Effects of wind-damage reducing forest management on yield, recreation- and life-style values – a simulation study

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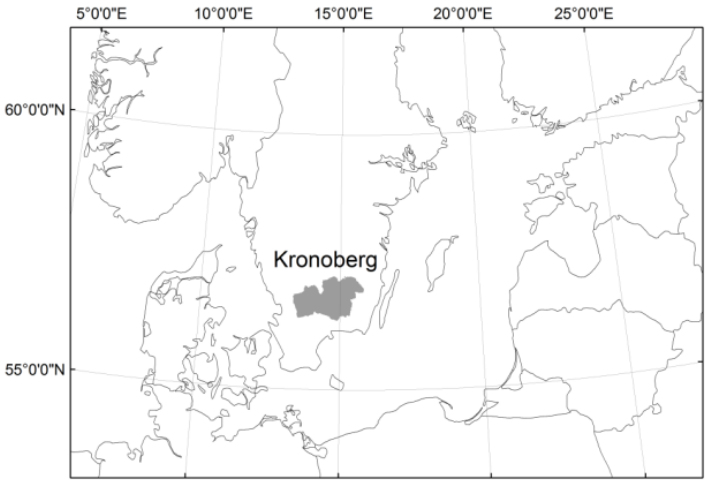
Owning a forest in Sweden

A life-style project (Törnqvist, 1995)

On average only 12% of household income from forestry (Mattsson et al., 2003)

In Kronoberg County 80% owned by private individuals

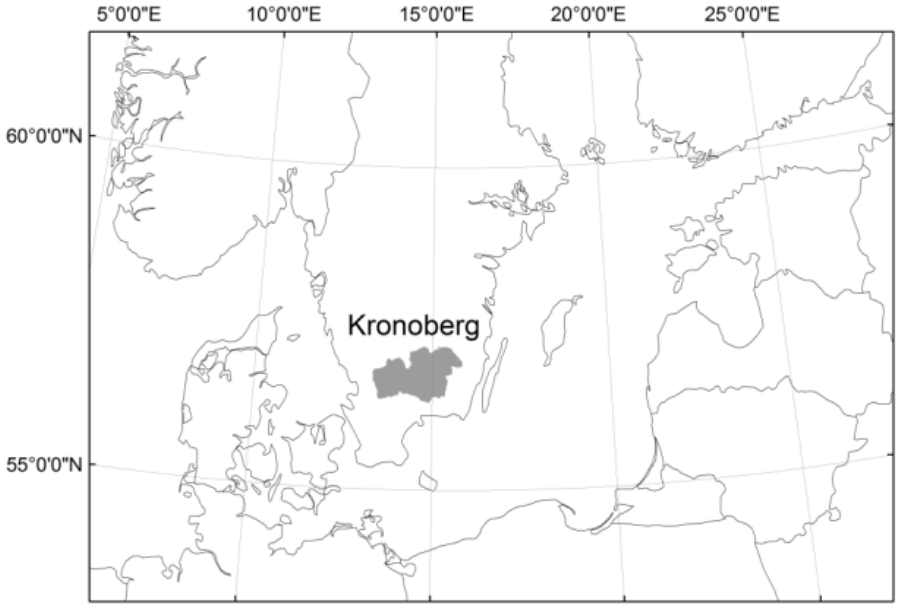


According to private individual forest owners in Kronoberg County

Damage by wind is

-one of the worst risks to their forestry (Blennow 2008)

-the climate change risk that increases the most (Blennow 2011)



