Economy of short-rotation production of downy birch on former peat production areas

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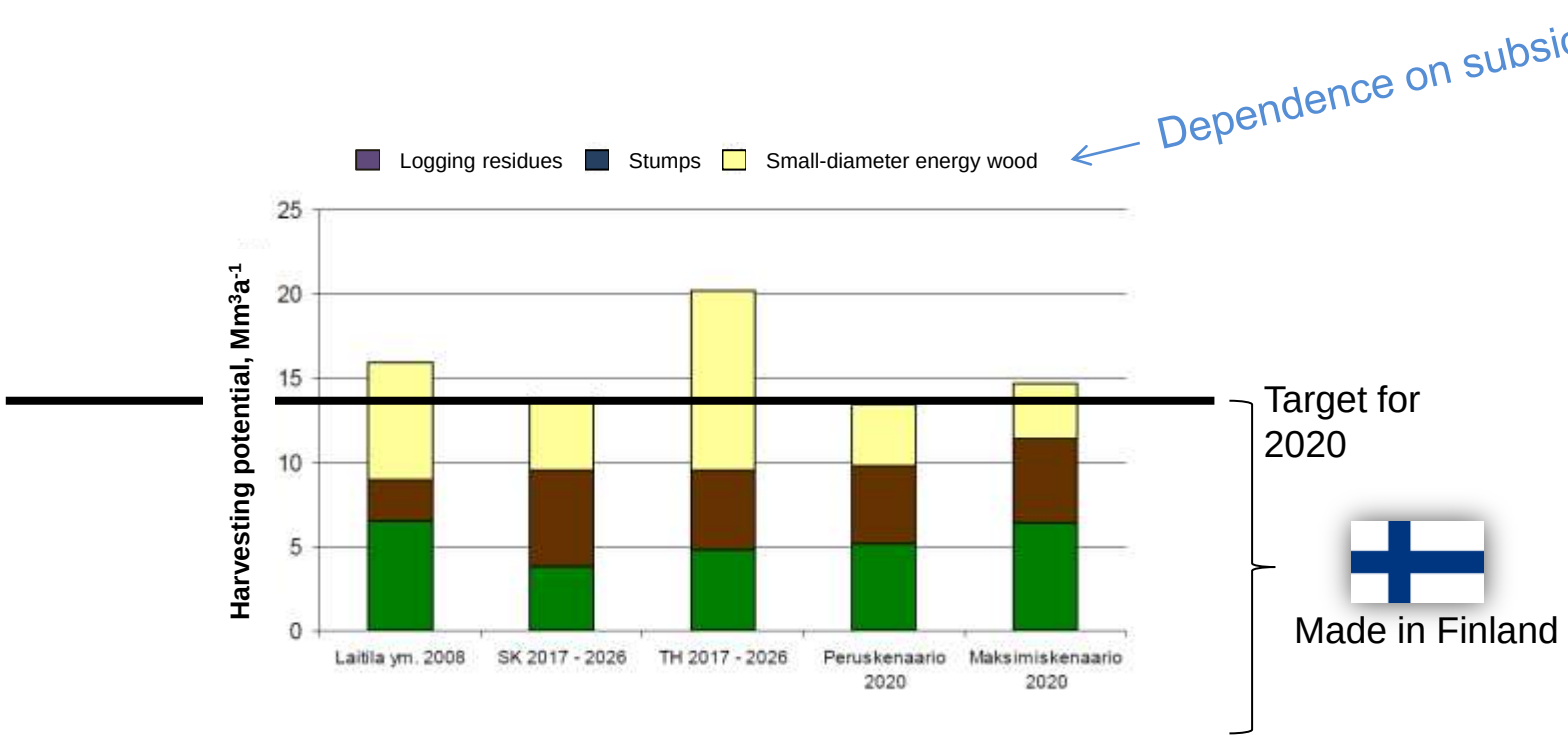
I Background

