Policy session – EAERE 2023

Water dialogues for sustainability

Organised by Carlos Mario **GÓMEZ** *(University of Alcalá and IMDEAWater),*

Rim **HAZIMEH** *(American University of Beirut),*

Juliette **LE GALLO** *(INRAE Montpellier),*

Francesco **SAPINO** *(University of Salamanca).*

Programme overview

9:00-9:40: Water dialogues for sustainability

- Introduction : Agricultural water management
  *Carlos Mario **GÓMEZ** (University of Alcalá and IMDEAWater)*
- Talanoa Water Dialogue for agricultural water management
  *Juliette **LE GALLO** (INRAE Montpellier)*
- Hydro-economic modeling for agricultural water policy
  *Francesco **SAPINO** (University of Salamanca)*
- Role of Earth Observation in Designing Transformative Water Policies
  *Rim **HAZIMEH** (American University of Beirut)*

9:40-10:00: Questions & answers

10:00-10:30: Panel roundtable

TALANOA - water -

EAERE2023 28th Annual Conference LIMASSOL CYPRUS

Agricultural water management

Introduction by Carlos Mario GÓMEZ (University of Alcalá and IMDEAWater

Policy Session:
Water dialogues for sustainability

Talanoa Water Dialogue for agricultural water management

Juliette LE GALLO

INRAE Montpellier, UMR Innovation

• The TALANOA-WATER project

- The objective of TALANOA-WATER is to inform and *catalyze* the adoption of robust *transformational* adaptation strategies to water scarcity under climate change that contribute to the IWRM objectives of social equity, economic efficiency and environmental sustainability.
- The Fijian word ***'Talanoa'*** refers to a participatory and transparent conversation among stakeholders to share stories, build empathy and trust, and make wise decisions for the collective good

  Inspired in UNFCCC Talanoa Dialogue to reduce the emissions of greenhouse gases

The TALANOA-WATER project

Bringing together a participatory approach and hydro-agro-economic modelling

Participatory approach with a group of actors to co-build and co-evaluate adaptation strategies

Hydro-agro-economic modelling to understand the current situation and evaluate strategies, taking into account global changes

