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Economics of paludiculture

Sphagnum farming, reed harvesting and cattail cultivation



Photo: S. Wichmann



Sabine Wichmann

Photo: S. Wichmann



Photo: S. Wichmann

Paludiculture (*palus*: swamp)

rewetting degraded peatlands

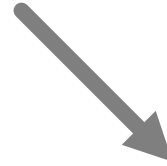
+ provision of external benefits

→ effects on society level!

+ use of biomass

→ profitable at farm level?

Paludiculture



Bogs

- Peatmoss
 - Sundew
- Sphagnum farming

Fens

- Reed
- Cattail
- Sedges
- Reed canary grass
- Alder

Sphagnum biomass: high-quality growing media constituent



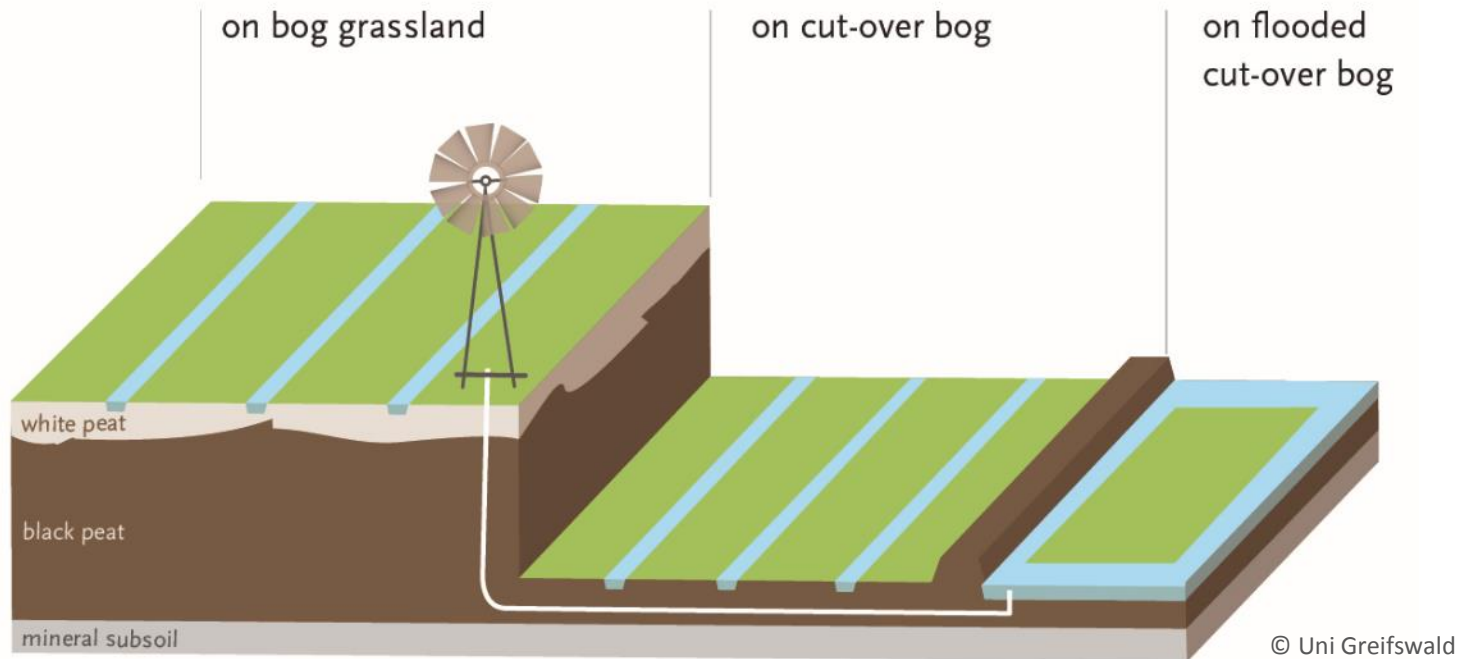
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Photos: University of Greifswald

Sphagnum farming on degraded bogs

- Most important: keeping water table high without flooding
- Comparing establishment costs for three different site types



