

Large Scale Irrigation Management Tools for Sustainable Water Management in Rural Areas and Protection of Receiving Aquatic Ecosystems – IR2MA

**Modern DSS tools
for assessing agricultural eco-efficiency
and water use at different scales**

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CIHEAM

Founded in 1962, the **International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM)** is an intergovernmental organisation comprising **thirteen member countries** from the Mediterranean Basin (Albania, Algeria, Egypt, Spain, France, Greece, Italy, Lebanon, Malta, Morocco, Portugal, Tunisia and Turkey).



MAI Bari - Italy



- Water resources management
- Protection of fruit crops
- Organic agriculture
- Sustainable development



MAI Chania – Greece



- Food quality
- Horticultural genetics and biotechnology
- Sustainable agriculture
- Environmental management
- Business economics and management



FOUR MEDITERRANEAN AGRONOMIC INSTITUTES

Training areas and research fields



MAI Montpellier - France



- Rural societies and territories
- Public policies
- Rural development
- Chains and actor's strategies



MAI Zaragoza - Spain



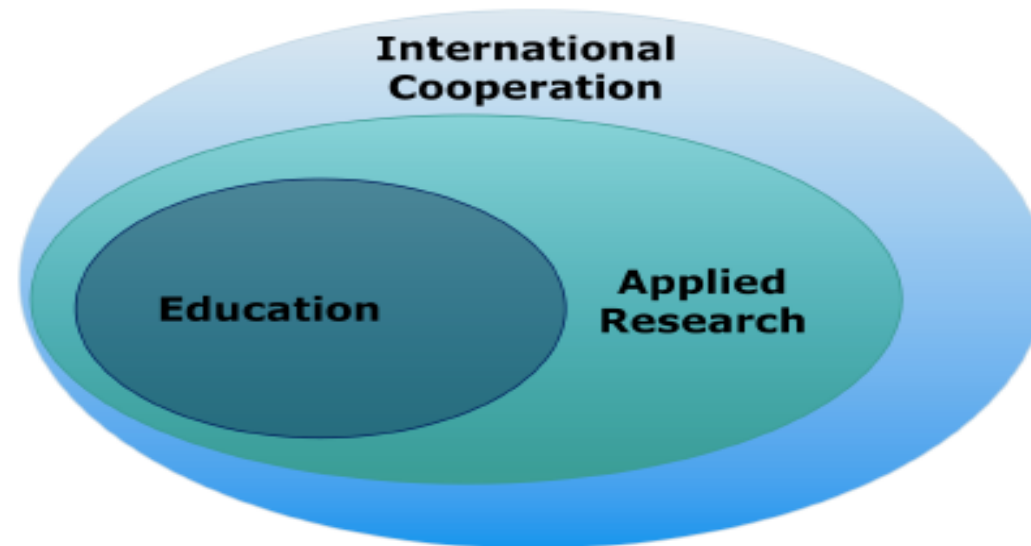
- Plant and animal production
- Integrated rural approach
- Product markets and marketing
- Fisheries and aquaculture



THE MISSION

for a sustainable agriculture in the Mediterranean

In pursuing its three central missions **EDUCATION**, **RESEARCH** and **COOPERATION**, CIHEAM has come to be recognised as an authority in its fields of activity: Mediterranean agriculture, food and sustainable rural development.





**Integrated pest management of
Mediterranean fruit crops**

**Land and water resources
management**

**Mediterranean organic
agriculture**

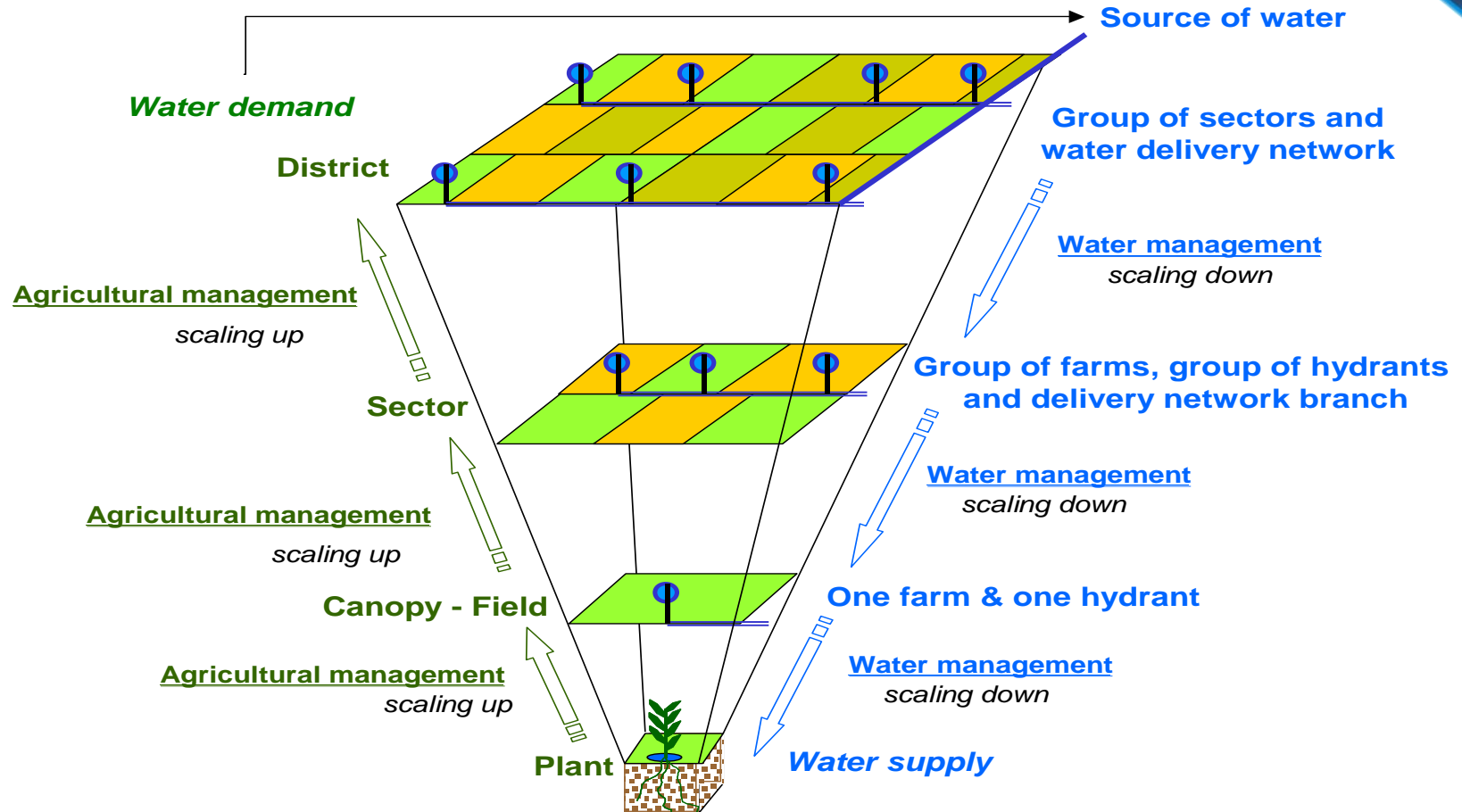
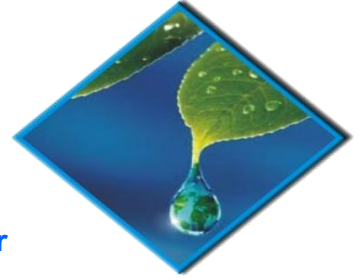
**Sustainable agriculture and
rural development**



