



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



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FROM WATER AND SOIL CHALLENGES TO SUSTAINABLE SOLUTIONS IN AFRICA

How WATDEV offers resilient solutions
in North and East Africa





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and Sustainable DEvelopment
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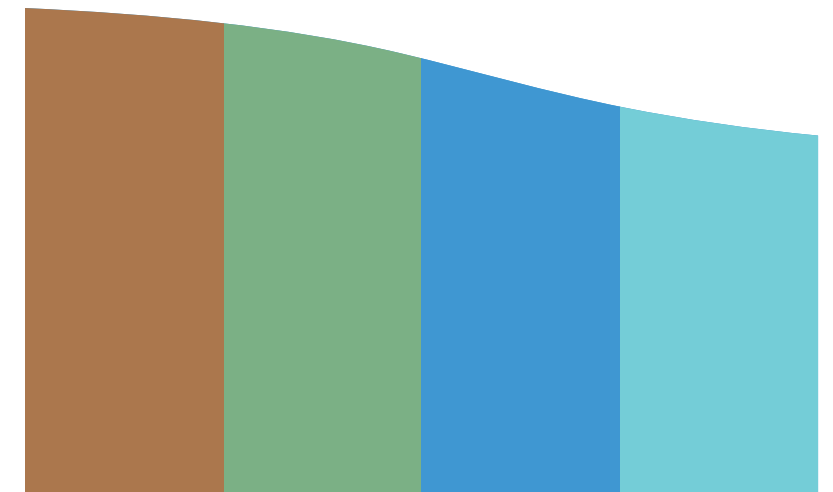
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Authors:

Gaetano LADISA, Silvia LECCI, Aymen SAWASSI,
Claudio BOGLIOTTI, (CIHEAM Bari).
Concetta BIANCO, Jacopo TAVASSI (AICS Cairo).

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FOREWORD

In a world increasingly confronted by climate change, water scarcity, environmental degradation and growing pressure on food systems, the WATDEV project – Climate Smart WATER Management and Sustainable DEvelopment for Food and Agriculture in North and East Africa – has represented far more than a development initiative. It has been a platform for scientific cooperation, regional dialogue and shared innovation, bringing together institutions, researchers, policymakers and local communities around a common challenge: building more resilient, sustainable and climate-smart agricultural systems for future generations.

Implemented by the Italian Agency for Development Cooperation (AICS) as Executive Agency, with the technical-scientific coordination of CIHEAM Bari, WATDEV reflects AICS's broader vision of development cooperation based on partnership, knowledge exchange and dialogue. In this framework, the project created opportunities for institutions and experts from different countries and disciplines to work together around shared regional challenges affecting water management, agriculture and climate resilience.

One of the most valuable and distinctive dimensions of WATDEV has been precisely its ability to foster meaningful dialogue among a wide range of institutions and actors. Ministries, universities, research institutes, technical agencies, extension services and local communities engaged throughout the project in a continuous process of discussion, comparison of experiences and collective reflection. This exchange of perspectives – scientific, institutional, operational and local – became one of the project's greatest strengths, contributing not only to technical achievements, but also to stronger

relationships, mutual understanding and a shared vision for sustainable development.

Research centres and technical partners from Italy, Finland, the Netherlands, Egypt, Ethiopia, Kenya and Sudan worked side by side, combining scientific expertise, operational experience and local knowledge in a collaborative environment that encouraged continuous exchange of ideas, methodologies and practices. This dynamic interaction transformed WATDEV into more than a technical programme: it became a space where knowledge was collectively built through dialogue, cooperation and shared field experience.

Through the integration of scientific research, field experimentation and participatory approaches, WATDEV contributed to advancing more sustainable water management practices in highly vulnerable contexts across North and East Africa. The project promoted innovative and climate-smart solutions capable of improving water-use efficiency, supporting agricultural productivity and strengthening resilience to climate-related risks affecting both ecosystems and rural livelihoods.

Among its key achievements, WATDEV developed integrated planning tools combining hydrological, agronomic and socio-economic modelling approaches to support evidence-based decision making at basin and sub-basin level. At the same time, the project strengthened institutional and technical capacities through regional trainings, knowledge-sharing activities and collaboration among ministries, research institutions, extension services and local stakeholders. In doing so, WATDEV helped bridge the gap between scientific knowledge and public decision-making, reinforcing the role of research as a practical instrument for sustainable development and policy formulation.

At the heart of the project was the conviction that sustainable solutions cannot emerge from research alone. They require dialogue, participation and continuous interaction between science, institutions and communities. WATDEV therefore invested significantly in creating spaces for peer learning, technical exchange and joint reflection, enabling stakeholders from different countries and sectors to collectively identify practical, locally adapted and scalable responses to shared challenges.

At the same time, the project highlighted the complexity of ensuring long-term sustainability in contexts increasingly affected by climate variability, demographic growth and growing competition

over natural resources. Preserving and expanding the results achieved by WATDEV will require continued investment in local capacities, stronger institutional coordination, sustained support to research systems and the ability to translate scientific evidence into concrete policies, operational tools and long-term strategies. Sustainability, in this sense, is not only a technical challenge, but also an institutional, financial and political responsibility requiring long-term commitment and regional cooperation.

This publication aims to capture part of this collective journey by showcasing experiences, lessons learned, success stories and reflections developed throughout the implementation of WATDEV. Beyond its technical achievements, the project demonstrates how international scientific cooperation and constructive dialogue among institutions can become powerful drivers for sustainable development, regional integration and shared resilience.

As WATDEV comes to an end, it leaves behind not only methodologies, tools and research outputs, but above all a strengthened network of institutions, researchers, practitioners and local actors committed to advancing sustainable water management and climate resilience across the region. This human and institutional legacy may ultimately prove to be the project's most valuable and enduring contribution to the future of North and East Africa.

Concetta Bianco and Jacopo Tavassi

AICS – Agenzia Italiana per la Cooperazione allo Sviluppo, Cairo Office

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1. THE DESIRA INITIATIVE IN A FEW WORDS

The DeSIRA Initiative (Development Smart Innovation through Research in Agriculture; <https://europa.eu/capacity4dev/desira>) supported research and innovation (R&I) for the sustainable transformation of agriculture and food systems in low and middle-income countries in Africa, Asia, and Latin America. Funded by the European Union, the first phase of the DeSIRA initiative ran from June 2019 until June 2026.