Sphagnum farming on former bog grassland

Initial state → site preparation + seeding



Sphagnum farming on former bog grassland

Initial state → site preparation + seeding → established culture



Sphagnum farming on cut-over bog

Initial state → site preparation + seeding



Photo: S. Wichmann

Differences in establishment:

- site preparation → less effort
- water management: no power supply
→ wind pump

Sphagnum farming on cut-over bog

Initial state → site preparation + seeding → established culture



Sphagnum farming on flooded cut-over bog

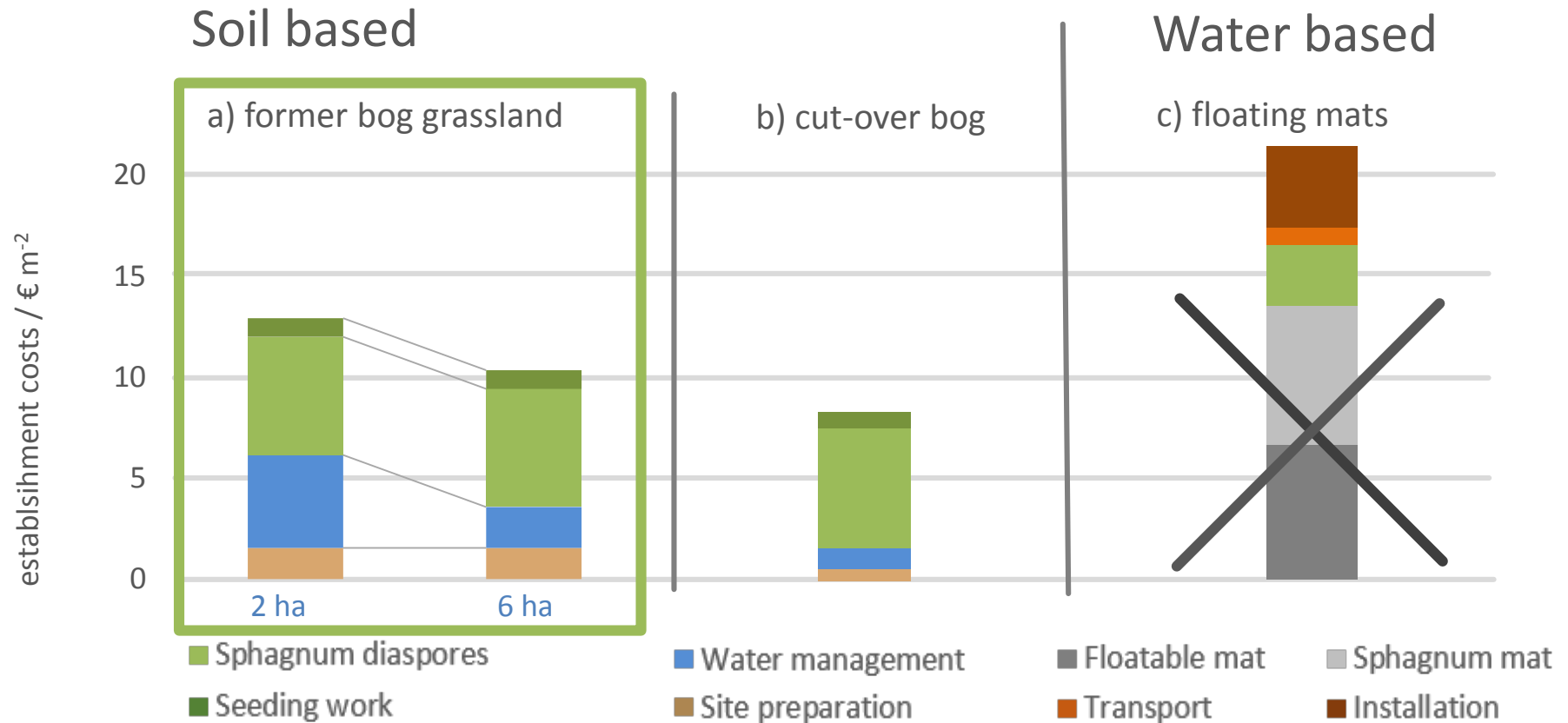
→ Floating mats

- a) Production of mats
- b) Pre-cultivation of Sphagnum mats
- c) Installation on artificial water bodies



