



Karina Engelbrecht Clemmensen

Cortinarius fungi, efficient decomposers with important roles in nutrient turnover. Karina Engelbrecht Clemmensen wants to raise the awareness of the fungal communities. Photo: Karina Engelbrecht Clemmensen, SLU.

Forestry and fungi – a neglected relationship

The consequences of forestry on fungal communities are seldom up to discussion in the debate, but new results indicate that logging have long-term impacts on important fungal groups. Disturbing the fungal balance may even lead to nutrient deficiency and reduced tree growth. This topic is one of many where researchers in the NEFOM network are involved.

Molecular methods have led to a revolution in studies of fungi in soils, since old inventory methods, based on finding and identifying fruit bodies, only detect minor portions of the fungal species.

Mycologists can now use DNA sequencing to quantify nearly all the taxa present in soil, and this has enabled many interesting studies on the consequences of forest management methods. A number

of Nordic published studies have investigated the impact on the fungal community from measures such as clear-cutting, ash fertilization and tree retention.

NEFOM network unites Nordic and Baltic mycologists

The mycology labs and research groups in the Nordic and Baltic countries help each other by sharing ideas and equipment. The cooperation has been going on for a long time, but since 2013, the network cooperation is formalised in the SNS-supported network NEFOM (North European Forest Mycologists).

A key activity is to establish and compile databases for identifying ectomycorrhizal fungi – and also all other fungi found in the environment. The largest is UNITE (Unified system for the DNA-based fungal species linked to the classification).

Several new results on the impacts

of forestry were presented at a recent NEFOM conference held in Uppsala in February 2018. Almost 60 researchers from the Nordic and Baltic countries, as well as from the UK, Netherlands, USA, Canada and Switzerland, were assembled under the theme “Roles of fungi in sustainable forestry”.

Fungi important in boreal forests

Fungi have particularly important roles in boreal coniferous forests. The bacteria and earthworms that are important decomposers in richer soils are much less abundant in the acid soils of boreal ecosystems. Instead, fungi are the key decomposers of organic material and major agents in nutrient cycling.

Degradation of the top layer of the forest soil, the litter, is strongly dependent on saprotrophic fungi



that release enzymes capable of efficiently decomposing not only simple substrates but also tough polymers such as lignin. Below, in the more decomposed humus layer, ectomycorrhizal fungi are responsible for much of the nutrient turnover.

Ectomycorrhizal fungi are essential in all forest ecosystems. They receive carbohydrates from the trees and pay them back by improving supplies of nutrients and water to their roots. But mycorrhizal fungi are not a homogenous group: some release more efficient degradative enzymes than others, which may have different functional roles.

Clear-cutting disturbs the fungal balance

When trees are cut, mycorrhizal fungi lose their symbiotic partners. Recent studies have shown that mycorrhizal species decrease after a clear-cut, and instead give room to free-living fungi with more efficient decomposition. This accelerates decomposition during the decade following clear-cuts resulting in a nutrient flush. Some mycorrhizal species recolonize the new forest stand, but others seem to be suppressed for longer times.

Fungi of the genus *Cortinarius* are particularly sensitive. Some of these fungi, despite being ectomycorrhizal, can produce strong enzymes which make them efficient scavengers of nutrients bound in organic matter. The nutrient peak after a clear-cut probably disfavour these fungi. In the long run, the balance between various groups of fungi will be disturbed.

Risks of nutrient deficiencies after clear-cutting

When the *Cortinarius* species decline, there is a risk of nutrient turnover slowing down as less efficient decomposers replace them. This may impair nutrient supplies to the trees.

Studies of chronosequences of managed pine stands in Sweden have shown that the fungal community is affected for a long time after clear-cutting. When all trees are cut,

mycorrhizal fungi almost disappears. The fungi return slowly, but other species are dominating the young forest compared to the older. It is not until an age of 60 years or so before the community resemble that of the old forest.

