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Nature 4.0

Inspired to invent change

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Environmental monitoring technologies

We design and build devices that combine cutting-edge sensors with **Internet of Things (IoT)** technology, enabling remote monitoring and **data** analysis.



Forest management

Innovative tools capable of monitoring **forest ecosystems** in real time to support the sustainable management and protection of woodlands.



Smart farming

Smart farming leverages data-driven technologies to **optimize agricultural production**, reduce waste, and enable timely interventions in cases of stress or disease.



Academic Research

The TreeTalker®Cyber is a key reference in academic research for **collecting data** and creating comprehensive ecological profile of plants and trees.



Public Administration

Continuous monitoring solutions assist local authorities in managing public green areas, ensuring early **detection** of structural tree risks in urban forests.

Our Products

TreeTalker®Cyber

The TreeTalker®Cyber is an advanced device designed to monitor forest ecosystems providing high resolution data in real time on the physiology of trees, on conditions environmental and forest health. The key parameters are **solar radiation** over 28 bands covering VIS (visible) and NIR (infrared) areas, **growth**, **tree stability**, **sap flow** and **microclimate data.**

TreeTalker®Water

The TreeTalker® Water measures sap flow velocity, air temperature, and relative humidity, enabling real-time monitoring of the plant's water status.

TreeTalker®Carbon

The TreeTalker® Carbon is an electronic dendrometer with a resolution of 0.5 µm (absolute error of 10 µm), designed to measure radial stem growth.

TreeTalker®Radiation

The TreeTalker® Radiation measures light intensity using a spectrometer with 28 spectral bands ranging from 410 to 940 nm.

TreeTalker®Soil

The TreeTalker® Soil monitors soil temperature and moisture. It is also equipped with a sensor to measure air temperature and relative humidity.

TreeTalker®G

The TreeTalker® G monitors the 3D position of trunks and branches. This monitoring is essential for preventing and detecting instability risks in urban environments, as it helps identify dangerous shifts or tilts that could compromise the safety of surrounding structures.

FireTalker

Designed to monitor and analyze all critical signals related to fire risk, it is equipped with a sophisticated sensor network including CO_2, ozone, smoke, and fine particulate detection. By measuring canopy temperature, infrared (IR) sensing, and RGB vision, the device captures any potentially dangerous visual and thermal variations. An air temperature and relative humidity sensor completes the system, providing a comprehensive and predictive environmental assessment.

CropTalker

A device for monitoring horticultural crops. It enables crop growth monitoring through a LiDAR system and assesses nutrient use efficiency through spectral band analysis.

AirTalker

A station for real-time air quality monitoring. It can measure up to 13 different parameters.

MarineTalker

Designed for continuous water quality monitoring, this buoy integrates an advanced sensor platform capable of collecting real-time environmental data and providing a comprehensive overview of the health status of the marine ecosystem.



Solar radiation

A **spectrometer** featuring 28 spectral bands for measuring canopy light transmission.

Radial growth

A 0.5 µm resolution (10 µm absolute error) electronic point **dendrometer** for radial growth detection.

Tree Stability

An **accelerometer** for the assessment of the inclination of the trunk in x, y and z directions.

TreeTalker®Cyber

Wireless device for remote monitoring of trees and plants.

Sap flow

A sap flow measurement system using **heat pulse velocity** algorithms.

Microclimate data

An **air** temperature and relative humidity sensor.

The TreeTalker®Cyber

The TreeTalkerCyber is an advanced device designed to monitor forest ecosystems providing high resolution data in real time on the physiology of trees, on conditions environmental and forest health. It is equipped with sophisticated sensors that collect information on growth of trees, on the flow of sap, on the water transport, on the carbon sequestration and it can detect environmental variables such as light intensity and conditions atmospheric, creating a complete ecological profile.
This device integrates Internet of Things (IoT) technology, which allows it to wirelessly transmit data to a centralized platform for analysis.

The key parameters are **solar radiation** over 28 bands covering VIS (visible) and NIR (infrared) areas, **growth**, **tree stability**, **sap flow** and **microclimate data.**



In particular, it contains:

1. A spectrometer featuring 28 spectral bands from 410 to 940 nm, covered by an optical light diffuser - cosine corrected for measuring canopy light transmission.
2. A sap flow measurement system using heat pulse velocity algorithms
3. A 0.5 µm resolution (10 µm absolute error) electronic point dendrometer for radial growth detection.
4. An air temperature and relative humidity sensor.
5. An accelerometer for the assessment of the inclination of the trunk in x, y and z directions.

Each sensor mounted on TT-Cyber is also available as a stand-alone device.

Explore all our products: www.nature4.org

Connectivity

The collected data are made available remotely through **NB-IoT** or **LoRa** technologies.
NB- IoT is more efficient for distant distributed trees (distance between them more than 600 m), it is provided with a 10-year prepaid sim card (500 MB). **LoRa** version needs a reachable gateway that will forward data packets to a server. LoRa solution performs better for region with weak internet signal or for numerous devices where the cost of the gateway is rewarded by the minor cost of the devices (over 30 devices). Unlike the NB-IoT solution, where each device directly uses the cellular data network, in a LoRa system only the gateway requires a connection to the cellular network, while the sensors communicate with it via a LoRa radio link.