Forest Management

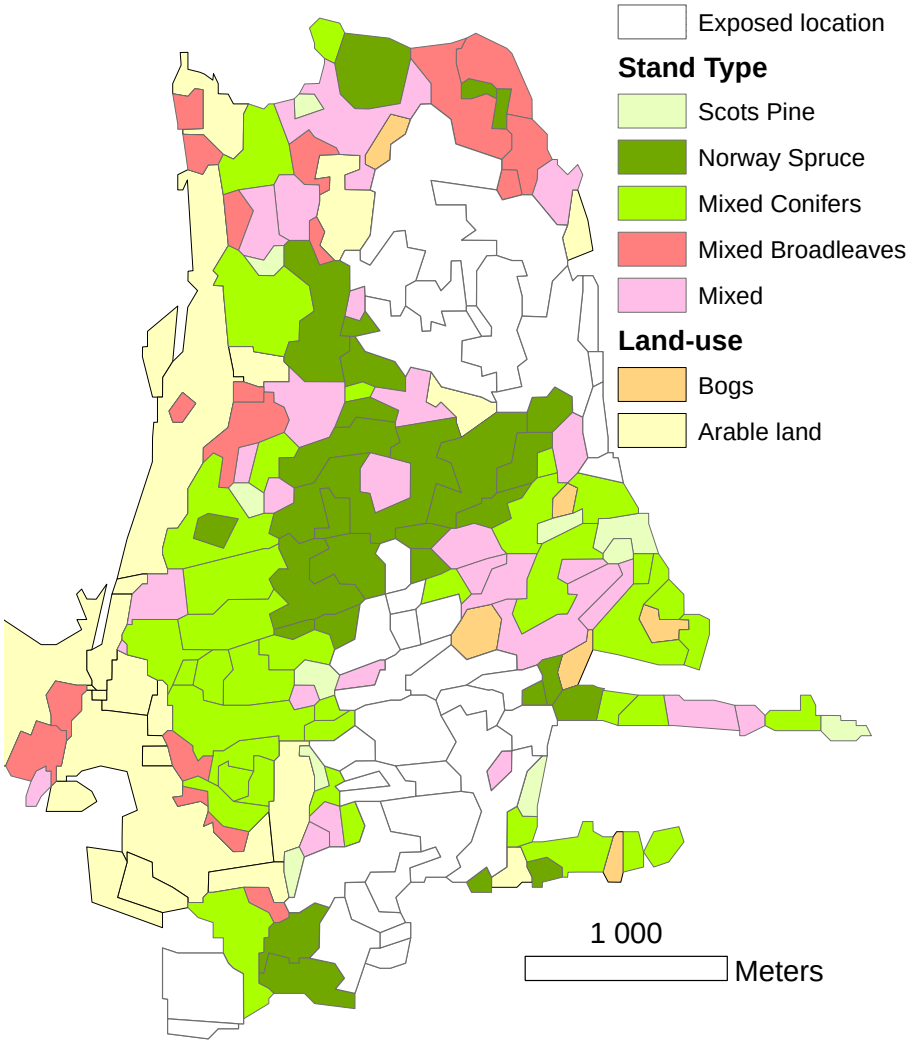
In consultation with stakeholders

Business as usual (BAU)	Adaptive measures to reduce the risk of wind damage
No change in species composition at stand level	Replace conifer stands at wind exposed locations with birch, 281 ha
Rotation periods: 150% of minimum allowed age for final felling	Shorter rotation periods, 120% of minimum allowed age for final felling
No thinnings in stands after they reach a top height of 25 meters	No thinnings in stands after they reach a top height of 21 meters

Objective

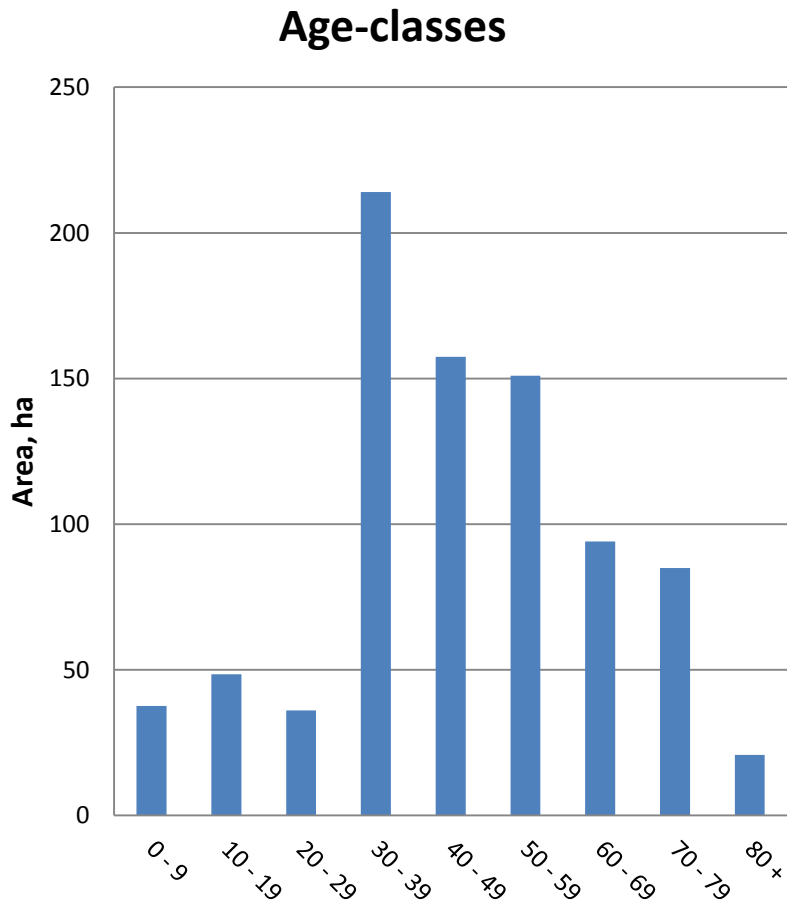
To assess effects of wind-damage reducing forest management on yield, recreation- and life-style values

