



Climate Smart WATER Management and Sustainable
DEvelopment for Food and Agriculture in East Africa

A2.2 Training and Capacity Building Course

Smart Platforms for Plant Phenotyping and Precision Agriculture: Tools, Practices, and Analytics



1. Preamble

The Climate Smart WATER Management and Sustainable DEVELOPMENT for Food and Agriculture in East Africa ([WATDEV](https://www.watdev.eu)) aims to enhance sustainability of agricultural water management and resilience of agro-ecosystems to climate change in Easter Africa and Egypt (<https://www.watdev.eu/partnership>).

[AICS](#) (Agenzia Italiana per la Cooperazione e lo Sviluppo) serves as the executive agency, [IAMB](#) (Centre International de Hautes Etudes Agronomiques Méditerranéennes – Mediterranean Agronomic Institute of Bari) acts as the leading scientific institution, working in partnership [CNR-IPSP](#) (National Research Council of Italy-Institute for Sustainable Plant Protection, Italy), [ASARECA](#) (Strengthening Agricultural Research in Eastern and Central Africa, Uganda), [KALRO](#) (Kenya Agricultural and Livestock Research Organization, Kenya), [WLRC](#) (Water, Land Resources Centre - Ethiopia), [WRC](#) (Water Research Centre, Sudan), [HU](#) (Heliopolis University, Egypt), [SYKE](#) (Finnish Environment Institute, Finland) and [ISRIC](#) (International Soil Reference and Information Centre, the Netherland).

The project develops an in-depth understanding of small to large-scale water and agricultural resource dynamics and management and people’s resilience to climate through innovative research, modelling, and capacity building approaches. The overarching objective of the project is to enhance sustainability of agricultural water management and resilience of agro-ecosystems to climate change in East Africa and Egypt.

The specific objectives include: (1) National Ministries and Research Institutions improve their knowledge and management of water in agriculture; and (2) Farmers and local actors, cooperatives and Water User Associations implement innovative/sustainable solutions and skills on water management.

2. Main objective of the Training and Capacity Building course

The primary objective of this Training and Capacity Building course is to strengthen participants' theoretical knowledge and practical skills in the use of advanced technologies for monitoring, analyzing, and optimizing plant performance in agricultural systems. The course focuses on building capacity in smart phenotyping platforms, sensor-based data acquisition, and data-driven approaches for precision agriculture. It is designed to equip researchers, technologists, and early-career professionals with the tools necessary to implement and interpret high-resolution, multi-scale plant and field data to support improved crop management and informed decision-making. A key component of the course is the promotion of knowledge transfer through hands-on training, collaborative learning, and the dissemination of best practices across institutions and countries. Ultimately, these innovative technologies will contribute to the effective implementation of Best Management Practices (BMPs) and promote sustainable agricultural development.

3. Course structure

The training course will span three days and is organized into three dedicated modules. Each module combines theoretical lectures with hands-on demonstrations, allowing participants to engage directly with trainers and gain practical experience with the operation of digital platforms. The three modules are outlined below:

Module 1: High Throughput Research infrastructures

- Comprehensive introduction to digital platforms for field and controlled-environment phenotyping, with a focus on their technical features and operational use.

- Training on FAIR data principles and metadata management, including the use of artificial intelligence for data interpretation and decision-making in phenotyping and precision agriculture.

Module 2: Ground Truth equipment and data collection

- Introduction and hands-on demonstration of hand-held and portable instruments used for validating remote and proximal sensing data, with a focus on recent technological advancements and their practical applications in the field.
- Overview of image processing techniques and the extraction of vegetation indices from proximal and remote sensing imagery, highlighting their relevance for crop monitoring, precision agriculture, and efficient water resource management.

Module 3: Application of statistical methods and Reuse of treated wastewater for irrigation

- Introduction to statistical methods, including hypothesis testing and regression analysis, with practical applications of machine learning models developed by the DEMETRIS-Hub to support phenotyping and decision-making in precision agriculture.
- Strategies for the safe and efficient reuse of treated municipal wastewater in irrigation, complemented by practical demonstrations of two operational treatment platforms.