Through the DeSIRA Initiative, 82 projects were implemented, and several strategic African and global initiatives were supported. With a funding base of €340 million invested by the European Commission and €60 million by European Union (EU) member states, DeSIRA strengthened R&I capacities, fostered co-innovation, and promoted policy dialogue to enhance agricultural innovation systems (AIS).

The DeSIRA Initiative focused on using participatory action research, along with local knowledge, to contribute to more productive, climate-resilient, and inclusive food systems. It also aimed to generate evidence to improve future interventions and policy-making. DeSIRA emphasised co-designing and disseminating climate-smart and agroecological solutions. Capacity strengthening was central, aiming to invest in technical, managerial, and functional capacities at individual and organisational levels. DeSIRA supported innovation through multistakeholder approaches involving communities, farmer organisations, nongovernmental organisations, private-sector actors, research institutions and development bodies.

The objective of the DeSIRA initiative was **to contribute to climate-relevant, productive, and sustainable transformation of agriculture and food systems in low and middle-income countries.**

DeSIRA aimed to put more science into development, considering that the solutions to achieve the Sustainable Development Goals (SDGs) are context-specific. It contributed primarily to the achievement of SDG 1 (no poverty), 2 (zero hunger), 5 (Gender equality), 8 decent work and economic growth, 13 (climate action), and 15 (Life on Land).

DeSIRA aimed at supporting research and innovation projects in Africa, Asia, Latin America, and strengthening research capacities and research governance involving key actors at national, regional, continental, and global levels.



Source and more info:
<https://europa.eu/capacity4dev/desira>



2. WATER AND AGRICULTURE UNDER PRESSURE IN EAST AFRICA

Water, agriculture and the environment in East Africa

Water is essential for life, food and economic development. In East African countries, water plays a central role in agriculture, which is the main source of income for millions of people. Most rural families depend on farming to produce food and earn a living.

Agriculture is also the largest user of freshwater in the region. In many countries, farming uses most of the available water, especially for irrigation. This means that how water is managed in agriculture has a strong impact on people, ecosystems and the environment.

East Africa is rich in natural resources, including large rivers, lakes and fertile lands. At the same

time, water resources are unevenly distributed and often limited. Rainfall is not regular: some areas receive very little rain, while others experience intense rainfall over short periods. This makes farming difficult and uncertain.

Population growth is increasing the pressure on water and land. More people need more food, more water and more space. In many areas, agricultural land is expanding without proper planning. Forests are cleared, soils are overused and water sources become polluted or depleted. Over time, this reduces the ability of nature to support agriculture and rural livelihoods.

Water management is particularly challenging in large river basins shared by several countries, such as the Nile Basin. Water does not stop at national borders. Actions taken in one area can affect farmers, ecosystems and communities far downstream. For this reason, cooperation and shared knowledge are essential to manage water in a fair and sustainable way.

Climate change: growing risks for water and farming

Climate change is already affecting East Africa and will continue to do so in the future. Rising temperatures and changing rainfall patterns are making water availability more uncertain and increasing risks for agriculture.

Droughts are becoming more frequent and more severe. Long dry periods reduce river flows, groundwater levels and soil moisture. Crops fail more often, livestock suffers and food production decreases. Farmers who rely on rainfed agriculture are especially vulnerable to these changes.

At the same time, rainfall events are becoming more intense. Heavy rains can cause floods, wash away fertile soil and damage crops, irrigation systems and roads. Instead of helping agriculture, these extreme events often create losses and long-term damages.

Climate change also affects water quality and ecosystems. Lower water levels and higher temperatures can degrade rivers, wetlands and lakes. Healthy ecosystems are important because they store water, protect soils and support agriculture. When ecosystems are damaged, farming systems become less resilient.

If these challenges are not addressed, the impacts can reinforce each other. Water scarcity, declining soil fertility and lower agricultural productivity increase poverty and food insecurity. This puts even more pressure on natural resources, creating a negative cycle that is difficult to break.

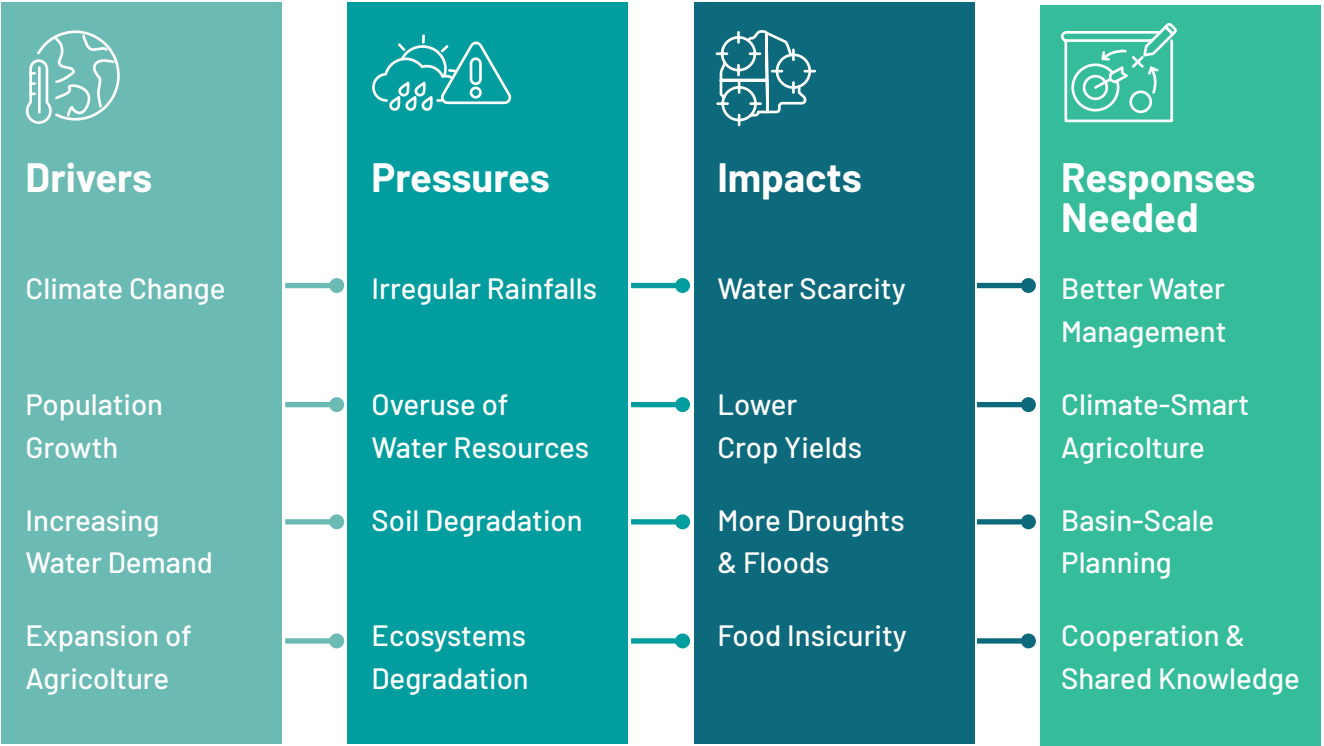
Why change is needed?

