

# ALTOS : Managing water resources within Mediterranean agrosystems by accounting for spatial structures and connectivities.

Frederic Jacob

**SUP'COM**  
Higher School of Communication of Tunis



**LISAH**

**CNRS**

National Council for Scientific Research



جامعة القاضي عياض  
UNIVERSITÉ CADI AYYAD



**IRTA**

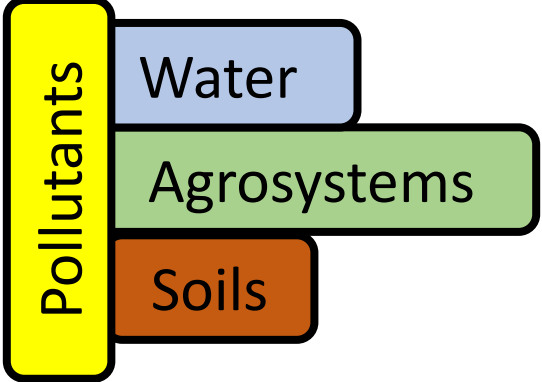


25/05/2021

# ALTOS KOM: project overview

- Science
  - Societal challenges, overall and specific objectives
  - Methodological challenges
  - Study areas and available assets
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- Outcomes and impacts
  - Results dissemination and exploitation
  - Deliverables & Milestones
- Governance