By structuring the training course around these integrated modules, participants will gain a comprehensive understanding of cutting-edge technologies, sustainable agricultural practices, and the practical application of digital platforms, all of which are essential for advancing and refining BMPs. The course will also support future project collaborations by opening avenues for funding and highlighting the importance of effectively communicating scientific and technical results. Through this training, participants will acquire the skills and knowledge needed to actively support the adoption and successful implementation of BMPs and technological innovations within their professional and local contexts.

4. Summary of Training course contents

The training course is strategically designed with a strong regional focus, aiming to generate a broad and lasting impact across the target countries (Kenya, Ethiopia, Sudan, and Egypt). It adopts a Training of Trainers (ToT) approach to maximize the multiplier effect, equipping participants not only with technical knowledge but also with the capacity to transfer skills and methodologies within their local communities and institutions. The course content builds on the 2024 training program on digital platforms and responds to the specific needs identified during the implementation of the WATDEV project, ensuring both its relevance to current field challenges and its practical applicability.

The primary beneficiaries of this course are professionals from Egypt, Ethiopia, Sudan, and Kenya who are engaged in water management and agricultural development. These participants are expected to play key roles in the implementation of Best Management Practices and technological innovations to enhance sustainability and resilience in their respective regions.

The course combines theoretical lectures with hands-on sessions, providing participants with valuable insights and a vast wealth of knowledge. Throughout the program, they will interact with international experts specializing in digital platforms, smart phenotyping, precision agriculture, and sustainable water resource management. This exchange will foster cross-regional learning and collaboration, enriching the training with diverse perspectives and expertise.

To ensure a high standard of instruction, the sessions will be delivered by experienced trainers with strong international profiles. Their guidance will support participants in developing the necessary skills to implement and scale innovative practices in their local contexts. Upon completion of the course, participants will receive an attendance certificate issued by CNR-IPSP, recognizing their active participation and commitment to advancing BMPs and technology adoption in agriculture. These certificates will serve as a professional credential, reinforcing their role as multipliers of knowledge and catalysts for sustainable innovation.

Organizers

CNR-IPSP

CIHEAM-Bari

5. Beneficiaries

The Training and Capacity Building Course targets a diverse group of beneficiaries involved in the use of smart digital platforms. Selected participants will include early-career researchers (PhD students and research fellows) and professionals. The course is designed to equip these individuals with the knowledge and practical skills needed to contribute effectively to research, innovation, and implementation projects that support the adoption of Best Management Practices (BMPs). By engaging in this multidisciplinary cohort, the training aims to foster a strong network of expertise capable of promoting sustainable development within their respective sectors. A maximum of **20 participants** will be selected, with up to **five (5) participants** from **each target country** (Ethiopia, Egypt, Kenya, and Sudan). **As participation costs will be fully borne by CNR-IPSP and CIHEAM Bari, applicants shall not be employed by WATDEV's partners or receive any other form of reimbursements by WATDEV's partners to attend the Training and Capacity Building course. Affiliation with WATDEV Partner Institution is permitted.**

Applicants from other partner countries are likewise welcome to apply with their own funds.

6. Participants' selection

The selection to enrol for the Training and Capacity Building Course on "Smart Platforms for Plant Phenotyping and Precision Agriculture: Tools, Practices, and Analytics" will be open on **22 September 2025**. For partners requiring a VISA, the selection process will close on **6 October 2025**. For all other Partners, deadline for selection will be **20 October 2025**.

The selection of participants will be carried out by the Partners to ensure maximum impact and to strengthen the capacity of local personnel in effectively disseminating the knowledge acquired during the training course. Although the Partners will lead the selection process, CNR-IPSP and CIHEAM-Bari will serve in an advisory capacity, particularly in defining the minimum eligibility criteria for participants. This collaborative approach is intended to identify individuals with the greatest potential to benefit from the training and to actively contribute to the implementation of BMPs and innovation within their respective communities.

7. Participants' profiles

The A2.2 Training and Capacity Building Course is open to early-career researchers (including PhD students and research fellows) from a range of scientific disciplines such as agronomy, ecology, geology, engineering, informatics, etc., as well as to professionals such as engineers, IT specialists, and data analysts with expertise or interest in sensor-based data acquisition and data-driven approaches for precision agriculture. The course recognizes the value of inclusivity and encourages individuals at various stages of their careers to participate.

