

The role of forest pests and diseases – expected future changes

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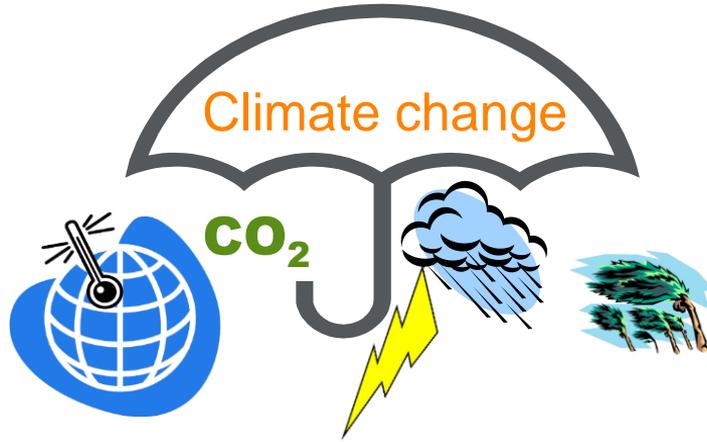


Funded by the European Union, the Russian Federation and the Republic of Finland

Climate change induces multiple risks to boreal forests and forestry in Finland: A literature review

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Expected future changes



- Increase in temperature
- Longer growing seasons
- Soil doesn't freeze as deeply or long period as earlier

- Increased precipitation
- Soil dryness increases due to increased evaporation (especially spring and early summer)

Insects and diseases

Rule of thumb

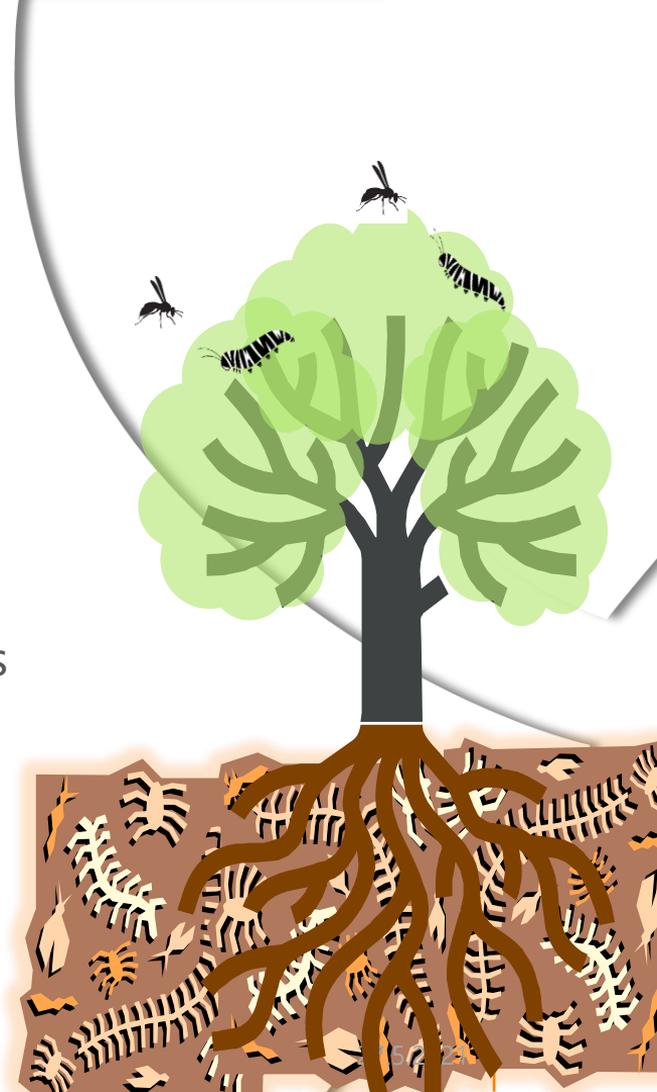
- insects (poikilotherms) benefit from warming
- diseases benefit from moisture (sporulation)

However, it is never “black and white”

Environmental change affects also performance of insects and diseases via host plants and natural enemies



Forest structure plays a role as well



Spruce bark beetle, *Ips typographus*



© Luke / Oksanen

Why the species benefits:

Directly warmer summers increase the development rate from egg to adult (~700 dd temperature sum), it can attack more trees per season as the second generation also develops as the growing season gets longer (~1500 dd)

Indirectly via host trees

Host tree condition, bark beetle attack success depends on the defense level of the tree: damaged or drought stressed trees provide lower resin defenses against the beetles. This results higher population size that can also overcome with the resin defenses of the healthy trees. Beetles vector the blue stain fungi that aid them in tree colonization.