Establishment costs

Wichmann et al. 2017, Mires & Peat



- Establishment costs: highest for water based Sphagnum farming
- **Diaspores = bottleneck:** highest costs and availability
- **Water management:** wide range of investment costs (automatic control vs. wind pump)
proportionate costs depend on size of irrigation area
- Highest area potential in Germany: bog grassland (92,000 ha)

Management costs

Weed mowing on Sphagnum cultivation strips

Cleaning of ditches

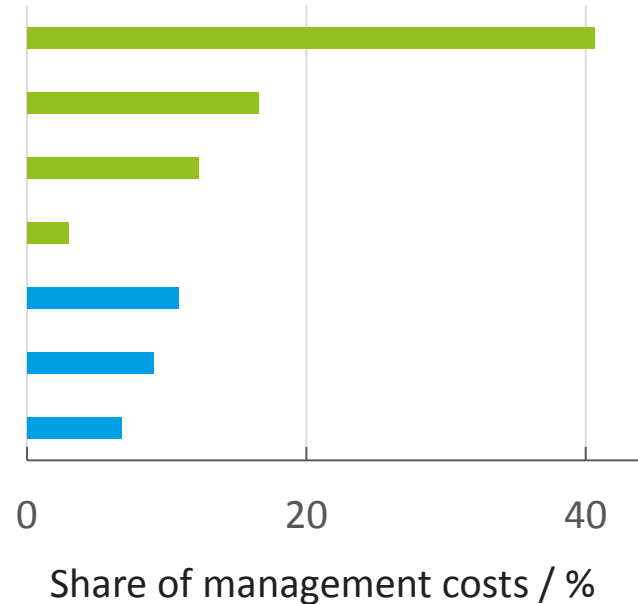
Mulching of causeways

Access road (repair work)

Regular on-site control

Power & phone/internet

Automatic water management (repair work)



Site
maintenance

Water
management

Wichmann et al., in prep.



2016: First large-scale harvest of cultivated *Sphagnum*

→ real-life costs + biomass yields + regeneration potential



Costs of Sphagnum farming on former bog grassland



- Experience and data of first rotation = 5 years
→ Upscaling to 20 years with 4 harvests
- Dynamic investment appraisal ($i=3\%$)

→ Present value of management costs > establishment costs

Profitability of Sphagnum farming on former bog grassland



Alternative to peat

- Competitive in quality
- Not profitable due to low prices for peat
- Higher willingness to pay for sustainable substrate?

Orchid cultivation

- Regional production instead of collection in wild populations
- Profitable with medium to high yields

Diaspores

- Sphagnum farming or restoration
- Profitable even with low yields

→ High potential to cut costs and reduce break-even price

Harvesting reed: Energetic and material use

A photograph of a lush green reed field under a blue sky with scattered clouds. In the background, a line of trees and industrial structures, including a tall chimney, are visible.

Summer harvest

- biogas

A photograph of a harvested reed field in winter. The reeds are dry and brown, and a muddy path with tire tracks leads through the field towards a body of water in the distance under a clear blue sky.

Winter harvest

- combustion
- thatching

Special-purpose tracked machinery

Wichmann (2017), Ecol.Eng.