There is no age limit for participants, and special consideration will be given to young people showing a strong commitment to making a positive impact in their fields. By prioritizing the involvement of young participants, the training aims to empower and nurture the next generation of leaders in BMP implementation and innovation.

Proficiency in the English language is essential as the training will be conducted entirely in English. This requirement ensures effective communication and facilitates seamless knowledge sharing among participants from diverse backgrounds.

Overall, the participant profile is characterized by a blend of educational qualifications, professional experience (where applicable), and a shared enthusiasm for advancing sustainable practices in BMPs and innovations. The course values diversity and encourages participants to bring their unique perspectives, contributing to a dynamic learning environment that fosters collaboration and cross-disciplinary knowledge exchange.

8. The Modules' structure and Duration

The Training and Capacity Building Course will be held in ALSIA "Metapontum Agrobios" Research Center – Metaponto (Matera, Italy): <http://www.ipsp.cnr.it/urt-metaponto>.

Each module is thoughtfully divided into various sessions to provide a comprehensive learning experience:

- **Theoretical Sessions:** Participants will engage in in-depth theoretical sessions led by subject matter experts. These sessions will cover fundamental concepts, principles, and theoretical frameworks related to the course topics. In particular, they will focus on the theoretical foundations of both high-throughput plant phenotyping (HTP) and precision agriculture platforms. This advanced knowledge will be essential for defining and implementing more effective BMPs.
- **Demo Sessions:** Participants will observe subject matter experts working with/on the topic illustrated during the Theoretical Sessions, taking the opportunity to clarify doubts or practical aspects that generally emerge during demonstration activities.
- **Hands-on Session:** to reinforce the theoretical knowledge, participants will actively engage in practical exercises aligned with the topics covered in the Theoretical and Demo Sessions. These *hands-on* activities will enable participants to immediately consolidate the knowledge acquired during the course, enhancing their ability to transfer skills and methodologies within their local communities and institutions.

9. Language

The course will be held in English.



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21-23 January 2026

Metaponto (MT)

CNR-IPSP (Italy)

Programme



10. Programme of the Training and Capacity Building Course

Legend of the Training and Capacity Building Course's Programme		
Theoretical Sessions	Demo Sessions	Hands On Sessions

21 January 2026 - Module 1: High Throughput Research infrastructures

TIME	SESSION	TITLE	CONTENT	SPEAKERS
9:00-9:30	WELCOME COFFEE AND REGISTRATION			
9:30-10:15	Course Overview	Opening remarks	Welcome statement to the participants.	<p>M. Centritto (Research Director CNR-IPSP)</p> <p>S. Fares (Director CNR-DISBA)</p> <p>F. Di Serio (Director CNR-IPSP)</p> <p>C. Bogliotti (WATDEV Coordinator, CIHEAM Bari)</p> <p>M. Blasi (Director ALSIA)</p>
10:15-10:45	HTP technologies	Controlled environment phenotyping in Metaponto: from lab to field	Presentation of greenhouse HTP platforms using both sensor-to-plant and plant-to-sensor approaches for shoot and root phenotyping.	<p>A. Petrozza S. Summerer (ALSIA)</p>
10:45-11:15		Field Platforms for Precision Agriculture and HTP phenotyping	Open-field HTP systems, including UAVs, phenoveros, gantry cranes, and remote/proximal sensing technologies.	<p>A. Conte G. Marino (CNR-IPSP)</p>
11:15-11:45	COFFEE BREAK			
11:45-12:15		Volatilomics & Metabolomics in Plant Phenotyping	Overview of advanced technologies for profiling secondary metabolites as phenotypic markers.	<p>C. Brunetti V. Lazazzara F. Menicucci (CNR-IPSP)</p>