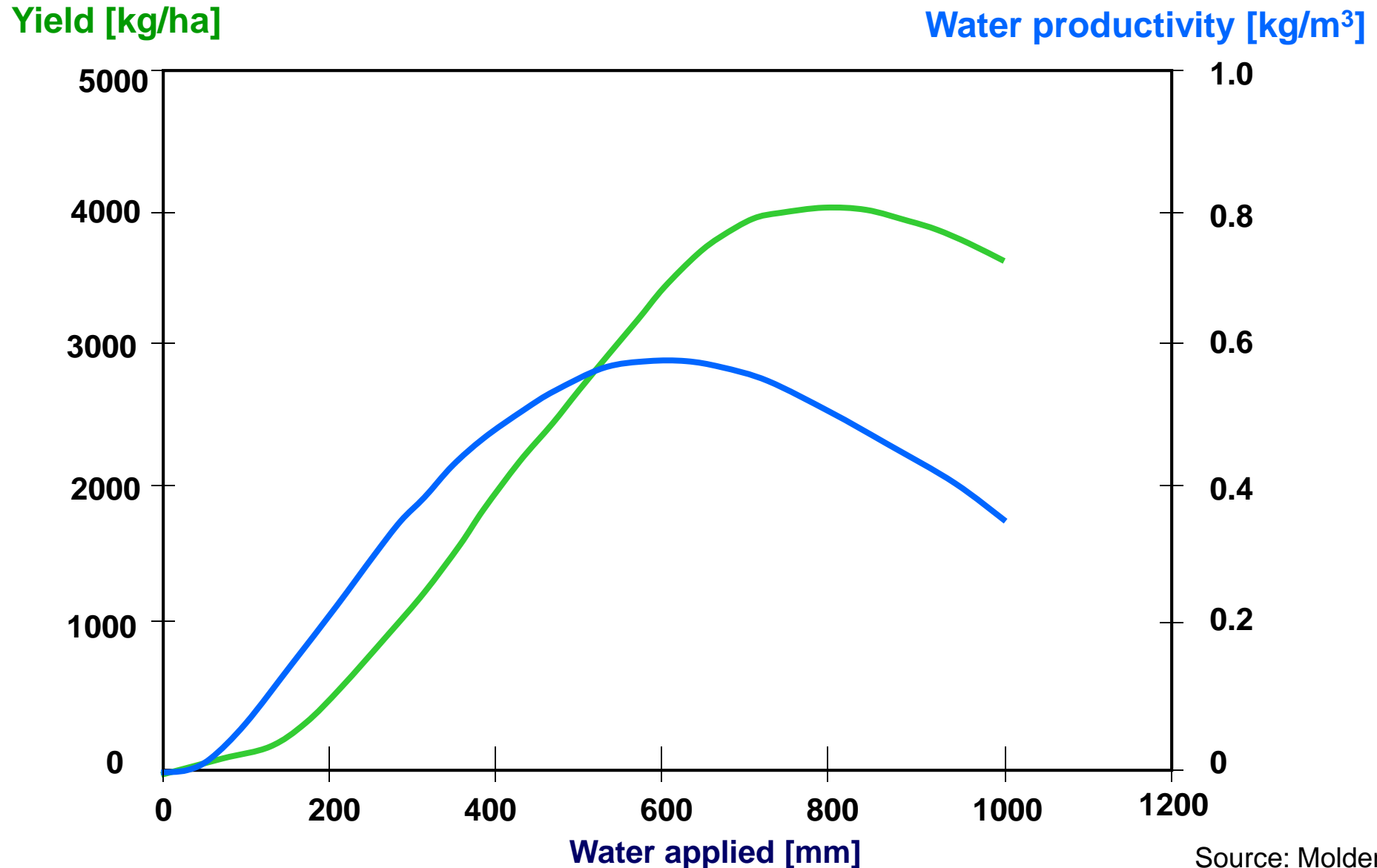
RESEARCH

Land & Water Resources Management (LWRM)

