

An aerial photograph of a dense forest of evergreen trees. A central path of trees is dead, appearing brown and skeletal, contrasting with the surrounding vibrant green forest. The text is overlaid on this image.

Stoppa borrharna! *Stop the bark beetle!*

Teams 2022-05-25

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Photo: Yaman Albolbol

Project 'Stop the bark beetle'

- Cooperation between ~20 government bodies, companies and organisations in central and southern Sweden, lead by Skogsstyrelsen (the Swedish Forest Agency, SFA).
- Aim for increased activity in the forest to minimise infestations and damages caused by *Ips typographus* (Ips).
- Together, we strive to
 - spread knowledge on Ips to the forestry sector and forest owners
 - slow down the spread of infestations without compromising natural and cultural values
 - monitor and survey infestations and damage caused by Ips
 - minimise economic losses in the forest

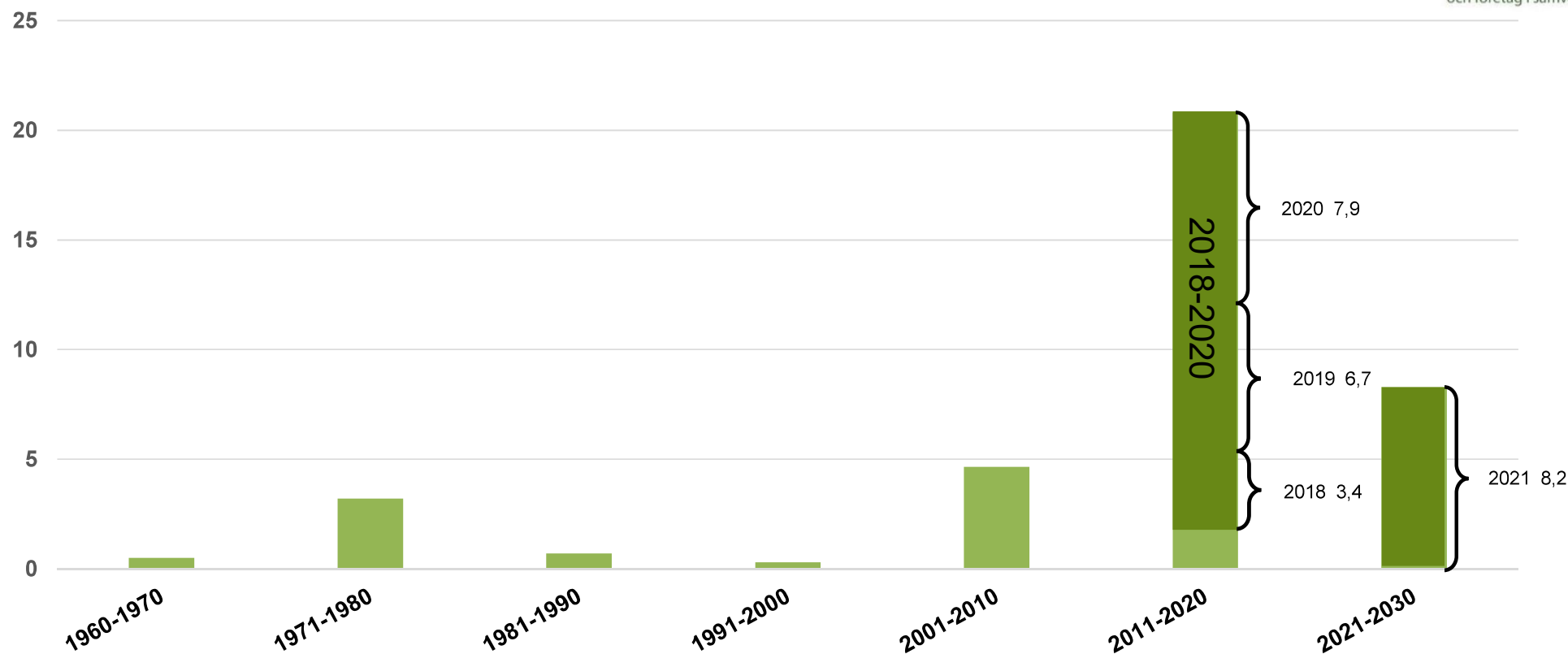
Project 'Stop the bark beetle'

- Taskgroups
 - Monitoring and survey
 - Protected areas
 - Knowledge and research
 - Communication
 - Resources and logistics (paused)
- Bark beetle school: e-learning modules aimed at forest owners and the forestry sector
- Riskindex
- 3 year project 2020-2022
- www.skogsstyrelsen.se/stoppaborrarna

