Project *brief*

Thünen Institute of Forest Ecosystems 2024/25a

Current research at the ICP Integrated Monitoring (ICP IM) site Neuglobsow

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- **The International Cooperative Programme Integrated Monitoring (ICP IM) monitors the effects of long-distance air pollutants and climate change on ecosystems**
- **At the lowland monitoring site Neuglobsow, nutrient and water balances are calculated for the catchment area of the oligotrophic lake Stechlin**
- **Further development of the monitoring programme in Neuglobsow and data comparability with ICP Forests will allow additional insights in the future**

Background

The International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP IM) is one of six International Cooperative Programmes under the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP or Air Convention). Germany contributes to the ICP IM programme with two monitoring sites at selected locations with low background pollution. One of them (DE02) is located in Neuglobsow, Brandenburg (Figure 1). Measurements have been carried out at this site since 1998 as part of the ICP IM and – since June 2023 – have been coordinated by the Thünen Institute of Forest Ecosystems (Thünen-WO) on behalf of the Federal Environment Agency (UBA). The lowland forest monitoring site Neuglobsow consists of Scots pine (*Pinus sylvestris* L.) and European beech (*Fagus sylvatica* L.) and can be considered an air pollution-free site. It is located in the catchment area of the oligotrophic lake Stechlin in the north of Brandenburg. The ICP IM programme shares several similarities with the ICP Forests intensive forest monitoring (ICP Forests – Level II). Since Thünen-WO is also responsible for the evaluation of data from ICP Forests at the German national level, there is potential for synergies in data management and analysis between the two ICPs.

Key objectives of the ICP IM

One of the key tasks of the ICP IM is the calculation of nutrient and water balances at catchment level. Based on these, conclusions can be drawn about the state of the considered ecosystem and about key processes within this system. This allows changes to be quickly identified, observed and described. Model simulations are used to assess the impact of potential changes in the deposition of air pollutants – also in the context of climate change.

Analysis of the extensive series of long-term measurements and modelling results also serve to verify the effectiveness of already implemented air pollution control measures. Based on this, proposals for an impact-based national air pollution control policy are derived. To achieve the program goals, the selected monitoring sites must be free of significant local sources of pollution and direct human intervention. At the Neuglobsow site, Thünen-WO complements the existing long-term monitoring activities with additional measurements to gain a better understanding of site characteristics and allow more in-depth analyses.

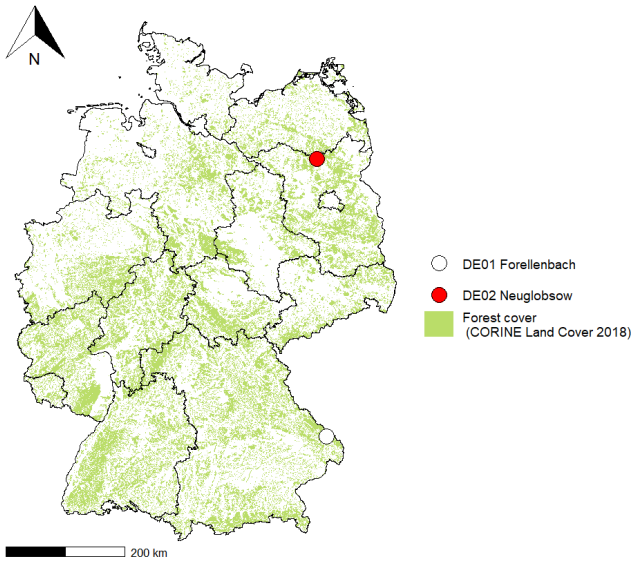

Figure 1: The location of the ICP IM area Neuglobsow (DE02) in the north of Brandenburg (Source: CLC= Corine Land Cover © GeoBasis-DE / BKG 2024, visualisation: © Thünen-Institut)

Methods

The Thünen Institute coordinates the data collection and reports to the Federal Environment Agency (UBA). UBA compiles the data and transmits it to the ICP IM Programme

Centre. Annual reports and scientific evaluations of the ICP IM programme are forwarded to the Working Group on Effects (WGE) of the Air Convention. Sampling techniques, their frequency and extent, and analyses follow international standards, which are documented in the ICP IM Manual. At the Neuglobsow site, mandatory surveys are supplemented by additional optional surveys from the ICP IM programme (Figure 2). Deposition collected with samplers for open field, stemflow and throughfall precipitation is measured monthly and used to build a canopy budget model. The composition of soil solution is evaluated on a monthly basis. The nutritional status of the forest stand is assessed annually by chemical analyses of needles and leaves. Every five years, a soil chemistry analysis is carried out.