Integrated multiscale approach

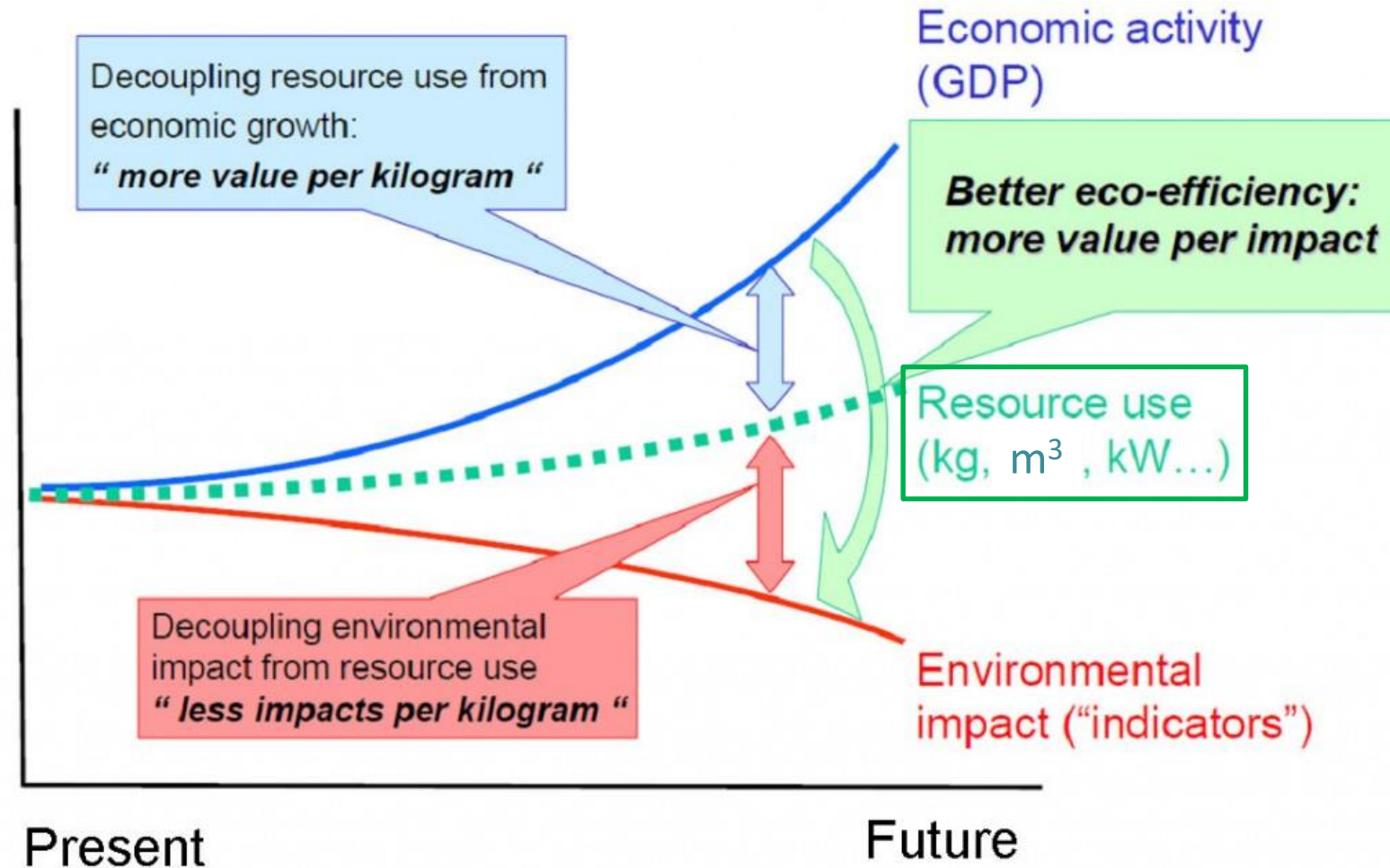


Maximizing YIELD vs. WATER PRODUCTIVITY

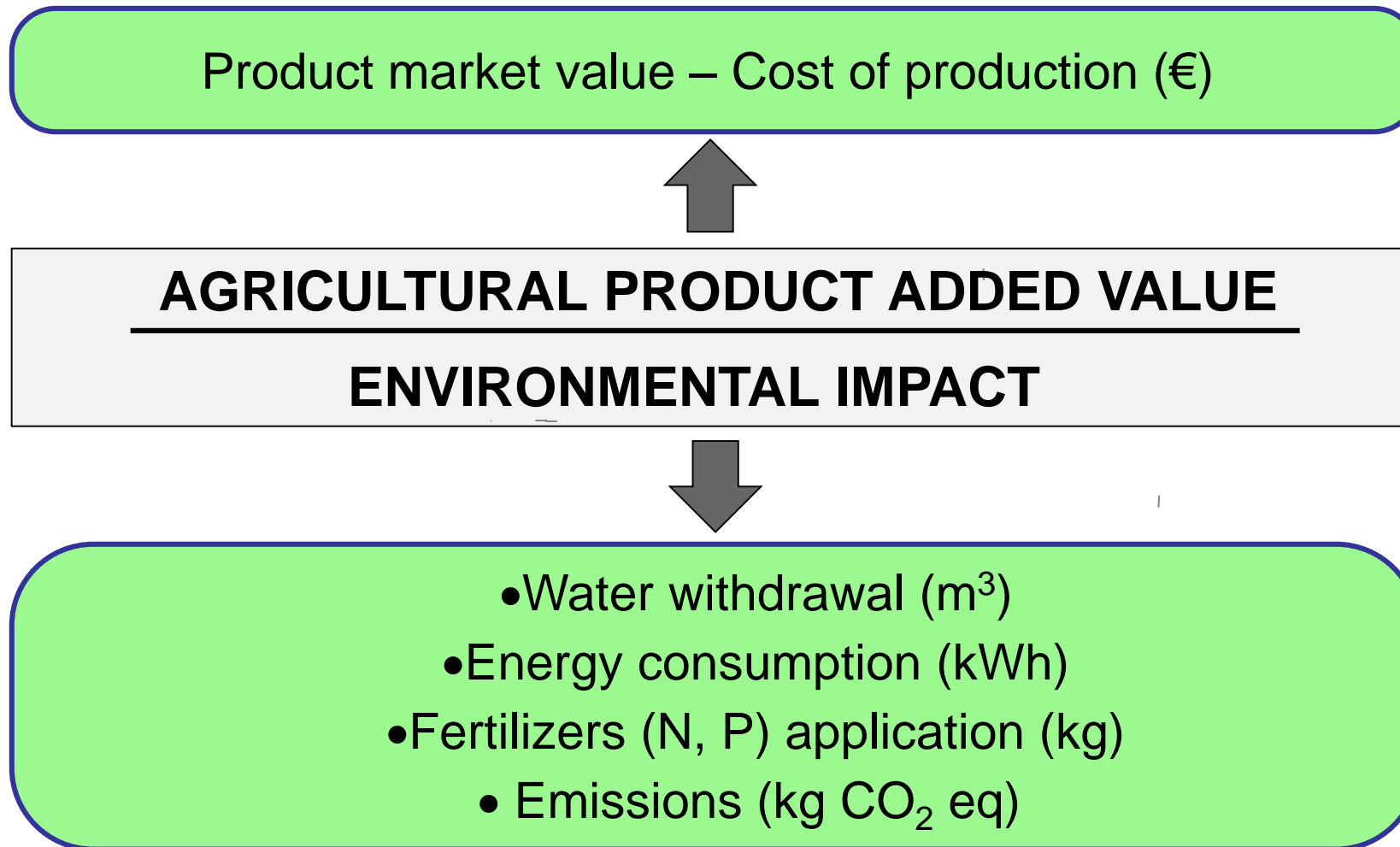


From efficiency to ECO-EFFICIENCY ...

