Harvesting wetland biomass:
specifying costs and benefits on company level

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Why to use wetland biomass?

Paludiculture
i.e. peat preserving agriculture on wet / rewetted peatlands
to open up new renewable resources (energy + material use)
→ Profitability on company level?

Management of natural / constructed wetlands
- nutrient removal
- restricting expanding reeds
- combating invasive species
- improving habitat conditions for target species
→ Ameliorating cost benefit ratio of measurement?
Suitability of machinery

1) Adapted grassland machinery
   - Dependence on strong frost

2) Small + light machinery
   - Just mowing, without removal

3) Seiga: balloon tyres

4) Tracked vehicles
   - Currently most promising

Economic feasibility?

- Wetland adapted machinery -> mostly prototypes
- Acreage performance -> ground conditions + biomass amount
- Efficiency of logistic chains -> to be optimised
- Reasonable processing avenues -> only partly existing markets

- Lack of reliable data
- Little large scale + long term experience
- Dependence on best guestimates + model calculations
Accuracy versus precision

- precise figures are demanded
- at our state of knowledge they get easily wrong
- aiming at accuracy in a first step

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<thead>
<tr>
<th>Imprecise</th>
<th>Precise</th>
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<td>Inaccurate</td>
<td>Accurate</td>
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“It is better to be vaguely right than exactly wrong.”
Carveth Read (1848–1931)

Method: Monte Carlo simulation

→ accounting for uncertainty
→ reflecting existing range of input data

**Fixed data**
- e.g. costs for labour (12€/h) and fuel (1,15€/l)

**Variables**
- e.g. yield/ha, revenues, costs for machinery
- probability: triangular or uniform distribution
- maximum, minimum, (modus)

**Correlations**
- e.g. yield/ha and harvesting costs/ha
- positive or negative factor

**Simulation**
- combinations of different variable values
- 10,000 iterations
Calculations for three harvesting regimes

- Vegetation: reed (*Phragmites australis*) dominated stands
- Machinery: tracked vehicles large scale harvest
- Equipment: adapted to respective biomass utilisation

1) Summer harvest → chaff for biogas
2) Winter harvest → bales for combustion
3) Winter harvest → bundles for thatching

Data:
- own field tests in VIP-Project
- interviews with practitioners
- literature research

1) Summer harvest → biogas

1. Mowing -> swath
2. Chopping + transport

**Advantage**
- long harvesting season
- combinable with nature conservation aims

**Disadvantage**
- limited suitability for biogas
- little revenues
1) Summer harvest → chaff for biogas

Probability:
- density
- cumulative

Preliminary results

Loss / Profit [€ per ha* a]

Specifying costs and benefits on company level

Without and with agricultural subsidies

Preliminary results

Loss / Profit [€ per ha* a]
2) Winter harvest → bales for combustion

1. Mowing + baling

2. transport

**Advantage**
- harvesting dry material
- suitability for combustion: comparable with straw

**Disadvantage**
- limited harvesting days
- machinery development still in progress

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Preliminary results

Loss / Profit [€ per ha* a]
3) Winter harvest → bundles for thatching

1. Mowing + cleaning + bundling

Advantage
- high quality product
- established machinery and logistic chain

2. Transport of big bundles

Disadvantage
- limited harvesting days
- legal limits (nature conservation)

Preliminary results

![Graph showing profit distribution](image-url)
Conclusions

• economic feasibility:
  chaff/biogas < bales/combustion < bundles/thatching
  \( \rightarrow \) probability not to cover harvesting costs: 71%, 33%, 0%

• long term and large scale experience is lacking for summer & winter harvesting of energy biomass

• Precision: smaller output range for specific situations feasible (e.g. investments for machinery, size of harvesting site)

• Large influence of agricultural and legal framework