Background to the current situation

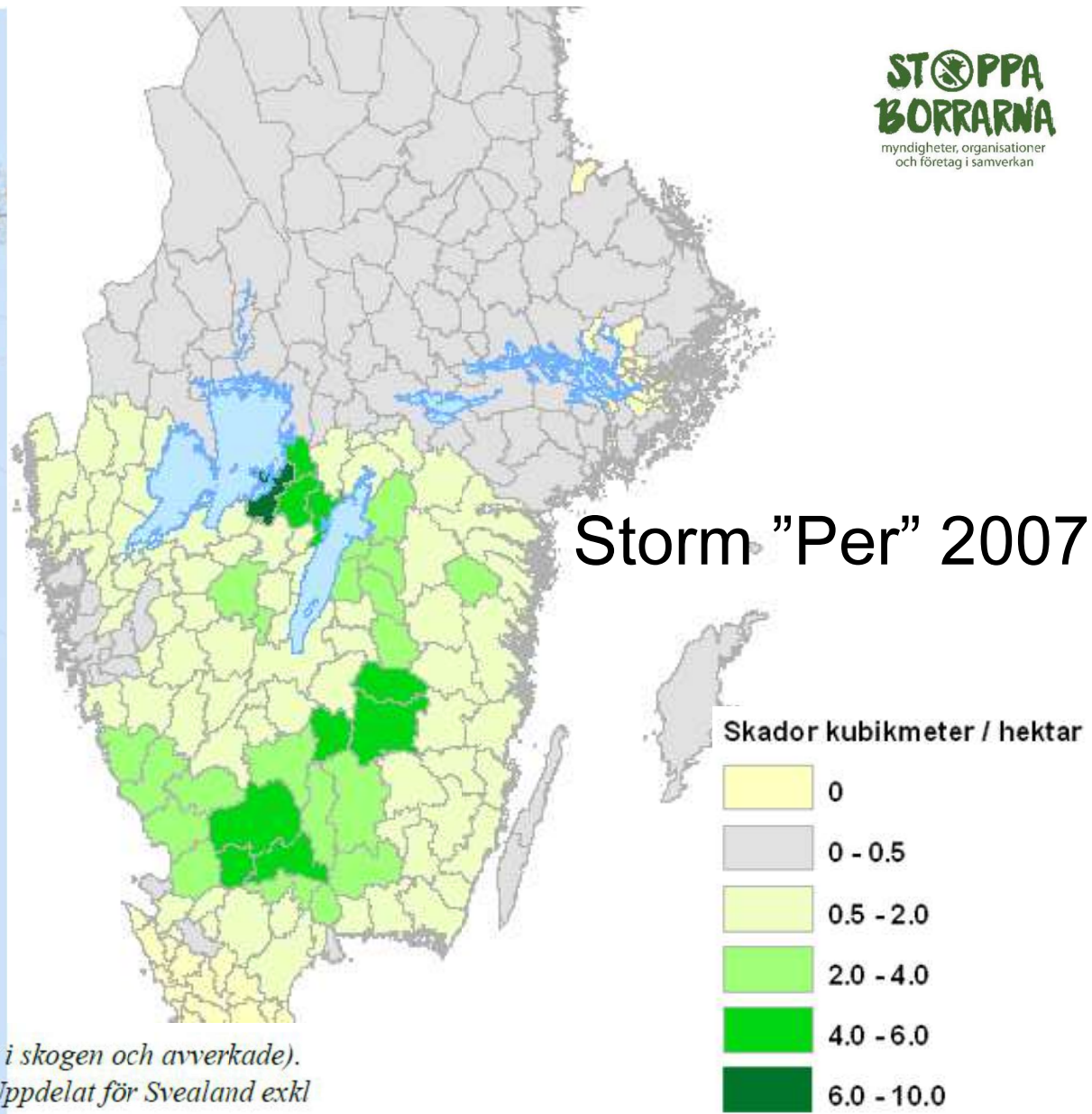
- During the latter half of the 2010's we've had weather that has stressed our forests and enabled bark beetle population expansion.
- Summer 2018 was extremely warm and dry over large parts of the country, especially south-eastern Sweden.
- The problems are partially a result of spruce being planted where site conditions are not optimal, for example, too dry.
- Without water, spruce can't produce sap, their main defence against bark beetle.