Economic activity, **RESOURCE USE**, environmental impact



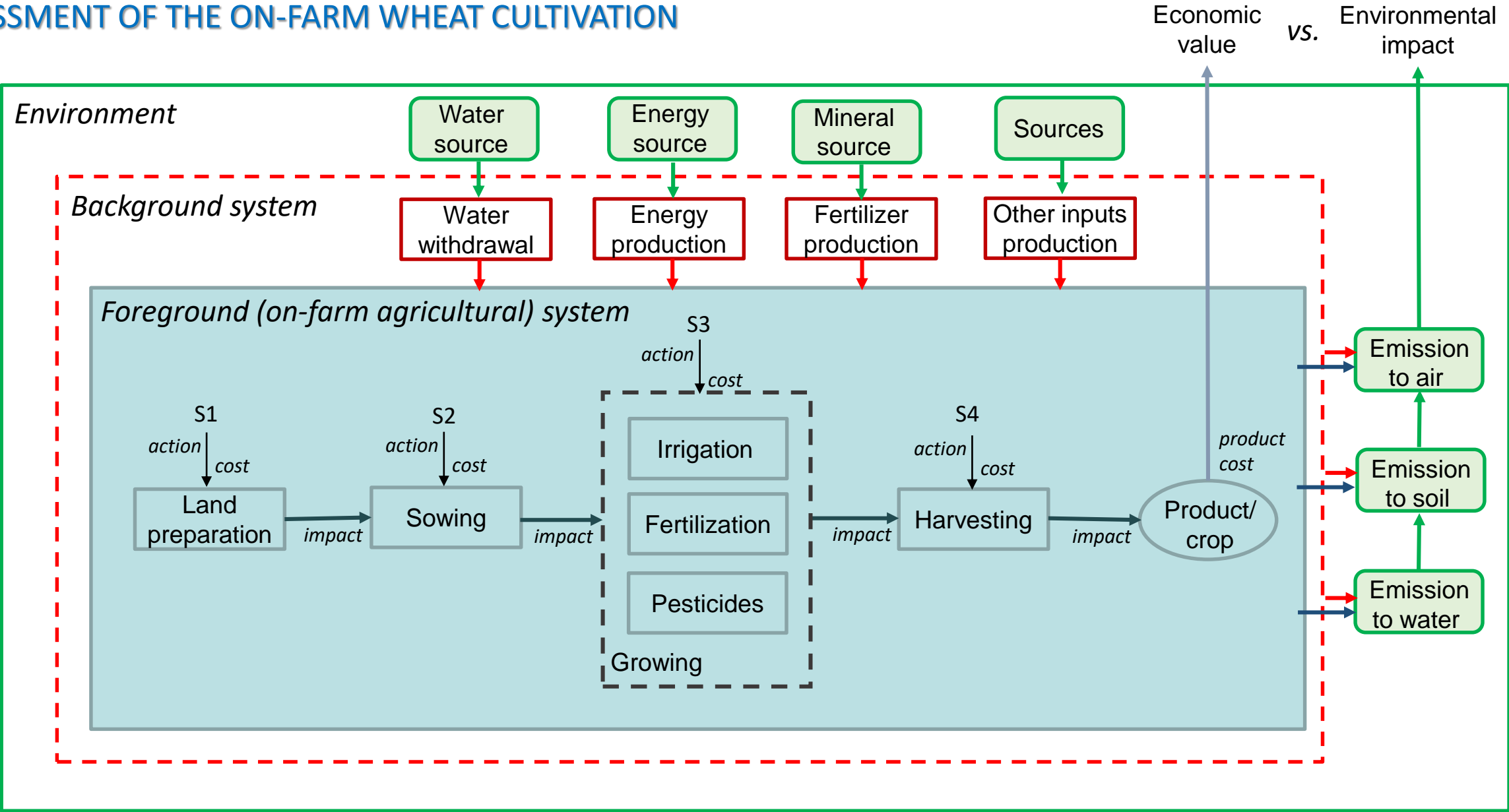
Assessing Agricultural Eco-Efficiency



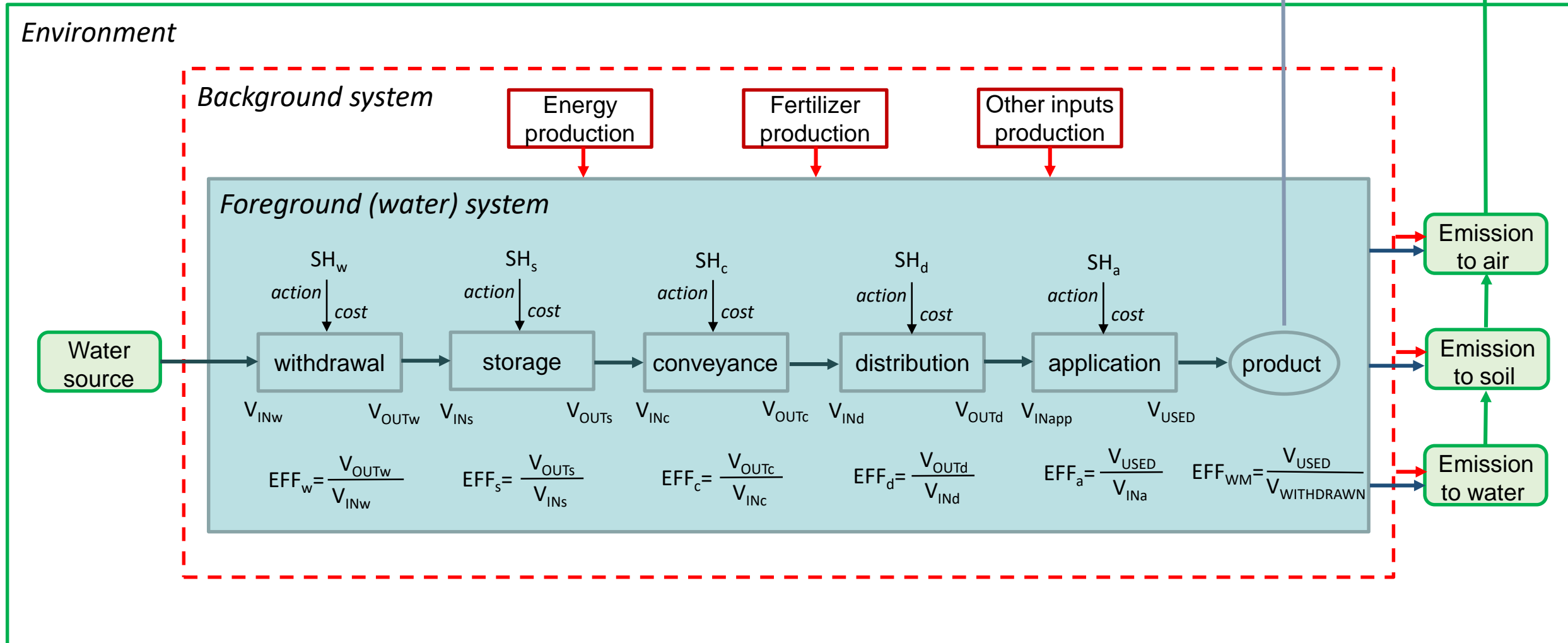
*Composite
System
Indicator*