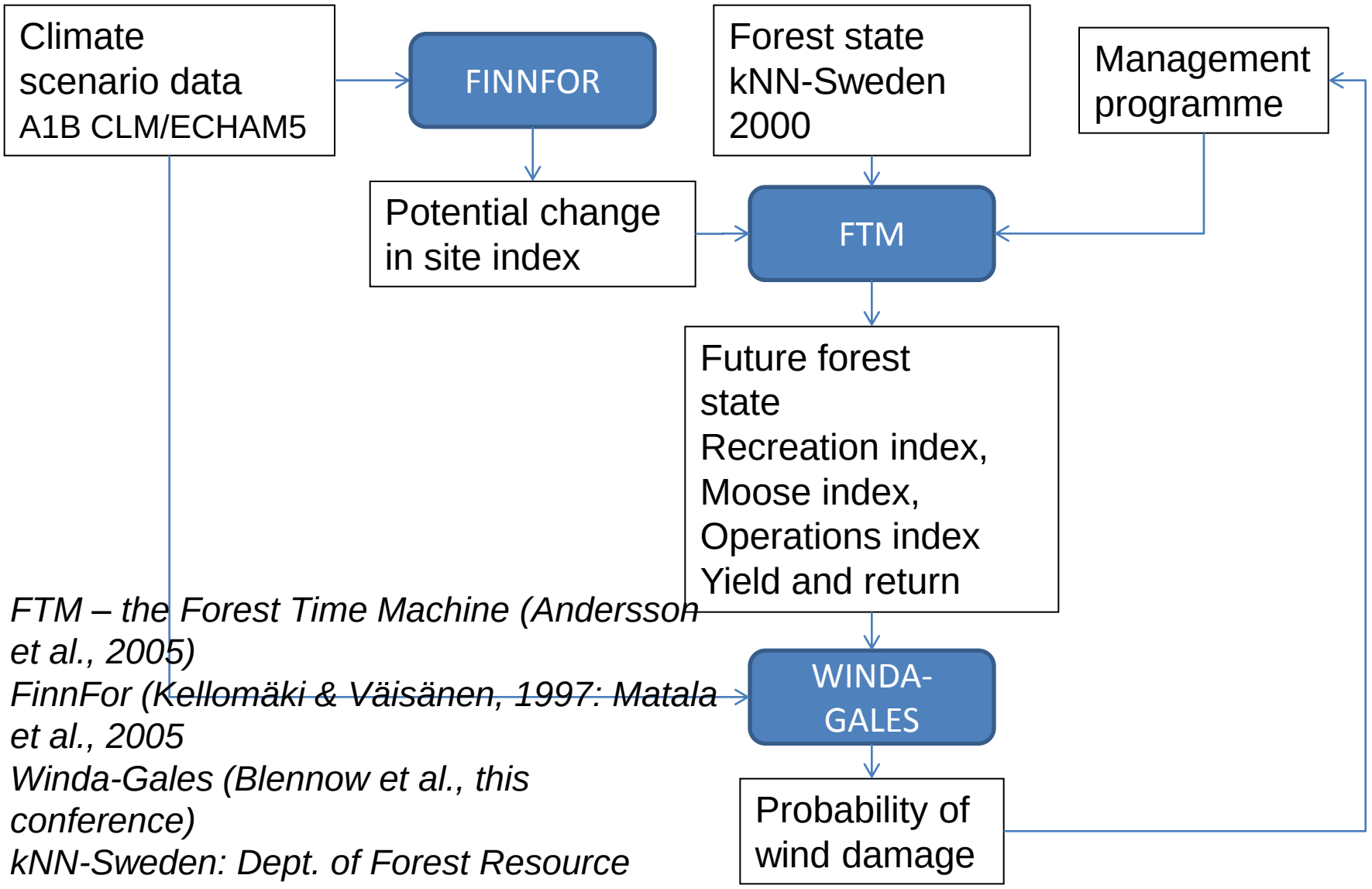
Study Area


Exposed location
Stand Type
Scots Pine
Norway Spruce
Mixed Conifers
Mixed Broadleaves
Mixed
Land-use
Bogs
Arable land
1 000
Meters

Study Area

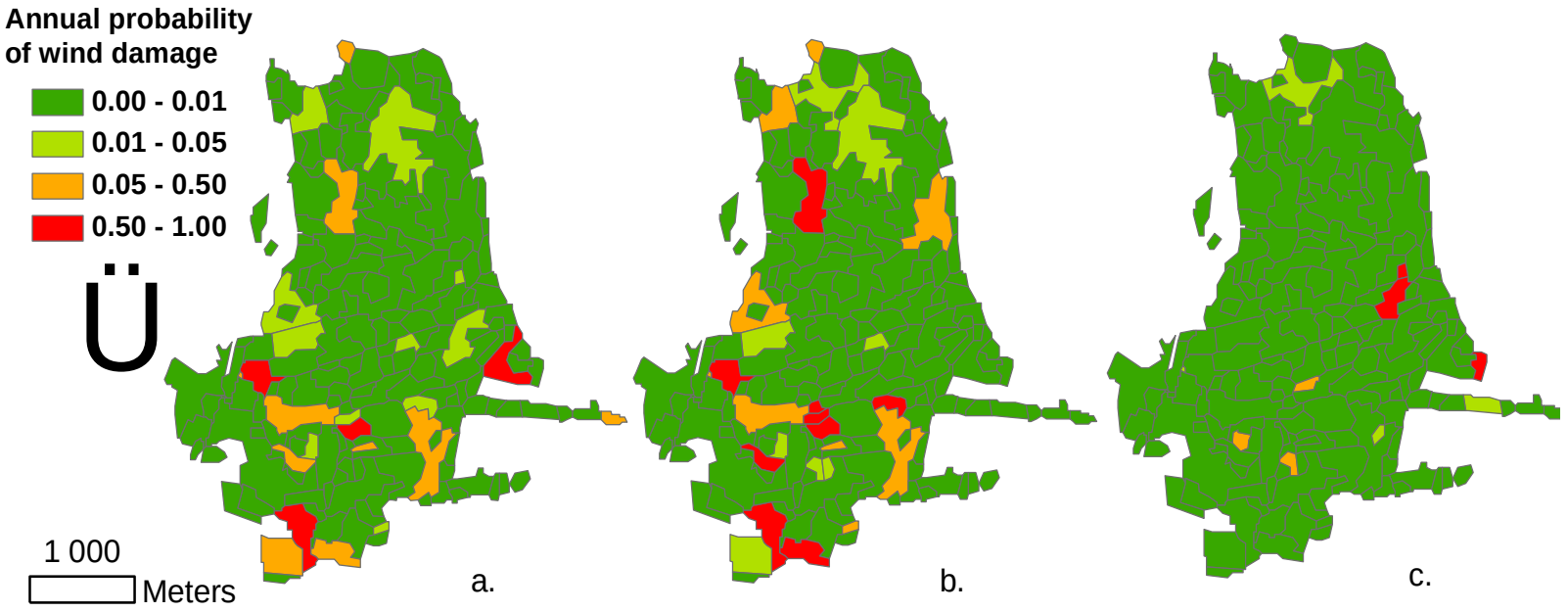
Forest land	844 ha
No. of stands	159
Standing Volume	200 m^3/ha
Tree Species	
Scots Pine	18%
Norway Spruce	70%
Birch	8%
Oak	2%
Other Broadleaves	3%
Mean site productivity	8.9 m^3/ha, yr
Current mean annual growth	13.6 m^3/ha, yr