# ALTOS: innovation in water resource management



**ACTIONS**

**Innovation**

Gaining from spatial structures and connectivities

Land use & downstream refill

Vegetation & hydraulic lift

DRY

WET

DRY

Reservoirs & aquifer refill

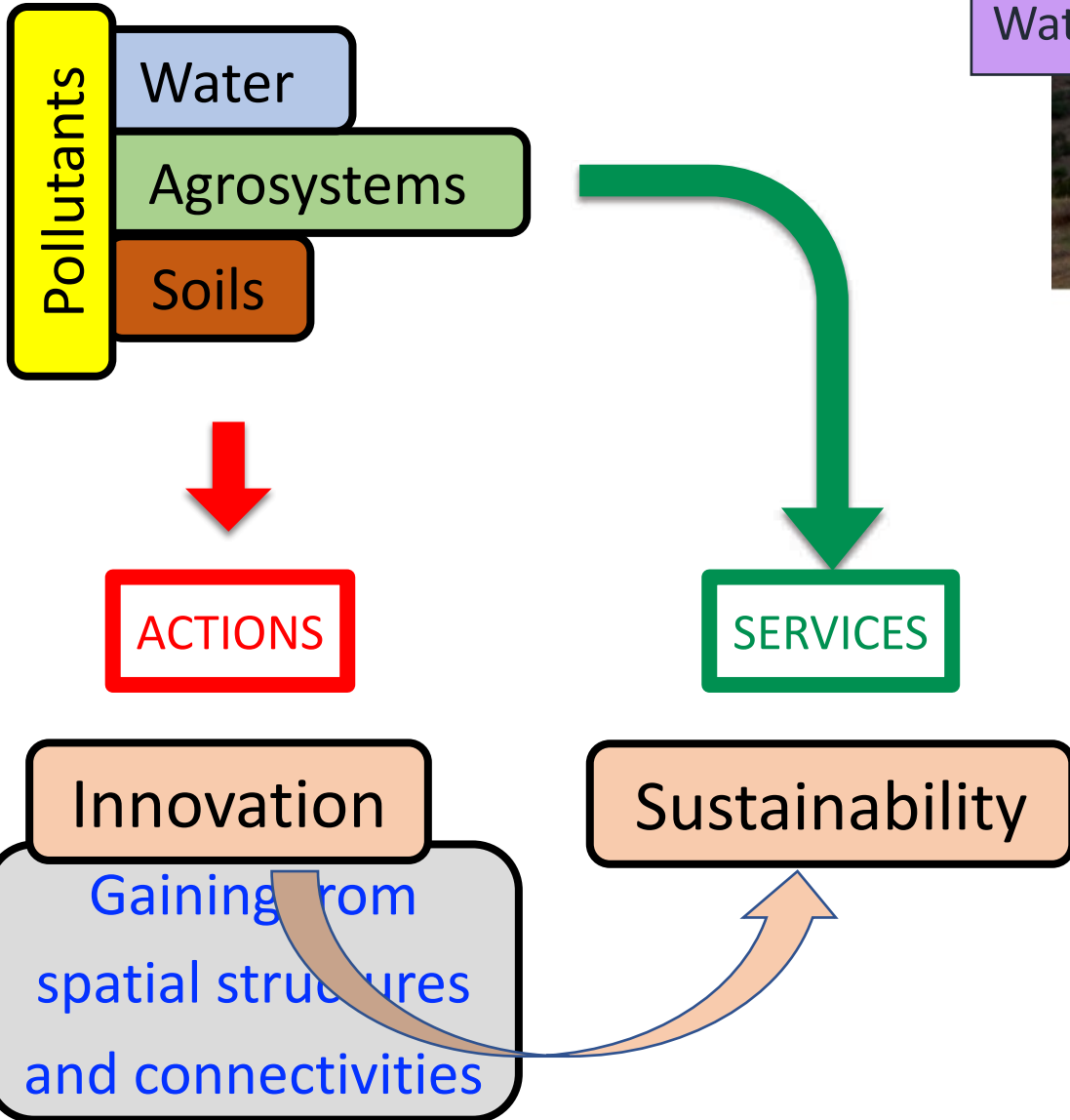
Inflow

Inflow

Infiltration

Vegetation & water consumption

# ALTOS: sustainability



Water harvesting for drinking & irrigation