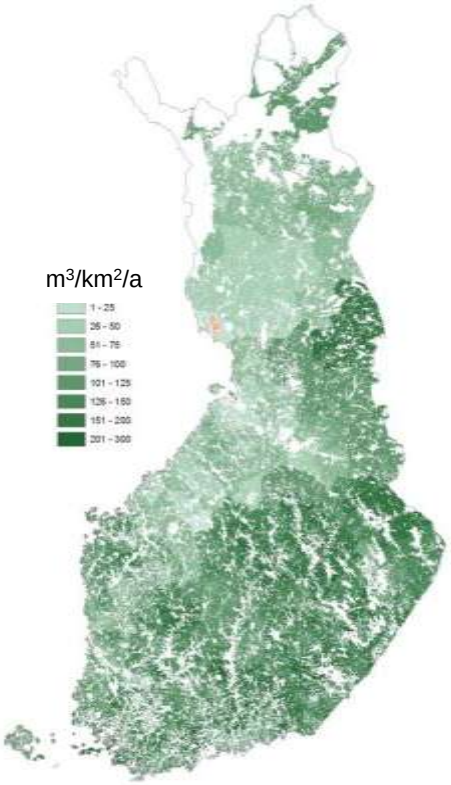


Anttila et al. (2014)

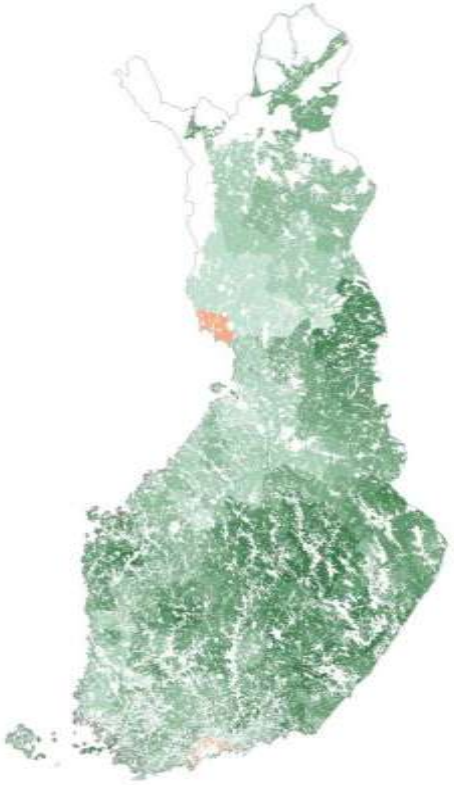
Utilisation of marginal lands?

Forest chip potential

2012

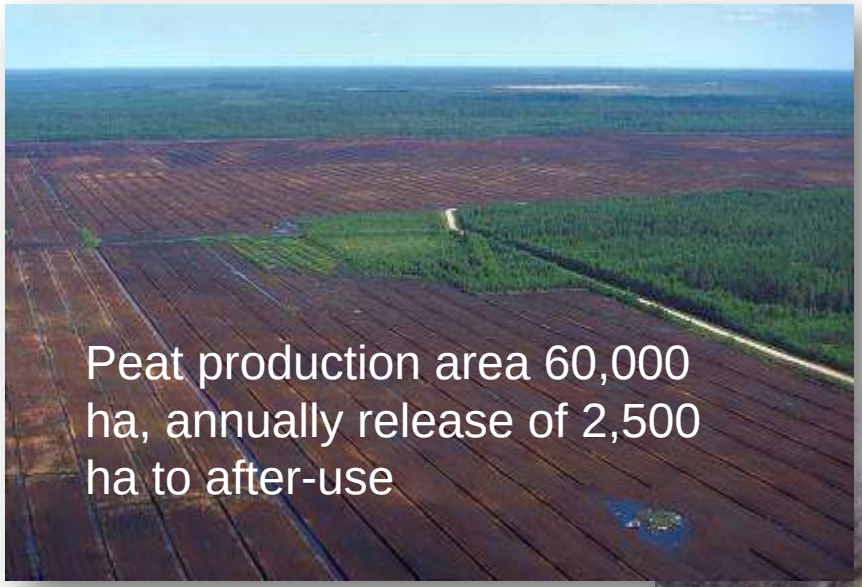


2020



(Anttila et al. 2014)