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Root rot *Heterobasidion annosum* ja *H. parviporum*

Wood decay causing *Heterobasidion* species are not sensitive to dry conditions as they habit the soil.

Heterobasidion parviporum

root and butt rot in **spruce**

increasing temperatures will increase spore dispersal

Growth rate of mycelia will increase, faster spread within infested site

Lack of soil frost will increase root damages and thus, pathways for infection.

Becomes more abundant in the north that earlier

Heterobasidion annosum

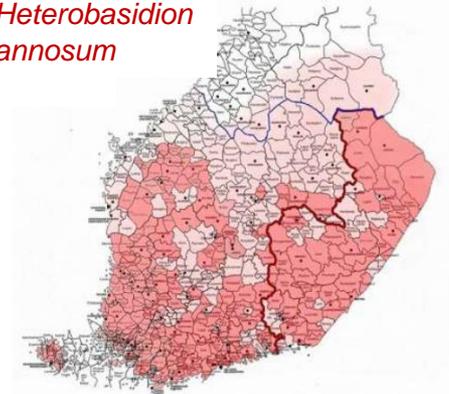
root and butt rot in **pine** (also in **spruce**) especially south-eastern part of Finland pines dry and die

Heterobasidion parviporum



© Luke

Heterobasidion annosum



Spruce bark beetle (SBB), *Ips typographus*

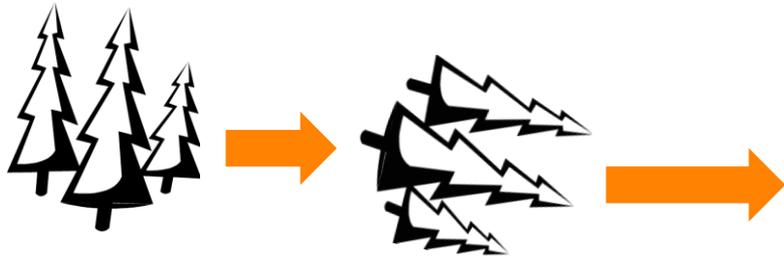
Shallow rooted spruce

Lack of soil frost

Increase in **root rot** occurrence



Risk for wind damage increases



In the eastern and northern Finland winter precipitation causes snow damage



Stem breakage

Bending

Up-rooting (no soil frost)