To face these challenges, a new approach to water and agricultural management is needed. Managing water farm by farm is no longer enough. What is needed is a broader perspective that looks at entire catchments and river basins.

Improved water management can help farmers produce more food with less water, protect soils from erosion and reduce vulnerability to climate change. Sustainable agricultural practices and innovative solutions can support both livelihoods and the environment.

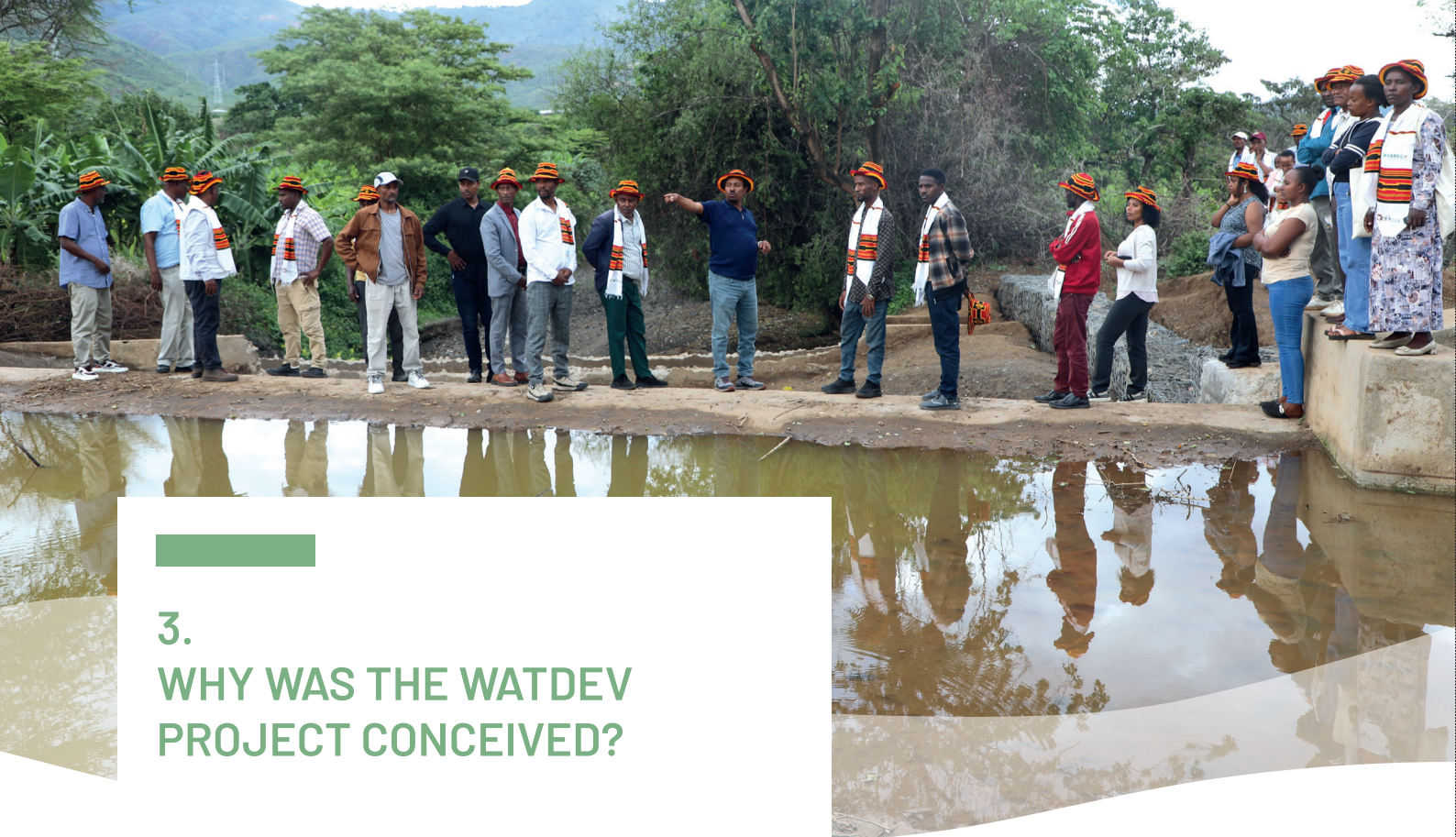
At the same time, decisions should be based on sound knowledge, data availability and dialogue among farmers, scientists and decision-makers. Cooperation between countries and stakeholders is key to managing shared water resources and preparing for future climate impacts.

This is the context in which WATDEV works: supporting climate-smart water management and sustainable agriculture in East Africa, to protect natural resources, strengthen resilience and improve food security in a changing climate.



Main pressures on water and agriculture in East Africa





3. WHY WAS THE WATDEV PROJECT CONCEIVED?

The project WATDEV - Climate Smart WATER Management and Sustainable DEvelopment for Food and Agriculture in East Africa and Egypt was conceived to increase the sustainability of agricultural water management and resilience of agroecosystems to climate change in Egypt, Ethiopia, Kenya, and Sudan. All these countries score poorly on the Human Development Index, and the scarcity or limited availability of their water resources, together with climate conditions, are severely compromising their agricultural production and food security.

The WATDEV specific objectives were:



To improve the national Ministries' and Research Institutions' knowledge and management of water in agriculture.



To increase farmers' and local actors' new skills in innovative and sustainable solutions for water management.

The WATDEV project achieved the following results:

- R.1.:** Identified the best fitting Best Management Practices (BMPs) and Innovations in project countries,
- R.2.:** Enhanced the implementation of BMPs/innovations in study areas,
- R.3.:** Performed the BMPs /Innovations upscale and out-scale scenarios,
- R.4.:** (Developed) A (water planning) modeling toolbox (available) for Researchers and Institutions,
- R.5.:** Strengthened knowledge and capacity building and established a regional "Water Knowledge" Hub.

