Pure Northern Finland

The special characteristics of Finland as a source of high-quality and safe raw materials for natural products

Pro Pakuri Finland ry 2023

Contents

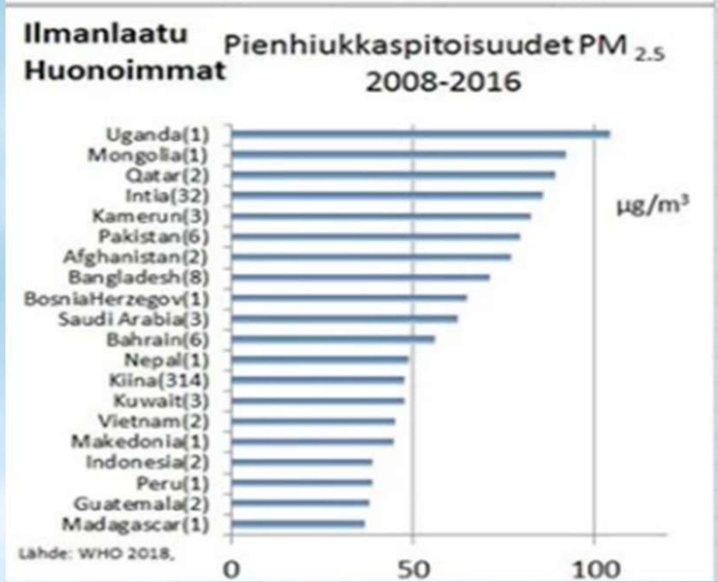
Living environment
- air
- forests.

Production environment – raw materials
- certified, verified production/collectively produced to organic standards
- bioactive compounds and their concentration.

Air

• According to statistics published by the WHO, Finland has the best air quality in the world.

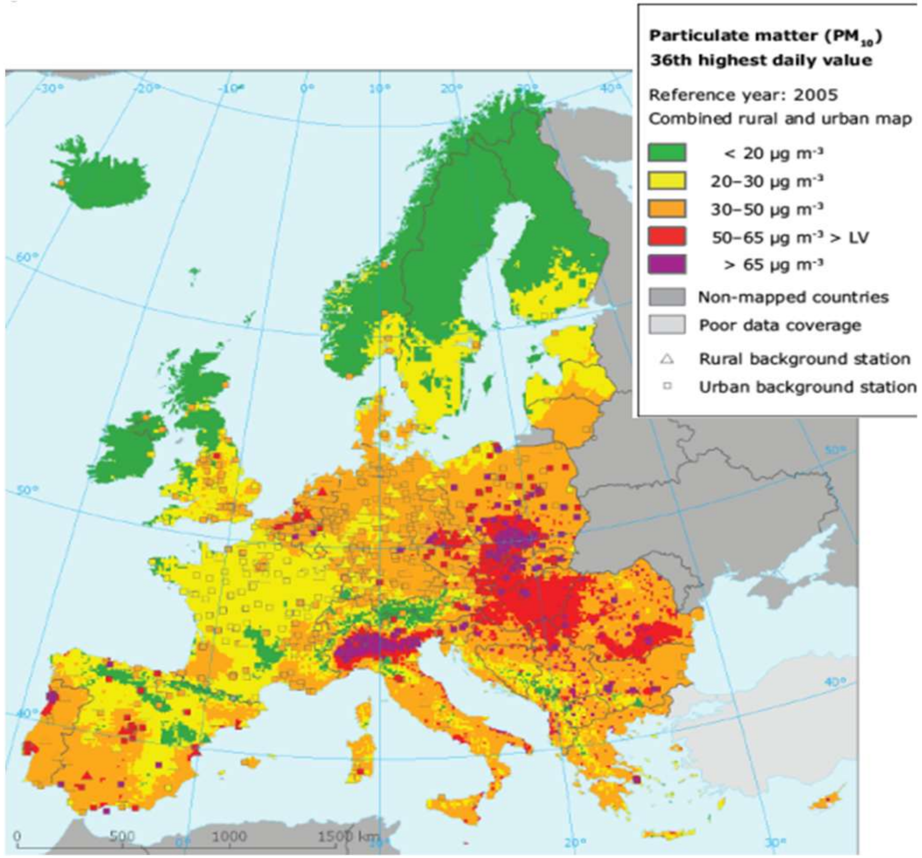
- The statistics are based on extensive data published by the WHO.
- The statistics include fine particulate matter measurement data from nearly a hundred countries for the period 2008–2016.
- In Finland, the average concentration of fine particulate matter in the air is 6 µg/m3.
- The northern countries of Estonia, Sweden, Canada, Norway and Iceland are at almost the same level.