Outlook

Future priorities will be as follows:

- To help determine the carbon balance of the forest monitoring site, six semi-automatic hood systems have been set up that measure cycles of CO_2 emissions from soil and ground vegetation for one full day every 14 days. As soil degassing depends on soil moisture and soil temperature, these parameters are also recorded. In this context, forest inventories are also carried out, including assessments of natural regeneration and dead wood.
- To exploit synergies with ICP Forests Level II data, a data structure is being developed that will allow comparison of data sets between the two programmes. A Shiny app – an Interactive website using the R package "shiny" – allows to explore the datasets. Adjusting the fractions in the ICP IM litterfall programme starting in June 2023 to match the fractions in ICP Forests Level II will improve comparability in the future.
- Ground-based and drone-based images will be used to derive information about the heterogeneity of the tree canopy and determine the Leaf Area Index (LAI).
- By installing sap flow sensors on five European beech and five Scots pine trees, the sap flow through the trunk is estimated and the transpiration of the tree crown can be calculated.
- Additional stemflow samplers on eight more trees are planned.
- Since 2024, temperature, humidity, air and vapor pressure as well a sand solar radiation have been measured in the context of stand climate.
- Wind measurements and sensors for green wavelength ranges (NDVI) and photosynthetically active radiation (PAR) are planned.
- Point dendrometers on 8 trees measure the development of tree diameter over time but also reflect changes during the course of the day.
- In autumn 2024, a soil profile will be described and methods for microbial decomposition will be integrated into the experimental setup.

Together, these measurements provide an integrated view of water, nutrient and carbon balances and their development under changing environmental conditions at this site.

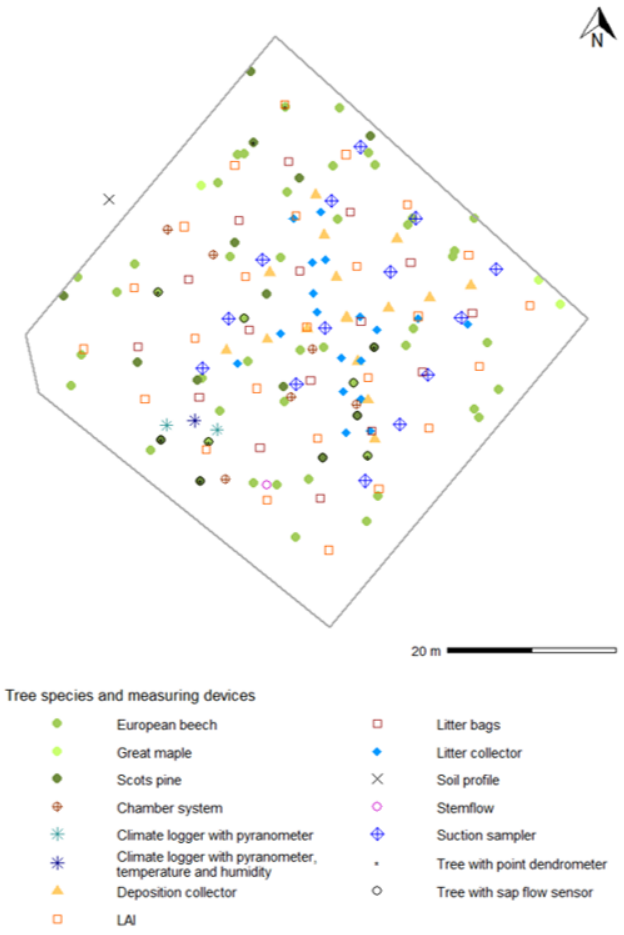

Figure 2: Overview of the measuring devices and the stocking on the ICP IM area Neuglobsow (DE02) - (Source: own illustration).

Further Information

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Partner

Federal Environment Agency (UBA)

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2692

References

ICP IM Manual (2022): https://www.slu.se/globalassets/ew/org/centrb/im/im_manual_edition_7.pdf

Shiny-App Neuglobsow: https://wo-apps.thuenen.de/apps/neuglobsow_dashboard/

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