After-use of cutaway peat bogs



3 years after establishment

Untreated

Ash fertilisation and broadcast seeding

Annual biomass production of downy birch (*Betula pubescens*) in naturally afforested peat production areas 3–4 ODt ha^{-1}

Regeneration by sprouting

II Material and methods

$$BLV = \left[R_S b^S - \sum_{s=0}^{S} c_s b^s \right] + \left[R_K b^K - \sum_{k=0}^{K} c_k b^{(k+S)} \right] + \left[R_L b^L - \sum_{l=0}^{L} c_l b^{(l+K+S)} \right] + F$$

Bare land value (BLV) as a criterion for profitability

- The present value of all future costs and revenues of a productive asset
- Gives an estimate of the value of the land
- A tool for identifying optimal management regimes
  - Decision about rotation length
  - Establishment input
  - Stand management
- A modified Faustmann rotation model was used
  - Chang, C.J.2014. Forest valuation under the generalized Faustmann formula. Can. J. For. Res. 44(1):56-63

Stand management assumptions

- Calculations for six case stands located on a cutaway peat bog in Northern Finland
  - 15–26-year old when inventoried
  - naturally afforested
- Stand establishment
  - Ash fertilisation or mounding (equal cost)
  - Natural or broadcast seeding

- Clear-cut of the first generation at the age of 15–26 years
- Coppice regeneration twice, soil preparation and broadcast seeding from 4th rotation onwards
- Equal biomass production in all rotations, coppicing and broadcast seeding shorten rotations by one year

Production of forest chips

- Whole-tree cutting with a new medium-sized harvester equipped with a biomass felling head
  - Productivity based on the the model of Fernandez-Lacruz ym. (2013), extrapolation!
  - Hourly cost parameters from industrial wood harvesting
- Forwarding with a new medium-sized forwarder equipped with a grapple saw
  - Productivity through a modified model of Kärhä et al. (2006) for thinnings
  - Hourly cost parameters from industrial wood harvesting
- Roadside chipping
- Chip transportation to the end-use facility, distance 60 km
- Overheads from the Finnish Forerst Industry
- Sales price of forest chips 21 € MWh^{-1} (moisture content 40%)
- **No subsidies!**

Costs and revenue

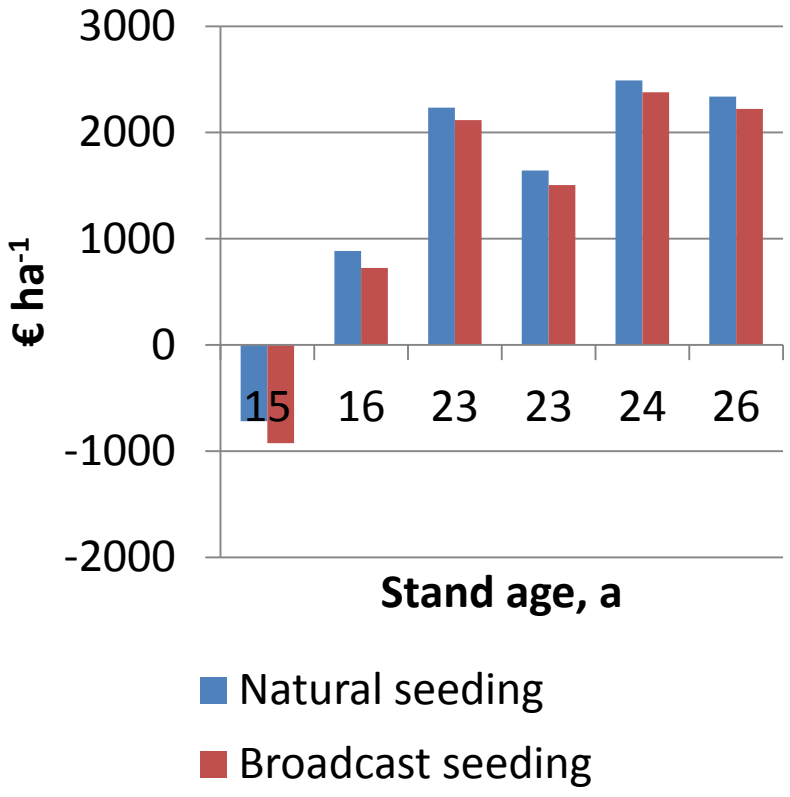
	€ ha^{-1}					
	Stand 1 15 years	Stand 2 16 years	Stand 3 23 years	Stand 4 23 years	Stand 5 24 years	Stand 6 26 years
Costs						
Ash fertilisation	310	310	310	310	310	310
Mounding	310	310	310	310	310	310
Broadcast seeding	195	195	195	195	195	195
Cutting	2 277	2 006	1 411	1 498	1 546	1 453
Forwarding	760	665	753	740	826	845
Chipping	422	490	648	627	725	738
Chip transportation	678	787	1 040	1 007	1 164	1 185
Overheads	252	293	387	375	433	441
Revenues						
Sales of forest chips	4 377	5 164	6 867	6 294	7 734	7 864