Source: the Finnish Meteorological Institute, the WHO 2016.

Air – factors measured through the air

- In Finland, the cleanest air is in Muonio, Western Lapland.
  - These statistics are based on extensive data published by the WHO.
  - In Muonio, the average concentration of fine particulate matter in the air is 4 µg/m3.
  - This figure is the lowest country-specific concentration level measured.



Source: the Finnish Meteorological Institute, the WHO 2016.

Air – Finland’s air quality is among the cleanest in Europe

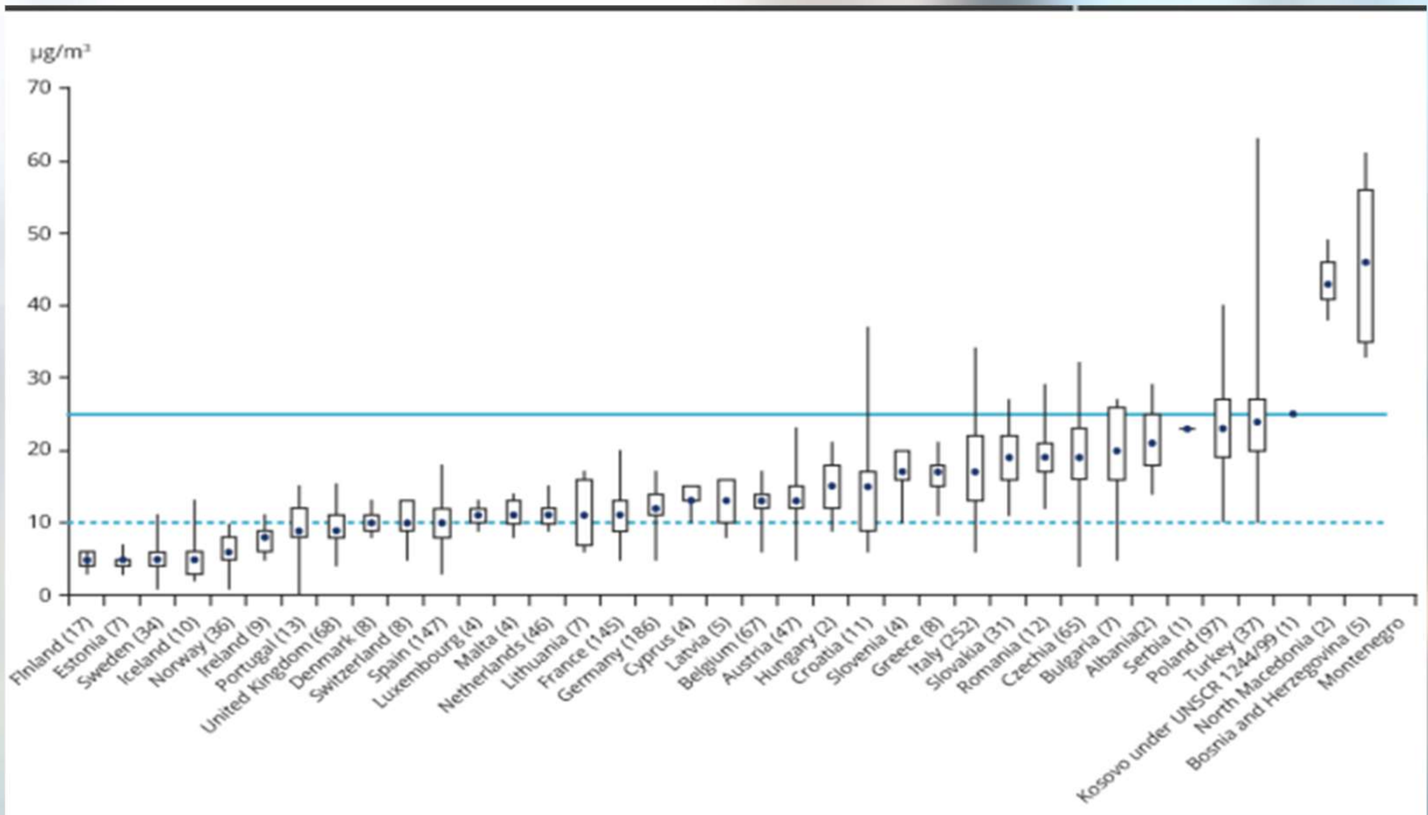
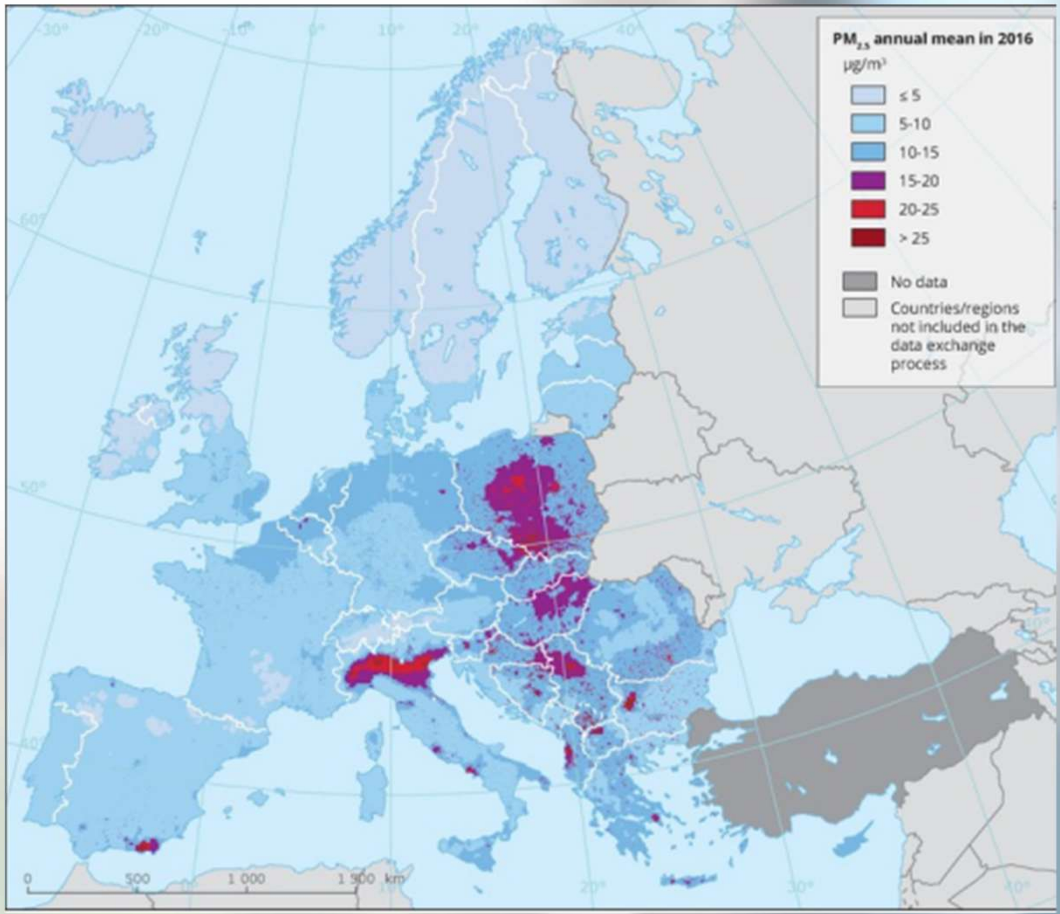


