LWF

Bavarian State Institute of Forestry

BAYERISCHE FORSTVERWALTUNG

Zentrum Wald Forst Holz Weihenstephan

Bavarian Forest Ecosystem Monitoring Plot

Kreuth

Cover photo: V. Kantelberg

Bavarian Forest Ecosystem Monitoring Plots

Forests have exceptional importance for the functionality of the natural environment and for the protection of natural resources. They are subject to constant change controlled by environmental factors. At the Bavarian forest ecosystem monitoring plots (WKS) environmental impacts and their effects on forests are continuously measured in different landscapes and forest regions.

The Bavarian State Institute of Forestry (LWF) has been operating the Bavarian forest monitoring programme since 1991. The network provides basic data and infrastructure to other research initiatives.

Forest monitoring plots

- basic programme
- meteorological measurements only
- core plots
- co-funded by LIFE+(EU)

The Monitoring Programme

Basic parameters measured at all plots

- Meteorology (e. g. temperature, precipitation)
- Deposition of air pollutants and nutrients
- Soil condition
- Soil solution chemistry
- Contaminant leaching below the root area
- Tree growth
- Crown condition
- Phenology (e. g. time of bud break)
- Tree nutritional status
- Ground vegetation

Special parameters measured at core plots

- Soil moisture and temperature
- Stand precipitation (throughfall, stemflow)
- Phenological garden
- Air pollutants (passive sampling)
- CO_2 emission from forest soils

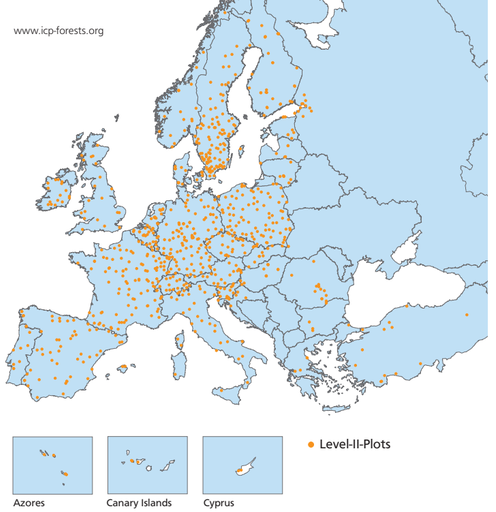
The most important results are published in the Bavarian Forest Condition Reports to make them accessible for policy makers, but also for science and forestry service. Up-to-date data and information are available from the Bavarian State Institute of Forestry (LWF).

The new »FutMon« project aims to further develop European forest monitoring and is co-funded by the EU in the framework of the LIFE+ (FutMon) programme. A total of 38 partners from 24 countries are involved in this project. LWF participates with ten Bavarian forest monitoring plots.

»FutMon« provides qualified and comparable information on environmental risks and impact of climate change for European forests. This creates a supraregional platform available to policy makers and the public.

The »Level II« plots are coordinated by the International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests).

www.icp-forests.org



Environmental Monitoring in European Forests

Bavarian forest ecosystem monitoring plots are part of a Pan-European network of intensive forest monitoring (EU/ICP Forests Programme Level II) for long-term assessment of environmental risks (atmospheric pollution, climate conditions) on the condition and the development of European forest ecosystems. The monitoring network, reaching from the North Cape to the Canary Islands, comprises almost 800 »Level II« plots of a total of 26 EU-member states and 15 non-EU countries.

A Closer Look at a Bavarian Forest Monitoring Plot

Forest Stand Subplot

A forest stand subplot is located within a stand, which is as homogeneous as possible with regards to tree species, age, structure and site. Contaminants are quantitatively and qualitatively measured. Changes in the forest soil (such as soil acidity or summer drought) are monitored to evaluate their implications for forest trees.

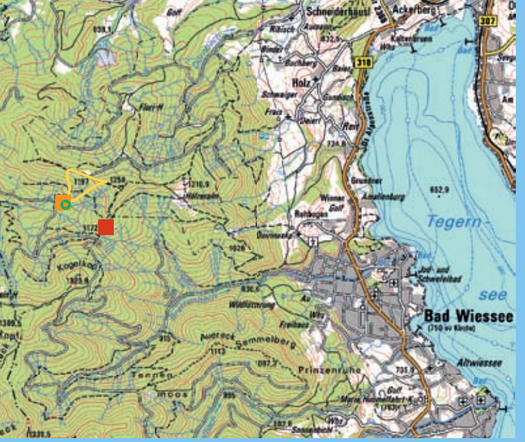
Clearing Subplot

Open-field measurements are made on larger clearings nearby to the stand subplot. Monitoring includes data on meteorological key quantities having an impact on the forest canopy (such as wind speed), as well as dry or wet deposition of contaminants. Due to spatial proximity, comparable altitude and terrain data from forest stand and clearing subplots can be closely linked to each other.