Estimated volume forest killed by Ips in Sweden 1960-2021, unit = million cubic meters standing forest m³sk



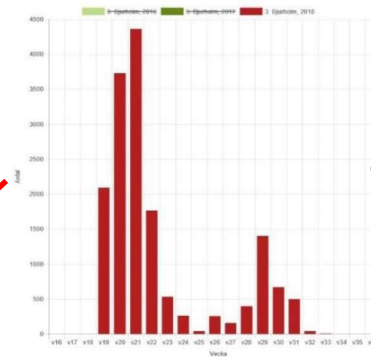
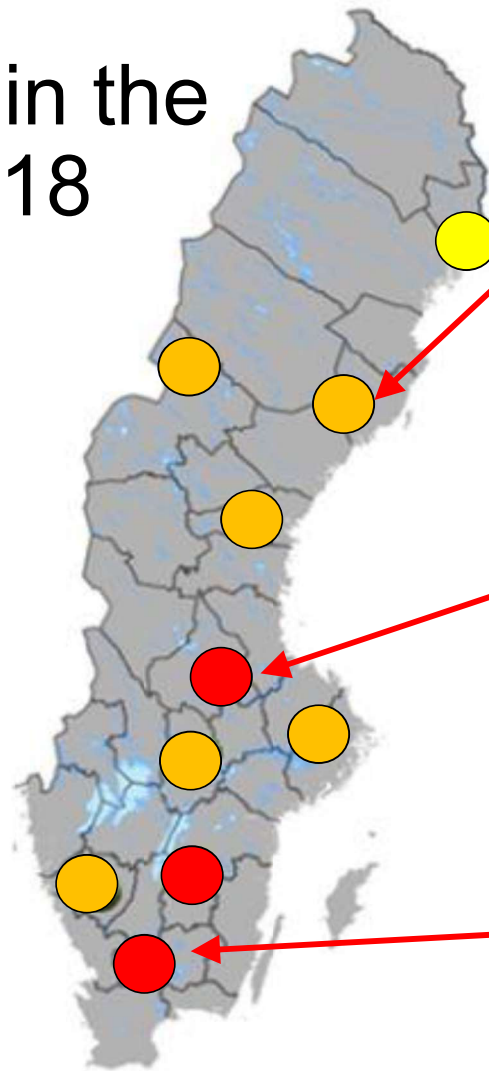


Figur 2. Volym gran per ha angripen av granbarkborre år 2021 (både kvar i skogen och avverkade). Äldre gallrings- och slutavverkningsmogen skog med granandel $\geq 3/10$. Uppdelat för Svealand exkl Dalarna samt Götaland exkl Gotland.



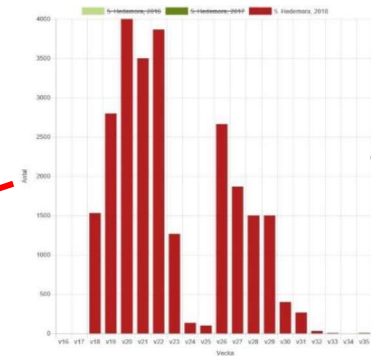
Two generations in the whole country 2018

- Diagram shows the number of bark beetle per week and trap in the SFA's swarming monitoring traps.
- All swarming monitoring traps noted two generations of bark beetles which is extremely unusual in northern Sweden.
- The new generation started swarming late June in the south, middle of July in the north.