FTM – the Forest Time Machine (Andersson et al., 2005)
FinnFor (Kellomäki & Väisänen, 1997: Matala et al., 2005
Winda-Gales (Blennow et al., this conference)
kNN-Sweden: Dept. of Forest Resource Management, Swedish University of Agricultural Sciences

Effectiveness of adaptive forest management program evaluated using the WINDA-GALES model



No climate change
Forest management
business as usual

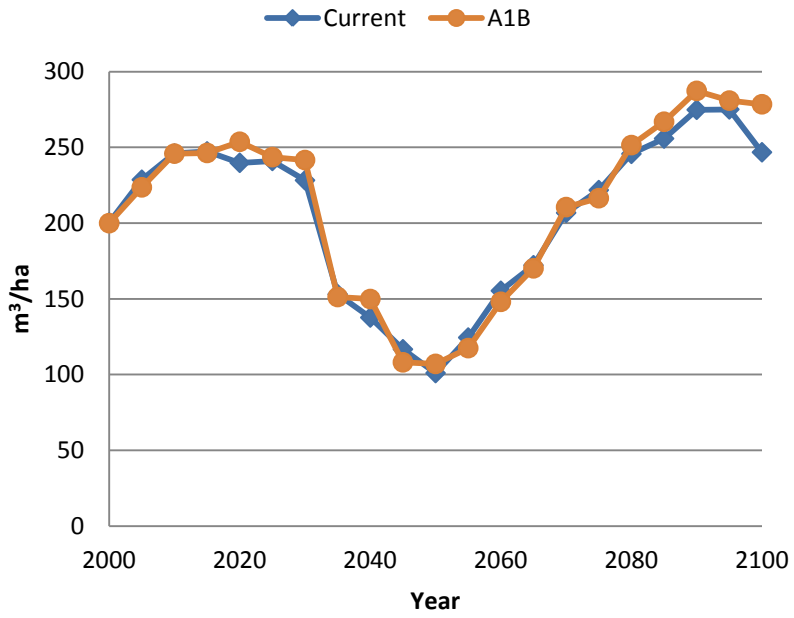
Climate change
Forest management
business as usual