12.4–21.0 € MWh^{-1}

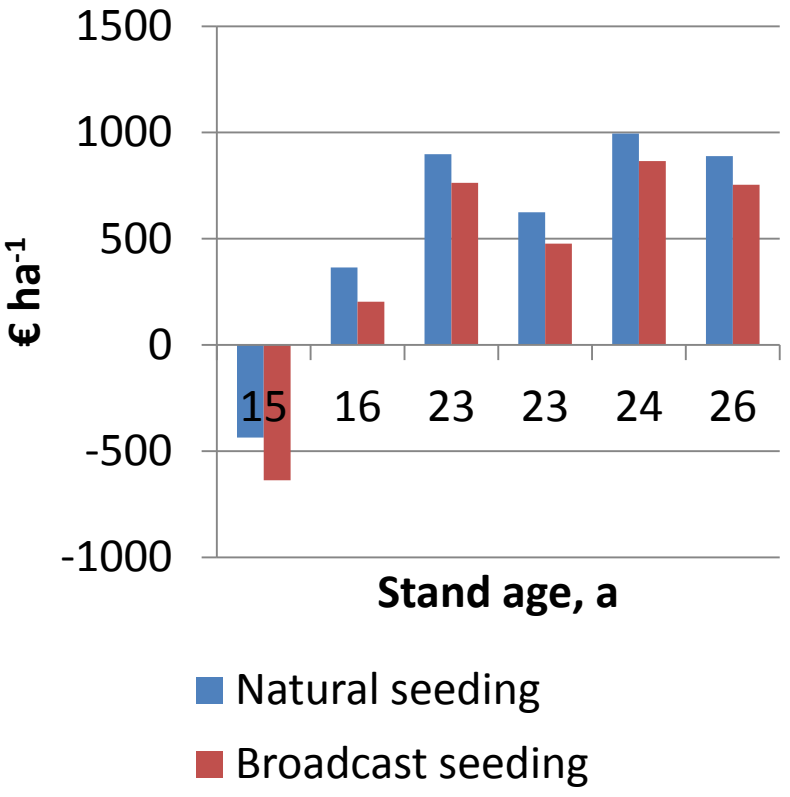
III Results

Bare land value

Interest rate 3 %

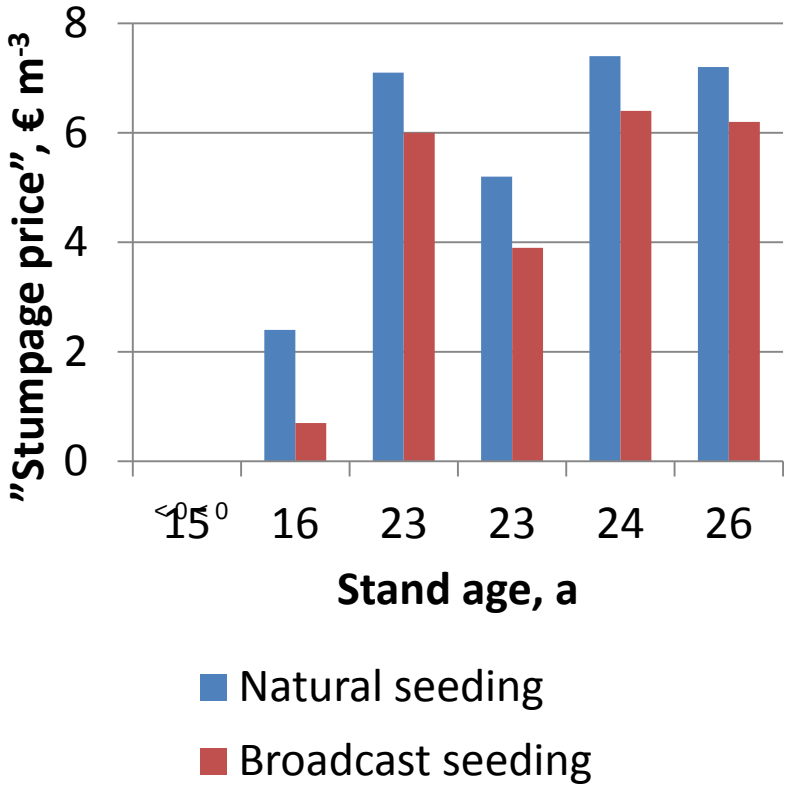


Interest rate 5 %

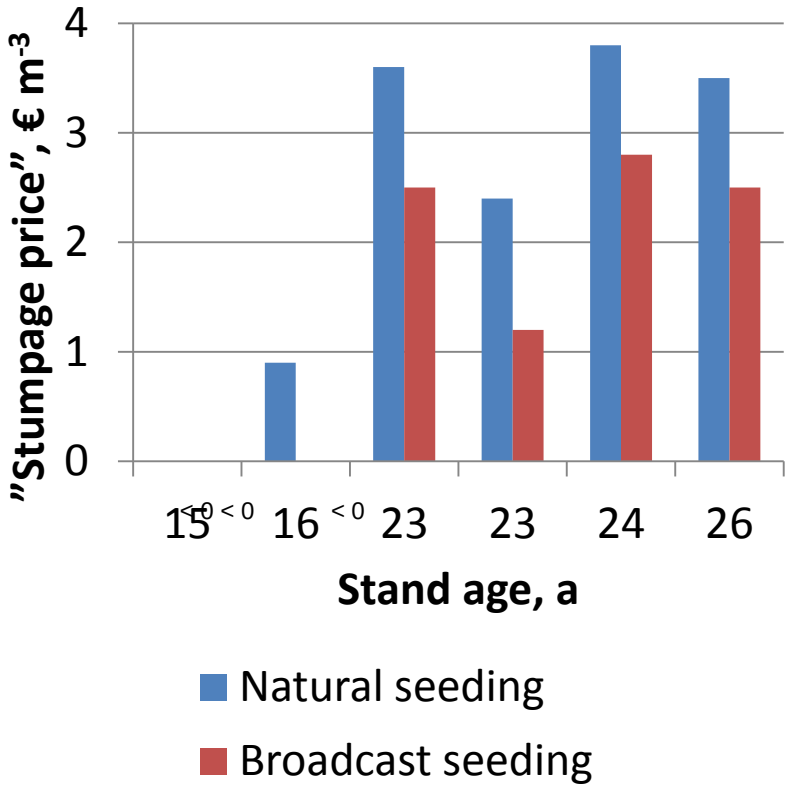


Sensitivity analysis, 1st rotation

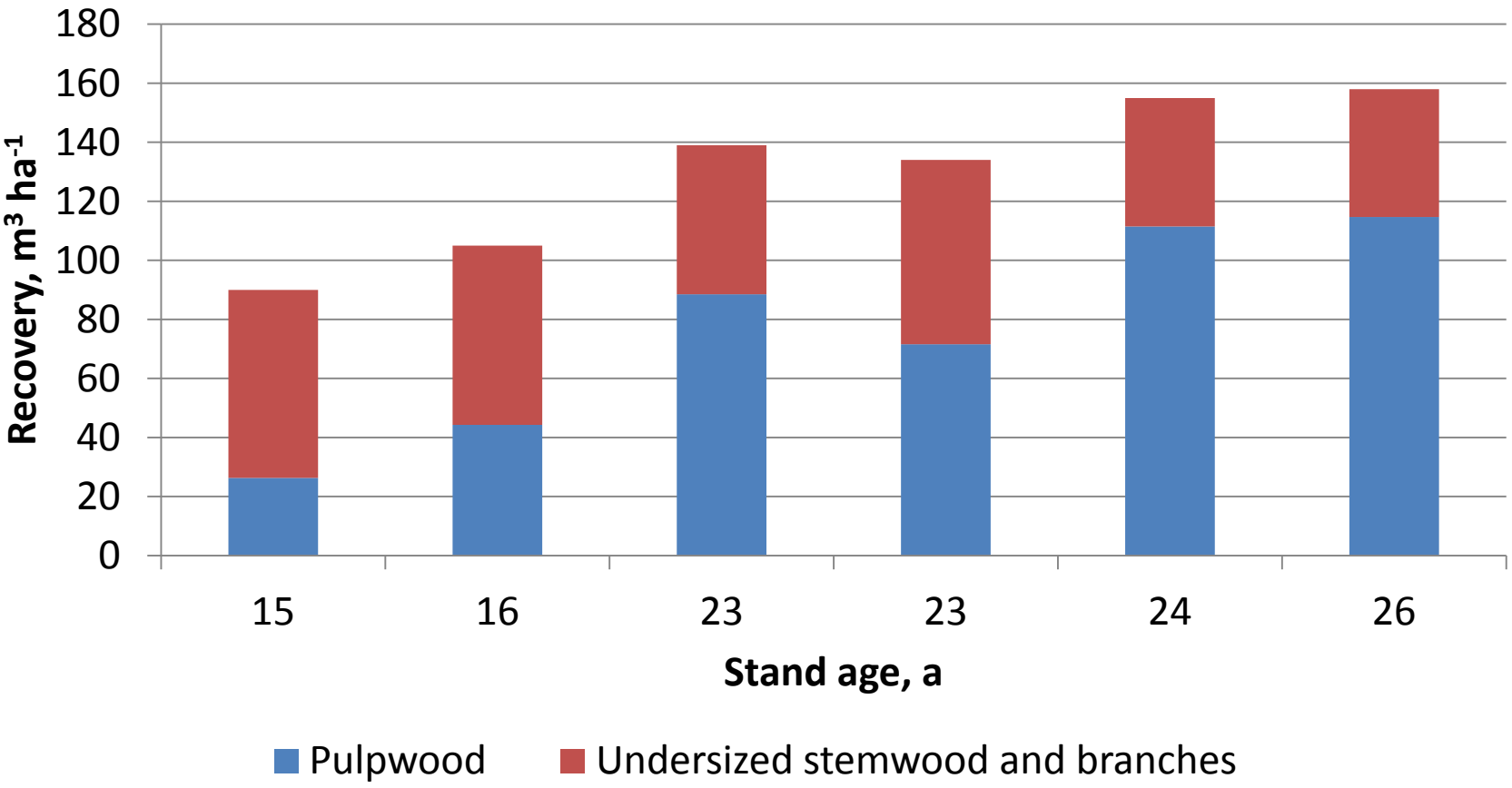
Interest rate 3 %



Interest rate 5 %



Composition of removal



IV Conclusions

- Cutaway peatlands have high production potential
  - Biomass production (3–4 ODt ha^{-1}) is at the same level with commercial willow plantations in Sweden
- Profitable when rotation exceeds ~ 20 years
  - Low investments in wood production, early income
  - The BLVs with the longest rotations (23–26 years) correspond to that obtained with planted spruce in a upland site with grass-herb vegetation in southern Finland (interest rate 5%)
  - Optimum rotation is unknown
- A flexible form of biomass production
  - In peatland forests poor thinning response (omitting thinnings does not impact negatively the forest)
  - An option to produce industrial roundwood
  - decision about the timing and method of harvesting can be made based on market situation and price relations of pulpwood and energy biomass
- Uncertainties
  - Continuity of coppicing
  - Stand development with diverging management alternatives