The studies have for example shown that *Cortinarius* and *Russula* species are absent for several decades, and increase only slowly after that.

Single retention trees is not the final solution

What can be done to prevent the long decline of certain mycorrhizal fungi? Some of the studies have considered effects of retention trees. However, results have indicated that leaving single trees, like in a seed-tree stand, does not preserve the ectomycorrhizal composition. The fungi nearest the tree may still have a diversity resembling the old forest, but this is not enough to restore the fungal community in the whole stand.

It is probably more efficient to leave retention trees as forest patches. Uneven-aged forestry, avoiding clear-cuts, could also be effective.

Important to raise awareness of fungi

Karina Engelbrecht Clemmensen at SLU in Uppsala is coordinator of NEFOM and one of the organisers of the conference in Uppsala. She wants to raise the awareness of the

important roles of fungi in the forest ecosystem. She finds, however, that the fungal community is usually neglected in the discussions about sustainable management.

– Two invited guests gave their perspectives on forest ecology and forestry research, and it was clear that fungi are overlooked in more general forestry research and management plans. We discussed means to raise the awareness of fungi. One idea was to conduct more cross-field research to ensure convergence between scientific research questions and forestry practices. We also need to tell our stories to the public and the forest sector. Research results must be made more easily available, in a context that engages the audience, she says.

The mycologists at SLU have made good efforts to produce popular news about their results, news that have been much exposed in media.

– The mission to disseminate new result applies to all NEFOM researchers. New results are constantly added, and we need to consider these when discussing sustainable forest management, says Karina Engelbrecht Clemmensen.

SNS network N2018-5 North European Forest Mycologist (NEFOM). Webpage <http://nordicforestresearch.org/nefom-northern-european-forest-mycologists/>.

Contact: Karina Engelbrecht Clemmensen, karina.clemmensen@slu.se



The NEFOM network meeting in Finse, Norway, 2016. Photo: Håvard Kauserud, University of Oslo.

Emerald ash borer - A potential new threat to Europe's ashes



Emerald ash borers. Photo: David Cappaert, Michigan State University (CC BY 2.0).

The ash trees in Europe have suffered severely from ash decline, caused by the pathogen *Hymenocyphus fraxineus*. Soon, a new threat may be added. If the emerald ash borer reaches Western Europe, the combined pressure from the insect and fungus will be fatal for the ash ecosystems. The EMERALD network will coordinate research efforts to counter the pest.

The Emerald ash borer (*Agrilus planipennis*) is an aggressive beetle native to North-eastern China,

Korea, Japan and Taiwan. It infests *Fraxinus* trees of all species, but is less detrimental to local ashes than *Fraxinus* species growing in North America and Europe.

Invasive in North America

The beetle was accidentally introduced into North America, where it was first detected in 2002. It was probably carried there in wood packaging from China. In South-east Michigan, the epicentre of the establishment, over 99 % of the ash trees with stems thicker than 2.5 cm have been killed. The beetle continues

to spread in North America, where there is a risk that the genus *Fraxinus* may be more or less wiped out.

Moving northwest

There are fears that the Emerald ash borer may also reach Western Europe, where ashes are already suffering from ash decline. In 2003, the first attacks were recorded in Moscow city. Since then, the

species has spread west and southwest, reaching close to the borders of Belarus and Ukraine in 2012.

An inventory in 2016 showed that the beetle is also slowly moving northwest from Moscow, and it was detected about 200 km outside Moscow towards Saint Petersburg. If it reaches this city, it will be fatal for the ash trees in parks and along roads.

Wilting trees

The beetle can act as a primary pest but also bears parasites. It infests lower and middle parts of stems, where the larvae feed and develop until they leave the bark next spring. The symptoms are initially vague, but attacks can be identified through the larvae galleries. Over time, infected trees start to wilt, and finally die.

There was a report of the species in Sweden in 2011, which caused some panic over a possible invasion of Western Europe. However, the specimen had been incorrectly identified. The emerald ash borer has still not (hopefully) reached Western Europe.