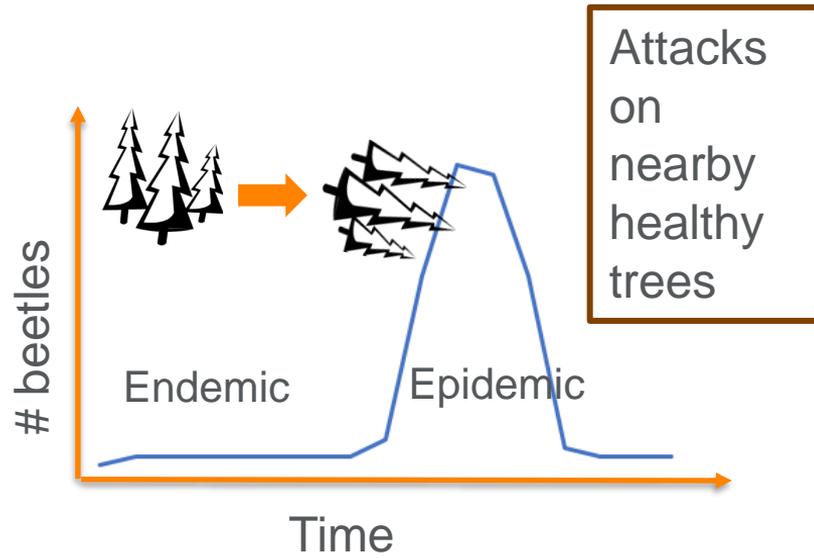


Host material for the bark beetle reproduction



Spruce bark beetle

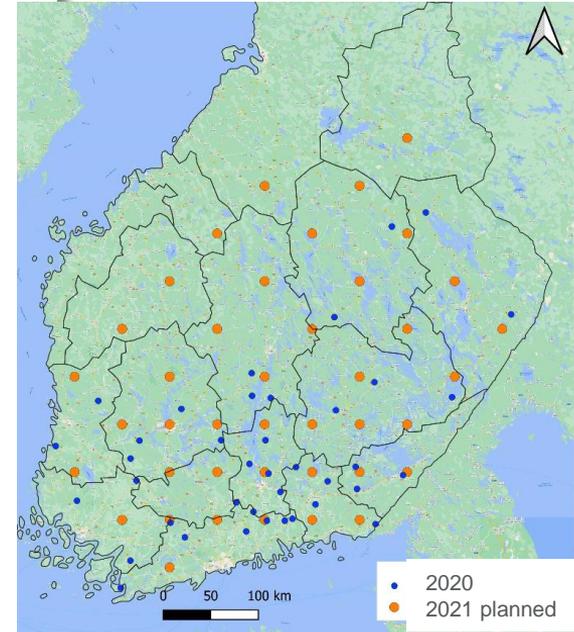
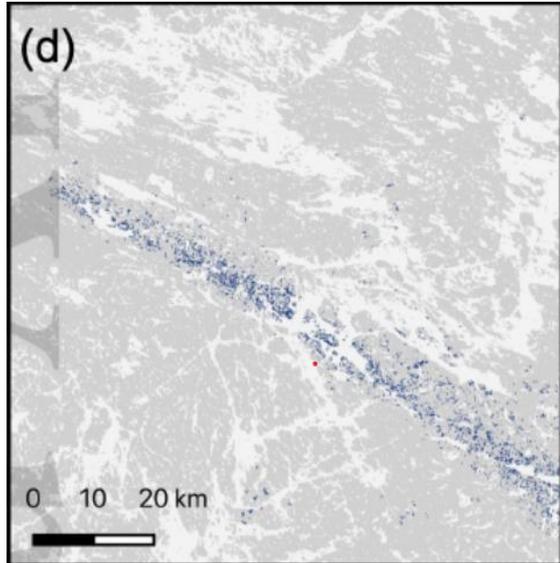
Transition from endemic state to epidemic state in current climate



Photos: Tiina Ylioja / Luke



Pheromone trap monitoring of spruce bark beetle 2012 ->



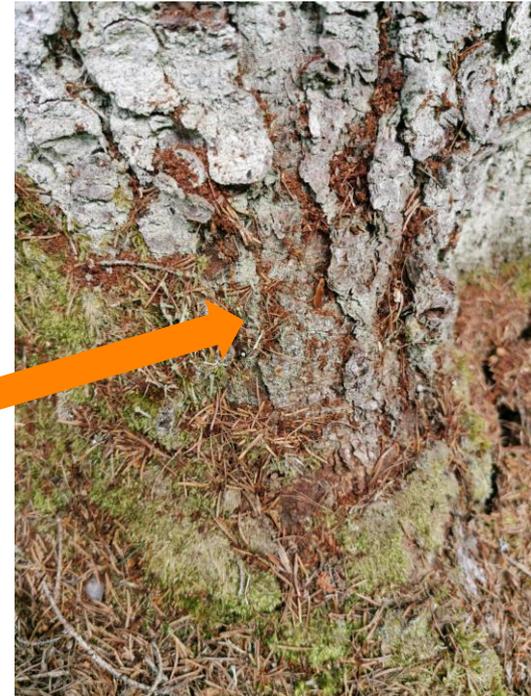
Thunderstorms in 2010
Source: [doi:10.1111/gcb.15679](https://doi.org/10.1111/gcb.15679)
Senf and Seidl (2021). Storm and fire disturbances in Europe: distribution and trends. Global Change Biology

To be prepared in current and near future climate

Forest Damages Prevention Act 1087/2013 (currently being renewed): precautionary measures against spruce bark beetle (and root rot).

Remove host material before emergence (700 dd) to prevent the beetles from spreading to surrounding forest

- timber with bark
- damaged trees including
- freshly attacked trees by SBB



At endemic state

Effort to remove infested trees to prevent further spread, small resolution



Photo: Tiina Ylioja / Luke



Photo: Evgeny Lopatin / Luke



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Contents lists available at ScienceDirect

Urban Forestry & Urban Greening

journal homepage: www.elsevier.com/locate/ufug

Remote sensing of bark beetle damage in urban forests at individual tree level using a novel hyperspectral camera from UAV and aircraft

Roope Näsi^{a,*}, Eija Honkavaara^a, Minna Blomqvist^b, Päivi Lyytikäinen-Saarenmaa^b, Teemu Hakala^a, Niko Viljanen^a, Tuula Kantola^c, Markus Holopainen^b

Int J Appl Earth Obs Geoinformation 82 (2019) 101900



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Contents lists available at ScienceDirect

Int J Appl Earth Obs Geoinformation

journal homepage: www.elsevier.com/locate/jag

Timing of red-edge and shortwave infrared reflectance critical for early stress detection induced by bark beetle (*Ips typographus*, L.) attack

Haidi Abdullah^{a,*}, Andrew K. Skidmore^{a,b}, Roshanak Darvishzadeh^a, Marco Heurich^{c,d}