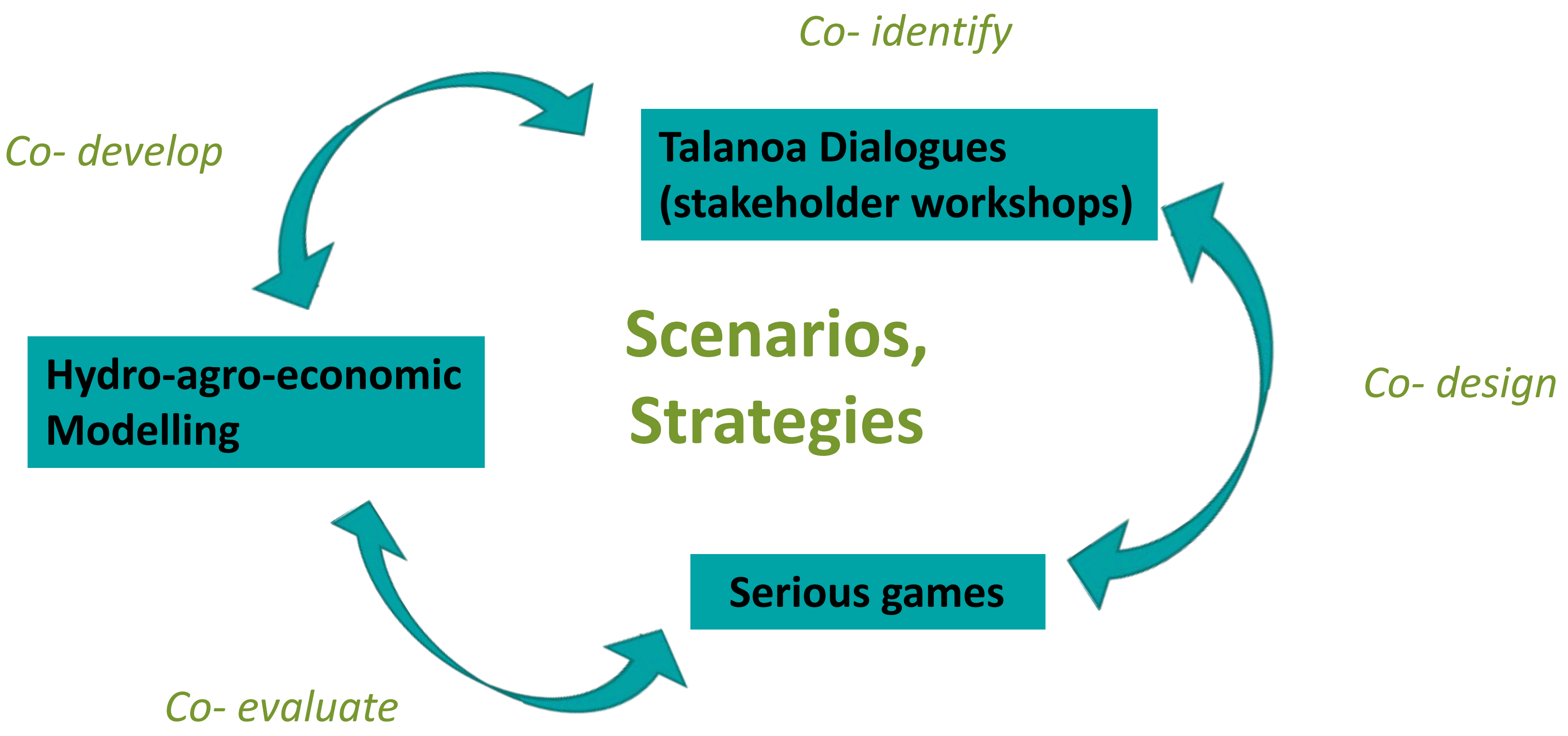
6 water labs: ecosystems of innovation

PRIMA project
2021 -> 2025

Principles of Talanoa

Dialogue for agricultural water management

- The concept : An iterative stock taking co-generation process



Principles of Talanoa

In practice: engagement, consensus building, knowledge sharing.

- Stakeholder engagement throughout the entire project
  - Local stakeholder platforms include different types of stakeholders:

River basin authorities · *technical institutes* · *Irrigators* · *insurers* · *Regional and local authorities* · *agricultural associations* · *infrastructure managers* · *civil society organizations (NGOs)* · *Industrial sector* · *Hydropower*

 Representative stakeholders: with an interest in the area under consideration, who can provide expertise and practical knowledge (Hegger et al., 2012)

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 Representative stakeholders: with an interest in the area under consideration, who can provide expertise and practical knowledge (Hegger et al., 2012)

For each platform : a ***Rapporteur*** has been nominated : Key stakeholder with a wide knowledge of the challenges of the river basin

Engagement along the project through communication channels and regular **science-policy workshops**

• Principles of Talanoa

In practice: engagement, consensus building, knowledge sharing.

- Stakeholder engagement throughout the entire project
  - **Science-policy workshops** organized all along the project
    - Participation tools, including serious games

- Games that are not intended to be played primarily for amusement (Abt, 1970).
- Used to focus participants' attention on specific aspects of a problem in order to (i) **build a shared vision of the problem** and (ii) di**scuss solutions collectively.**
- Useful to explore decision making possibilities in uncertain environments, **including for drought management** (Pérez-Blanco et al. 2021).
- Simplify a complex system and simulate current and future dynamics linked to agricultural development and water access: different responses to different scenarios.
- Identify and test innovative policy instruments
- Enables dialogue on water management, policy decisions

WS on 09/03/2023 (INRAE)
Working on shared socio-economic pathways and measures

- Iterative processes : modelling ⇔ participation.

INRAE

Thank you for your attention

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Policy Session:
Water dialogues for sustainability