Connectivity: **NB - IoT**
Cellular data network: **Yes**



Connectivity: **LoRa Wan**
Cellular data network: **No**



Connectivity: **LoRa Wan**
Cellular data network: **Yes**

LoRa Wan or NB-IoT connectivity is user selectable at the time of purchase.

NB - IoT

NB-IoT version is more efficient in urban areas, in locations with good cellular data network coverage, or for trees spaced far apart (distances greater than 600 m).



The NB-IoT connected devices are **fully autonomous**. This version comes with a prepaid SIM card (500 MB) valid for 10 years.



LoRa Wan

LoRa solution performs better for region with weak internet signal or for numerous devices where the cost of the gateway is rewarded by the minor cost of the devices (over 30).



LoRa version needs a reachable gateway that will forward data packets to a server: the"***Cloud***".

The data transmission range between the Cloud and devices is 1-3 km in urban areas, 0.6-1 km in forest environments and >10 km line-of-sight.

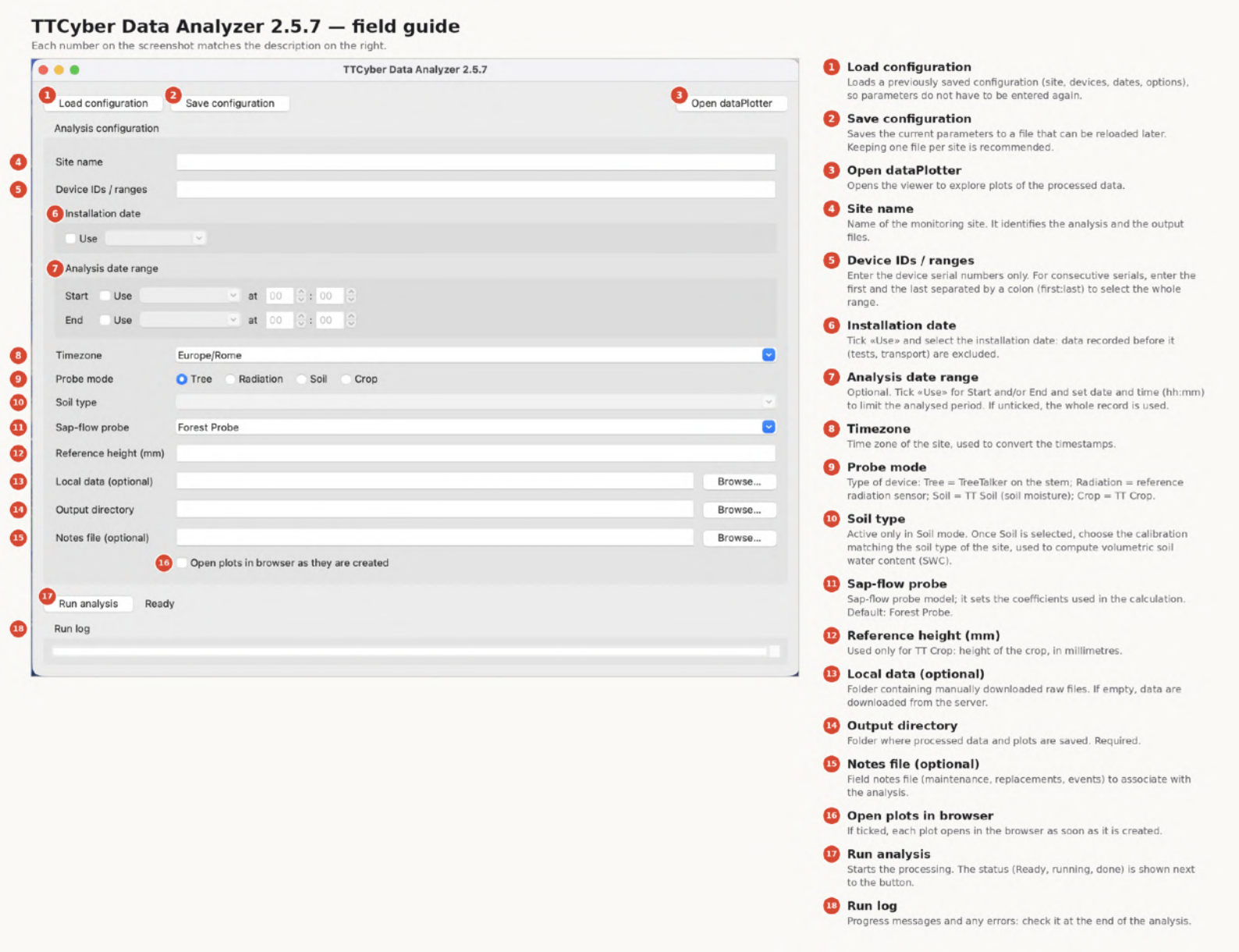


To power the Cloud, you need either the **Solar Kit for Cloud** or access to standard electrical power.