WATDEV project in a nutshell

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



CRIS FOOD/2021/425-767

Website:
www.watdev.eu

Duration:
01.01.2022 - 30.06.2026

Budget:
7,499,897 Euros

N. of partners:
10

Countries of intervention:
Egypt, Ethiopia, Kenya, Sudan

4. THE PARTNERSHIP



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the European Union



CIHEAM
BARI

The **Italian Agency for the Development Cooperation (AICS)** is the Executive Body and assures the overall project coordination and monitoring. The **International Centre for Advanced Mediterranean Agronomic Studies - Institute of Bari (CIHEAM Bari)** is the technical and scientific project lead partner.

The partners are:



National Research Council of Italy

CNR-IPSP

The National Council for Scientific Research, Institute for Sustainable Plant Protection (*Italy*).



Suomen ympäristökeskus
Finlands miljöcentral
Finnish Environment Institute

SYKE

Finnish Environment Institute
(*Finland*).



ISRIC

International Soil Reference and Information Centre, independent research foundation (*The Netherlands*).



WLRC

Water and Land Resources Center
(*Ethiopia*).



WRC

Water Research Centre (*Sudan*).



ASARECA

Association for Strengthening Agricultural Research in Eastern and Central Africa (*Uganda*).



HU

Heliopolis University (*Egypt*).



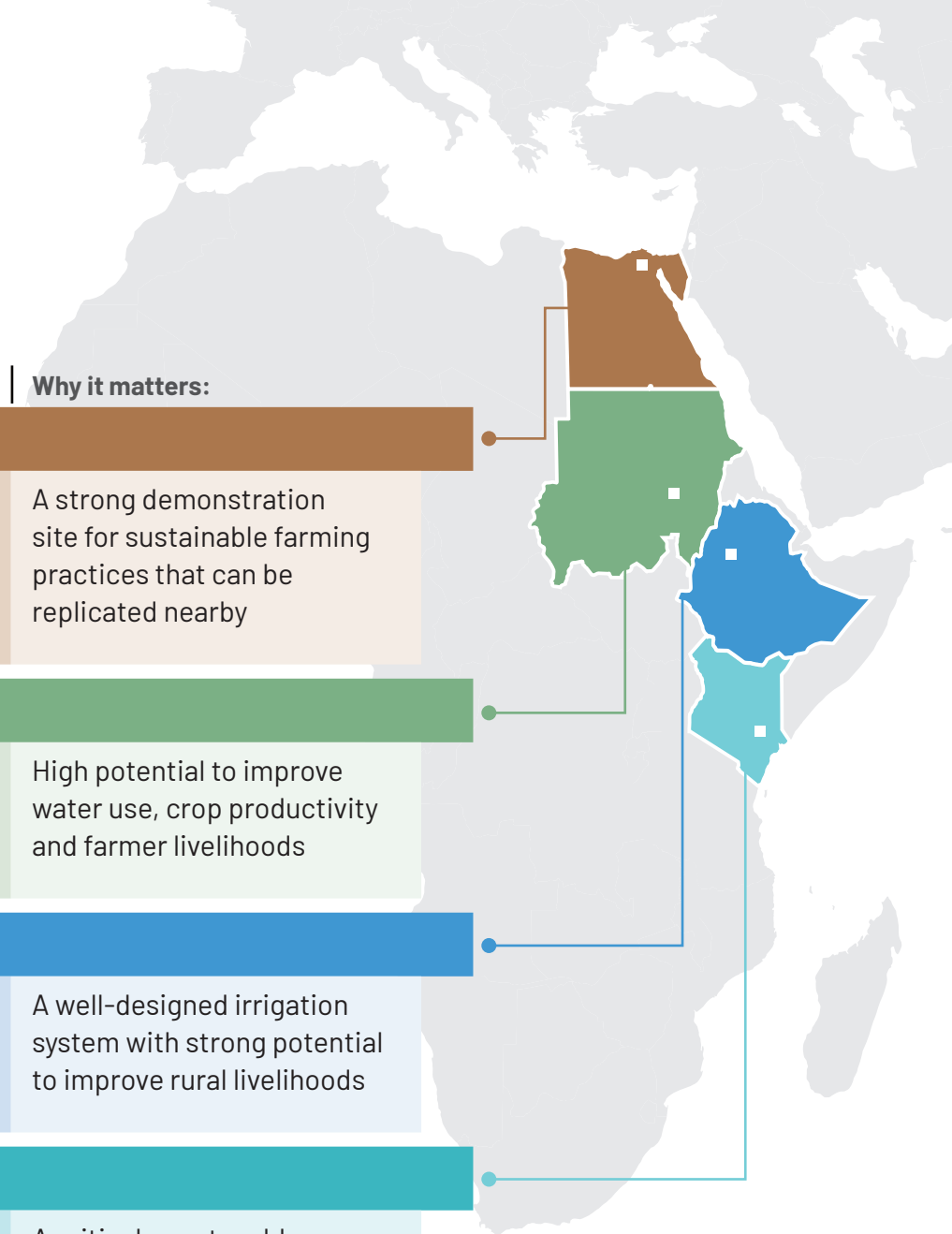
KALRO

Kenya Agricultural & Livestock Research Organization (*Kenya*).



5. PROJECT TARGET AREAS

Where:	Climate:	Farming systems:	Key challenges:	Why it matters:
EGYPT – Belbies District, SEKEM Farm				
Nile Delta area, a flat and fertile agricultural region in Sharkia Governorate	Hot and dry most of the year, with mild winters and limited seasonal rainfall	Intensive crop production, including wheat, cotton, rice, maize and citrus fruits	Pollution of soil and water from intensive farming practices and overuse of groundwater	A strong demonstration site for sustainable farming practices that can be replicated nearby
SUDAN – Gezira Irrigation Scheme				
Large irrigated area between the Blue and White Nile Rivers	Very hot and dry, with low and irregular rainfall	Large-scale irrigated farming producing food and export crops for the whole country	Aging irrigation infrastructure and weak management systems	High potential to improve water use, crop productivity and farmer livelihoods
ETHIOPIA – Koga Irrigation Scheme				
Koga catchment area, near Bahir Dar in north-western Ethiopia	moderate temperatures during the year with short rainy season	Smallholder farming, mainly rainfed, with growing use of irrigation	Seasonal water scarcity, inefficient water use and land degradation	A well-designed irrigation system with strong potential to improve rural livelihoods
KENYA – Hola and Bura Irrigation Schemes, Lower Tana River Area				
Lower part of the Tana River, in Kilifi County	Very dry and hot, with scarce rainfall and high water losses	Mixed farming and pastoralism, strongly dependent on river water availability	Water shortages, floods, land degradation and invasive plant species	A critical area to address water, land and food security in a fragile context





6. WORKING TOGETHER TO IMPROVE WATER MANAGEMENT

Water management for agriculture is a shared challenge. Climate change, water scarcity and environmental degradation affect farmers, communities and public authorities at the same time. For this reason, farmers, researchers and policymakers worked together throughout the project in a continuous process of dialogue, learning and cooperation to develop better and more sustainable solutions.