Hydro-economic modeling for agricultural water policy

Francesco SAPINO

Dep. of Economics and Economic History & IME Business school

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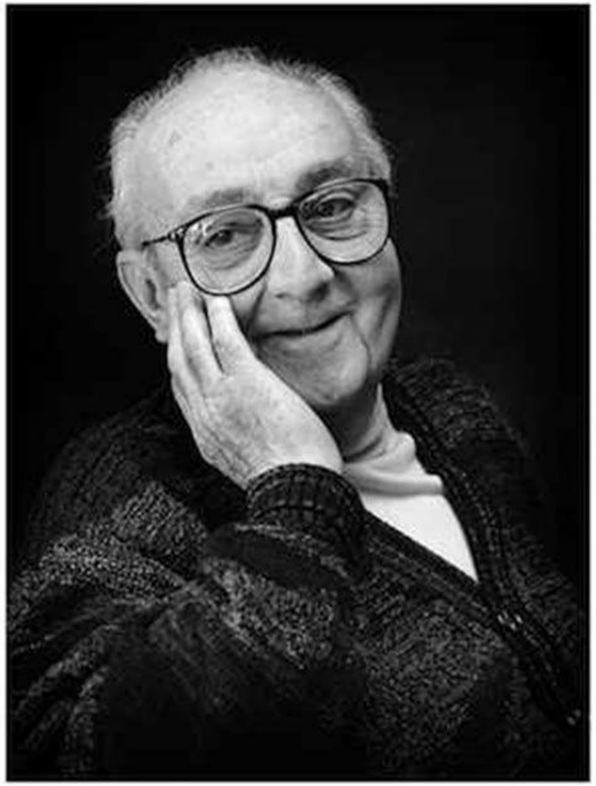
The challenge: advise reliable policy in water management

- Water management policies usually target the **agricultural sector**

- Policies are informed by **models**



“Essentially, all models are wrong, but some are useful”
George E. P. Box

Conventional models do not consider uncertainty and interdependency

Uncertainty

- Modeling is inextricably linked to uncertainty
  - White swans: we know all plausible futures and their probability
  - Grey swans: we know all plausible futures, but ignore their probability -> Deep uncertainty
  - Black swans: We ignore some plausible futures -> Deep uncertainty

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- Deep uncertainty cannot be addressed with conventional modeling tools.
  - Requires scenario exploration, ensembles, heuristics, complex system thinking, expert judgement

- Under deep uncertainty, we should not prioritize efficient outcomes through point prediction – but rather robust outcomes through ensembles

Handbook for actionable science

- Modeling human and natural systems dynamics demands socio-ecological science

- Considering uncertainty requires ensembles and scenario discovery

- We need to use the language of policy makers (use their models (if possible) also if they are not the state-of-the-art)

We assess irrigators response through an ensemble of **microeconomic models** coupled with **hydrologic model(s)** and (if possible) **macroeconomic model**

to assess farmers response to policy and/or climate change

to generate estimations of water allocation

to consider price (and yield) response to land use change

TALANOA approach: a modular hierarchy

- Individual components (modules) are easy to understand
- Their interactions generate new outcomes that could not be predicted by each system in isolation (cascading uncertainties)
- Uncertainty sampled through ensembles of models & scenarios

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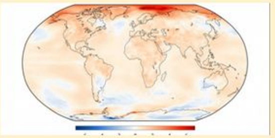
Example from the TALANO-WATER project

4 CLIMATE MODELS

- GFDL-ESM2M
- HadGEM2-ES
- IPSL-CM5A-LR
- MIROC5



3 CLIMATE CHANGE SCENARIOS

- RCP 2.6
- RCP 6.0
- RCP 8.5

8 HYDROLOGICAL MODELS

- CLM45
- H08
- LPJmL
- MATSIRO
- MPI-HM
- PCR-GLOBWB
- WaterGAP2
- WaterGAP2-C

WATER MANAGEMENT MODEL

- AQUATOOL (DSS of Spanish river basins)

3 MANAGEMENT SCENARIOS

- All additional infrastructures considered in the river basin management plan
- All additional infrastructures, excluding irrigation expansion
- All additional infrastructures, excluding irrigation expansion and irrigation modernization

MICROECONOMIC MODEL

Ensemble of MPMs

MACROECONOMIC MODEL

CGE (Computable General Equilibrium)

Thank you for your attention

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Policy Session – EAERE 2023

Water Dialogues for Sustainability

Role of Earth Observation in Designing Transformative Water Policies

Rim HAZIMEH

Dr. Hadi JAAFAR
Department of Agriculture
American University of Beirut

28 June 2023

PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

1. Challenges in water-scarce and data-poor countries

Growing water demand and climate change impacts

- Substantial damages to farmers, households, industries, and ecosystems
- High cost of irrigation for small sized and fragmented holdings
- Lack of awareness of farmers of both water value and its balanced use

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In **data-poor countries** with **water-scarce basins**, agricultural water management **challenges** are serious due to:

- Limited **resources** for data collection
- Limited data collection **networks**
- Inconsistent data collection **practices**
- Limited data **sharing**, making it not readily accessible for stakeholders
- Inadequate integration of **traditional and local knowledge:** possession of valuable local knowledge about water resources - often hardly integrated with scientific data collection efforts, resulting in data gaps.