Climate change
Adaptive forest
management

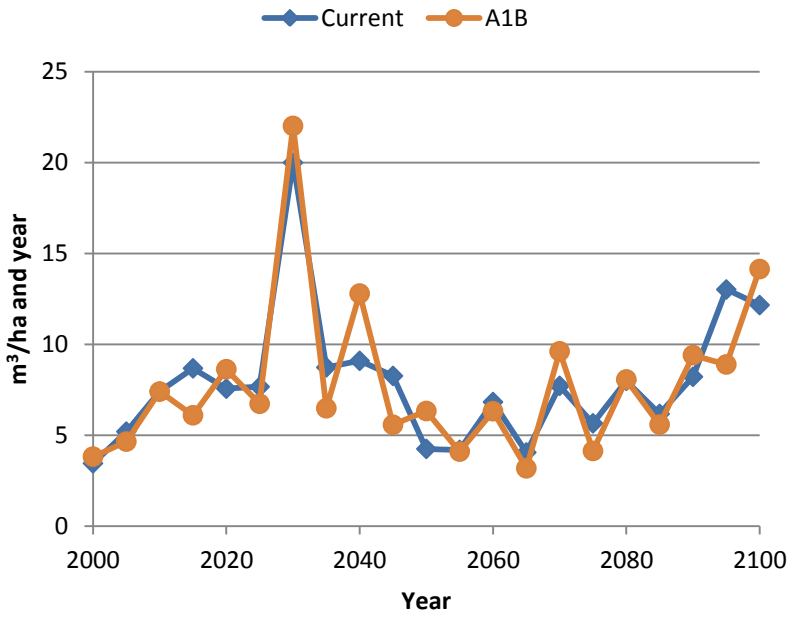
Growth and Yield

BAU management under different climates

Standing Volume



Harvested Volume



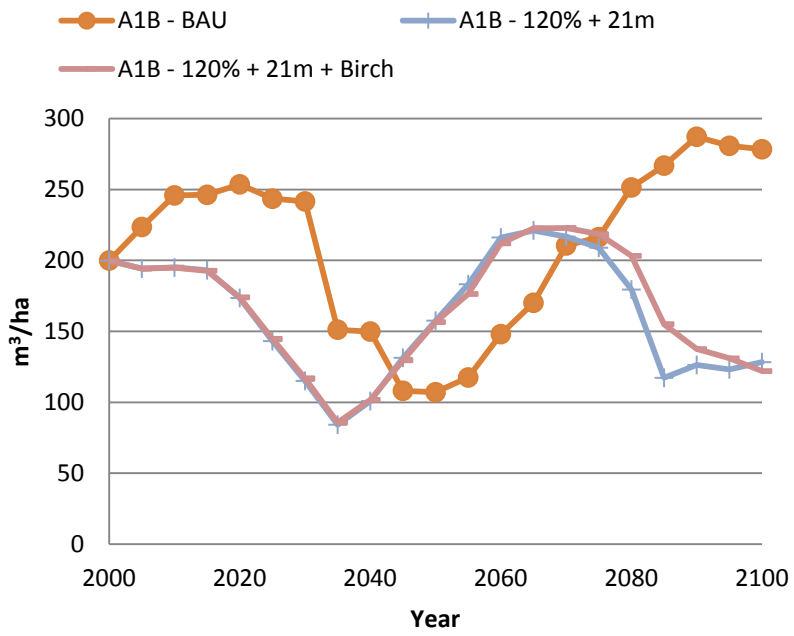
Average annual growth, m3/ha

Current:	8.36
A1B:	8.55

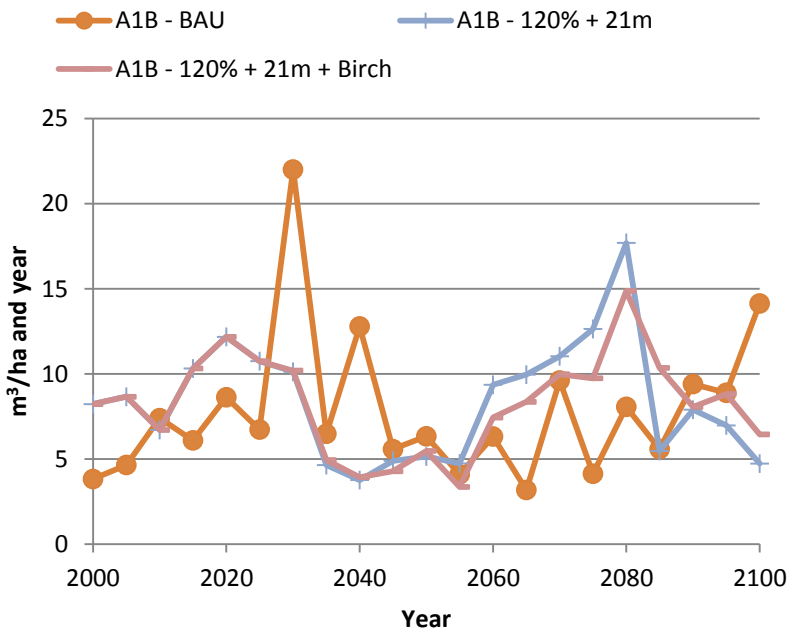
Growth and Yield

Climate change and adaptive measures

Standing Volume



Harvested Volume



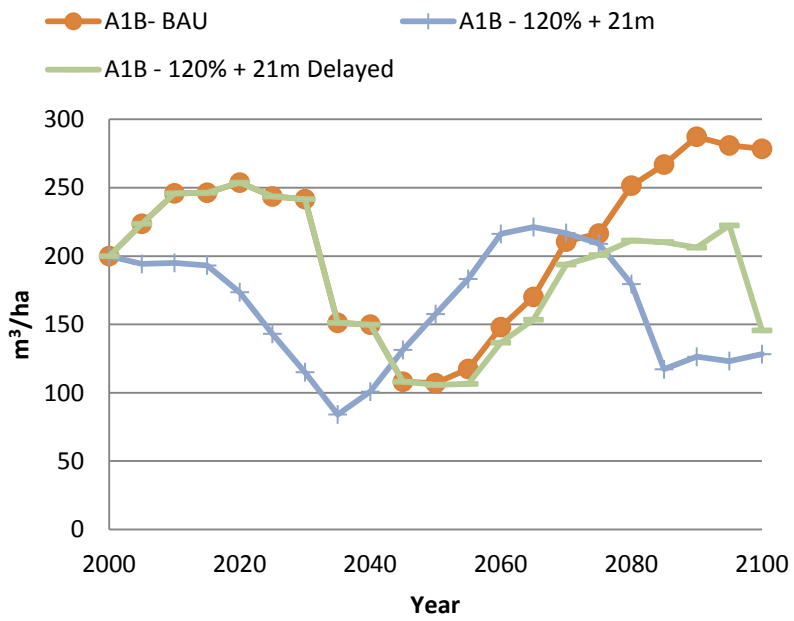
Average annual growth, m3/ha

A1B - BAU:	8.55
A1B - 120% + 21m:	7.69
A1B - 120% + 21m + Birch:	7.50

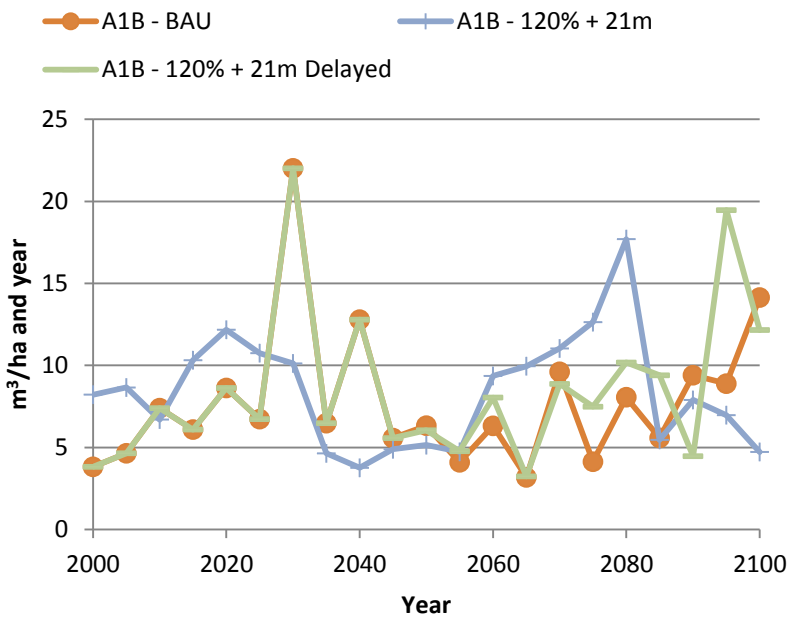
Growth and Yield

Climate change and delayed adaptive measures

Standing Volume



Harvested Volume



Average annual growth, m3/ha

A1B - BAU:	8.55
A1B - 120% + 21m:	7.69
A1B - 120% + 21m Delayed:	7.97
A1B – 120% + 21m + Birch Delayed	8.05

