

# Smart thinning of young dense stands for simultaneously extracting and keeping ecosystem service values



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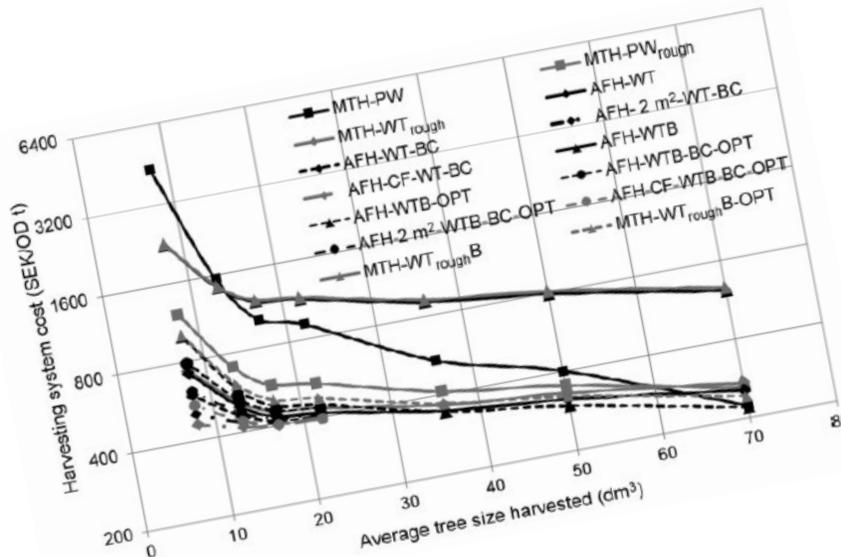
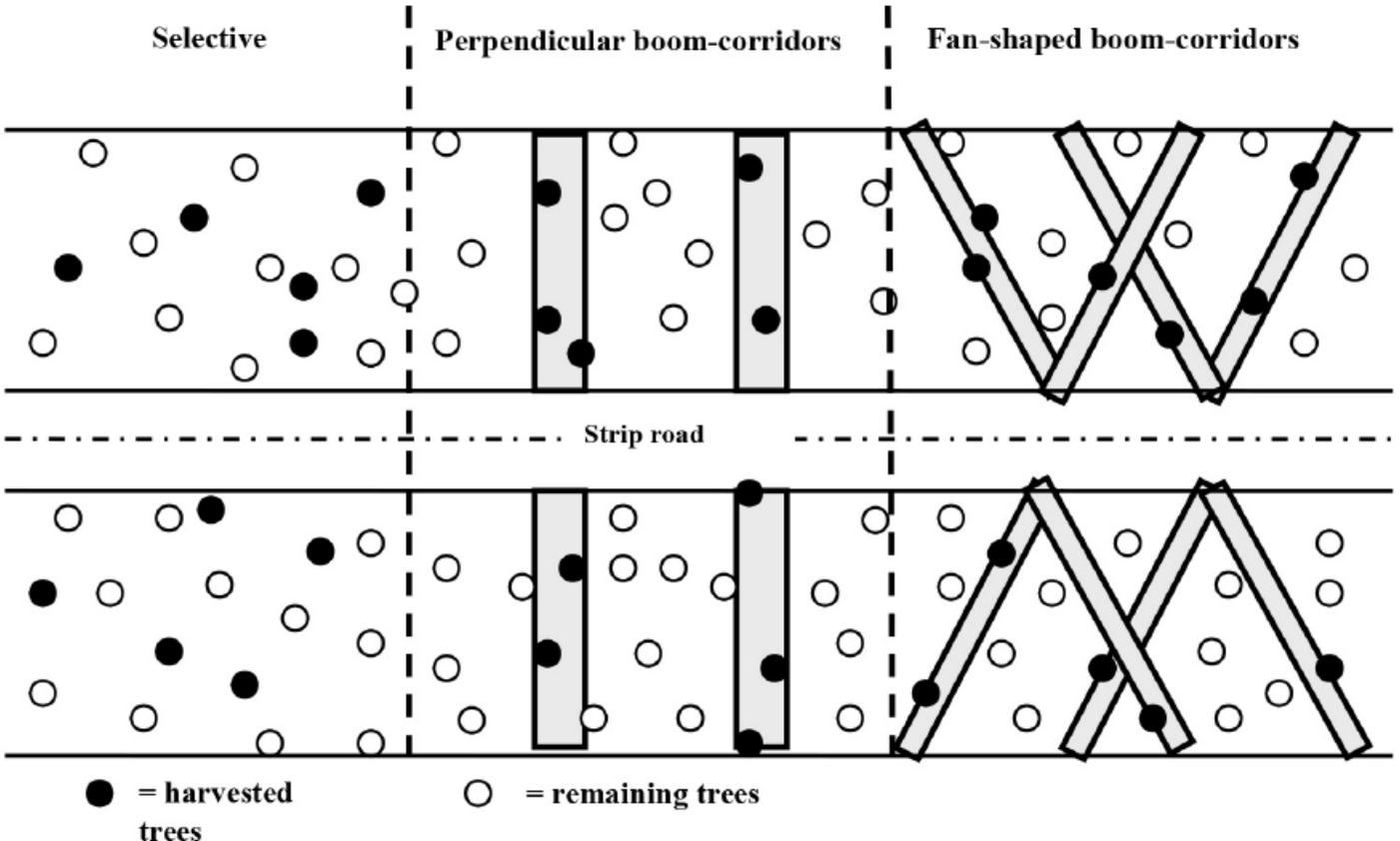
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# Background