Table. Country-specific comparison of PM2.5 concentrations in the year 2017.
The chart is based on annual average PM2.5 values.
For each country, along with the numbers of measuring stations used, the smallest, largest and median values recorded at the stations are also given (µg/m3).
The rectangles represent the 25th and 75th percentiles.
For 25% of the stations, the concentrations are below the lower of these two percentile points, while for 25% of the stations the concentrations are above the higher of these two percentile points.
The upper horizontal line represents the limit value set in EU legislation.
The lower horizontal line represents the WHO AQG level.
Table: European Environment Agency (EEA) 10 December 2019



Map. PM2.5 annual mean in the year 2016.
This map displays PM2.5 particle concentrations (annual mean) calculated by combining data from regional and urban background monitoring stations with results from the European Monitoring and Evaluation Programme's (EMEP) Chemical Transport Model and other additional information.
Map: European Environment Agency (EEA) 16.10.2017

Dia 7

A0 Vuodelta puuttuu jotain (16.10.201) - pitäisikö se olla 2017?
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Air – factors measurable with bioindicators

When examined with bioindicators, Northern Karelia has the best air quality:

- The study is a continuation of regional bioindicator studies conducted in 1998–1999 and 2010.
- In the study, air pollutant effect indicators, such as lichen growing on pine trees and elemental concentrations in mosses, were used, as in the previous studies.
- As a summary of the study, it can be concluded that based on lichen observations, the lichen species composition in North Karelia was slightly altered but closer to its natural state than lichen in the rest of the southern half of Finland.
- In comparison to monitoring studies conducted over the last 15 years, lichen damage was lowest in North Karelia and the region's air quality index was the highest.
- Pine bark lichen are effective bioindicators of air quality, especially in terms of describing long term change trends. They react slowly but sensitively to air pollutants.
- The air quality in North Karelia is better than that of other areas studied in Finland.