Growth and Yield

Climate/Management	Mean standing volume, m^3/ha	Mean annual growth, m^3/ha, yr	Mean annual harvest, m^3/ha, yr
Current			
BAU	206	8.4	7.9
120% + 21m	160	7.7	8.3
120% + 21m + Birch	166	7.4	8.2
120% + 21m Delayed	186	7.7	7.9
120% + 21m + Birch Delayed	186	7.7	7.9
A1B			
BAU	209	8.6	7.8
120% + 21m	162	7.7	8.4
120% + 21m + Birch	166	7.5	8.2
120% + 21m Delayed	188	8.0	8.5
120% + 21m + Birch Delayed	190	8.1	8.6

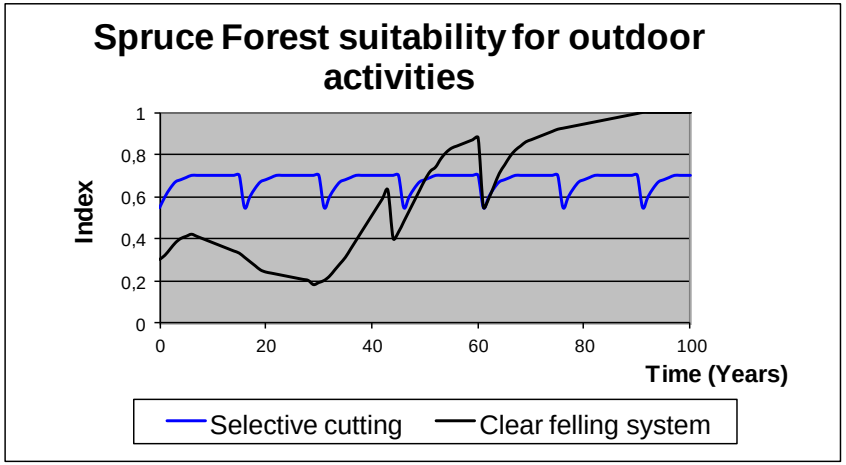
Economy

Climate/Management	Total Net, MSEK	Net present value (3%), MSEK
Current		
BAU	194.0	59.8
120% + 21m	179.8	62.6
120% + 21m + Birch	154.9	56.8
120% + 21m Delayed	189.2	59.6
120% + 21m + Birch Delayed	185.7	59.3
A1B		
BAU	190.6	58.7
120% + 21m	181.6	62.0
120% + 21m + Birch	155.7	56.5
120% + 21m Delayed	202.5	60.0
120% + 21m + Birch Delayed	202.3	59.9

Recreation

Recreation Index (0-1)

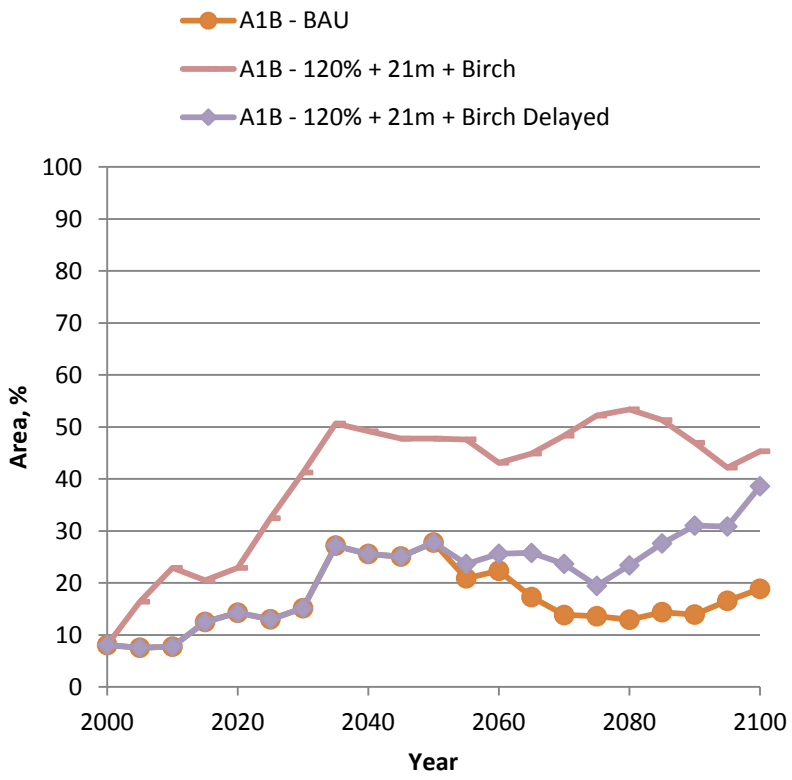
Stand Features	
No. of medium sized trees (20+ cm)	+
No. of large sized trees (48+ cm)	+
Broadleaves	+
Uneven age	+
Young forest (<10 m)	-
Logging residues	-
Dead trees	-
Ground damages	-