The large amount of data collected (approx. 750.000 measurement values per year) allows identifying cause-effect relationships of environmental impact factors, such as storms, droughts and contaminants. Data are used, for example, for determining the date of bark beetle swarming. The monitoring is basically operated by the local forest authority.

The local forest officer takes a throughfall sample for laboratory analysis of nitrogen deposition.

Photo: Lehmann



Topographic data: Bavarian Surveying Administration, scale 1:65.000

- Forest stand subplot
- Clearing subplot
- Catchment area
- Water gauge Schreibach

Ecosystem Monitoring Plot Kreuth
The Kreuth monitoring plot is located 4 km west of Bad Wiessee and 1 km north of the »Kogelkopf« summit.

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ICP Forests, *www.icp-forests.org*

FutMon, *www.futmon.org*

Ecosystem Monitoring Plot Kreuth

Location
Pertaining to the Flysch zone of the Tegernsee Alps, growth district Upper Bavarian Alpine Flysch foothills (»Oberbayerische Flysch-Voralpen«); steep hillslope position in a basin exposed to the northwest; approx. 1.100 metres above sea level

Climate
Annual mean air temperature: 6.6 °C, annual mean precipitation sum: 1920 l/m² (1998–2009); ample water supply all year round due to orographic lift and frequent summer thunderstorms ; mean growing season approx. 140 days; water catchment areas (approx. 4–16 hectares)

Geology
Interbedded strata of clay layers with lime/marl lime (»Obere Bunte Mergel«); underlying bedrock of cretaceous ocean sediments; the forest soils in the Flysch zone have a strong tendency towards waterlogging and are particularly at risk of erosion

Soil
Brown earth/hill gley with interflow (German soil classification: »Braunerde-Hanggley«); a tendency to water logging and slight acidification of the upper soil layer, due to presence of marl lime below a soil depth of 40 cm neutral pH values and a high nutrient availability to plants are found

Stand characteristics
Approx. 120-year old vital and vigorous mixed mountain forest with spruce (50%), beech (30%) und fir (20%), individual occurrence of Sycamore and European mountain ash; timber stock approx. 870 cubic metres per hectare (in 2007); average annual volume increment ca. 16.6 cubic metres per hectare (1997–2007)

Vegetation
Potential natural vegetation: woodruff beech forest *(Galio-Fagetum polytrichetosum)*; characteristics of ground vegetation: woodruff *(Galium odoratum)* and haircap *(Polytrichum formosum)*

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The natural mixed mountain forest here at Kreuth monitoring plot is an example for a stable tree composition at a hillside location in the Bavarian Alpine foothills. This provides protection against soil erosion even under condition of steep slopes and frequent heavy precipitation events.

1

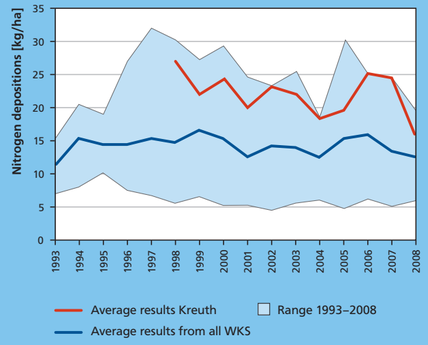
Photo: H. Herzig

Kreuth
Special features

2

Nitrogen deposition is above average. Nitrogen originates from industry, traffic, private households and agriculture. Especially at foothills of the Northern Alps inflowing air masses are likely to be congested in the hillslope basin and filtered by the canopy of the stand. If high nitrogen deposition persist in the future, adverse effects on forest ecosystem functions are to be expected.

Nitrogen depositions



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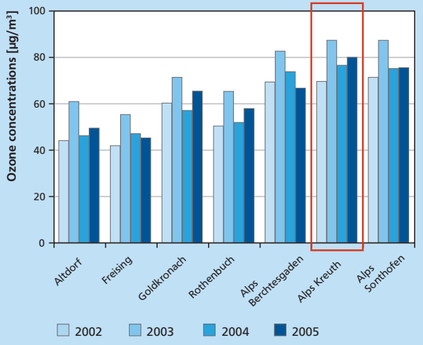
In alpine mountain ranges forests are exposed to elevated ozone concentrations due to higher radiation levels compared to lowland plots. Taking into account current thresholds for the protection of vegetation the forest stand here in Kreuth is at high risk of ozone damage.

Ozone concentrations



The forest stand subplot is located within the catchment area of the creek »Schreibach« (6.3 hectares). The Bavarian State Office for Water Management Rosenheim is measuring the discharge at this torrential creek with a weir since almost 20 years. Additional water quality samples are regularly taken for analysis in the LWF laboratory. Consequently, element budgets for a larger landscape section can be provided.

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Photo: L. Zimmermann