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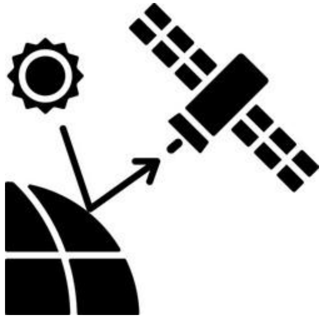
Earth observation technologies
offer a means of
managing water resources.



REMOTE SENSING

- Remote sensing is the science of gathering information about objects from a distance using satellite imagery and sensors.
- Reproducible technique

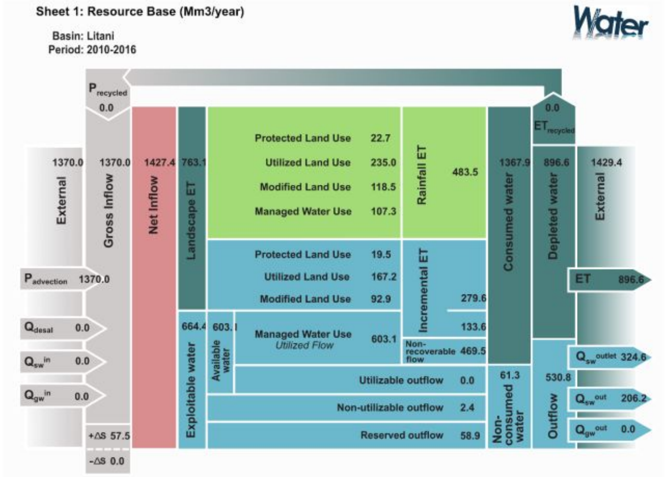
- **Advancements in Remote Sensing for Agricultural Applications**
  - Quantifying water use to identify irrigation needs
  - Estimating crop yields and analyzing yield patterns spatially
  - Monitoring crop water stress and drought monitoring
  - Optimizing resource utilization with precise application of fertilizers and pesticides
  - Assessing vegetation health

2. Applications of Remote Sensing for Water Policy Design from TALANOA-WATER

a. Water Accounting – Socio-Hydrology Science

Analysis of water stocks and fluxes within a geographical domain, involves tracking components of the water balance, including precipitation, evaporation, surface water flows, groundwater recharge and discharge, and water withdrawals

adapted from Steduto et al., 2012; Batchelor et al., 2016



DATA: Remote sensing data is the key stone of WA+ complemented by: Hydrologic data, station data, land use data

ALLOWS TO:

- Understand the current state of water supply and demand (water availability, withdrawals, consumptive & non-consumptive use)
- Identify areas of potential water stress or overuse
- Manage water balance and safe caps

Globally Applicable

Open-access data and tools

Standardized Framework

CONTRIBUTION TO POLICY:

- Identify areas where water use exceeds sustainable limits
- Supports water allocation & enables policymakers to identify sectors that require attention

b. Remote Sensing and Microeconomic Modeling

in the Upper Litani Basin, Lebanon to assess the socioeconomic impacts of climate change

DATA: Integrates remotely-sensed ET and biomass data into multi-model ensembles of MPMs that are fed with remote sensing and economic data.