Data visualization

With every purchase, you will receive a dedicated software (in .exe format) for data visualization, along with a practical video tutorial that will guide you step by step through its use. The software is compatible exclusively with Windows operating systems.



The software allows you to load a previously saved configuration (**1**) or create a new one by entering the site information. It is also possible to manually load collected data (**13**).
Subsequently, users can select the relevant sensors and define the time interval of the data to be displayed. If no time interval is specified, the program will analyze all available data. Once the configuration is completed, it can be saved using the "**Save Configuration**" function, allowing it to be quickly reloaded in future sessions without the need to re-enter all settings.
Through the "**Output directory**" option, you can choose the destination folder where the files generated (**.json**, **.html**, **.csv**) by the program will be saved.

View the data visualization guide: LINK

View the manual data download guide: LINK

Installation scenario

The Phytophthora genus includes many oomycete pathogens that cause severe root and collar diseases, significantly impacting plant vitality and productivity in chestnut orchards. In the Cimini Mountains (Viterbo province), an active outbreak of Phytophthora cinnamomi—the main cause of ink disease ("mal dell'inchiostro") in chestnuts—was identified. To combat this, the TreeTalker®Cyber remote monitoring system continuously tracks key physiological parameters, enabling early detection of pathogen-induced stress and evaluation of treatment effectiveness.





Area type: Tree crop

Region: Lazio (Italy)

Area to monitor: 5 hectares

Objective: Continuous monitoring

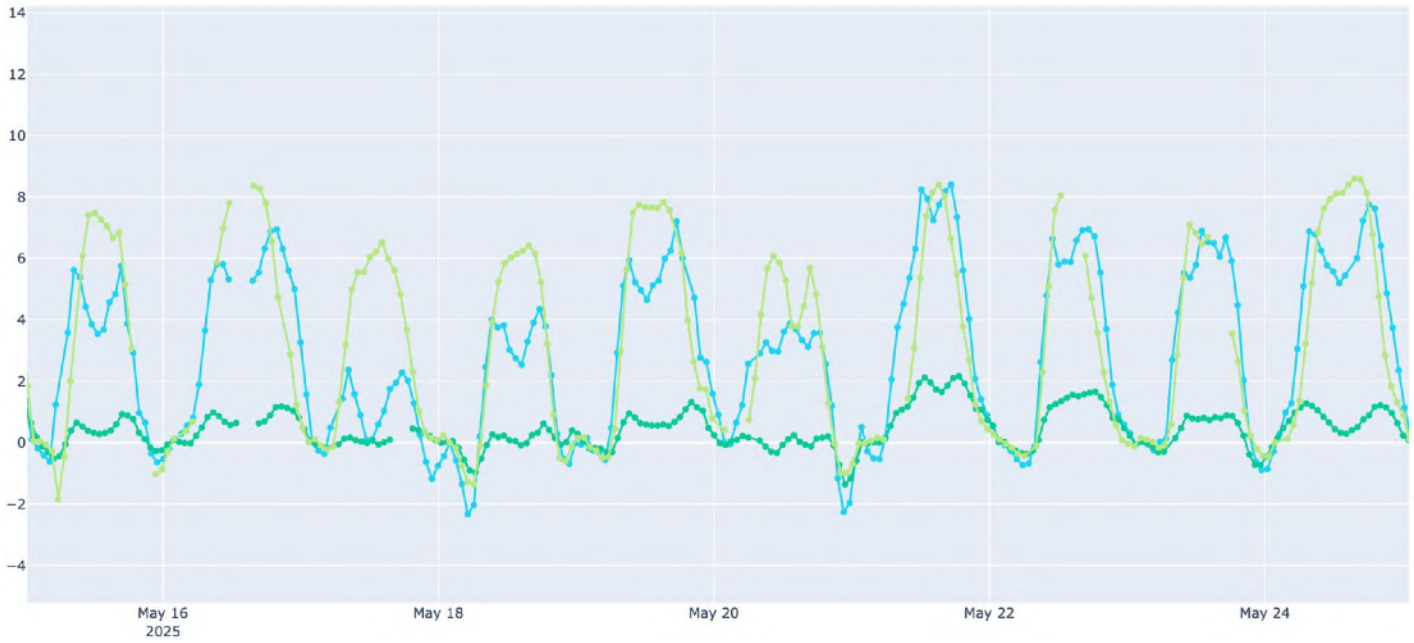
Devices: 21 TreeTalker@Cyber units

Connectivity: NB - IoT



21 TreeTalker®Cyber
Connectivity: **NB - IoT**
Cellular data network: **SI**

The 21 TreeTalker®Cyber devices provide continuous data that enables us to compare tree health status and evaluate treatment effectiveness. The following graph analyzes sap flow across the three different test groups in the study:



Dark green indicates disease-affected plants, blue represents healthy controls, and light green shows data from the treated diseased plant.

Graph analysis reveals markedly different values in the infected specimen versus the healthy control, demonstrating the pathogen's negative impact. However, the treated diseased plant, though starting from a compromised condition, displays values very similar to those of the healthy plant."

In conclusion, early data shows the treatment successfully helps plants better manage water-use efficiency.

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