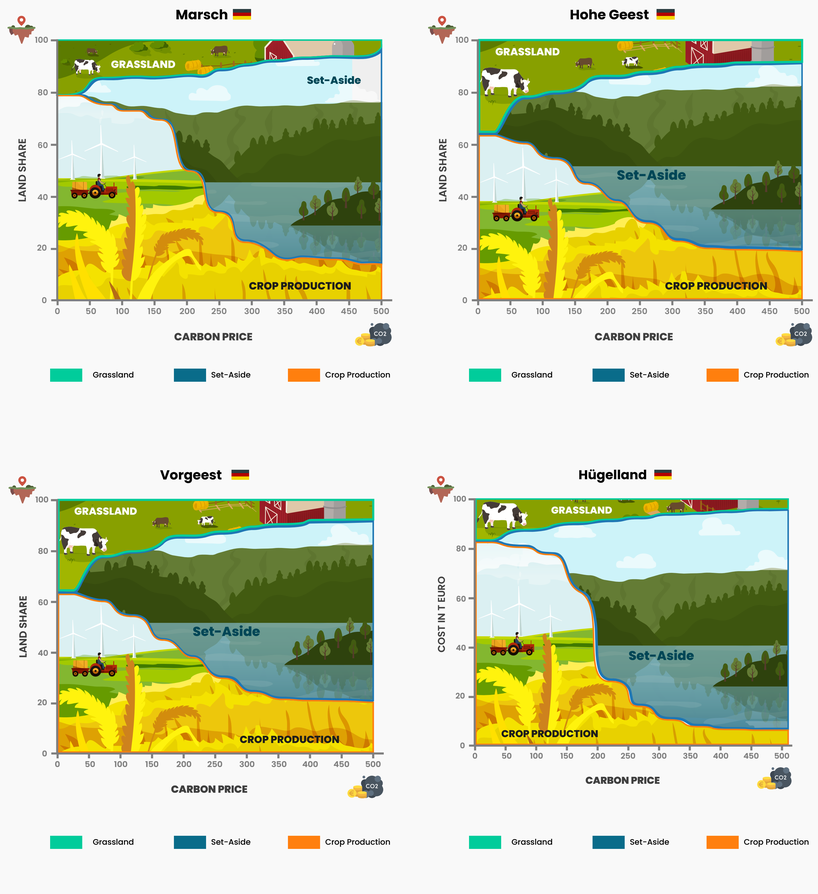
Approach

- **Market Simulation:** Carbon prices range from **$0 to $500** per tCO_2
- **Framework:** Linear Programming (LP) model, maximizing profits with respectto factor endowments[2], **4 regions** with major differences in productivity. Additional revenue is generated when activities reduce carbon emissions (negative CO_2 term), enabling farmers to earn from carbon credit payments in addition to commodity sales.

$$R_Q = P \times Q + P_{CO_2} \times CO_2$$

R_Q: Revenue of the activity, P: Price of the commodity, Q: Production of the activity, P_{CO_2}: Price of tCO_2, CO_2 : Emissions in tCO_2

- **Data:** 15,000 farms in Schleswig-Holstein aggregated into 416 representative farms for the LP model.



Abstract

- **Regional Productivity Differences:**
The Marsch and Hügelland regions have high crop productivity due to superior soil quality. This productivity makes them slower to adopt set-aside land use at low carbon prices.
- **Adoption Patterns:**
High-productivity regions require higher CO2 prices to justify switching to set-aside land. **$150–200/tCO$_2$e** range triggers the largest land-use change, as carbon credit revenues become competitive with crop production profits.
- **Emission Reductions:**
At $150–200/$tCO_2$e: Total CO_2 savings: **2,615 – 3,233 tCO$_2$e.** Higher carbon prices further increase savings, but with diminishing marginal effects on set-aside adoption in the most

Conclusion

Peatland restoration is a viable solution to reduce emissions in Northern Germany. The price range of $150-200/$tCO_2$e is consistent with values discussed in the Paris Agreement.

However, further research is necessary to evaluate the impact on food security in the region.

References

[1] Nordbeck, R., & Hogl, K. (2023). National peatland strategies in Europe: Current status, key themes, and challenges. Regional Environmental Change, 24(1), 5. https://doi.org/10.1007/s10113-023-02166-4

[2] Henningsen, A., Henning, C., Struve, C., & Mueller-Scheessel, J. (Eds.). (2005). Economic Impact of the Mid-Term Review on Agricultural Production, Farm Income and Farm Survival: A Quantitative Analysis for Local Sub-Regions ofSchleswig-Holstein in Germany. https://doi.org/10.22004/ag.econ.234609

Acknowledgement: Financial Support was provided by the Agricultural Economics Society (AES) to participate at the 2025 EAAE Conference in Bonn, Germany. Authors are grateful for this support.

[1]*School of Veterinary Medicine, University of California, Davis, CA 95616, United States*
[2]*CAU University Kiel*