

WHAT SHOULD WE DO TO PROTECT NORDIC FORESTS FROM CLIMATIC CHANGE AND ALIEN PESTS AND PATHOGENS?

- **Multidisciplinary research including the most recent technical developments.**
- **No planting of spruces to dry soils.**
- **The genetic diversity of Seed Orchard materials should be maintained high enough.**
- **Preventing alien pests and pathogens from being introduced to the Nordic region.**
- **New and more efficient means should be developed and applied to stop the spread of pests and pathogens through the international trade of plants and plant products.**
- **Collaboration among the global scientific community as well as intensive participation of authorities and stakeholders.**

Introduction

The climatic change has a wide effect on forests throughout the world. It affects tree growth, soil characteristics and also organisms associated with trees. The increasing international trade of plants and plant products forms another and even more topical problem to forest health. This is because pests and pathogens are associated with the trade, and are causing growing forest damages throughout the world.

In Nordic countries the temperatures are expected to increase more than in southern latitudes, the frequency of spring frost events may rise and also annual rainfall will increase although also longer periods of drought are expected in summertime. Climate change will affect forest management and land use, often with unexpected effects on the forest health.

The climatic changes will favour many pests and pathogens already occurring in the region, and also make Nordic forests more suitable to southern organisms which may disperse towards north. The worst case scenario has become true in Western North America, where the mountain pine beetle has caused massive pine forest deaths with extreme impacts on the

economy and turned affected forests from carbon sinks to greenhouse gas sources.

Multidisciplinary research including modern technologies is needed

In Nordic countries the threat caused by climatic change and also international plant trade should be addressed in many levels. In science the different disciplines should be combined to find solutions to the problem before it is faced. Especially the possibilities provided by novel genetic methods such as genetic modification or gene editing are underused in Nordic countries although they could solve many problems on e.g. resistance breeding. Therefore, multidisciplinary research including the most recent technical developments should be applied and supported.

Forest resilience via forest management and breeding populations

The indigenous tree populations in Nordic countries always have resistance or tolerance against local pests and pathogens, which may cause massive damage only if the environment changes considerably. In Nordic countries increasing temperatures and possible long draught periods are expected to cause weakening of especially spruce trees, which predisposes them to attacks of especially insects but also some pathogens. Therefore, planting spruces to dry soils should be avoided. Also the genetic diversity of Seed Orchard materials should be maintained high enough to retain resistance genes.

Preventing the introduction of alien pests and pathogens

Alien pests and pathogens have caused a number of catastrophes with massive tree deaths



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throughout the world during the last century (White pine blister rust, Chestnut blight, Dutch elm disease and Ash dieback to name few). This history shows, that the most efficient means to avoid such catastrophes is preventing introductions as once established organisms, especially pathogens, are practically impossible to eliminate. Tree populations usually include individuals with genetic resistance against alien pests and pathogens, but it may be very rare as seen e.g. during the ongoing ash dieback. Therefore even the worst pathogens will probably not wipe out any tree species completely, but single individuals remain alive and will form the basis of future populations with a narrower genetic base. This does not, however, prevent the forest economy from collapsing nor ecosystem services from vanishing due to alien species. Neither does it prevent losses of biodiversity from disappearing biotypes. Therefore specific attention should be put in preventing alien pests and pathogens from being introduced to the Nordic region.

New solutions needed to control the risks of international trade of plants and plant material

There is international legislation, based on risk evaluation of single pests or pathogens, aiming to prevent spread of pests and pathogens. Despite that, the problem has not been solved but pest and pathogen introductions continue with increasing rate also in Europe. More stringent regulations and more intensive inspection of plants and plant products are often suggested. However, even the most stringent regulations and inspections (take Australia as an example) have not stopped the spread of harmful organisms. Therefore forest pathologists throughout the world have proposed that international

trade of plants and plant products, which has a low overall economic benefit but high risk of pest and pathogen spread should be phased out (Montesclaros declaration). Such regulatory actions are strongly opposed by advocates of free trade e.g. WTO. Therefore it has been suggested that the pest and pathogen risks should be included in the prices of internationally traded plants and plant materials. That would remove the indirect subsidies supporting international production against more safe local production, and therefore reduce the problem by improving the competitive position of local production and motivating the actors in international plant trade to put more attention in the hygiene of their production lines. Taken together, in order to rescue the Nordic forests from further alien pests and pathogens new and more efficient means should be developed and applied to stop the spread of pests and pathogens through the international trade of plants and plant products.

Global collaboration is essential

It is possible to prepare for risks associated with climatic change and global trade. The risk analyses require adequate infrastructure and resources for professional phenotyping of trees against known pests and pathogens. It should also be possible to look at multiple stresses simultaneously and/or in sequence. In addition, a more efficient international alarm network on pest and pathogen introductions could be useful as early warning system should be even more efficient than early detection of alien threats. For all these purposes collaboration among the global scientific community as well as intensive participation of authorities and stakeholders would be essential.

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