Biogas: chaff



Combustion: bales



Thatching: bundles

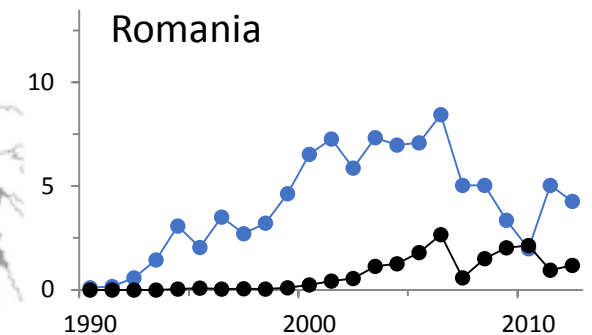
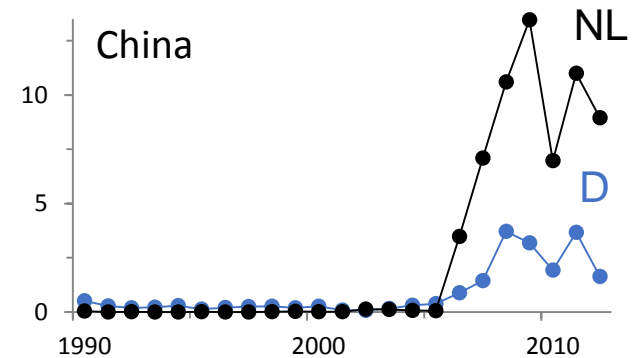
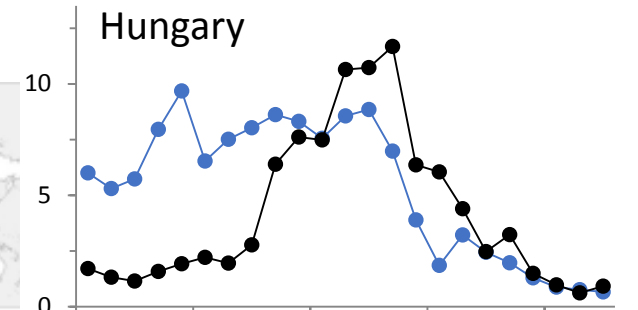


Reed market in Europe (1990–2012)

Wichmann & Köbbing 2015,
Ind. Crops and Products

Demand: ca. 15 Mio bundles / year

NL, D, UK, DK → **import rate: 75-85%**



Cost calculation → bundles for thatching

- yield: 500 bundles /ha → 300 – 1000 bundles
- revenues: 2.00 € /bundle → 1.90 – 2.50 € (3.50 €)



