Monitoring vegetation parameters: current status and developments from the ICOS Research Infrastructure

What is ICOS

The Integrated Carbon Observation System (ICOS) is a **European Research Infrastructure** with the goal to **monitor the GHG balance of Europe**. It consists of three components (Ecosystem, Atmosphere and Ocean) with in total 145 stations distributed over 14 countries

The Ecosystem component

The Ecosystem component of ICOS consists of **85 stations** covering forests, grasslands, crops and mires distributed over the most important climatic zones.

The station network is coordinated by the **Ecosystem Thematic Centre (ETC)** where tasks are shared between University of Tuscia (continuous variables), University of Antwerp (vegetation parameters) and INRAE (chemical analysis of soil and vegetation).

The **ETC has the following tasks**:

- Centralized data **quality check** and **processing**
- Test and **develop** methods, sensors, and protocols
- **Evaluate** the performances of the stations
- **Assistance** to the ecosystem network and training
- **Coordinate** with other networks and companies

Vegetation parameters monitored within ICOS

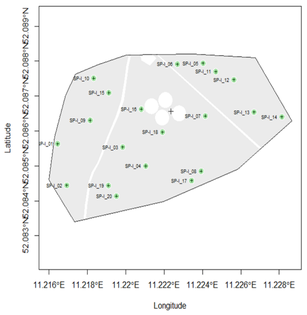
Current status

Ecosystem characterization and vegetation parameters.

Key ancillary biological parameters such as **species composition, biomass, llitter and Green Area Index** are monitored at the ICOS stations. The quality control and processing are performed by the ETC on the basis of field measurements done at the stations following the **ICOS Instructions**.

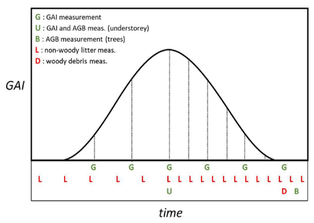
Spatial sampling design

Target Area is characterized with a number of sparse ancillary data measurements (species, biomass, GAI, soil sampling, trees characteristics etc.) as (SP-I). **following a stratified random design with 20 areas** (700m^2). In addition 2 to 4 **Continuous Plots (2000m^2) are monitored permanently**.



Temporal sampling design

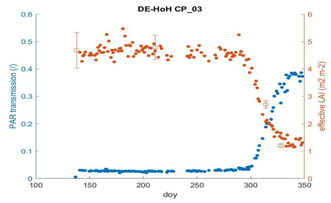
All measurements are performed following as strict temporal sampling with **seasonal measurements** for GAI and litterfall **and annual measurements** for biomass



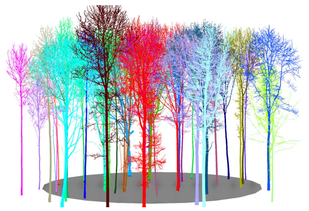
Future developments

Below canopy PAR measurements to estimate GAI

Below-canopy PAR measurements are being implemented at ICOS forest stations to obtain continuous time series of GAI.



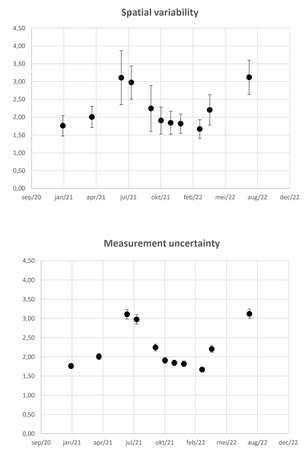
Terrestrial Laser Scanning (TLS) to estimate standing biomass



A measurement campaign with TLS at 6 ICOS forest stations was performed in order to obtain standing biomass and canopy structure parameters.

Discussion

Spatial variability versus measurement uncertainty



Often measurement uncertainties are requested by data users. However it should be noted that for vegetation parameters **the spatial variability in most cases exceeds the measurement uncertainty**. An example is given here for GAI estimate by hemispherical pictures at a Scots pine forest.

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