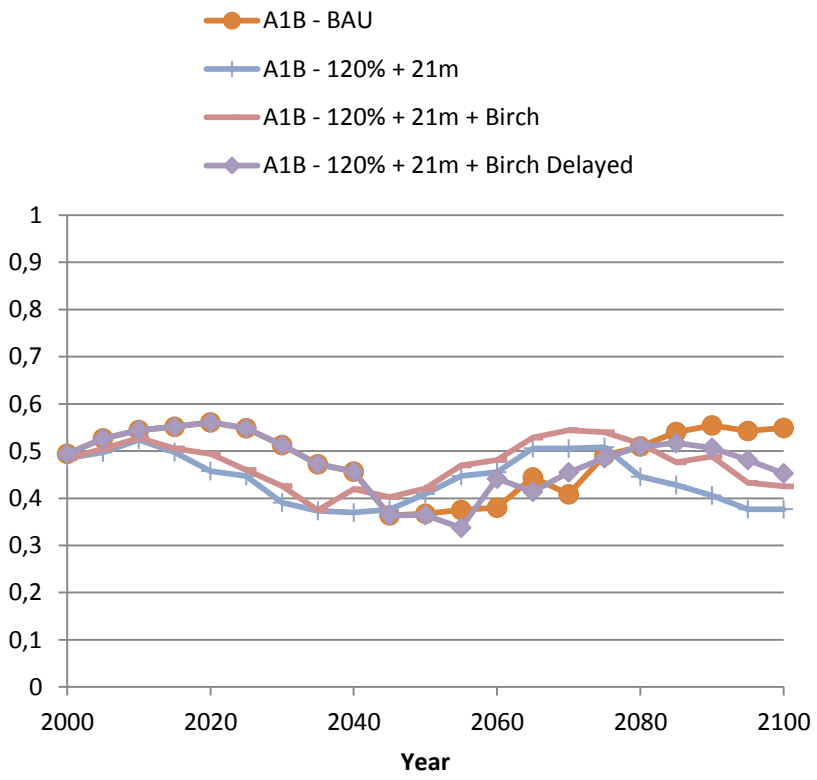
(By Lindhagen)

Recreation

Proportion of Broadleaves (Area)

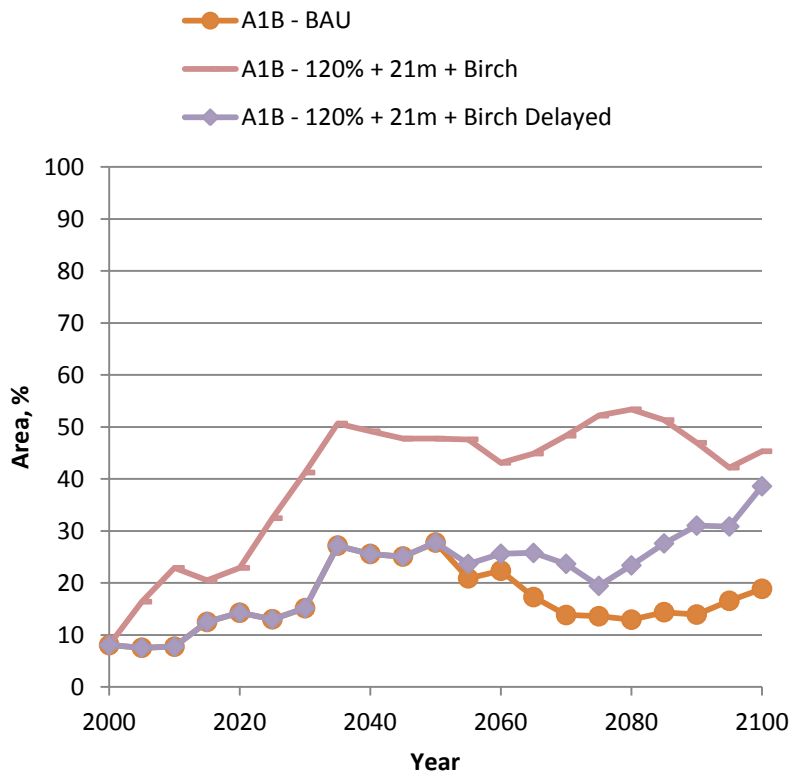


Recreation Index (0-1)