Deterministic Calculation

→ Point values

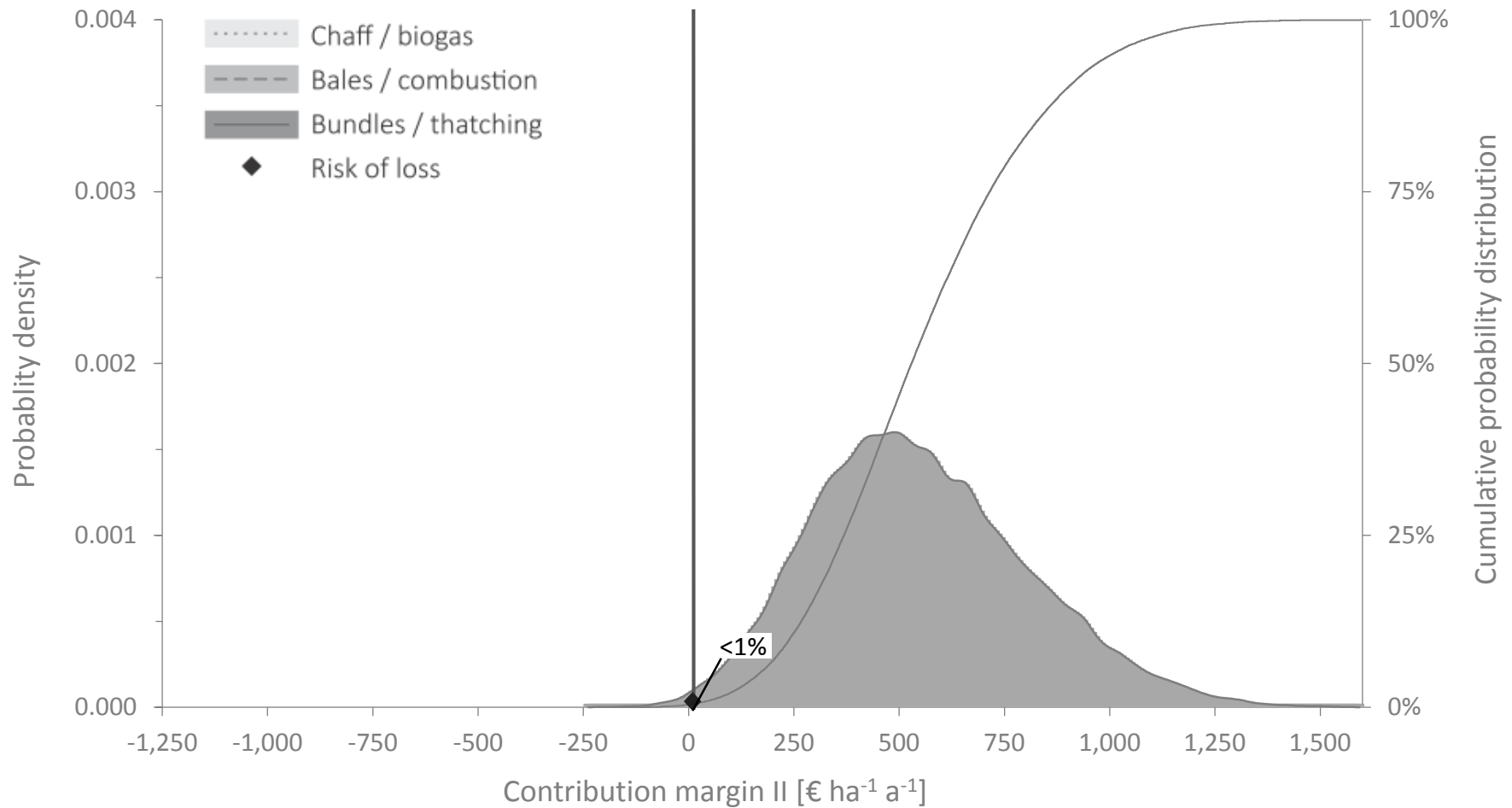
Revenues from the sale of biomass	€ ha ⁻¹	1000
variable machinery costs	€ ha ⁻¹	- 112
labour costs	€ ha ⁻¹	- 280
Contribution margin I	€ ha⁻¹	608
fixed machinery costs	€ ha ⁻¹	- 125
Contribution margin II	€ ha⁻¹	483