Reference: Ruuth, Janne; Keskitalo, Toni; Talvitie, Tuomas; Korhonen, Kari T. 2021. Pohjois-Karjalan maakunnan ilmanlaadun bioindikaattoriseuranta vuonna 2020 (Air quality bioindicator monitoring in the North Karelia region in 2020). Reports 15/2021. North Karelia Centre for Economic Development, Transport and the Environment.

Air – the impact of fine particulate matter on ecosystems and the economy

The economic impacts of fine particulate matter

- The effects of air pollution on health, crop yields, ecosystems, the climate and the built environment also result in significant market and e-market costs.
- The market costs of air pollution include decreased labour productivity, additional healthcare expenses and crop and forest yield losses.
- Non-market costs are costs related to increased mortality and morbidity (e.g. diseases causing pain and suffering), and deterioration of air and water quality and consequently the health of ecosystems and climate change.

The impact of fine particulate matter on ecosystems

- Air pollutants cause a number of significant environmental impacts and can directly affect natural ecosystems and biodiversity.
  - For example, emissions of nitrogen oxides (NOX, the sum of nitric oxide NO and nitrogen dioxide NO2) and ammonia (NH3) disrupt terrestrial and aquatic ecosystems by introducing excessive amounts of nitrogen nutrients.
  - This can lead to eutrophication, which is an excess of nutrients that can result in changes in species diversity and the introduction of new species.
- NOX, together with sulfur dioxide (SO2), also contributes to the acidification of soil, lakes and rivers, which leads to a reduction in biodiversity.
- Lastly, ground-level ozone (O3) damages crops, forests and plants by reducing their growth rate and yields and it has negative impacts on biodiversity and ecosystem services.

Air – cleanliness is important for health

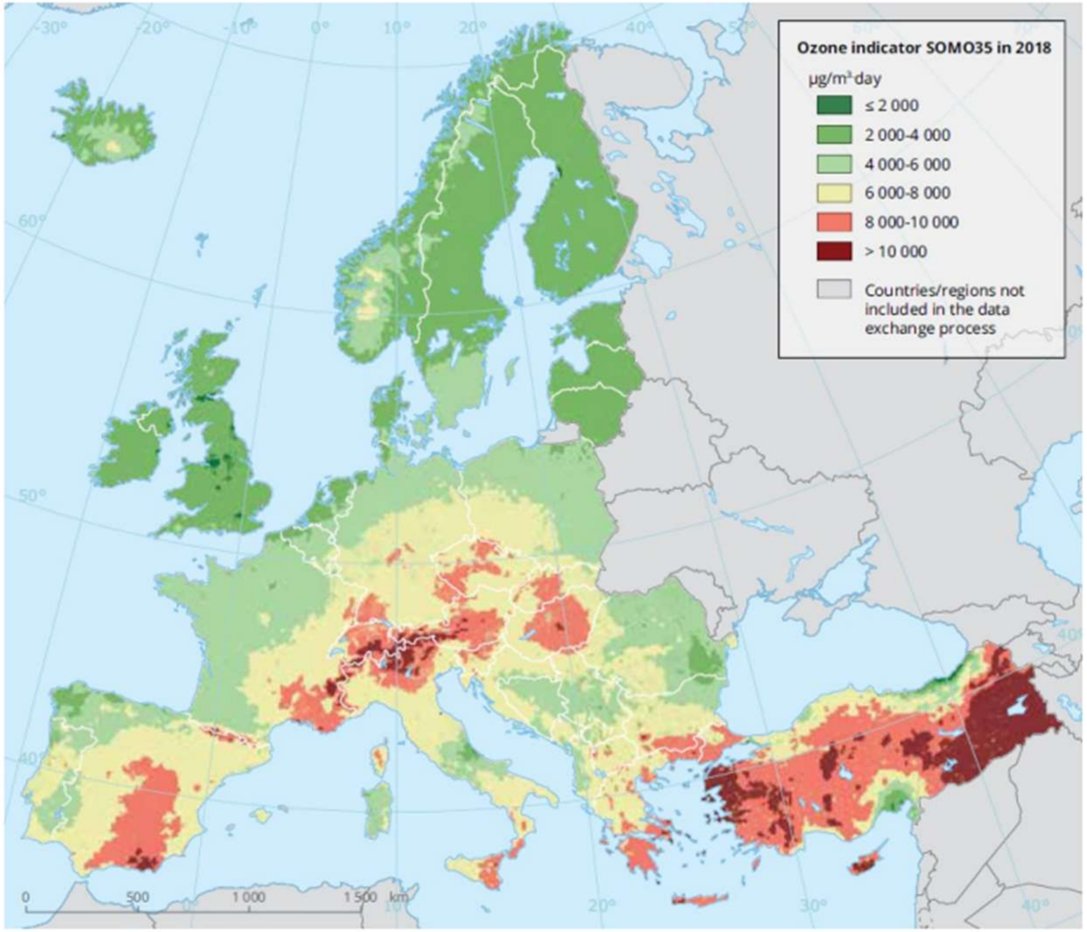
The impact of fine particulate matter on health