■ Farmers: knowledge from the field

Farmers are at the heart of WATDEV. They are the first ones to experience the impacts of droughts, irregular rainfall, and declining water availability and quality. Their daily experience provides essential knowledge about local conditions, risks, and practical constraints. In WATDEV, farmers take part in meetings and discussions where they share needs, priorities, and ideas. Their feedback helps ensure that proposed practices are realistic, acceptable, and adapted to local farming systems.

■ Researchers: turning knowledge into innovative solutions

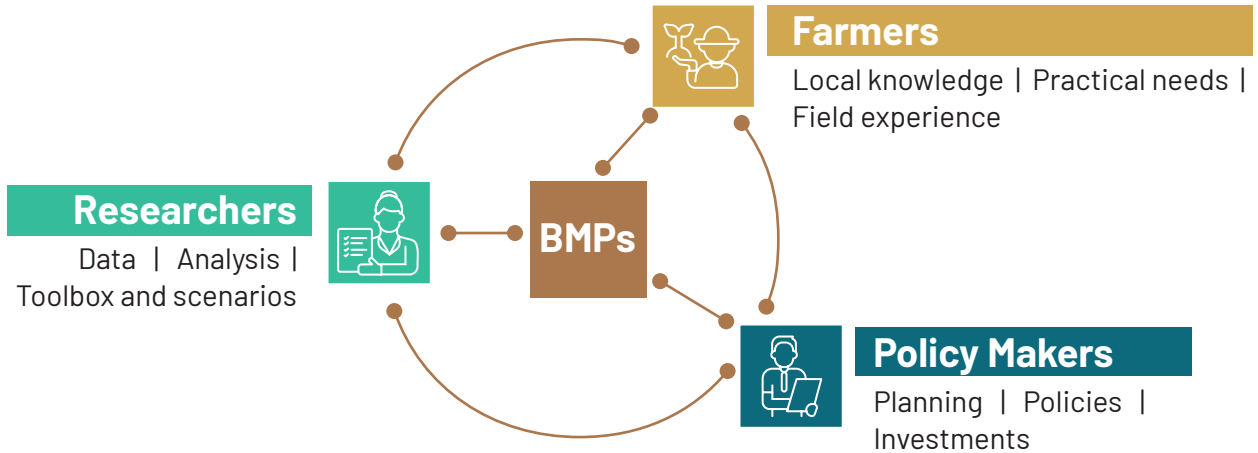
Researchers support the process by analysing water, soil, and agricultural systems. They provide data, tools, and scenarios to explore how different management options may perform under current and future climate conditions. In WATDEV, researchers work closely with farmers and local stakeholders. They listen, adapt their analyses, and explain results in a clear and accessible way. Their role is to connect scientific knowledge with real-world practice.

■ Policymakers: enabling change

Policymakers and planners influence how water and agriculture are managed through rules, investments, and long-term strategies. Their involvement is essential to turn ideas into action. WATDEV engages policymakers from the early stages of the project. By participating in discussions and Regional Workshops, they gain a better understanding of local challenges and the potential impacts of different choices. This helps align policies with on-the-ground realities and increases the chances that successful solutions can be scaled up.

■ Learning and co-creating together

The multi-actor process in WATDEV is based on shared learning and co-creation. Solutions are not imposed from the top but developed together. Local Feedback Meetings and Regional Workshops create spaces for dialogue, trust and mutual understanding. This two-way exchange strengthens cooperation and increases the chances that solutions can be adopted and scaled up. By linking farmers, researchers and policymakers, WATDEV helps turn knowledge into action and supports climate-smart water management for more resilient agricultural systems in East Africa.



How the WATDEV integrated process works



7. THE MULTI-LEVEL AND MULTI-ACTOR APPROACH IN WATDEV

The participatory approach adopted throughout the WATDEV project implementation was designed to ensure that key research progress and outcomes, as well as discussions held, were shared with different levels of responsibility involved in water management in Agriculture.

Farmers, researchers, and policy makers were included in a multi-level, multi-actor dialogue on management topics of common interest, at key stages of project development.

A STAKEHOLDER FORUM was created at the outset of the WATDEV project, with the cooperation of project partners based in the study areas. Its main function was to give recommendations and input on project development, regarding the work plan and relations with beneficiaries, local actors, and communities. It was comprised of twenty members (five members from each country) coming from Kenya, Sudan, Ethiopia, and Egypt. The members belonged to the following stakeholders' categories: policy and decision-makers; farmers' organizations; private sector; scientific or academic bodies.

A WORKING GROUP ON MODELLING was instituted with researchers from ISRIC, CIHEAM Bari, and SYKE. The working group has worked throughout the project duration to carry out a complex process of selecting the right models for the best agricultural management practices, integrating

models, selecting modules for coupling, adapting source codes, managing data, testing, validating, and customizing the modelling toolbox. Its overarching aim was to facilitate comprehensive and innovative planning through the seamless transmission of variables within and between the selected models and collected data.

FARMERS' ORGANIZATIONS from the countries of intervention have been involved throughout the project, to take part in decisions-making process concerning the implementation of BMPs and in knowledge-sharing sessions.



160 participants

took part in



4 Meetings

in the four study areas for the BMPs selection and assessment of their suitability to farmers' needs.



More than 300 farmers

from the study areas attended



3 local-feedback meetings

to discuss feasibility studies.