Stochastic simulation

→ ranges

Contribution margin II € ha⁻¹ -162 – 1542

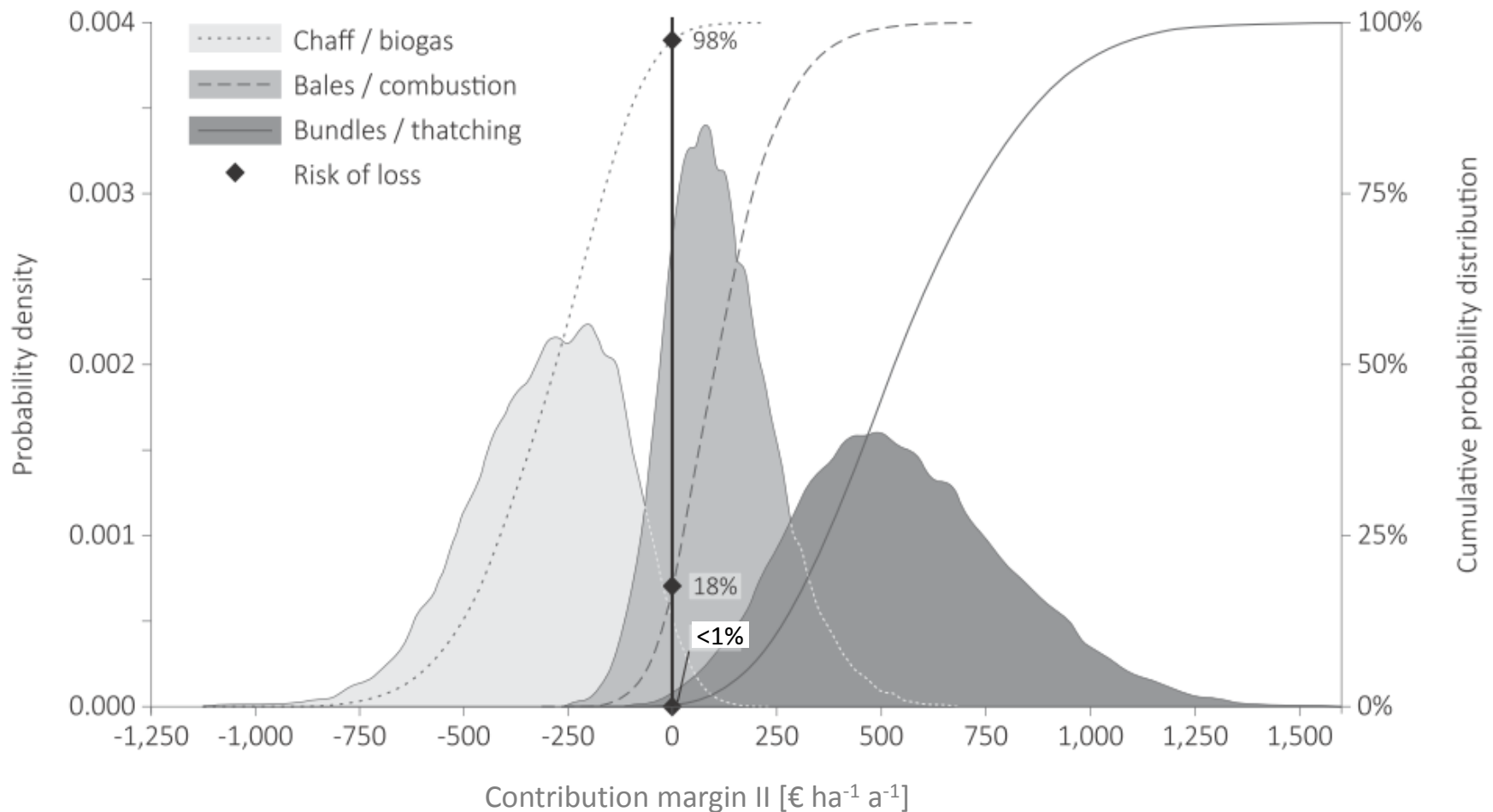
Stochastic simulation: ranges, distribution, 10,000 iterations