- Boom corridor thinning (BCT) has been proposed as a cost-effective technique for biomass thinning in young dense stands.



## **Some refs.**

- Bergström D. (2009). Techniques and systems for boom-corridor thinning in young dense forests. Doctoral thesis. Acta Universitatis Agriculturae Sueciae 87. ISBN 978-91-576-7343-0.
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- Bergström D, Bergsten U, Nordfjell T, Lundmark T. (2007). Simulation of geometric thinning systems and their time requirements for young forests. Silva Fennica 41(1): 137–147.
- Bergström D, Nordfjell T, Bergsten U. (2010). Compressing processing and load compression of young Scots pine and birch trees in thinnings for bioenergy. International Journal Forest Engineering 21: 31–39.
- Fernandez-Lacruz R., Di Fulvio F., Athanassiadis D., Bergström D., Nordfjell T. (2015). Distribution, characteristics and potential of biomass-dense thinning forests in Sweden. Silva Fennica 49(5) article 1377.
- Karlsson L., Nyström K., Bergström D., Bergsten U. (2015). Development of Scots pine stands after first biomass thinning with implications on management profitability over rotation. Scandinavian Journal of Forest Research 30(5): 416–428.
- Sängstuvall L, Bergström D, Lämås T, Nordfjell T. (2011). Simulation of harvester productivity in selective and boom corridor thinning of young forests. Scandinavian Journal Forest Research 27(1): 56–73.
- Ulvcrona K.A. (2011). Effects of Silvicultural treatments in young Scots pine-dominated stands on the potential for early biofuel harvest. Doctoral thesis no. 2011:79. Faculty of Forest Sciences, 15

# However,

- There is little (nothing!) published on the effects of BCT on stands structure and future development!



# The objective

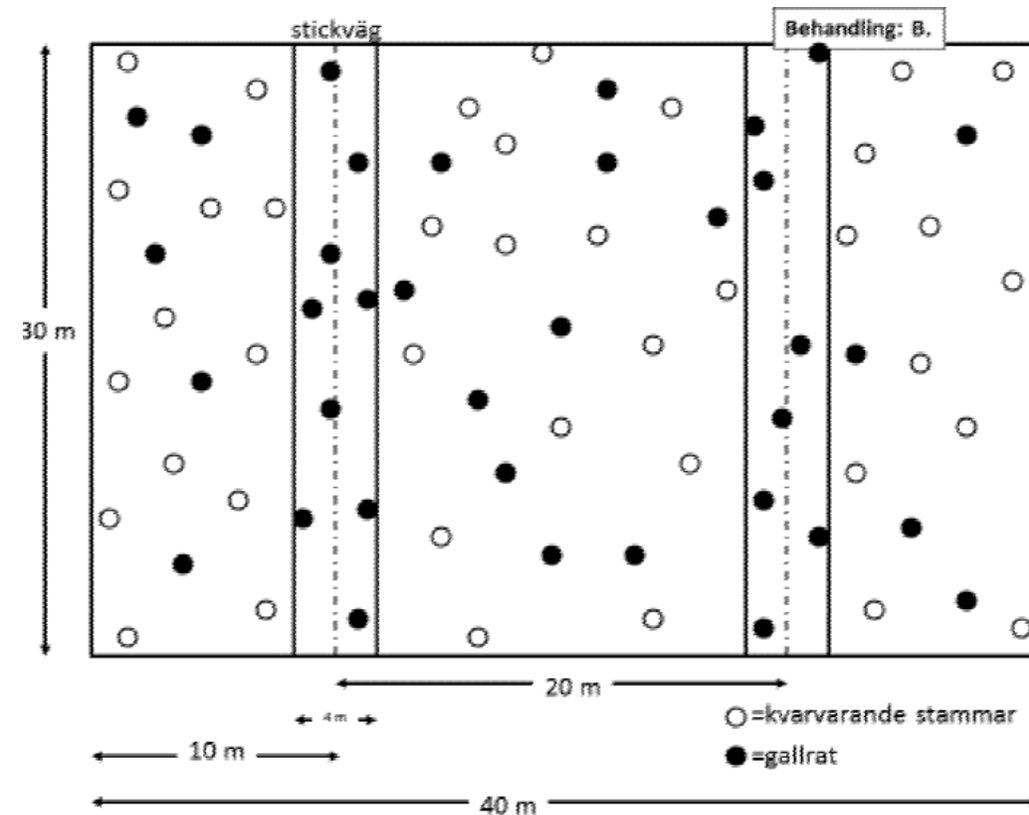
- To determine how various BCT operations affect stand structure following biomass thinning and to compare the results with conventional selective thinning methods.