- Air pollution is the leading cause of premature death and illnesses and the single largest environmental health risk in Europe, with around 400,000 deaths annually in the EEA-39 (except for Turkey) as the result of exposure to PM2.5 particles (particles with diameter of up to 2.5 μm).
- Heart diseases and stroke are the most common causes of premature deaths due to air pollution, followed by lung diseases and lung cancer.
- The international Agency for Research on Cancer has classified air pollutants generally, along with particulate matter as a major component of air pollution, as carcinogenic.

The air in Finland is clean!

- To assess the exposure of the entire European population to various pollution standards, interpolation of the annual statistics from reported monitoring data from the year 2018 was carried out.
    - This combines monitoring data from rural and urban background stations (and traffic hotspots in the case of PM and NO2), taking into account traffic hotspots as a significant source of particles and especially NO2.

- The map shows PM2.5 and NO2 particles as well as the accumulated O3 concentration (maximum eight hours per day) exceeding 35 ppb (ppb), known as SOMO35, for O3.
    - The population exposure is assessed by combining these concentration maps with population density information.



Map. Concentration maps (a) PM10 (annual average, µg/m3), (b) PM2.5 (annual average, µg/m3), (c) O3 (SOMO35, µg/m3 day) and (d) NO2 (annual average, µg/m3) For the year 2018 (continuation). (ETC/ATNI (2020d). Map: EEA report No 9/2020

A0 Mihin tämä '58' viittaa?

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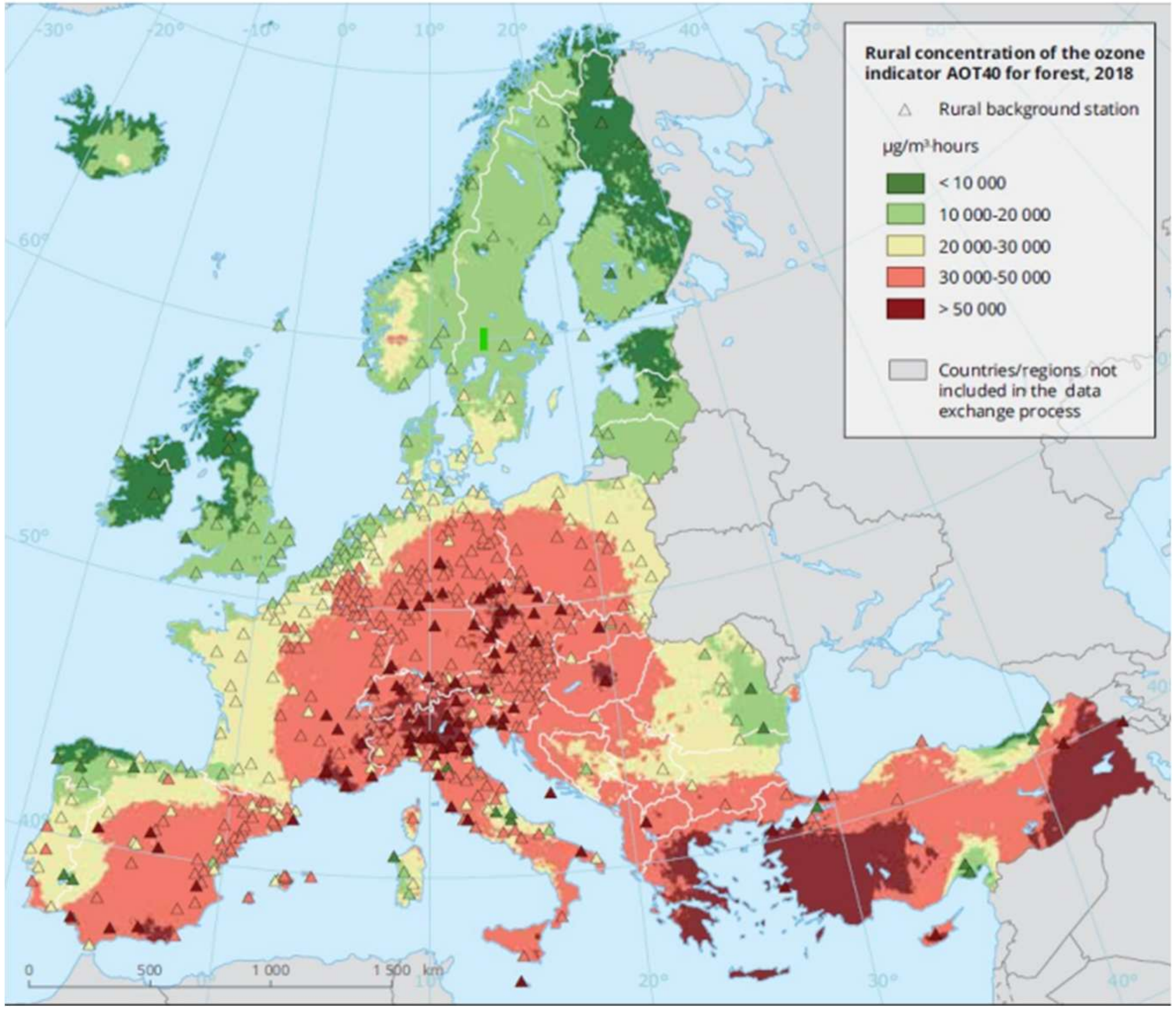
Air – why good air quality is important for the health of forests