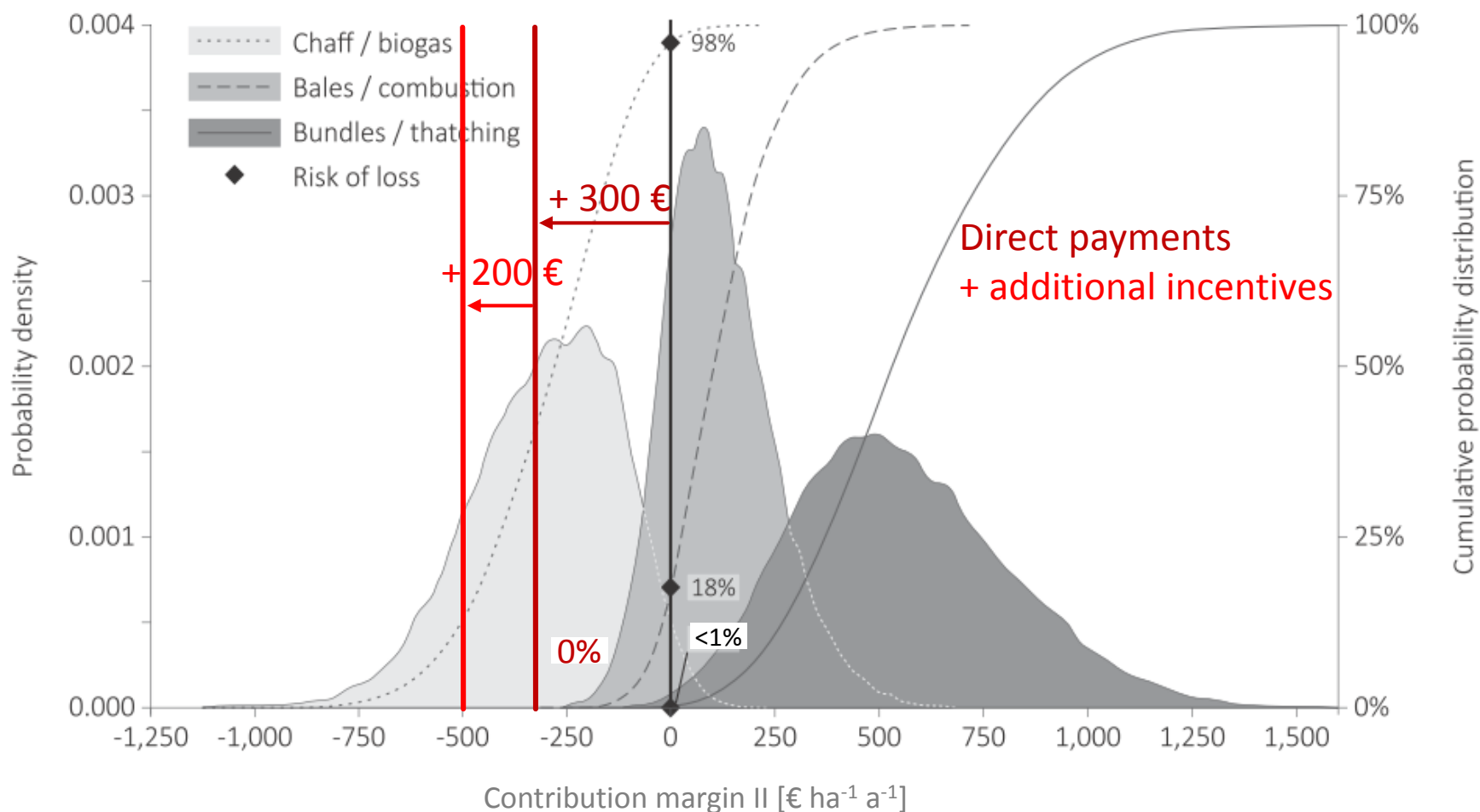
Comparing profitability

Wichmann (2017), Ecol. Eng.

Stochastic simulation: ranges, distribution, 10,000 iterations



Stochastic simulation: ranges, distribution, 10,000 iterations



➔ Increase economic viability and competitiveness of plaudiculture

Typha establishment on fen grassland



No costs:

- 5 ha, site in NE Germany
- Neighbouring plot rewetted for restoration
- Typha established by succession
- € 0 ha⁻¹

Medium to high costs:

- 0.5 ha pilot trial in NL
- Excavating basin or constructing dams, investment in pump
- planting seedlings
- Ca. € 5000 ha⁻¹ – € 20,000 ha⁻¹

Typha as insulation material

- Winter harvest: bundles
 - Drying + chopping
 - Machine processed cavity insulation → Excursion 2
 - Alternative: panels → 2c Robert Schwemmer, Martin Krus
- marketable products + high demand



S. Wichmann

b) Typha as fodder for dairy cows

- Summer harvest: chaff
- fresh biomass or ensilaged
- Yields + nutritional values → 2c Jeroen Pijlman

→ enables transition from drainage-based to wet peatland use



Photo: Tobias Dahms



Summary

Sphagnum farming on bog sites

- Costs: diaspores, investment in irrigation, site maintenance
- High potential of cutting costs → break-even price ↓
- Current profitability: replacing peat - | orchids (+) | diaspores ++

Reed and cattail on fen sites

- Machinery for harvesting and processing available, but improvable
- Profitability of harvesting reed: thatching > combustion > biogas
- Cattail cultivation: starting conditions influence costs + utilisation options