4 feasibility Studies

were conducted based on a multi-level process of data collection to feed feasibility indicators



10 implementation protocols

are available for selected BMPs scenarios

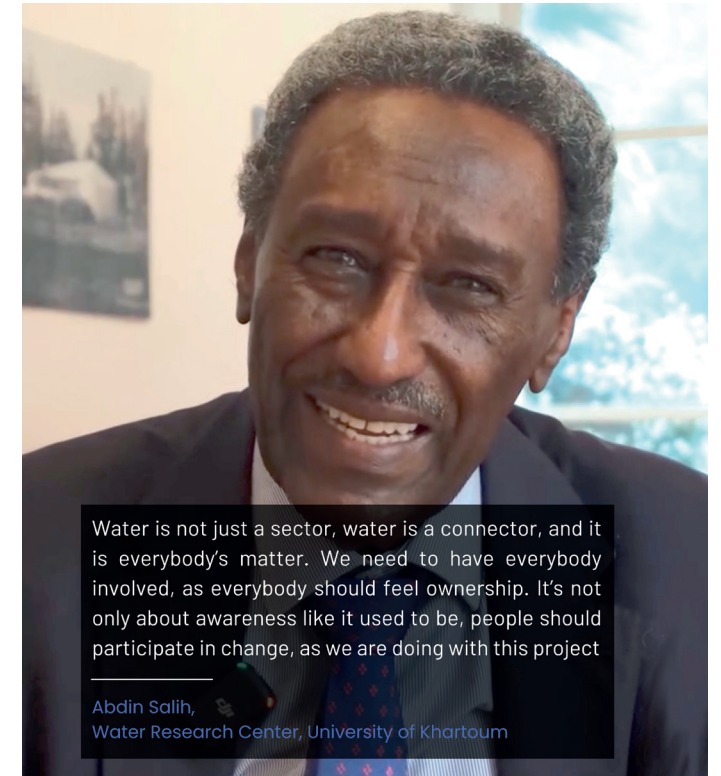


The Stakeholder Forum gathered 4 times **up to 20 organizations** from the four countries



4 Modelling working group meetings

were held in four different venues, with international researchers, to design and test the Modelling Toolbox





8. AN INVENTORY OF BEST MANAGEMENT PRACTICES (BMPs) TO ENHANCE SUSTAINABLE WATER AND LAND MANAGEMENT

Best Management Practices (BMPs) are actions that can enhance, improve, and in some cases correct, the balance between the Human and Environmental subsystems.

They support farmers and local communities in increasing productivity while protecting natural resources and adapting to climate change.

In simple terms, BMPs are:

- Practices that help solve local environmental and agricultural challenges;
- Techniques that improve water efficiency and protect soils;
- Solutions that support both farmers' livelihoods and ecosystem health.

Examples of BMPs in the WATDEV project

- Crop rotation
- Manuring/composting
- Soil conservation measures
- Agroforestry practices/intercropping with trees
- Water Users Associations and participatory water management
- Improved Seeds

Building the WATDEV BMPs Inventory

Within the WATDEV project, an inventory of about 200 BMPs was developed collaboratively by CNR, HU, KALRO, WLRC, WRC, and CIHEAM Bari. The aim was to identify, collect, and analyze sustainable practices already applied or potentially applicable in the project study areas.

The process combined:

- Scientific research and previous project experiences;
- Consultations with farmers, technicians, and institutions;
- Analysis of local environmental and water-related challenges.

The selected BMPs were assessed according to different criteria, including:

- Water-saving potential;
- Environmental benefits;
- Economic feasibility;
- Social acceptance;
- Potential for replication in other regions.

The BMPs inventory provide a practical knowledge base to support farmers, researchers and decision-makers in choosing sustainable solutions for water and land management.

The inventory is available at:
www.watdev.eu/water-management-knowledge-portal





Atmosphere

Atmosphere:

protect the atmosphere,
mitigate climate change.

Land Cover (Crop, surface water)

Crop:

protect and improve
the crop productivity.

Soil layers (Soil texture and morphology, fertility)

Soil:

improve soil quality and
reduce impact on it
(erosion, loss of organic matter,...).

Groundwater resources

Water:

improve water management
and reduce impact on it.

Green House Gas emssion reduction / Soil carbon sequestration improvement

- Agroforestry practices
- Crop rotation
- Manure management practices

Climate variabilities resilience improvement

- Early maturing varieties
- Improved seeds

Crop productivity improvement

- Chemical fertilization combined with green manure
- Microfertilization
- Mulching

Food security / livelihood

- Drought resilient / tollerant crops

Enhancing resistance to pest

- Crop Rotation
- Biological control

Minimize soil erosion

- Gully rehabilitation and stabilization
- Grass strips
- Cross slope barriers
- Stone lines
- Planting plants

Mitigate Soil salinization and alkalinization

- Mulching
- Tied ridges
- Cover crop
- Combined with: rotation / mineral fertilization

Stabilize soil structure

- Agroforestry
- No tillage / Zero tillage
- Manure

Groundwater improvement

- Recharge wells
- Agroforestry

Loggin / Salinization control

- Tillage
- Chemical / Organic fertilizers for salinity control
- Crop rotation
- Biochar

Evaporation / evapotranspiration reduction

- Mulching
- No tillage / Zero tillage

Specific genotype use

- Genotype salt-resistant use
- Early Maturing Varieties

Farmers engagement

- Water User's Association

Enhance soil organic matter content

- Crop rotation
- Manure
- Crop residue management

Soil water retention improvement

- Agroforestry
- In-situ water harvesting (trenches and percolation pits)

Surface water improvement

- Sand dams
- Sub-Surface Dams
- Jessor

Improve water use efficiency

- Water Control Canals
- Water-spreading weir
- Irrigation
- Water User's Association



9.
THE BEST MANAGEMENT
PRACTICES (BMPs)
SELECTED IN THE STUDY AREAS

EGYPT

What is the practice?

Why is it useful?



AGROFORESTRY (Intercropping with trees)

Grow food crops together with citrus trees on the same fields, increasing crop diversity while protecting soils and improving farm resilience

- Increases farm productivity and income diversification
- Improves soil fertility, moisture and erosion control
- Enhances biodiversity and carbon storage



COMPOSTING

Replace chemical fertilizers with compost made from organic waste, improving soil structure, moisture retention and long-term soil health.

- Improves soil fertility and nutrient availability
- Enhances water-holding capacity and soil structure
- Reduces pollution of soil and groundwater



WATER USERS' ASSOCIATION

Strengthen farmers' organizations to jointly manage irrigation water, promote efficient irrigation methods and coordinate water allocation.

- Improves water use efficiency and allocation
- Reduces conflicts among water users
- Promotes fair and inclusive water governance

ETHIOPIA

What is the practice?