The impact of air pollutants on the condition and productivity of the environment.

- Air pollution leads to environmental degradation and affects natural ecosystems and biodiversity.
- Ground-level ozone (O3) can harm plants, forests and other vegetation, weaken their growth and impact biodiversity.
- Deposition of nitrogen compounds can lead to eutrophication – an excess supply of nutrients. Similarly to sulfur compounds, nitrogen compounds also have acidifying effects.
- Both eutrophication and acidification can affect terrestrial and aquatic ecosystems, leading to changes in species diversity and the intrusion of new species .
- Acidification can also lead to increased mobilisation of toxic metals into water or soil, increasing their risk of entering the food chain.
- In addition to their environmental toxicity, toxic metals and persistent organic pollutants (POP) have a tendency to accumulate in animals and plants and biomagnify, meaning that concentrations in organisms’ tissues increase successively at higher levels of the food chain

Ozone concentrations, trends and vegetation exposure to ground-level ozone

- High O3 concentrations damage plant cells and impair plant reproduction and growth, leading to reduced agricultural yields, forest growth and biodiversity.
- In many parts of Central and Southern Europe, including the EU's Natura 2000 grasslands, there is a risk that exposure to current O3 levels could alter plant community composition and affect the flowering and seed production of certain species.
- Changing climate conditions and the increase in emissions of carbon dioxide (CO2) and other pollutants, like reactive nitrogen, are altering vegetation responses to O3.
- In addition to affecting plant growth, they also influence the amount of O3 taken up by leaves, altering the magnitude of impacts on plant growth, yield and ecosystem services



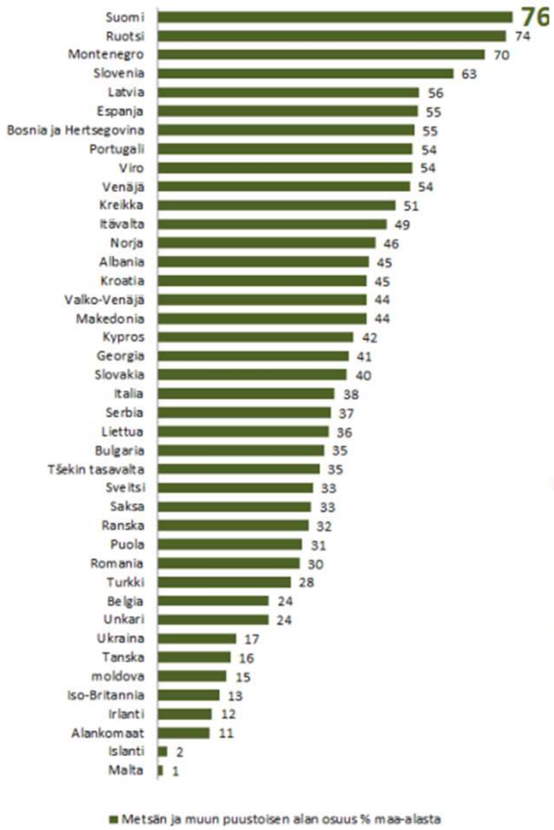
Map. Background concentration in rural areas of the O3 indicator for forests AOT40, 2018. Map: EEA Technical report No 9/2020 (ETC/ATNI (2020d)).