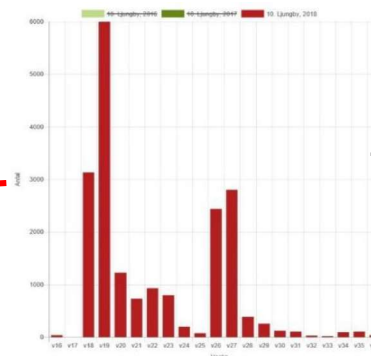


Bjurholm
Tot ca
16.000

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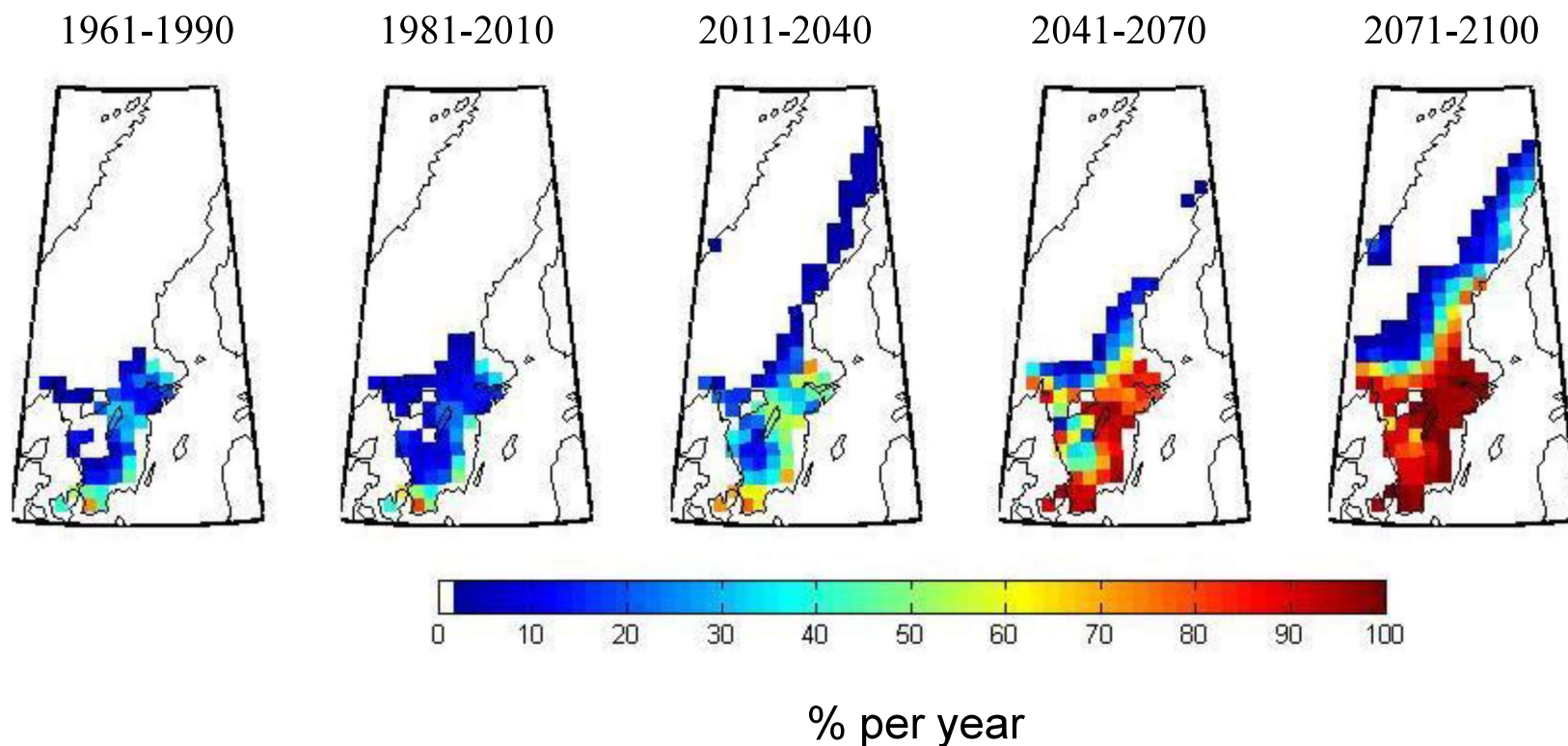


Hedemora
Tot ca
25.000



Ljungby
Tot ca
19.000

The likelihood of two generations of bark beetles per season is increasing



Reproductive success (daughters per female)

Uppskattad förökningsframgång
Genomsnittligt antal döttrar per hona



- Between 2018 and 2019 reproductive success decreased from 1:5.1 to 1:2.3, as spruce regained vitality.
- In 2020, reproductive success decreased to 1:0.7 and 1:0.8
- In 2021, reproductive success increased to 1:2 and 1:1.



Field officer taking bark samples
Photo Anders Samuelsson

Measures against Ips

- Taking care of storm-felled spruce
- Specific search and selective removal, summer months
- Specific search and selective removal, winter months
- Felling spruce stands deemed to be at risk of infestation
- Timber traps, for capture and removal
- Insect traps

- Pheromones in the future? No exemption from Kem. 2023?

- In the long term, forest management needs to be adapted due to increased risk of severe infestations.

Specific search and selective removal, spring/summer months



- The aim of the method is to search for infested spruce and remove them from the forest, and/or prevent their offspring from developing before they are ready to leave the bark.
- To find infested trees in time, the forest needs to be monitored regularly (every 4th week) from the first swarming in April/May up until August/September.
- SFA's monitoring of swarming can be followed online from week 16 to 36 at www.skogsstyrelsen.se/svarmningsovervakning
- Infested trees need to be removed from the forest or have their bark stripped while the bark beetle is developing under the bark.
- Difficult situation now to remove all infested trees from the forest as the general population is so high.