TIME	SESSION	TITLE	CONTENT	SPEAKERS
12:15–12:45	HTP technologies	Data Management and AI for Plant Phenotyping	Data Management and processing for Plant Phenotyping: From FAIR data principles to AI/ML application for data analysis.	A. Fabbri (CNR-IPSP) A. Montagni (CNR-IBE)
12:45-13:15		AI Applications in Phenotyping and Precision Agriculture	Leveraging artificial intelligence for data interpretation and decision-making in phenotyping and farming.	V. Renò (CNR-STIIMA)
13:15-15:00	LUNCH			
15:00-16:00	Demo Session	Greenhouse HTP Systems in Action	Live demonstration of greenhouse platforms using sensor-to-plant and plant-to-sensor setups.	A. Petrozza (ALSIA)
16:00-17:00		Plant-to-Sensor Imaging Analysis	Introduction to plant trait extraction using image analysis).	S. Summerer (ALSIA)

22 January 2026 - Module 2: Ground Truth equipment and data collection

TIME	SESSION	TITLE	CONTENT	SPEAKERS
09:00-09:30	Demo	Ground Truth instrumentation	Introduction to gas exchange (CIRAS 3–4), nutrient status (Dualox, SPAD), chlorophyll fluorescence (Handy-PEA), canopy structure (LAI 2200C) and Raman spectroscopy measurements (Finder Edge – Zolix)	F. Alderotti C. Brunetti C. D’Errico (CNR-IPSP)
09:30-10:30	Hands on	Ground Truth Data collection	Students will collect data in the field with the previously described instrumentation	F. Alderotti C. Brunetti C. D’Errico (CNR-IPSP)
10:30-11:00	COFFE BREAK			

TIME	SESSION	TITLE	CONTENT	SPEAKERS
11:00-11:30	Demo	Field HTP Systems in Action	On-site demonstration of open-field phenotyping tools: proximal sensors, rovers.	V. Montesano M. Grieco (CNR-IPSP)
11:30-12:00		UAVs fleet in Action	Data acquisition with UAVs (RGB, Thermal, LIDAR, Multispectral and Hyperspectral Camera)	G. Marino A. Daccache (CNR-IPSP)
12:00-13:00		Photogrammetry and 3D Modeling from UAV Imagery	Processing UAV images into spatial data products (georeferenced orthomosaics, DSMs, DTMs)	S. Mazzoni G. Marino (CNR-IPSP)
13:00-14:30	LUNCH			
14:30-15:00	Hands on	Leaf Photosynthetic parameters	Evaluating plant responses to abiotic stress through A/Ci and light response (LRC) curve analysis.	M. Haworth A. Conte (CNR-IPSP)
15:00-16:30		UAVs data processing and extraction of Vegetation Indices from proximal and remote sensing imagery	Extraction of vegetation indices from RGB, multispectral, and thermal imagery.	A. Conte S. Mazzoni (CNR-IPSP)
16:30-17:00	Best Practices	Root Plasticity, Phenotyping, and Root-Associated Microbes	Integrative Strategies for Plant Stress Resilience	R. Balestrini (Research Director CNR-IBBR)
20:00	Social Dinner			

23 January 2026 - Module 3: Application of statistical methods and Reuse of treated wastewater for irrigation

Venue: Ferrandina Town Hall

TIME	SESSION	TITLE	CONTENT	SPEAKERS
08:15-08:45	Travel to Ferrandina (MT)			
09:00-9:30	Best Practices	Statistical tools for HTP studies	Application of statistical methods: parametric/non-parametric ANOVA, equivalence testing, and state-of-the-art regression with machine learning.	D. Danzi A. Conte (CNR-IPSP) A. Montagni (CNR-IBE)