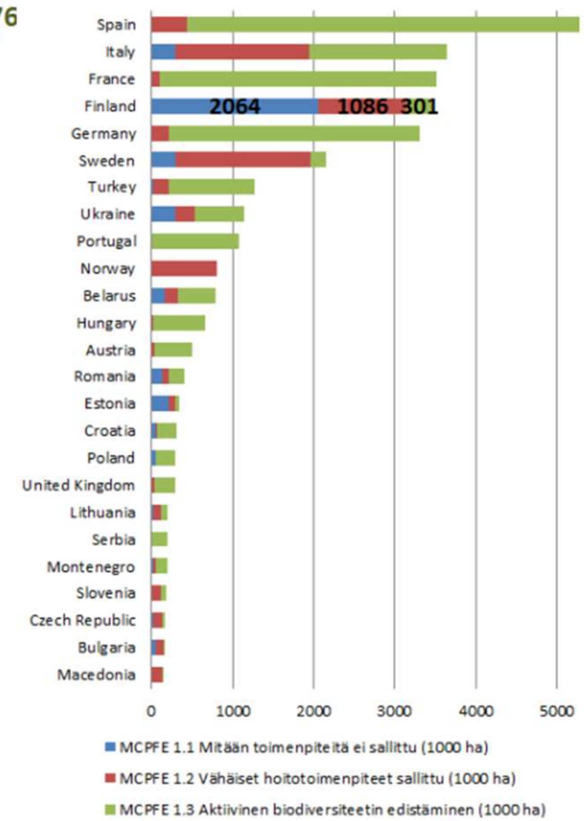
Finland is the most forested country in Europe

- Finland is the most forested country in Europe.
  - In addition to this, Finland has a significant number of protected areas relative to its size.

- In Finland, strict protection is promoted in conservation areas.
- Due to conservation programmes, there are a total of nearly 3 million hectares of protected and limited forestry-use forests in Finland, accounting for about 13% of the forest area.

- Europe’s largest conservation areas without human intervention are located in Finland.
  - Their total area is 841,000 hectares, which equates to approximately 5% of Finland's forest land.
  - This constitutes nearly half of the total area of strictly protected forests in the entirety of Europe.





Production environment – ORGANIC

- In Finland, there is tremendous potential for organic certification in forests – depending on the area, 97–99% of our forests could be certified as organic with current forestry practices.
- At the end of 2015, there were a total of 12.2 million hectares of organic collection areas in Finland.
- In 2015, 30% of the world's total organic collection area, amounting to approximately 40.7 million hectares, was located in Finland.
- The area covered about 40% of Finland's land area. If our certifiable forests were certified, 87% of Finland's land area would be organic certified.

REFERENCE: Partanen, P. 2016. Luomukeruualueiden sertifiointi (Certification of organic areas), University A0 Helsinki, Ruralia Institute.

Dia 17

A0 Pitäisikö nimi olla 'Partanen, B.'? https://researchportal.helsinki.fi/en/activities/luomukeruualueiden-sertifiointi-2

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Production environment – the Artic North

- The northern location and environment create a production environment that has an impact on the production of bioactive compounds in plants and fungi.
- Plants and fungi produce the compounds during the growing season due to the influence of abundant light.

Production environment – the Artic North

- Finland's summer, with its long and bright summer nights, is excellently suited to producing high-quality cumin.
- The long days result in high concentrations of essential oils in cumin seeds
- It has been shown that cumin grown at northern latitudes produces more volatile oil than when it is cultivated in a warmer climate.