Why is it useful?



AGROFORESTRY

Intercropping of Avocado trees with crops in part of the command area to diversify food production, and agroforestry with Eucalyptus trees plantations upstream from the Koga dam to control erosion.

- Improves soil stability and water quality
- Reduces sedimentation in the reservoir
- Enhances biodiversity and climate resilience



CROP ROTATION AND SOIL HEALTH

Introduce planned crop rotations combining irrigated and rain-fed crops to improve soil fertility, yields and production stability.

- Increases soil organic matter and nutrient recycling
- Improves crop productivity over time
- Reduces dependence on external inputs



WATER USERS' ASSOCIATION

Coordinate irrigation planning and water sharing among farmers using surface and groundwater resources more efficiently.

- Ensures fair water distribution
- Reduces water-related conflicts
- Improves agricultural productivity and market access

KENYA

What is the practice?

Why is it useful?



AGROFORESTRY

Convert part of irrigated land to mango plantations and add vegetated strips along fields and canals to protect crops and improve landscapes.

- Increases farm income and crop diversification
- Improves soil fertility and water infiltration
- Enhances carbon storage and ecosystem connectivity



WATER USERS' ASSOCIATION

Improve water availability by managing canals better, reducing water losses and coordinating irrigation practices among farmers.

- Reduces conflicts over water use
- Improves irrigation efficiency
- Strengthens local water management capacity



SUDAN

What is the practice?

Why is it useful?



IMPROVED SEEDS

Promote the use of certified, high-yield and drought-tolerant seed varieties to improve crop performance under dry conditions.

- Increases crop yields and food security
- Improves resilience to climate variability
- Enhances household incomes



WATER USERS' ASSOCIATION

Improve irrigation scheduling and canal management through better coordination among farmers and irrigation managers.

- Enhance efficiency of irrigation systems
- Improve collaboration among farmers
- Supports sustainable water and food production





10. BUILDING CAPACITY IN THE TERRITORIES TO BOOST SUSTAINABLE AND CLIMATE-SMART AGRICULTURE

Training and capacity-building sessions were fundamental to developing research and achieving the specific objectives of the WATDEV project. Research institutions, farmers, local actors, and national authorities were involved in targeted training activities.

Among the training activities, the Course “Water, soil and crop management in climate-smart agriculture” and the Winter School “Smart Platforms for Plant Phenotyping and Precision Agriculture: Tools, Practices, and Analytics” provided training sessions to selected trainers in effectively implementing the selected Best Management Practices (BMPs) and Innovations in their respective territories and communities. These training courses for trainers were structured in modules carefully designed to address the identified training needs and covered the following macro-subjects: a comprehensive introduction to the selected BMPs and the assessment of their sustainability; exploration of cutting-edge technologies in agriculture and water management, digital agriculture and decision-support tools; networking for cooperating, project design, and funding opportunities. The WATDEV project also allowed the delivery of Sandwich PhD programs and the organization of advanced training modules for researchers and decision-makers on the use of the water management modelling toolbox designed by the modelling research team. More achievements are summarised on the following page.

The project successfully involved **more than 800 people**, including researchers, local actors, and farmers, in dedicated training sessions on innovative and sustainable water management practices, and achieving a high level of satisfaction among the participants. Namely, the following results were achieved:



4 PhD students
students from Egypt, Ethiopia, Kenya, and Sudan completed a sandwich PhD program between their universities and Wageningen University to contribute to developing the modelling toolbox



178 stakeholders
took part in
4 awareness event
on selected BMPs
in the four study areas



341 farmers
from the study areas and the
surrounding basin attended
**7 follow-up
training sessions**



80 Trainers
were selected among
researchers and extensionists
from the study areas and
attended in person
**4 trainings
for trainers (ToT)** in Italy



3 training sessions
were attended by
122 participants
on BMPs implementation
protocols outside
the study areas



3 training sessions
on the use of the modelling
toolbox were attended by
74 participants



www.watdev.eu/training



11. INTEGRATED MODELLING AND DECISION-SUPPORT TOOLS

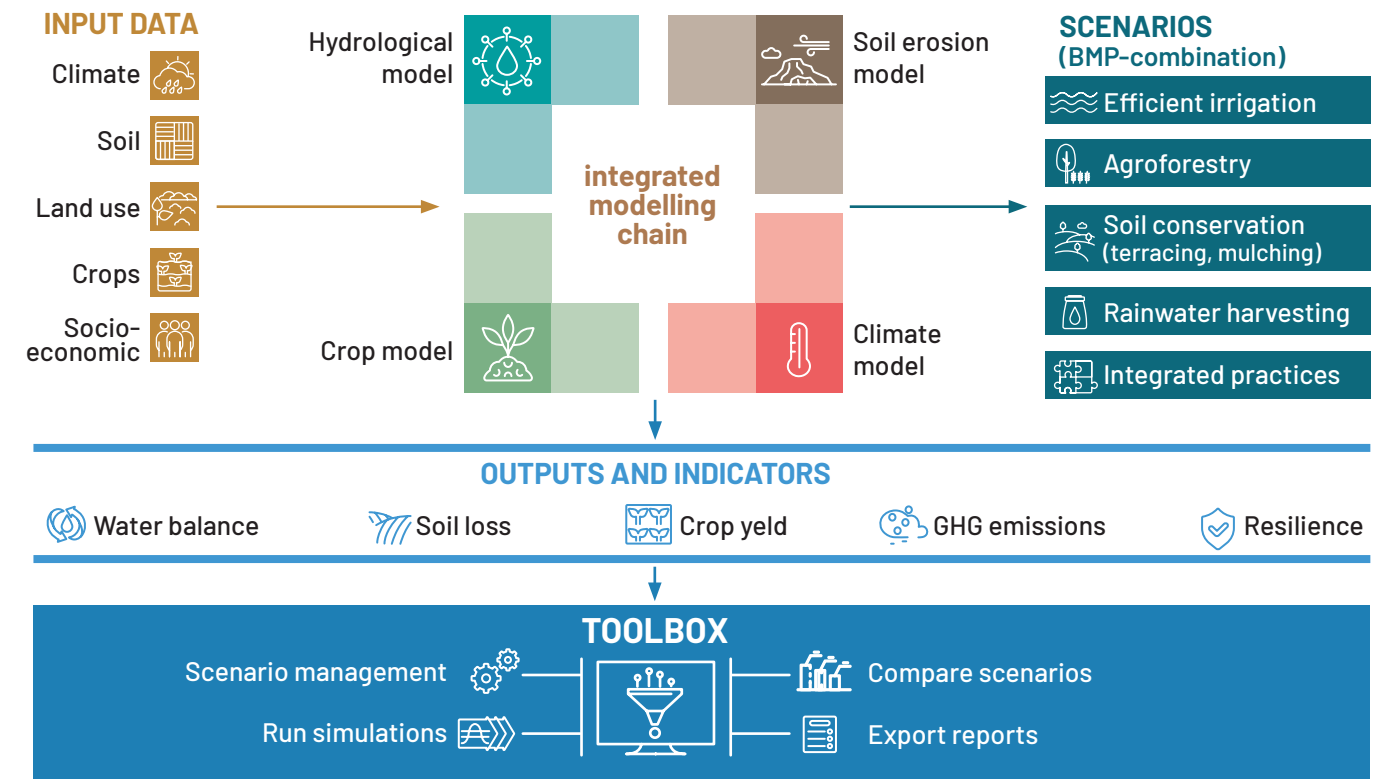
Exploring future scenarios for water management and agriculture