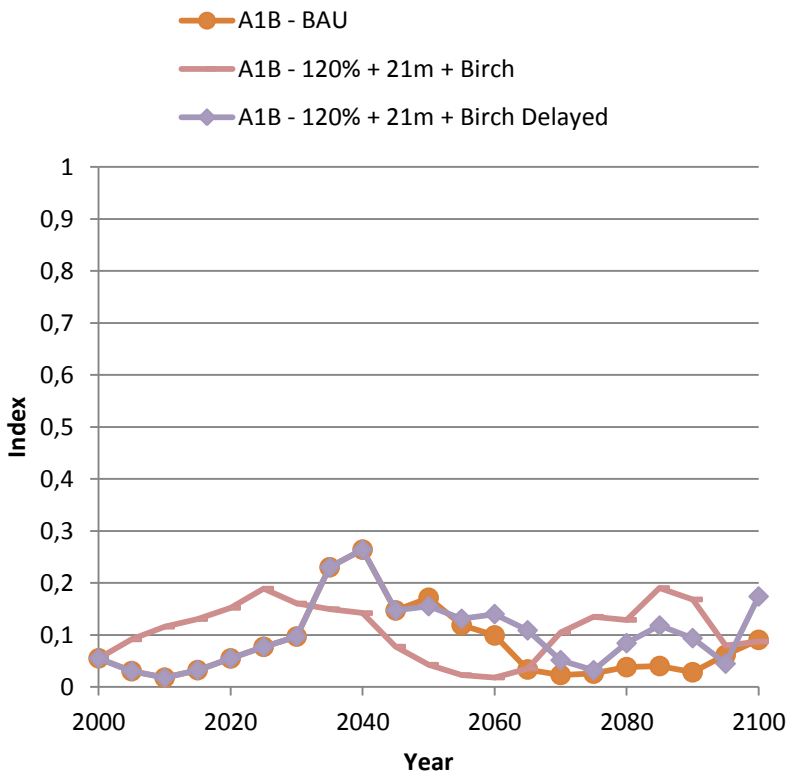


Moose Habitat – sensitive to availability of young pine and birch

Proportion of Broadleaves (Area)

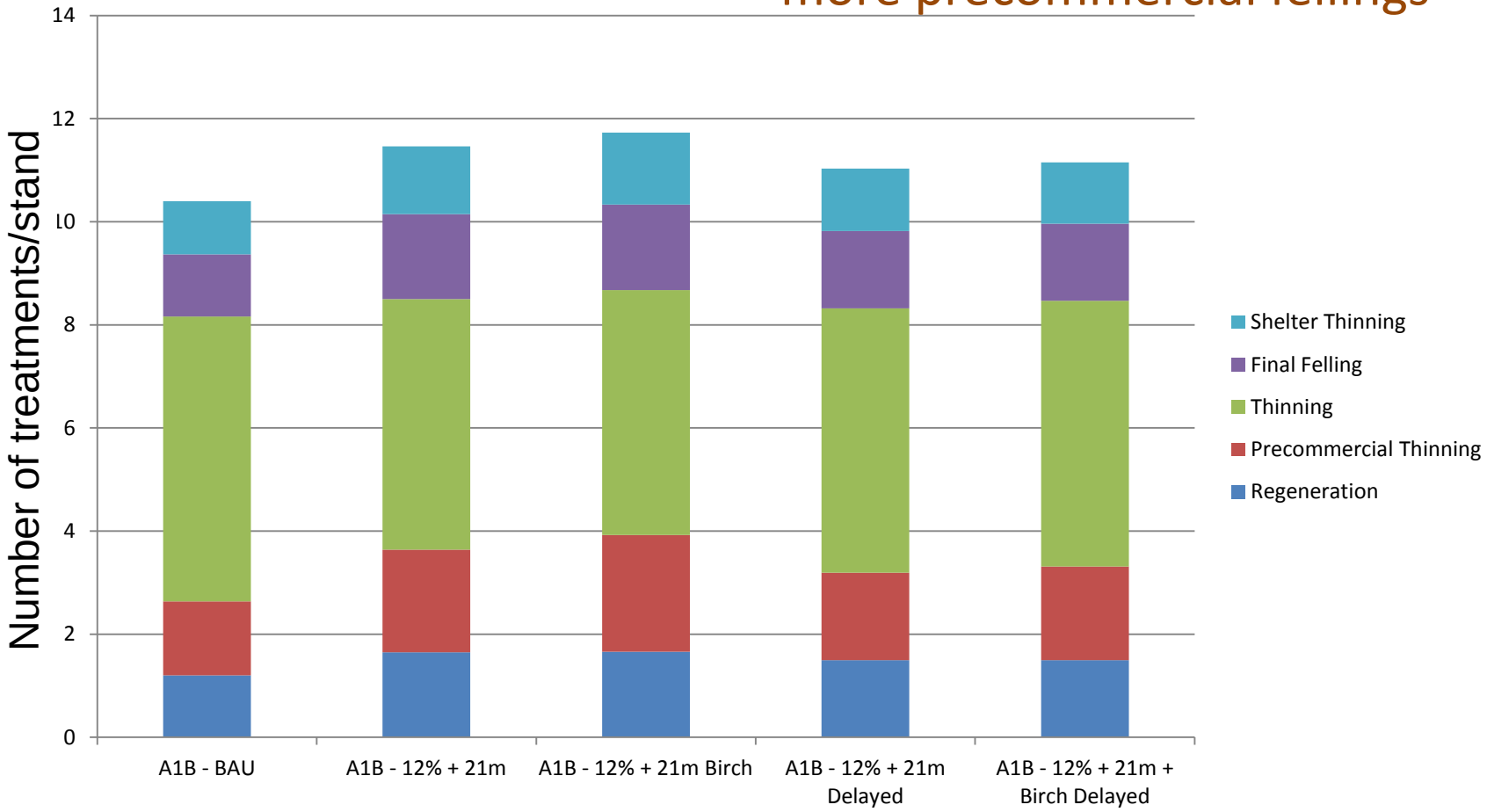


Suitability Index



Forestry Operations

Adaptive management:
more final fellings
more precommercial fellings



Conclusions

- Climate change in terms of the A1B CLM/ECHAM5 scenario has little simulated influence on forest growth, fellings, and return, given that wind damage does not occur
- Both adaptive measures and occurrence of wind damage will have bigger influence:

  Shorter rotation period leads to
  - Less old growth forest which is negative for recreation values
  - More young forest -> more moose feed and negative for recreation values

  Increasing share of broadleaves leads to
  - Less Norway spruce -> Increasing moose feed
  - Broad leaves increases recreation index