

Overview - Bob Su

WUNDER Field Sites

The latest updates

The [WUNDER](#) consortium, with 19 partners from public and private sectors, aims to understand the resilience of diversified water-soil-plant systems to droughts, and applies this knowledge to develop optimal adaptation measures to mitigate drought damage to agriculture productivities.

Field measurements of soil and vegetation and their functioning are one fundamental tool of the WUNDER project. In 2023 we have completed the installation of four observation networks. These are the Voedselbos Glanerbeek, Wenumseveld Herenboeren, Voedselbos Ketelbroek and Speulderbos.

We have installed two automatic weather stations and four stations of soil moisture and soil temperature profiles at Voedselbos Glanerbeek, one automatic weather station and three stations of soil moisture and soil temperature profiles at Wenumseveld Herenboeren, and two automatic weather stations and two stations of soil moisture and soil temperature profiles at Voedselbos Ketelbroek.

The team conducted extensive field sampling and analysis of soil physical and chemical properties in the Geoscience Laboratory of the University of Twente. In a greenhouse of the HAS University of Applied Science, the team conducted a water and nutrient treatment experiment to study the impacts of water and nutrients stress on the productivity of Romaine lettuce, with soils collected at the Voedselbos Glanerbeek.

A complete energy balance and flux observation station is operational at Wenumseveld since summer of 2023.



Vegetation/soil sampling sites at Voedselbos Glanerbeek 18 May 2023.



WUNDER field measurement networks.

Is a voedselbos more resilient during droughts? - Bob Su

Voedselbos Glanerbeek

Field measurements and laboratory analysis

Light, water and nutrients determine the growth and health of plants. We have started to deploy a variety of field instruments in order to record detailed information on weather, soil water content and vegetation growth at different locations. In the young Voedselbos Glanerbeek that was established in 2022, we have installed automatic weather stations and stations of soil moisture and soil temperature profiles on 18 May 2023.

Two automatic weather stations measuring each twelve meteorological variables are operational and continuously send data to a cloud platform for access and monitoring by the WUNDER team and their stakeholders.

Four stations of soil moisture and soil temperature profiles, measuring from 2.5 cm to 80 cm below the ground also send data for inspection continuously. In addition to these measurements, soil samples from different sites were collected for laboratory analysis of soil physical and chemical properties.

The analyzed soil properties will include: saturated soil water content, saturated hydraulic conductivity, bulk density, soil texture, soil organic matter, soil organic carbon and nitrogen content, as well as available potassium and phosphorus content. Other soil minerals and nutrients will be sent to a professional laboratory for routine analysis in the coming years of the WUNDER project duration.

Vegetation measurements take place at biweekly intervals. Leaf area index, biomass and vegetation water content are measured by a team of PhD students of the University of Twente.

Satellite data from the Copernicus programme will be collected and analyzed together with drone flights for monitoring the soil, water and vegetation conditions. More specialized measurements will take place in 2024.

Agricultural crops and vegetables – Bob Su

Wenumseveld Herenboeren

What is the water use of different crops?

The measurement program in Wenumseveld Herenboeren aims to answer questions about water use of different crops. One automatic weather station and three stations of soil moisture and soil temperature profiles are installed. These stations will support the collection of more detailed information by distributed temperature sensing using optical cables in the soil and above the surface. Surface energy balance and land atmosphere exchanges of fluxes of sensible heat flux, latent heat flux or evapotranspiration as well as CO₂ flux will be measured by pyranometer, pyrgeometer, soil heat flux plates, eddy covariance and scintillometers.



Eddy Covariance and energy balance Station (left) and automatic weather station (right).

Follow vlog by Liduin Bos -

<https://www.youtube.com/watch?v=uk8PP1kB7uk>.



Locations of field stations at Wenumseveld Herenboeren.



Greenhouse measurements

Enting Tang, Yijian Zeng, Bob Su

Greenhouse experiment

How water and nutrients stress influence growth?

Crop yields are influenced by drought and nutrients stress. These stresses affect photosynthesis and can be observed by laboratory experiments by measuring soil water, biomass and chlorophyll fluorescence.

To advance the modelling of nutrient and water stress effects on vegetation functioning on various

ecosystems, an experiment was conducted at the greenhouse of the HAS University of Applied Science in Den Bosch. Variability in chlorophyll fluorescence and functional traits of Romaine Lettuce are examined under varying water and nutrients availability.

The main aim was to quantify how changes in soil conditions and functional traits influence fluorescence as a direct indicator for photosynthetic activity of plants under stress. Chlorophyll, nitrogen and mineral concentration, and fluorescence were measured at the leaf level together with observation of environmental factors, such as soil moisture, soil water potential and soil temperature.

The experimental data and resulting relationships support the development of a biogeochemistry module in a new coupled model, STEMMUS-SCOPE-T&C. The resulting coupled model incorporates water and nitrogen stresses into the photosynthesis simulation and mechanistically simulates dynamic root growth, as well as hydraulic resistance from soil to root and leaf. Four HAS students participated in the experiment.



Fluorescence measurements

Yijian Zeng, Bob Su

WUNDER Annual Assembly 2023

The latest updates



@ ITC building, University of Twente

The WUNDER annual assembly 2023 took place on 13 October 2023 at the University of Twente.

Professor Freek van der Meer, the dean of the faculty ITC welcomed the participants and briefly introduced research and education activities related to climate change and Earth observation. Dr. Bea Pauw, senior programme manager of NWO, provided guidelines and clarification for project management. Each work package leader and team members reported progresses made during 2023 and presented plans for the coming year.

Yijian Zeng, Bob Su

Excursion to Voedesselbos Glanerbeek

The latest updates

The owners of the voedesselbos Glanerbeek, Jessica van Rossum, Dagobert Bergmans and Maud Aarts welcomed the WUNDER participants to their new voedesselbos and introduced the various designs and planting of the different plots. The voedesselbos Glanerbeek was established in 2022 and has an area of 25 ha.

The excursion was concluded by a delicious evening barbecue.



Excursion to the Voedesselbos Glanerbeek (Dagobert, Maud, Wouter van Eck - co-chair of WUNDER stakeholder committee, and Jessica and other participants, from left to right)



WUNDER Annual Assembly 2023 taking place at the faculty ITC of the University of Twente.