Adaptation of policy and legal framework

- Paludiculture allows balanced provision of ecosystem services
- Incentives can support acceptance + economic viability, e.g. long-term remuneration of external benefits

Don't miss the Poster Session



This research is part of the project "CHAMPREDIA - Comparative analysis, integration and exemplary implementation of diverse peatland use practices in agricultural regions with progressing land-use change after cessation of agricultural peatland reclamation". Further information: www.champredia.eu, info@champredia.eu

Introduction

Peatlands are marginal lands, their utilization has been highly influenced by economic incentives. For achieving a shift from drainage-based to wet agriculture, the development of incentives that account for social and environmental costs and benefits has been identified as a major action.

Our review examines measures and instruments that already exist in the European Union (EU) and that encourage peatland restoration measures (RE) as carbon storage, regulation of water quantity and quality, habitat of specialized species or cultural values.

Next to the EU in focus, incentives can differ according to the financing (Fin), the duration (small vs. long-term payment), orientation on actions or results and the point addressed along the production chain (Chain), there are present national examples existing in the four project countries (Proj) which may be used to support the implementation of peatland uses.

Key Types of economic incentives & financing

- Government financial instruments, e.g. agri-environment and climate measures (current pillar of EU CAP) or national payment schemes for conservation management.
- Compulsory measures: compensating flooding or mining activities, enterprise financial (positively affecting).
- Taxes, levies, charges.
- Instruments such as voluntary markets for CO₂ allowing to private sector or private persons investments.

The Netherlands

Naturally open areas (Natura & Landschap) (NLA)

The eligibility of an area for subsidies is determined by potential value, management (area) index of current status and condition. These components are distinguished: natural areas, agricultural, nature type, landscape elements.

Natural areas

- Government financial actions, only national money.
- Including or management types, e.g. additional harvest of blocking land, < 1000 ha².

Agricultural Nature & Landscape Management (ANL)

- Government financial national + EU money (NLA).
- Payment compensation is compulsory (since 2015), agri-environment applies for subsidies for their area, individual requests are not eligible, are effective and efficient.
- Management for species of international importance (bird and habitat diversity) + water quality, meeting, inventory.
- Examples: granted for *recreation* (NLA) per ha: € 0.04 - € 0.08; € 0.05; € 0.06; € 0.07; € 0.08; € 0.09; € 0.10; € 0.11; € 0.12; € 0.13; € 0.14; € 0.15; € 0.16; € 0.17; € 0.18; € 0.19; € 0.20; € 0.21; € 0.22; € 0.23; € 0.24; € 0.25; € 0.26; € 0.27; € 0.28; € 0.29; € 0.30; € 0.31; € 0.32; € 0.33; € 0.34; € 0.35; € 0.36; € 0.37; € 0.38; € 0.39; € 0.40; € 0.41; € 0.42; € 0.43; € 0.44; € 0.45; € 0.46; € 0.47; € 0.48; € 0.49; € 0.50; € 0.51; € 0.52; € 0.53; € 0.54; € 0.55; € 0.56; € 0.57; € 0.58; € 0.59; € 0.60; € 0.61; € 0.62; € 0.63; € 0.64; € 0.65; € 0.66; € 0.67; € 0.68; € 0.69; € 0.70; € 0.71; € 0.72; € 0.73; € 0.74; € 0.75; € 0.76; € 0.77; € 0.78; € 0.79; € 0.80; € 0.81; € 0.82; € 0.83; € 0.84; € 0.85; € 0.86; € 0.87; € 0.88; € 0.89; € 0.90; € 0.91; € 0.92; € 0.93; € 0.94; € 0.95; € 0.96; € 0.97; € 0.98; € 0.99; € 1.00; € 1.01; € 1.02; € 1.03; € 1.04; € 1.05; € 1.06; € 1.07; € 1.08; € 1.09; € 1.10; € 1.11; € 1.12; € 1.13; € 1.14; € 1.15; € 1.16; € 1.17; € 1.18; € 1.19; € 1.20; € 1.21; 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Any questions?



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