



J • ENSUU

**Rooted in
Research**

**A Nordic
Living Lab
for Innovation**

Welcome to the European Forest Capital!

Forests are everywhere in Joensuu: from near-by forests and the outskirts of the city to the city centre. We are the fourth-largest forest-owner city in Finland, and our 9,000-hectare forest property includes plenty of sites suitable for research, development, and innovation activities.

This is where sustainable forest expertise, expert knowledge in photonics (science and technology involving light), digital solutions, and high-quality data come together. The city's attentive development community makes RDI collaboration easy.

The forests owned by Joensuu include near-by forests, commercial forests, recreational forests, and nature reserves. There are some one thousand hectares of near-by forest in the areas covered by the city plan, so research subjects can be found within walking distance of the university campus.

There are just under 6,000 hectares of commercial forest in various parts of the city and its vicinity, such as in Tuupovaara and Kiihtelysvaara. The range of site types covers everything from lush groves to barren heaths. About a fifth of the forestry land is bog, and the city's forests in the east extend all the way to the Russian border.

We know our forests well. The city's forest resource data covers the site type, development class, tree stand information, and drainage status of each forest. The data can be found in the public Oskari map service, and more detailed materials are available to RDI actors as appropriate.

Joensuu offers numerous applications for forest RDI activities. Take a look and find out what's happening in our forests!

Joensuu's forest resource data

The city's forest resource data provides information on site types, development classes, tree ages, basal areas, average tree heights and diameters, and drainage status. The data can be checked in the public Oskari map service. Material for research use is also available directly from the systems.



READ MORE

Joensuu – Forest Capital of Europe

<https://www.joensuu.fi/en/city-and-development/development-and-innovation/european-forest-capital/>



9,000 ha
of city-owned forest

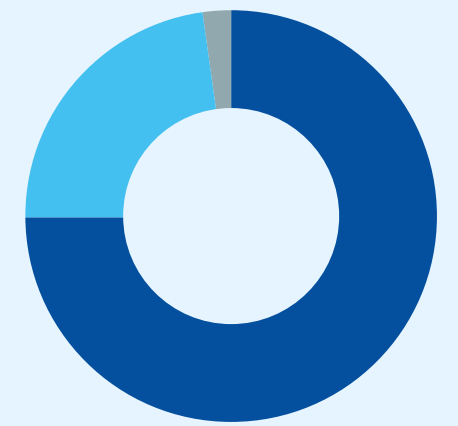
Approx.
1,000 ha
of near-by and
recreational forest in
the city's
residential areas

4th
largest
forest-owner city
in Finland

900,000 m³
of trees in
commercial forests

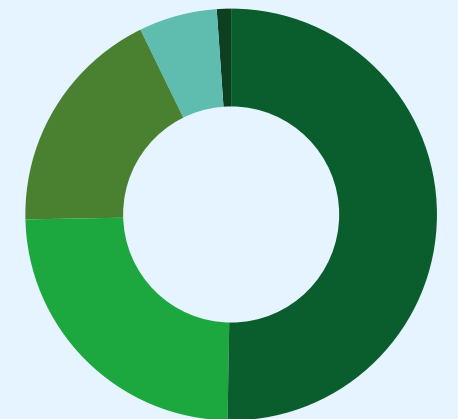
&

The strong and impactful
Forest Joensuu
innovation ecosystem
which was awarded the
Internationalisation Award
of the President of the Republic of
Finland in 2024



**Distribution
of forestry land**

● Heathland	75%
● Peatland	23%
● Poorly productive and unproductive land	2%



**Site types
in forest land**

● Mesic heath forest	50%
● Sub-xeric heath forest	24%
● Herb-rich heath forest	18%
● Xeric heath forest	6%
● Barren heath forest	1%

The figures describe the city's commercial forests.
Source: City of Joensuu forest resource data, 2026.

Breeding Ground for Innovations

Forests are more than a material resource for us. They provide research environments for researchers and open doors for companies to export sustainable solutions.

In Joensuu, the value of forests was recognised as early as 1982, when the Faculty of Forestry was established at the University of Eastern Finland. The headquarters of the European Forest Institute was established in Joensuu in 1993. Since 2023, forest-related RDI work has been led by the Forest Joensuu innovation ecosystem.

Forest RDI activities are a collaboration between the city, the research and education community, and companies, with the aim of opening up pathways to new jobs. Digital forest expertise, which is developed at the interface of photonics and forests, lies at the heart of this in Joensuu.

Here, forests are inventoried by using machine vision and forest fires are prevented through artificial intelligence. We also have our sights set on the forest industry, machinery and equipment manufacturing, and wood processing. Joensuu is home to the world's largest forest machine factory, and the machines manufactured there are driving sustainable timber harvesting around the world. In wood processing, there is great demand for valuable side streams and new wood-based materials.

We have all the prerequisites for RDI work in biorefining: versatile laboratory facilities, research infrastructure, and a readiness to implement various pilot projects.

The RDI use of forests owned by the City of Joensuu is always agreed upon on a case-by-case basis, on the terms of forest management and the research topic. You can find examples of collaboration on the following pages!

“Finland is the only country in the world where all trees thicker than an arm have an ID number.”

– Seppo Tossavainen,
Head of Economic and International Affairs,
City of Joensuu



Forest Joensuu

- An innovation ecosystem that connects the education community, companies, and actors interested in development and innovation collaboration
- Guides companies to international markets and networks
- Supports Business Joensuu's invest-in work in business relocation and investments in the Joensuu region
- Launched in 2023

READ THE FULL ARTICLE
Side streams, piloting, and export potential – Joensuu's forests provide a breeding ground for innovations



<https://www.joensuu.fi/en/latest/articles/side-streams-piloting-and-export-potential-joensuus-forests-provide-a-breeding-ground-for-innovations/>

Marteloscope Brings Research Down to Individual Tree Level

A marteloscope provides information on how biodiversity can be better taken into account in forest management. It leaves no tree unassessed as part of the wider picture.