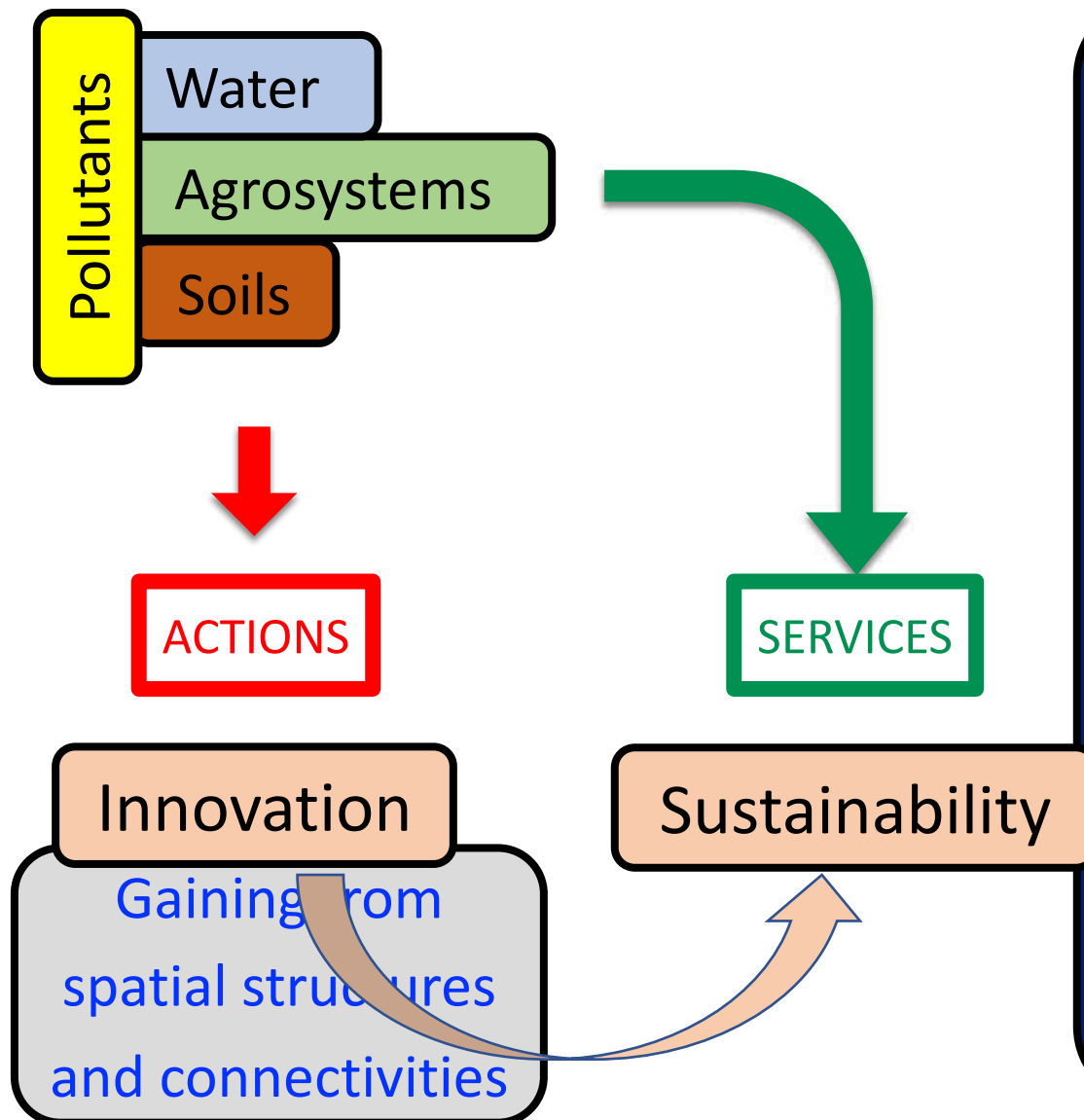
Enhancing crop production



Minimising contaminations



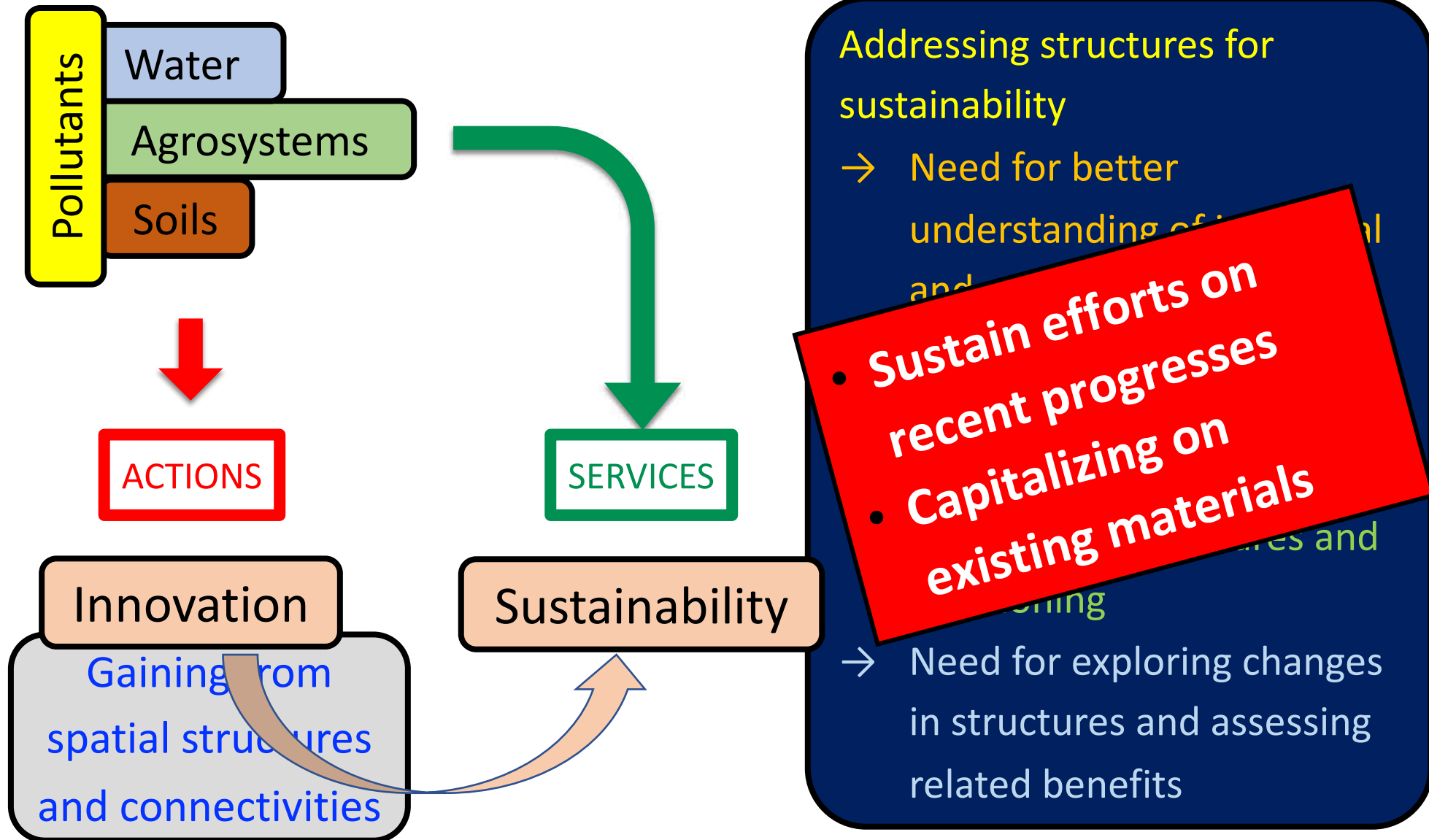
# ALTOS: spatial structures & connectivities