TIME	SESSION	TITLE	CONTENT	SPEAKERS
09:30-10:00	Best Practices	New paradigms for the assessment of "best practices" to combat desertification	Framing agronomy research practice in a changing world	P.P. Roggero (UNISS)
10:00-10:30		Designing Drought Stress Experiments	Guidelines for irrigation scheduling, fertilization, and agronomic practices under water-limited conditions.	V. Montesano (CNR-IPSP)
10:30-10:45	COFFE BREAK			
10:45-11:15	Best Practices	Neglected and underutilized crops in a saline agriculture context	Effects of salinity on edible salt-tolerant species growth and quality.	G. Atzori (CNR-IPSP)
11:15- 11:45		Use of salty water for agricultural purpose	Modelling approach integrating climate projections for coastal groundwater management	M. Polemio (CNR-IRPI)
11:45-12:15	Demo	Reuse of treated wastewater for irrigation	Opportunities and challenges in the use of reclaimed wastewater in agricultural systems	S. Masi (UNIBAS)
12:15-12:45		Transportable Wastewater Treatment Demonstrator for Irrigation Use	An advanced plant for municipal wastewater treatment and reuse	C. Di Iaconi (CNR-IRSA)
12:45-14:00	LUNCH			
14:00- 15:00	<p>CLOSING REMARKS</p> <p><i>"The Mattei Plan for Africa"</i></p> <p>M. Cerreto (MP, Member of the Agriculture Committee of Italian Chamber of Deputies)</p> <p>A. Andretta (Sole Administrator of Acquedotto Lucano)</p> <p>C. Lisanti (Mayor of Ferrandina)</p> <p>L. Mongiello (Regional Councillor for the Environment of the Basilicata Region)</p> <p>S. Masi (Full Professor University of Basilicata)</p>			
15:00-16:00	Guided Tour at the Ferrandina urban wastewater treatment plant			
16:00	Return to Hotel			

11. Venue of the Training and Capacity Building course - ALSIA "Metapontum Agrobios" Research Centre

Metapontum Agrobios is a research center of ALSIA (the Lucanian Agency for Development and Innovation in Agriculture). For over 30 years, the center has been committed to research, development, and the transfer of innovation in the agri-food sector. Its core activities include the development of biotechnological processes and, more recently, the **implementation of precision agriculture practices**.

The center designs and implements advanced technological platforms to support **food traceability, plant selection, and biodiversity characterization**, key components for developing new industrial crops.

A flagship component of the center is its **High-Throughput Plant Phenotyping (HTP) platforms**, part of the European **EMPHASIS** research infrastructure. This automated, non-invasive system uses **RGB, NIR, and 3D imaging** technologies to analyze plant growth, physiology, and stress responses under both controlled and field conditions. It enables detailed, real-time monitoring of traits such as biomass, water use efficiency, and drought tolerance, accelerating research in crop improvement and digital breeding.

The Metapontum Agrobios infrastructure includes:

- 2,200 m² of laboratories
- 3,620 m² of facilities for machinery and general operations
- 5,400 m² of greenhouses
- 5 hectares of experimental field

Address: S.S. Jonica 106 Km 448.2 - 75012 Metaponto di Bernalda (MT) – ITALY.

12. Transports

The following transportation related to the activities of the Training and Capacity Building Course will be arranged and covered by the organizers:

- **21 January 2026: departure at 7:45 from Hotel Federiciano (Bari) to the ALSIA Research Center in Metaponto;**
- **Daily transport from the Best Western hotel (Nova Siri, MT) to the school venue and back;**
- **24 January 2026: departure at 6:30 from Hotel Imperiale, Best Western (Nova Siri, MT) to Bari Palese Airport "Karol Wojtyla.**

13. Practical information

WI-FI connection

Free Wi-Fi is available throughout the Metapontum Agrobios Research Centre. A password will be provided to all participants of the course.

Medical assistance

In case of emergency, a team of voluntary first aid workers guarantee immediate assistance and ambulance transportation to the closest hospital.

There are currently no COVID-19-related entry restrictions in Italy

Meals

Lunch will be served at the canteen of the Metapontum Agrobios Research Centre from 13:00 to 14:30. Dinner will be served at the hotel from 20:00 to 21:30.

If you are vegetarian, celiac, or have any other dietary requirements, please inform the organizers before **your arrival**. Tap water is safe to drink.

Emergency telephone numbers in Italy

- Medical emergency: 118
- Police: 112
- Fire: 115.

Weather forecast

Temperatures in Metaponto are expected to be around 10°C during the day and 5°C at night. We strongly recommend that you check the weather forecast before your arrival, some rain may happen.

Timezone

Italy operates on Central European Time (CET), which is GMT+1.

Electricity

In Italy, the standard voltage is 220 volts. Power plugs are of the type with three round pins arranged in a row.