# Study design

- Two series of field experiments were established;
  - BCT 1-series: Three sites in south of Sweden with five treatments, including a control, conventional selective thinning and three BCT treatments.
  - BCT 2-series: Three regions in Sweden (in the north, centre and in the south), with two stand sites in each region with different tree heights. Treatments were control, pre-commercial thinning (PCT), conventional selective thinning and BCT (high and low thinning).



Parcell 1 Blå: Behandling I, KKG låggallring  
Parcell 2 Röd: Behandling II, KKG höggallring.  
Parcell 3 Gul: Behandling III, Konventionell gallring ner till 2 000 stammar/ha.



...

- The first, BCT 1, were all planted with Norway spruce (*Picea abies* (L.) H. Karst.). Other species found were *Betula* spp., *Salix* ssp., *Populus tremula* L. and *Sorbus aucuparia* L. and Norway spruce from natural regeneration.
- The second, BCT 2, Each region consisted of two sites with different tree heights (4/9 m and 5/10 m in mean/dominating tree height). Planted Norway spruce and Scots pine (*Pinus sylvestris* L.) dominated all sites, and *Betula* spp., *Salix* ssp., *P. tremula* and *S. aucuparia* from natural regeneration were also found. *Betula* spp. was the most common deciduous species in all sites.

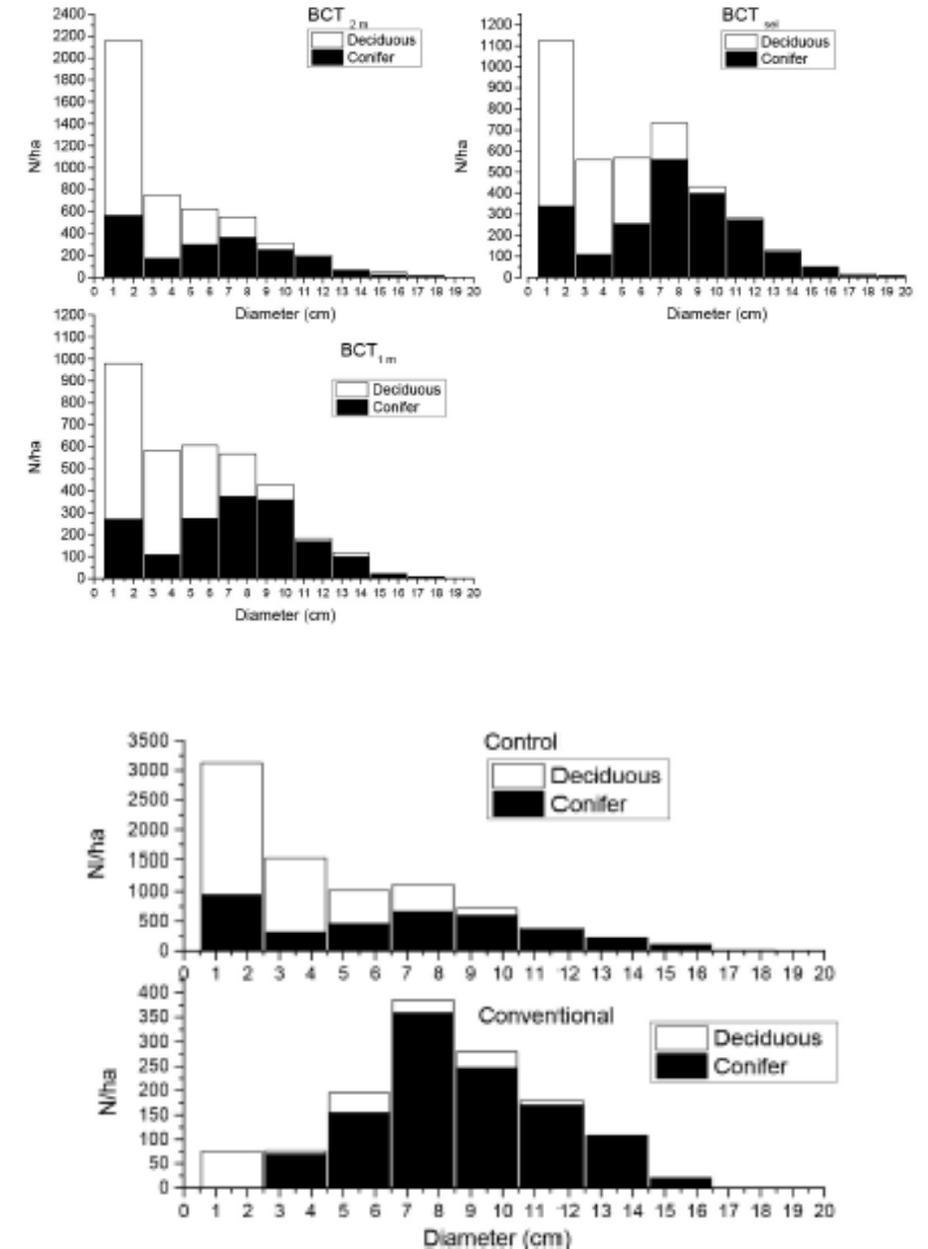
# Measures...