Resource Exploitation Indicator (withdrawal/availability), REI

SYSTEM BOUNDARIES AND STAGES (S) FOR THE ECO-EFFICIENCY ASSESSMENT OF THE ON-FARM WHEAT CULTIVATION

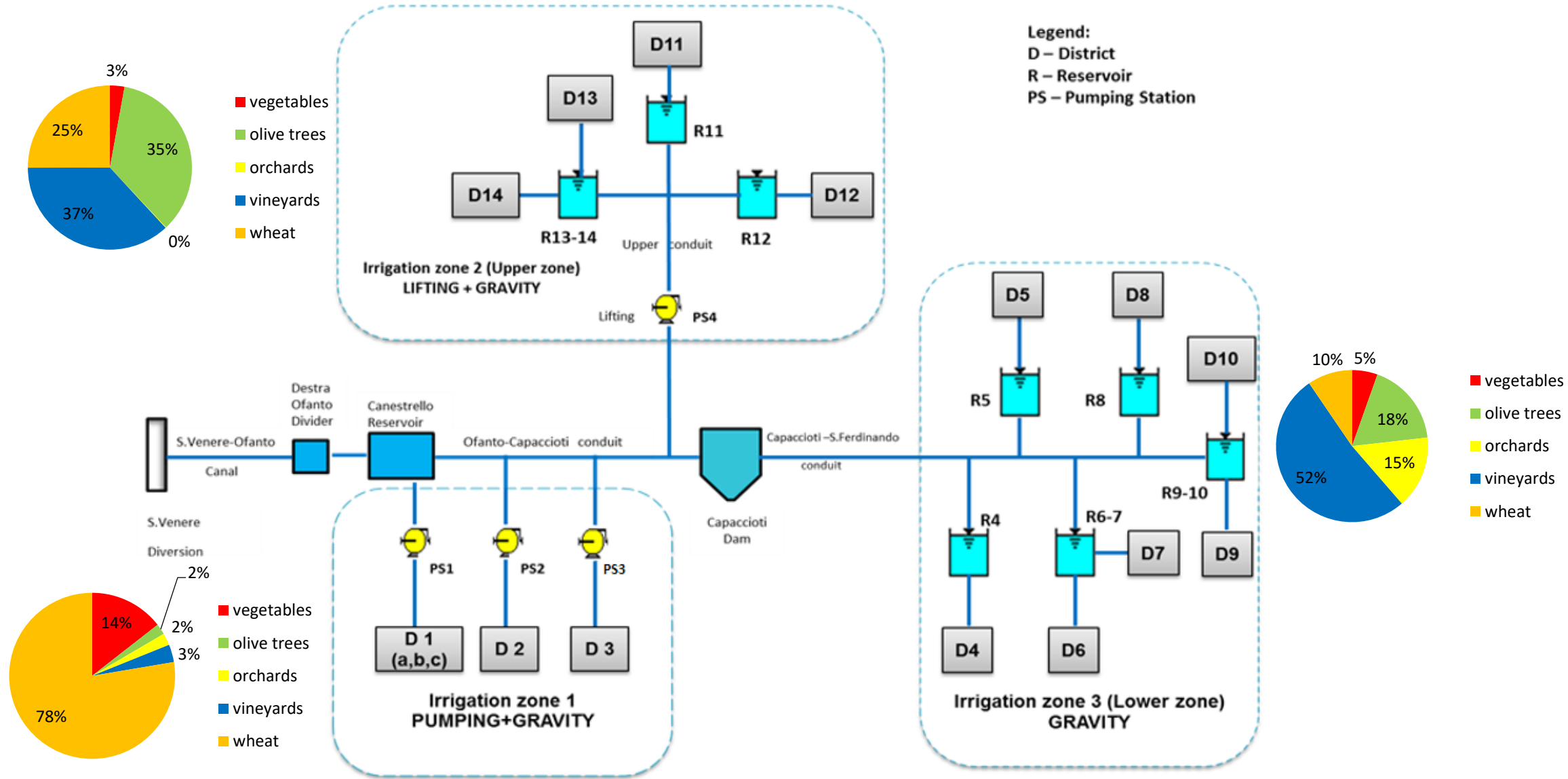