Ips winter activity

- Ips survive winter as fully developed insects
- Pupa and larva usually die at temperatures under 0 degrees.
- The fully developed insect tolerates freezing temperatures but can die due to reasons such as fungal infection or because of natural enemies.
- Variation in how many bark beetles survive winter in the soil or under bark:
 - In central Europe, majority under bark
 - In southern Sweden, half and half
 - In northern Sweden, majority in the soil

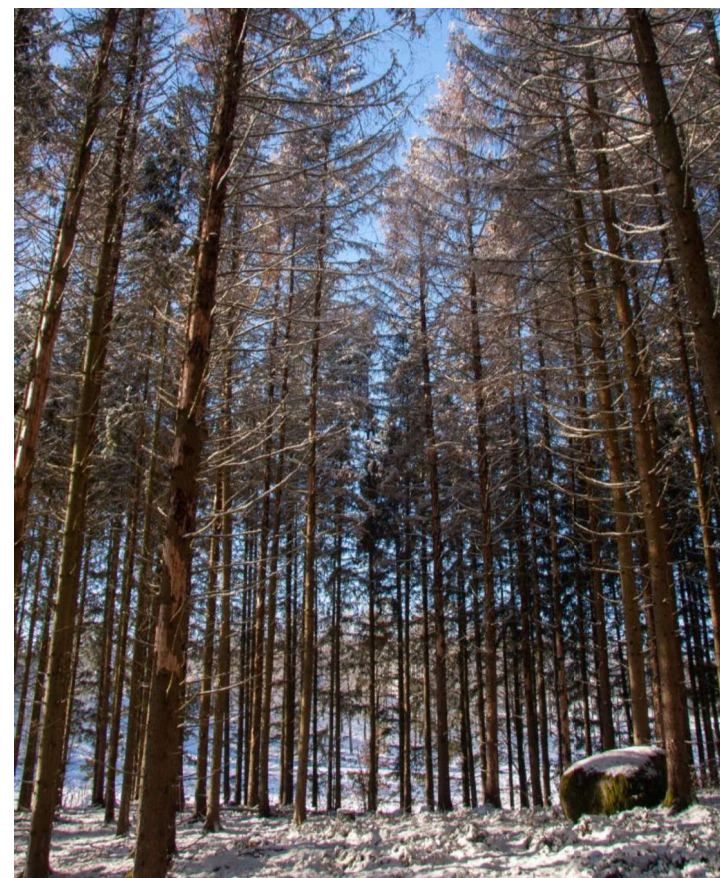


Foto: Mattias Sparf

Winter felling of infested stands

- Infested stands may need to be felled to enable regeneration with the help of soil scarification, or to save the timber value.
- It can also be necessary to fell remains of older spruce stands which have been infested earlier or have a high risk of infestation.
- Winter felling (of infested trees from previous summer) as an effective mitigation measure is doubtful, as many bark beetles live in the soil over winter. The bark beetles who live under the bark are also often left in the forest as bark is stripped at felling or transport.
- If winter felling is to be considered an effective mitigation measure, the felling should occur at temperatures below freezing and most of the bark needs to be transported out of the forest.
- Spruce which have been dead for more than a year are not habitat for bark beetle.

Site condition and climate adaptation

- Adaptation to site conditions is fundamental for management of the effects of climate change and to minimise the risk of future damages.
- General categories based on site conditions:
 - Pine dominance
 - Mixed forest
 - Spruce dominance
 - Deciduous forest



SFA's advice to minimise the damage caused by Ips



- Create natural boundaries of birch between stands, at thinning.
 - Research has shown that bark beetles avoid birch or are at least less likely to attack spruce in mixed stands.
- Don't thin spruce stands which are older than 40 years or taller than 20 meters.
 - Increased risk for storm damage if older spruce forests are thinned.
- Thin at the right time, so trees don't become stressed.
 - If the trees don't have space to flourish, they are more stressed both before and after thinning.
- Avoid creating stand boundaries against older spruce forest, if possible.
 - Large risk of storm damage and bark beetle infestation if stand boundaries are older spruce.
- Save dead trees in the forest, even those without bark.
 - This creates habitats for natural enemies of the bark beetle.

SFA's advice to create robust forests for the future

- Spread risks
 - Invest in different species and management regimes, for example monoculture vs mixed stands, single aged stands vs mixed age.
- Adapt to site conditions
 - Choose those species which are likely to thrive in the natural site conditions.
 - Avoid planting spruce in dry stands as it doesn't tolerate drought.
- Wildlife management
 - Aim for ungulate population levels which make it possible to grow those species which are best adapted to the site conditions.

The forests of the future are in our hands!

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www.skogsstyrelsen.se/granbarkborre

Photo: Mattias Sparf