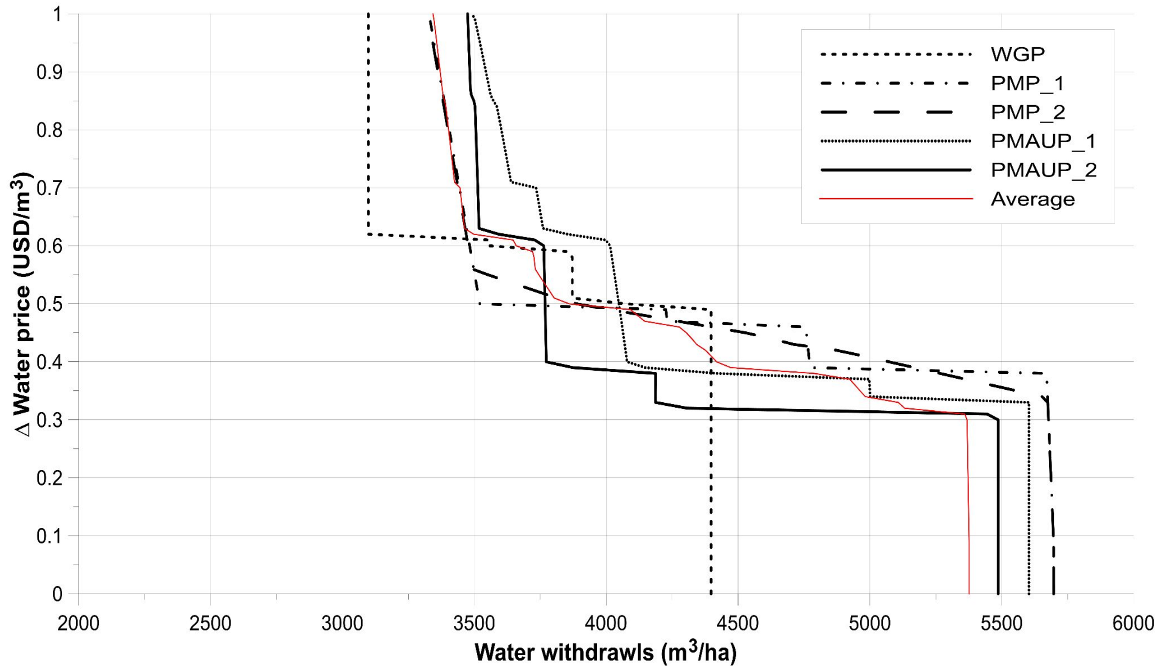
ALLOWS TO:
Understand the drivers of irrigators' behavior and predict their responses to behavioral instruments under climate change.

CONTRIBUTION TO POLICY:

- Informs policies on the effectiveness and economic costs of behavioral instruments such as water pricing & reduction in water availability.

- Contrasting stakeholder perspectives about the water pricing policy in Lebanon – a social challenge

Water Pricing Simulations

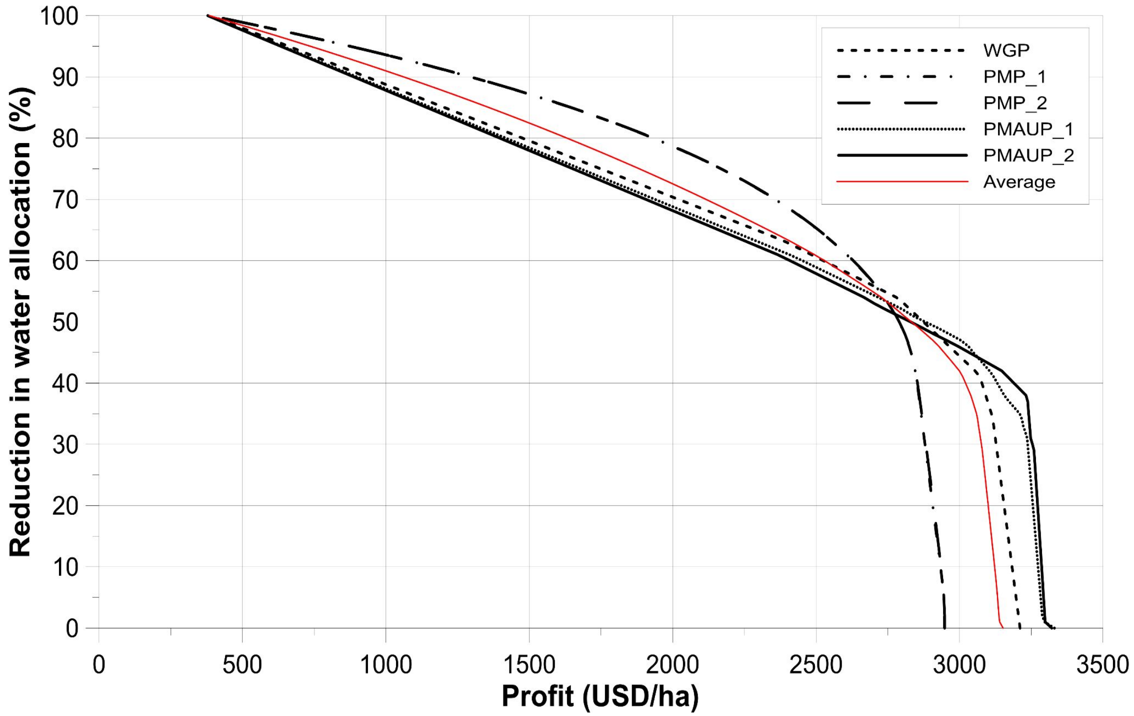


Change in water withdrawals in response to a hypothetical price increase

The change of water withdrawals in response to a hypothetical price increase is inelastic until a 0.3 USD/m3 and above 0.6 USD/m3 price increase and generates significant water savings between 0.3-0.6 USD/m3.