A marteloscope is a virtual learning environment that helps researchers and students to study forest management and biodiversity. The one-hectare square sample plot demarcated within the forest contains information about all the trees in the area: the volumes of saw logs and pulpwood, as well as the diameter and height of the trees. Microhabitats that are important for forest biodiversity have also been identified for each tree.

Different types of harvesting can be compared in the sample plot. Trees to be retained and those to be removed are sorted out by using an application that calculates the volumes and biodiversity values of the trees in each group. To examine the effects of climate change and the carbon balance, the application also calculates the amount of carbon sequestered by the trees to be removed and the amount of carbon remaining in the forest stand.

The Joensuu martelosopes are part of the international Integrate network. Their data is stored in the marteloscope database, from which the material can be utilised for various purposes. The martelosopes are freely available to everyone. There is an information board at all the sample plots in Joensuu, and anyone can download the application free of charge.

“The city is happy to offer these various forest areas for research and development use.”

– Ari Talkkari,
Principal Lecturer,
Karelia University of Applied Sciences



Marteloscope

- 1 ha sample plot (100 × 100 m)
- Every tree mapped, measured, and assessed
- Microhabitats identified on a tree-by-tree basis
- Part of the international Integrate network
- There are currently three martelosopes in the forests owned by the City of Joensuu, and the application and sample plots are freely available to everyone

WATCH THE VIDEO
*Detailed Information
on Forest Biodiversity
Using a Marteloscope*



<https://www.youtube.com/watch?v=dqT1N17m-UA>

Hullunkolmio: a Glimpse into the Future of Forest Measurement

Hullunkolmio, a reference sample plot located next to the Joensuu campus of the University of Eastern Finland, serves everyone interested in forests and forest bioeconomy. The area serves as a test field where modern forest research solutions, such as imaging methods, laser scanning, and drones, come into their own.

Studying forests requires precise measurements. Hullunkolmio, located near the University of Eastern Finland, enables the use of digital methods for forest measurement. The sample plot provides a platform for the development of virtual environments and augmented reality applications, for example.

Forest inventory is also being tested in Hullunkolmio. Various imaging methods, laser scanners, terrestrial lasers, and drones have been put to good use at the plot. The material produced by Hullunkolmio can be shared around the world and utilised for forestry needs.

Joensuu's forests have always been of interest to researchers. We are constantly exploring new opportunities that the city's 9,000-hectare forest property can offer for RDI activities.



**“Anyone with a good idea can
seize the possibilities
the forests of Joensuu offer.”**

– Lauri Sikanen, Principal Scientist,
Natural Resources Institute Finland (Luke)

The many possibilities of Hullunkolmio

- Imaging methods and multispectral imaging
- Laser scanning: terrestrial lasers and drone platforms
- Virtual and AR applications for educational use
- Forest artificial intelligence
- Reference data for use by international partners

WATCH THE VIDEO
Forest R&D Expands
in Joensuu – Hullunkolmio's
New Forest Research Plot



<https://www.youtube.com/watch?v=ZhsP-0iq9DK>

Developed in Joensuu, scaled for the world

In Joensuu, the city and educational institutions have together developed the Weather Vulnerability Index, a model that can be used to identify the areas in cities that are the most vulnerable to climate change. The universal method can be applied in any city where climate change causes problems.

Climate change is making cities increasingly demanding environments to live in: heat islands make streets hotter, floods become more common, and the building stock is exposed to severe weather events. The Weather Vulnerability Index (WVI) model helps to target measures where they are needed the most.

The method divides the city into sectors of 62,500 square metres, within which the buildings are assessed by using several variables, from the number of inhabitants to building temperatures. The method can be used to compare, for example, the impact of wind and sunlight on the vulnerability of urban infrastructure.

The research was conducted at Karelia University of Applied Sciences as part of the Sustainable Building Technologies – Community of Practice project, funded by the Ministry of

Education and Culture of Finland. The City of Joensuu supported the research by providing building data, while the work was supervised in collaboration with the University of Eastern Finland and Glasgow Caledonian University. A demo version of the model, EvaGrid, is being developed for testing it further. It allows city decision-makers to adjust the weightings of the variables and identify risk areas on their own.

The WVI is a great example of what Joensuu's RDI collaboration produces at its best: internationally scalable research that is created by combining data provided by the city and the expertise of researchers.



“The method is universal. The target areas are all cities around the world – from Joensuu to Los Angeles.”

– Jouni Pykäläinen, Professor,
University of Eastern Finland

EvaGrid

Energy Vulnerability
Assessment Grid

- The demo version of EvaGrid is being developed based on the WVI model by S.Keya et al. 2025.
- The user adjusts the weightings of the variables and identifies risk areas on their own
- Results published in Journal of Cleaner and Responsible Consumption, 2025. DOI: 10.1016/j.clrc.2025.100366
- Developed and tested in Joensuu- scalable to cities around the world

READ THE FULL ARTICLE

When the climate poses a problem, data responds – Joensuu developed a model for sustainable urban planning

<https://www.joensuu.fi/en/latest/articles/when-the-climate-poses-a-problem-data-responds-joensuu-developed-a-model-for-sustainable-urban-planning>





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Joensuu is a global leader in forest expertise, and the city is known as the European Forest Capital.

A hub that is truly unique:
Joensuu is the only place in the world where all levels of forest education, top level research, practical processes and world-class companies meet.



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Photonics Joensuu