VALUE CHAIN OF WATER FROM THE SOURCE TO THE PLOT

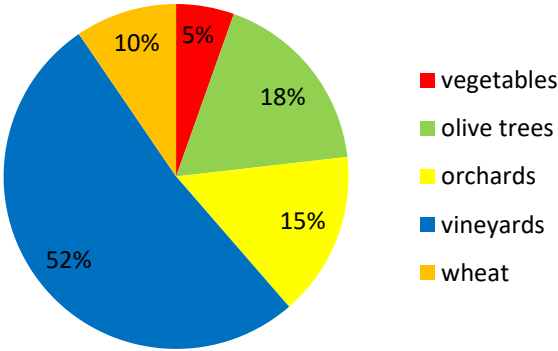
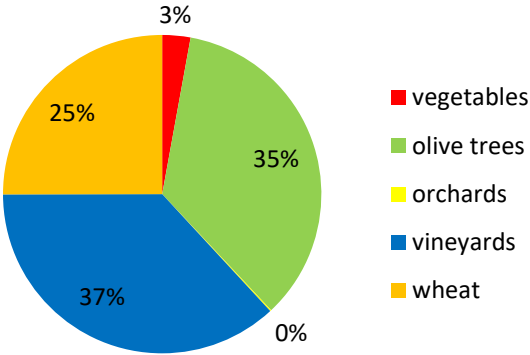
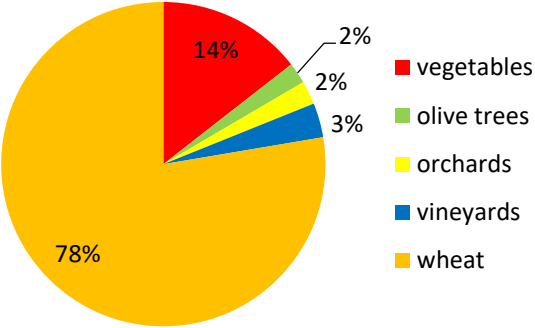
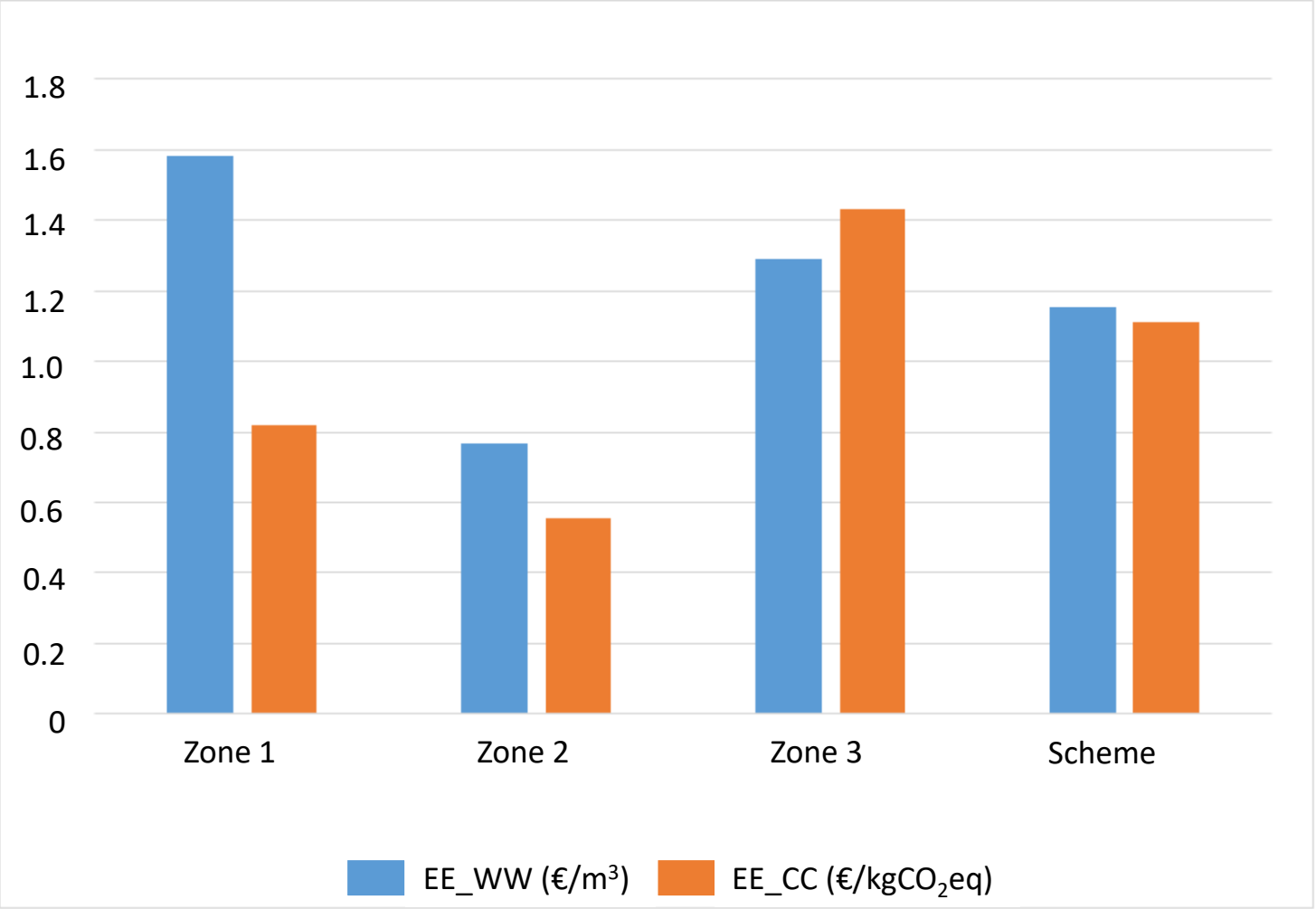