Sources

Selikhovkin et al. 2017. The frontline of invasion: the current northern limit of the invasive range of Emerald ash borer, Agrilus planipennis Fairmaire (Coleoptera: Buprestidae) in European Russia. Baltic Forestry 23, 309-315.

Musolin, D. et al. 2017. Between ash dieback and emerald ash borer: Two Asian invaders in Russia and the future of ash in Europe. Baltic Forestry 23, 316-333.

www.jordbruksverket.se, *Agrilus planipennis angriper ask (faktabladd)*.



Trees damaged by the emerald ash borer in Ontario. Photo: Michael Hunter, CC BY 4.0.



EMERALD, cont.

About EMERALD

The EFI-NORD/SNS-supported network “Emerald ash borer (*Agrilus planipennis*), invasive deadly pest approaching eastern EU border: preparing for the worst case scenario” (EMERALD) connects researchers in Northern Europe working on the invasive species. They include entomologists, tree breeders, silviculturists, tree pathologists, bioeconomists and social scientists from eight countries.

In 2018 a workshop and excursion near the frontline between Moscow and Saint Petersburg will be held. A session on *Agrilus planipennis* will also be organised at an Ash and Elm conference in Uppsala and Visby in August-September. The involved researchers will also

collaboratively prepare a joint Horizon 2020 proposal on invasive pests.

Coordinator and contact: *Rimvys Vasaitis, Swedish University of Agricultural Sciences:*
rimvys.vasaitis@slu.se



Rimvys Vasaitis. Photo: Audrius Menkis.

Successful Matchmaking Day

On 8 May 2018, SNS and EFINORD organised a Matchmaking Day in Alnarp, Sweden. The aim was to pave the way for new research collaboration with young and senior researchers from all over the Nordic countries. The first Matchmaking Day was held in 2015, and it resulted in several cross-sectoral networks and projects, combining for example forestry, agriculture and horticulture. The corresponding day in 2018 was deemed to be very successful, and SNS is discussing the need to repeat the event more often.

Read more: www.nordicforestresearch.org



Matchmaking discussions. Photo: Mimmi Blomqvist.

Call for research projects

Nordic Forest Research (SNS) announces a research project call. Research projects should relate to the following focus areas:

- Meeting the demands of sustainable forest management in a growing economy.

- Maintenance and increased utilisation of ecosystem services.

Deadline for application is 15 August 2018.

Read more: www.nordicforestresearch.org

Shortcuts

Finland:

Climate change increases storm risk

The aim of the Storm wood project (Myrskypuu) is to develop an open, free-of-charge map of wind damage risks. The experts believe that the wind damage in northern Europe will increase due to climate warming. The maps will be finalized in 2019.

Source: www.smy.fi

Sweden:

Public support against invasive species are media-driven

A study from among others SLU shows that the acceptance towards actions against invasive species is linked to media coverage of ongoing attacks. The survey was conducted in nine countries. There was a consensus on counteractions such as stricter rules, education and labeling of plant origin. However, people were less motivated to personal sacrifices such as paying more for the plant materials.

Source: www.slu.se

Norway:

Better soil waters in Europe

International agreements on acid rain have been effective. A recent study involving researchers from ten countries shows that the amount of sulphate, nitrate and aluminium in European forest soil waters has decreased dramatically. NIBIO is one of the partners in the project.

Source: www.nibio.no

Contact News & Views

Write to the editor:

Mats Hannerz,
Silvinformation AB
mats.hannerz@silvinformation.se

More info about SNS:

www.nordicforestresearch.org

News & Views is a newsletter from SNS containing short, popularized articles covering Nordic forest research and forestry. Articles presenting SNS-supported activities are prioritized. The newsletter is published eight times per year, and is available for download from the SNS and Scandinavian Journal of Forest Research websites.



News & Views is edited and produced by Mats Hannerz, Silvinformation AB
mats.hannerz@silvinformation.se