The WATDEV project developed an integrated modelling approach to better understand how different agricultural and water management practices may affect the environment, farming systems and climate resilience in the study areas.

The project combined different scientific tools to analyse:

- SWAT water availability and river flows;
- groundwater dynamics;
- soil conditions and crop productivity;
- the effects of climate variability and land management practices

This approach made it possible to explore how different practices/BMPs – such as agroforestry, efficient irrigation, crop rotation, mulching, and rainwater harvesting – could influence both agricultural production and natural resources.



From data to practical decision

To facilitate the use of these modelling results, WATDEV also developed an integrated modelling toolbox for researchers, technicians, and decision-makers.

The toolbox allows users to:

- Compare different management scenarios;
- Use local data to explore possible impacts
- Visualize results through indicators and maps;
- Support planning and evidence-based decision-making

The integrated toolbox represents an innovative decision-support system that helps in transforming complex information into accessible knowledge that can support more sustainable water and land management.

12

FROM ACTIONS TO IMPACT: HOW WATDEV SUPPORTS DIFFERENT STAKEHOLDERS

Stakeholder group	Farmers	Technicians & Extension Officers	Researchers & Research organisations
How they are involved in WATDEV (actions)	- Participation in needs assessment and local discussions - Involvement in awareness meetings - Training on Best Management Practices (BMPs) - Feedback on proposed solutions and scenarios	- Participation in training (Training of Trainers) - Involvement in workshops and knowledge exchange - Support to farmers in implementing BMPs	- Collection and analysis of data on water, soil and agriculture - Development of models and future scenarios - Interaction with farmers and stakeholders - Contribution to selection and assessment of BMPs
Expected impacts (benefits)	- Better understanding of water-saving practices - Improved crop productivity and resilience - Reduced vulnerability to droughts and climate risks - Greater capacity to adopt innovative solutions	- Stronger technical and advisory skills - Improved ability to transfer knowledge to farmers - Better tools to support climate-smart agriculture - Increased role as innovation facilitators	- Better alignment of research with real-world needs - Increased impact and usability of scientific results (Toolbox) - Stronger collaboration with stakeholders and policymakers - Improved capacity to support innovation and decision-making

WATDEV brings together different groups of stakeholders who play a key role in water and agricultural management. Each group is involved in specific project activities, from sharing knowledge to testing solutions on the ground. This collaborative approach helps ensure that actions respond to real needs and local conditions. By working together, stakeholders can improve their skills, exchange experiences and support better decision-making. As a result, the project creates practical benefits for people, the environment, and future sustainable water management.

Stakeholder group	Management Authorities (irrigation schemes)	Local governments	National ministries (water, agriculture, energy, environment)
How they are involved in WATDEV (actions)	- Participation in multi-actor meetings - Contribution to selection of BMPs - Involvement in scenario discussions and planning	- Participation in regional workshops - Engagement in dialogue with stakeholders - Use of project results for planning	- Involvement in Stakeholder Forums - Participation in validation of project results - Policy dialogue activities
Expected impacts (benefits)	- More efficient water management at scheme level - Better planning of water allocation - Reduced water losses and conflicts - Improved system sustainability	- Better-informed local planning decisions - Improved integration of water and agriculture policies - Increased capacity to address climate risks - Stronger coordination with local actors	- Better alignment between policies and local needs - Increased use of scientific evidence in decision-making - Support for scaling up successful practices - Stronger regional cooperation on water management

13.

WHAT WE HAVE LEARNT DURING THESE YEARS OF APPLIED RESEARCH AND COOPERATION

WATDEV has shown that improving water management for agriculture requires more than technical solutions. Many results rely on how knowledge, people and decisions are connected between each other. The project has provided a set of key lessons that can support future initiatives in similar contexts.

■ Think in an integrated way

Sustainable solutions require looking at the whole agroecosystem, including water, soil, crops, environment and people. Addressing these elements together leads to more effective and long-lasting results.

■ Work with people, not only for people

Involving farmers, technicians, researchers and policy-makers throughout the process helps ensure that solutions respond to real needs and can be applied in practice.

■ Combine knowledge sources

Farmers already have valuable local and traditional knowledge. When combined with scientific research and innovation, this creates stronger and more adapted solutions.

■ Choose solutions that are sustainable in all aspects

Effective practices should consider environmental, social and economic aspects at the same time, supporting both livelihoods and natural resources.



■ Plan participation carefully

Not all stakeholders need to be always involved in the same way. Identifying the right actors and engaging them at the right moment improves efficiency and impact.

■ Engage decision-makers early

Involving policy-makers and authorities from the beginning of the process helps ensure that project results are recognised, supported and integrated into policies and plans.

■ Build trust through two-way communication

Participation is not only about collecting opinions. Providing feedback and sharing results with stakeholders strengthens trust, ownership and long-term engagement.

■ Use science to support decisions

Models, data and scenarios can help understand future impacts and guide better choices, especially in the context of climate change.

■ Strengthen capacities for long-term impact

Training and knowledge exchange are essential to ensure that practices can be adopted, adapted and replicated beyond the project.

■ Think beyond the project

Solutions should be designed with scalability and replication in mind, so that they can be applied in other regions and contexts.



Climate Smart WATER Management
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for Food and Agriculture in East Africa



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ISRIC
World Soil Information



www.watdev.eu
info@watdev.eu