V indicates water volumes – inflows and outflows for different stages indicated as w (withdrawal), s (storage), c (conveyance), d (distribution), a (application). SH and EFF indicate the corresponding stakeholders and water management efficiencies, respectively.

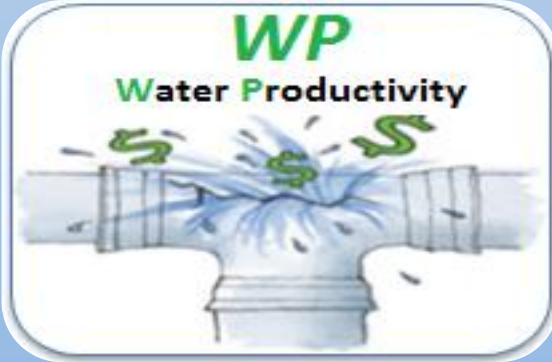
Water supply chain mapping of *Sinistra Ofanto* irrigation scheme



Eco-efficiency of *Sinistra Ofanto* irrigation scheme



ECO-INNOVATIVE technologies for agricultural water use



Monitoring SPAC, smart irrigation scheduling
More efficient irrigation techniques (drip, subsurface)
Remote automated control of irrigation water supply
Devices for control of water withdrawal from aquifers
Cropping pattern change
Use of treated waste water



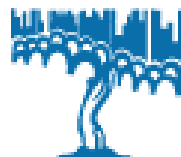
Electricity/Solar powered irrigation pumps
Eco-friendly variable speed pumps
Network sectoring and dynamic pressure regulation



Cropping pattern change
Application of minimum tillage
Use of biodegradable mulches
Organic Farming



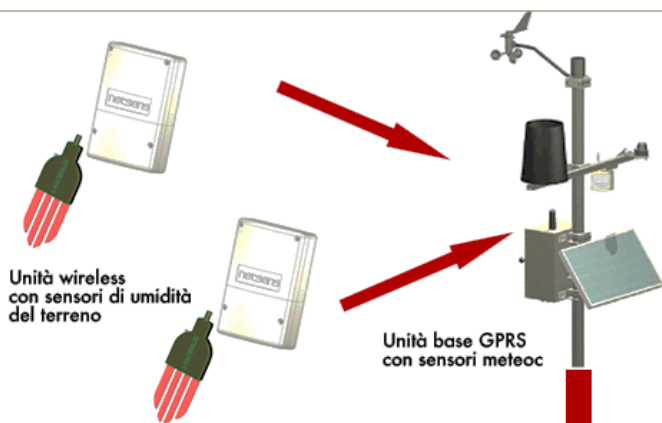
amastuola



DATA ACQUISITION

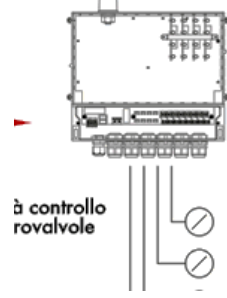
SENSORS
(meteo, soil,
crop)

**WEATHER
FORECAST**
(3-7 days)



REMOTE CONTROL

IRRIGATION SYSTEM
(opening/closing valves and
pumps)