För-sök	Avd	För-söks-led	Kvarvarande bestånd						Utgallrat virke				
			Dia- meter , cm	Medel -höjd, m	Övre höjd, m	Stam - antal, st/ha	Grund -yta, m <sup>2</sup> /ha	Volym , m <sup>3</sup> sk/h a	Dia- mete r cm	Stam - antal, st/ha	Grund -yta, m <sup>2</sup> /ha	Volym m <sup>3</sup> sk/h a	Gallr -ing, %
1204	2	A	6.0	10.2	12	7161	26.7	1488	0	0	0	0	0.0

- Standard measures... DBH, Height, damages...
- The selection process of numbered trees for height measurements followed routines developed by the Swedish University of Agricultural Sciences for long term forest field experiments.
- Simpson index (D) was used to estimate the biodiversity among tree species (Simpson 1949).
  - Simpson index of diversity (1-D) represents the probability that two samples randomly selected from a sample will belong to different species (Simpson 1949). The value ranges between 0 and 1, e.g. 0 give no diversity (only one species).

# Results

- Boom corridor thinning (BCT) results in more stand structure heterogeneity than conventional thinning or pre-commercial thinning (PCT), maintaining both smaller-diameter trees and deciduous species.
- Neither dominant height nor number of possible future crop trees is jeopardized.
- The technique is flexible as various corridor types give similar stand structure results.



# Conclusions

- BCT and selective thinning approaches result in similar stand structures based on the amount and average sizes of remaining possible future crop trees.
- BCT also maintains diverse tree sizes, deciduous species, and leaves more trees per ha.
  - **Hence, BCT should be a cost-effective option for thinning that can increase vertical complexity in stands, and as a result possibly increase biodiversity and ecosystem service values.**
- In our study we only consider tree species for biodiversity analysis and in the studied forest the number of species are low and predominated (in terms of volume) by conifers (pine and spruce). The index shows that the diversity of tree species for all trial series is somewhat higher for boom-corridor treatments than selective ones.
  - **Thus, schematic thinning renders keeping the tree diversity at the same level as for the untreated stands.**

# Whats up?

- 1st revision of BCT 2-series will be made in Autumn
  - Stand structure, damages and production
    - MSc...
- FlowCut head is developing
  - Field trials in Autumn with Skogforsk et al.
- Field trials in Finland!?
  - Waiting for Dr. Y. N. at LUKE to give me a call...
- Simulation of novel technologies for BCT
  - EFFORTE – soon submitted to journal!



# Thanks!

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(Read more: Ahnlund Ulvcrona, K., Bergström, D. & Bergsten, U. 2017. Stand structure after thinning in 1–2 m wide corridors in young dense stands. *Silva Fennica*, 51(3), id 1563.)