REFERENCE: Angers, P., Keskitalo, M., Ngo-Duy, C.-C. & Arul, J. 2013. Caraway seed oil content and composition in 6 accessions grown at two latitudes in Finland. 6th European Symposium on Plant Lipids, Bordeaux, France

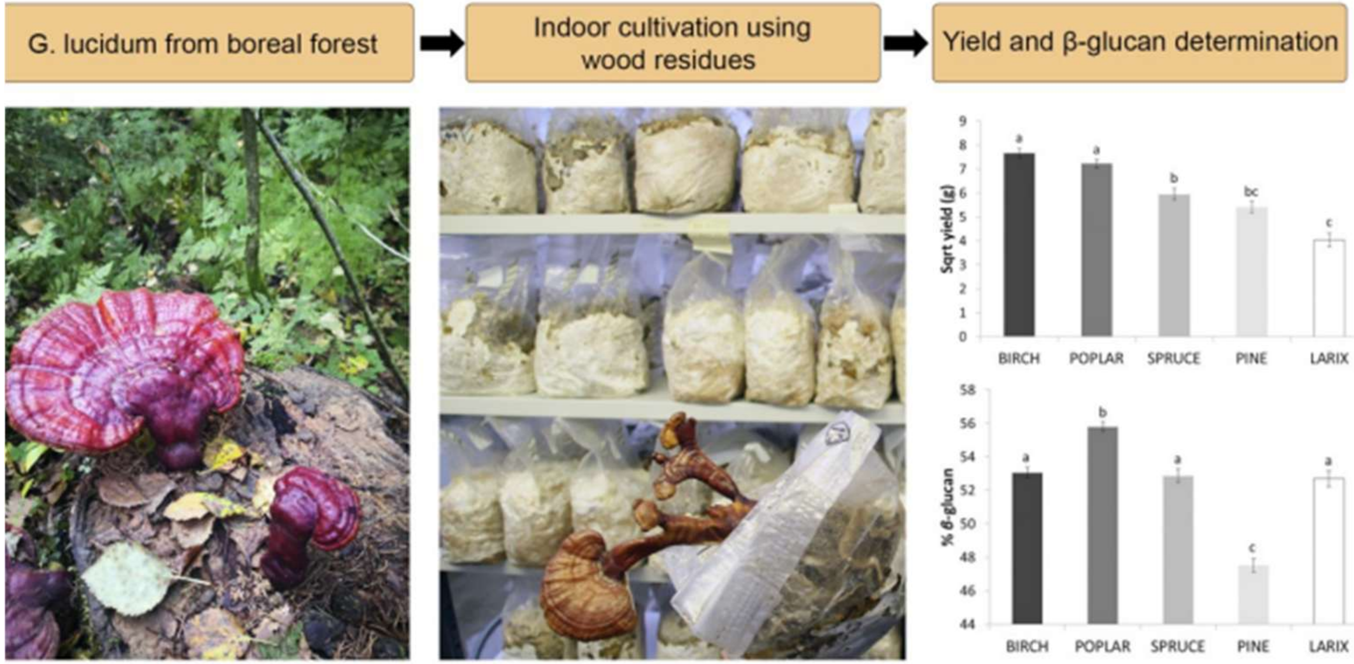
Production environment – the Artic North

- The anthocyanin content of blueberries and bilberries has been observed to increase the further north the plants are.
- High levels of anthocyanin are influenced in particular by the amount of light and day length, but they are also determined through genetic characteristics.
- The northernmost populations have genetically adapted to long daylight and high light levels, resulting in high anthocyanin levels even when transplanted in the south.

REFERENCE: Åkerström, A., Jaakola, L., Bång, U. & Jäderlund, A. 2010. Effects of Latitude-Related Factors and Geographical Origin on Anthocyanidin Concentrations in Fruits of Vaccinium myrtillus L. (Bilberries). J. Agric. Food Chem. 2010, 58, 22, 11939–11945

Production environment – the Artic North

- Finnish specimens of the chaga fungus have a high beta-glucan (β-glucan) content in their fruiting bodies
- The beta-glucan content of chaga strains collected from different parts of Finland varies between 47.5 and 55.9 g/100 g dm.
- Due to their high beta-glucan content, the fruiting bodies are a valuable source of bioactive compounds for the food and pharmaceutical industries.



REFERENCE: Cortina-Escribano M, Pihlava J-M, Miina J, Veteli P, Linnakoski R, Vanhanen H. Effect of Strain, Wood Substrate and Cold Treatment on the Yield and β-Glucan Content of *Ganoderma lucidum* Fruiting Bodies. Molecules. 2020; 25(20):4732.

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Ministry of Agriculture and Forestry

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Thank you |

Pro Pakuri Finland ry is a non-profit association. The association works to develop cultivation and provides its members with fungal mycelium to be planted.

RURAL 2020

Centre for Economic Development, Transport and the Environment

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