**HARDWARE
COMPONENTS FOR
DATA ACQUISITION
AND CONTROL**

DATA ELABORATION

**SINGLE PLOT
CROP WATER
BALANCE**

DATABASE

**MULTI-PLOT
MANAGEMENT
SYSTEM**

PLOT CONFIGURATION

MODEL PARAMETERS

WATER, CROP, SOIL DATA

MANAGEMENT CONSTRAINTS

**AGRONOMICAL AND
TECHNOLOGICAL
ASSISTANCE**



**SENSORS
DATALOGGERS
ACTUATORS**

**CLOUD
(web
services)**

**USER DEVICES
WEB – APP
SOFTWARE**



**SOFTWARE
COMPONENTS AND
CLOUD SERVICES**

PLANNING AND MONITORING

**Daily crop water balance
and irrigation scheduling**

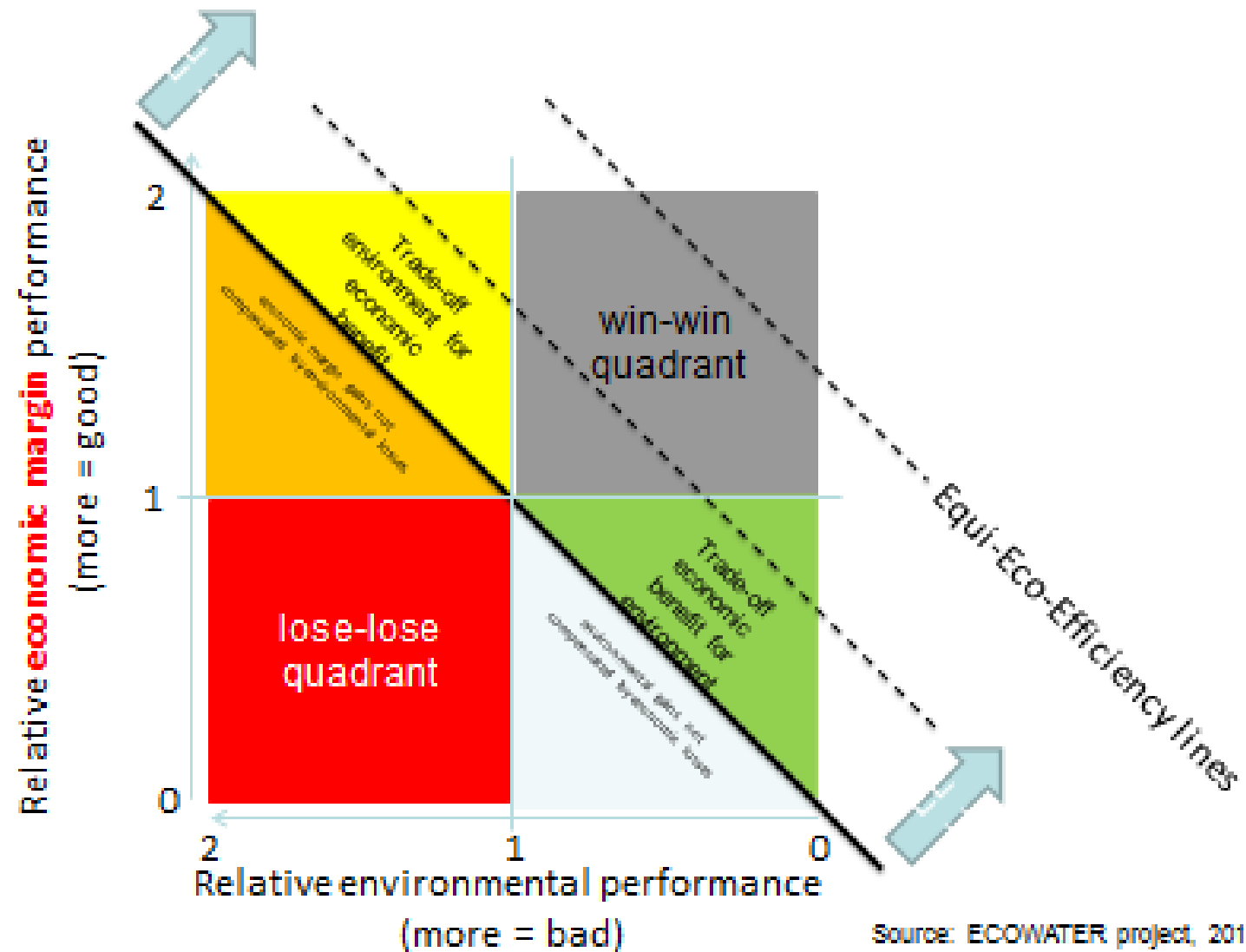
**Schedule the timing of
irrigation valves/pumps**



Hydro-Tech – BLULEAF - IRRITECH: main features

- Combines soil/crop water status **monitoring** and soil water balance **modeling**
- Multi ETo model (depending on data availability) – up to 14 formulas
- “Adjustable” K_{Rs} and R_s_measured, K_c to local conditions, W_S to local conditions
- Multi crop development model (days/heat units) with adjustable number of development stages
- Multi “Crop response to Water” model and yield prediction (Stewart+Rao)
- Weather forecasting use in DSS and missing data generation - **METEOBLUE**
- Separate crop development and water management **phases/thresholds** (RDI)
- Completely/partially **automated** (level of automation managed by user)
- Real time remote control and management
- Multi plot/crop management ... **Multi-scale** (field, farm, irrigation district)
- Water management optimization for **dynamic management strategies** for different crops/fields
- On field/crop specific management strategies (priorities water / yield / energy / profit ..., inclusion/exclusion of irrigation days/time, etc.)
- **Eco-efficiency** considered
- **Flexible/Improvable** – permits insert of new/additional sensors/modules

Way forward ...



CIHEAM STRATEGIC AGENDA 2025