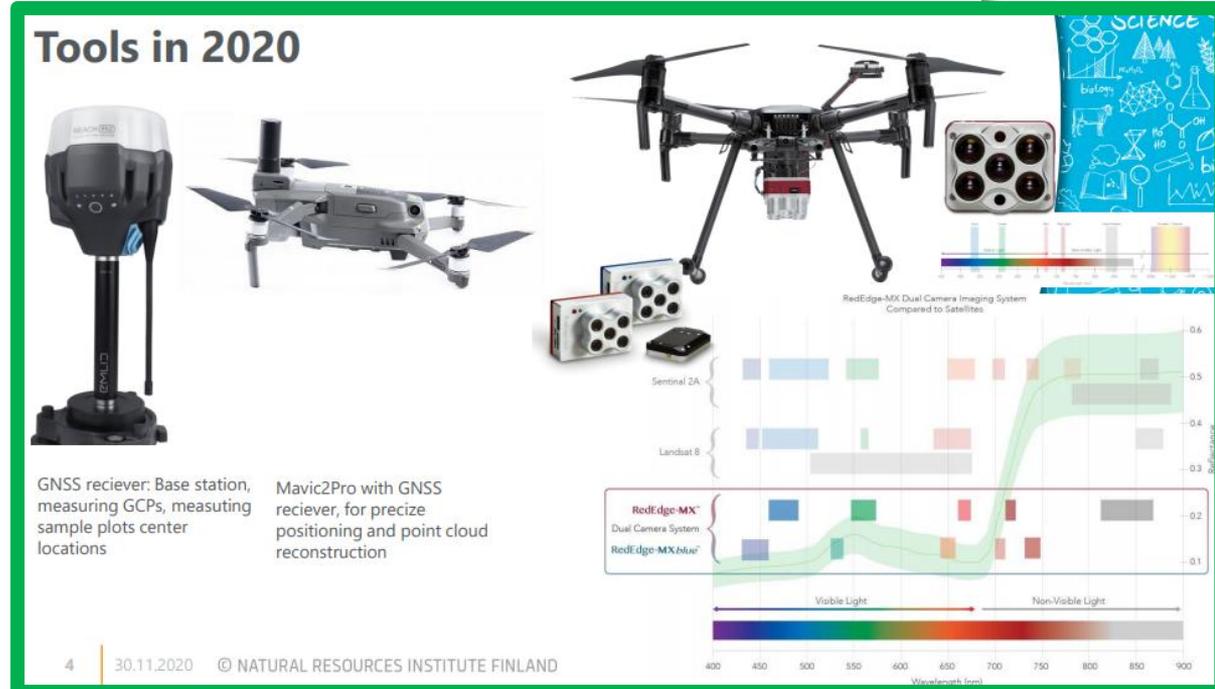
Sanitation felling:

effort to remove freshly attacked trees to prevent the beetles further spreading

Small scale remote sensing

In 2020 we tested UAV mounted multispectral camera to detect bark beetle infested trees.

Satellite images have not turned useful for finding bark beetle infestations in Finland, yet. Infestations, groups of dead trees, are small.



Slide presented by E. Lopatin 2020/12/01

At epidemic state

- In the future, warm summer temperatures not only allow a 2nd SBB generation to emerge before winter but also periods of drought will play larger role in building up spruce bark beetle epidemics
- Similar conditions are also prerequisite for forest fires
- The need for remote monitoring and inventory of forest damages will increase
- From a biodiversity point of view SBB killed trees that no longer host SBB could be left to the forest without any further risk of SBB spreading from them.
- Large scale SBB calamities, such as seen in Central Europe, can also provide fuel for forest fires if not salvage logged.
- Salvage logging: effort to remove trees for timber, to salvage the wood.

Cross-border collaboration and remote sensing of forest damages

- Warming climate increases both abiotic and biotic damage risks (not all of them, though)
- Pine defoliators such as pine beauty moth (*Panolis flammea*), pine looper moth (*Bupalus piniarius*) and pine sawflies (*Neodiprion sertifer*, *Diprion pini*) are likely to increase their abundance as well as defoliators of birch. The nun moth (*Lymantria monacha*) is extending its range and abundance
- New invasive alien species are a common concern, e.g. such as emerald ash borer, *Agrilus planipennis*

Insects and diseases do not respect borders

Large windthrow areas, snow damaged areas in the vicinity of the border, on either site, are likely to induce secondary insect damages to both countries.



HYBRID FORMAT

HOTEL "INDIGO"(ST.PETERSBURG) AND ZOOM

28.05.2021

14:00-18:00

FINAL CONFERENCE

KS1309 INNOFORESTVIEW



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Registration link:

<https://forms.gle/YsB2ypbCdUBKoPmc9>