Sapino, F., Hazimeh, R., Pérez-Blanco, C.D., Jaafar. H. 2023.

Climate Change Simulations



Impact of water availability reductions on farmers' profit

Progressive reduction in profit, followed by a steep decline in profit when water availability is reduced by 50% or more.

Sapino, F., Hazimeh, R., Pérez-Blanco, C.D., Jaafar. H. 2023.

c. Economic Irrigation Water Productivity

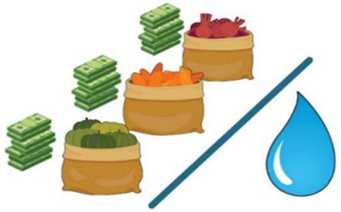
The **ratio** ($/m3) between the **increase in profit** ($/ha) **caused by irrigation** per cubic meter of irrigation water applied (m3/ha).

Biomass Data

Water Use Data

Economic Data

DATA: Combines remotely-sensed ET and biomass data and economic data.
ALLOWS TO: Estimate irrigation water economic value and detect the spatial variations in EIWP within a basin.



CONTRIBUTION TO POLICY:

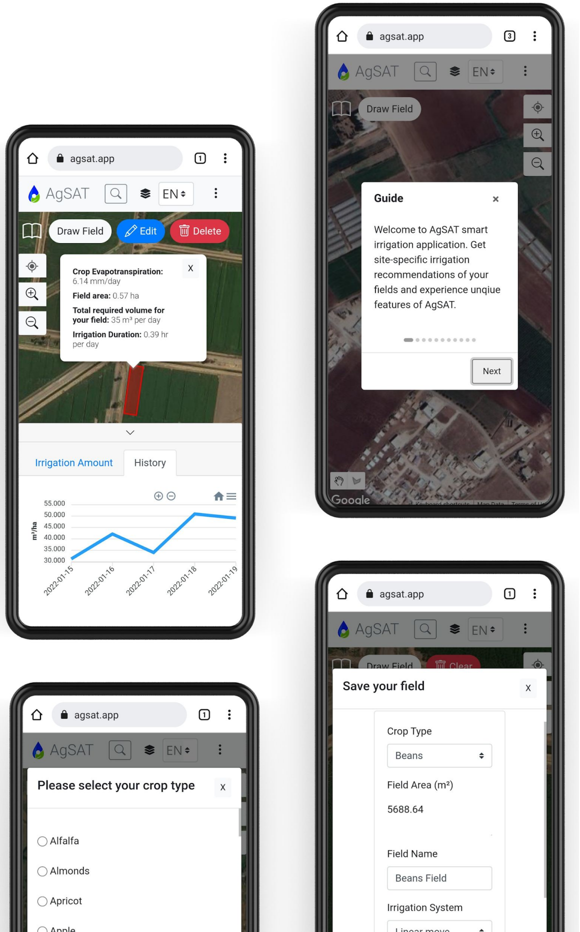
Primary Policy Options	Use of Remote Sensing
Control of irrigated areas	Can identify unlicensed cropping systems and areas with high evapotranspiration
Change cropping patterns	Identify irrigated areas and monitor the impact of policies on cropping patterns
Promote irrigation best practices	Monitor variations in ET and crop yields among farmers who have implemented optimal practices

FAO & World Bank. (2022). Irrigating from space – Using remote sensing for agricultural water management. Investment brief. Rome.

4. AgSAT: Empowering Farmers with Smart Irrigation Solutions

Jaafar, H., Mourad, R., Hazimeh, R., & Sujud, L. (2022). AgSAT: A Smart Irrigation Application for Field-Scale Daily Crop ET and Water Requirements Using Satellite Imagery. Remote Sensing, 14(20), 5090.

Download on the App Store



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Department of Agriculture

Thank you
for your attention!

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American University of Beirut, Lebanon

Questions & Answers

Panel round table

Thank you
for your attention !