## Addressing structures for sustainability

- Need for better understanding of individual and collective processes within spatial organisations
- Need for new observation and modelling tools to characterize structures and functioning
- Need for exploring changes in structures and assessing related benefits

# ALTOS: spatial structures & connectivities



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# ALTOS: structures and scales

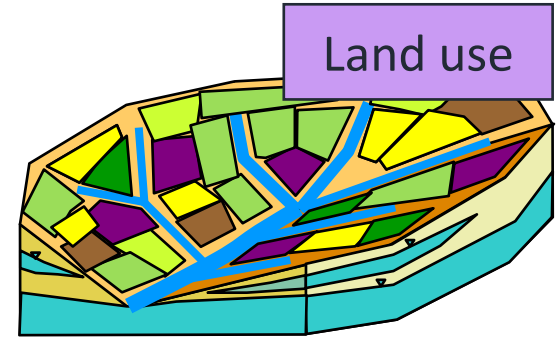
Canopy



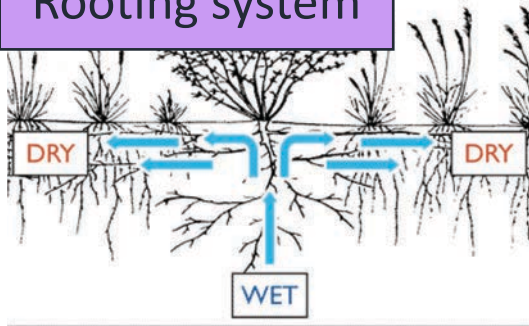
Bench networks



Land use



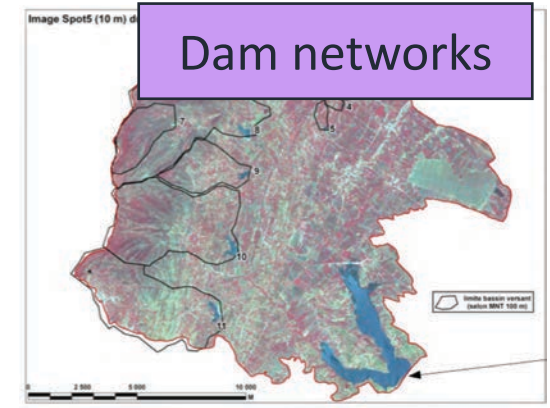
Rooting system



Hilly lake



Dam networks



SPATIAL SCALES

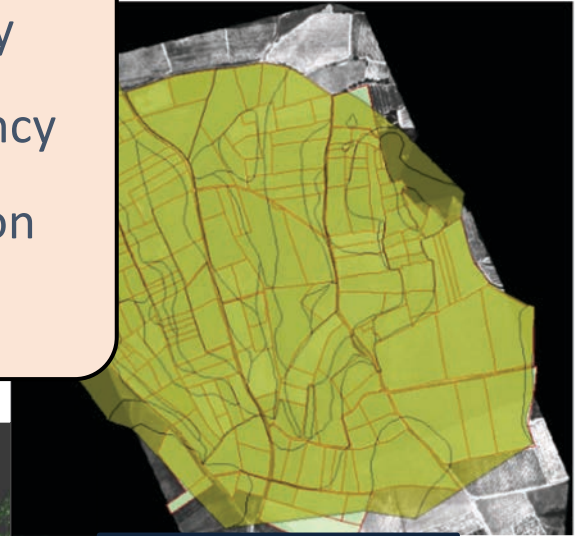


# Methodological challenges in (1/6) monitoring structures

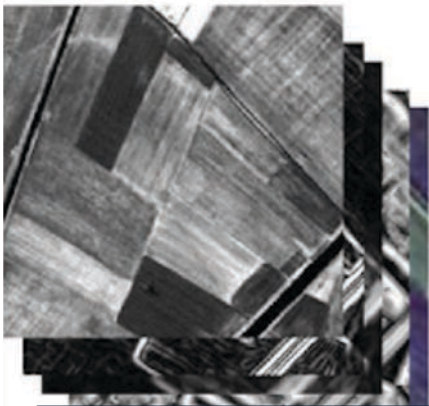
Photogrammetry



- Measurement quality
- Time series consistency
- Information extraction
- Product accuracy



Digital representation



Multi-temporal high resolution imagery



# Methodological challenges in (2/6) monitoring fluxes

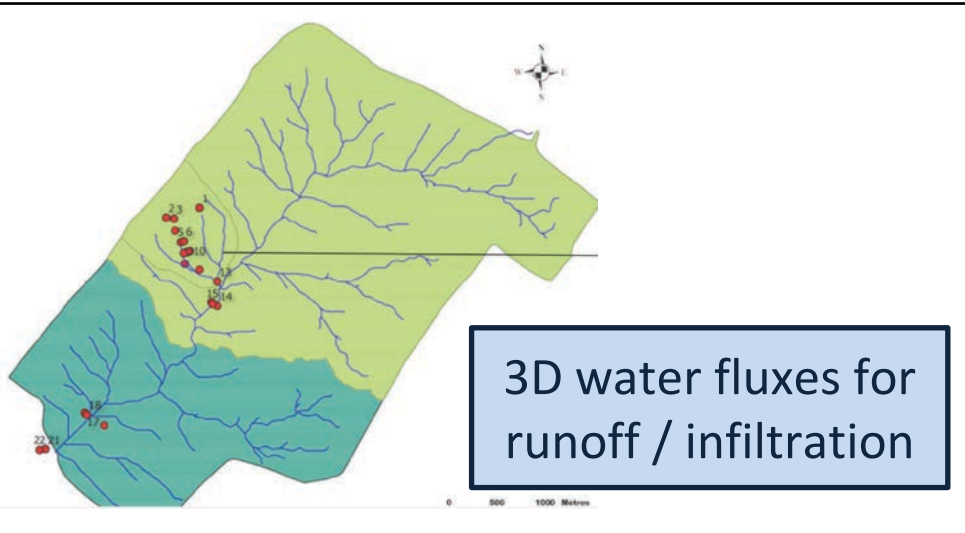
3D water fluxes for vegetation



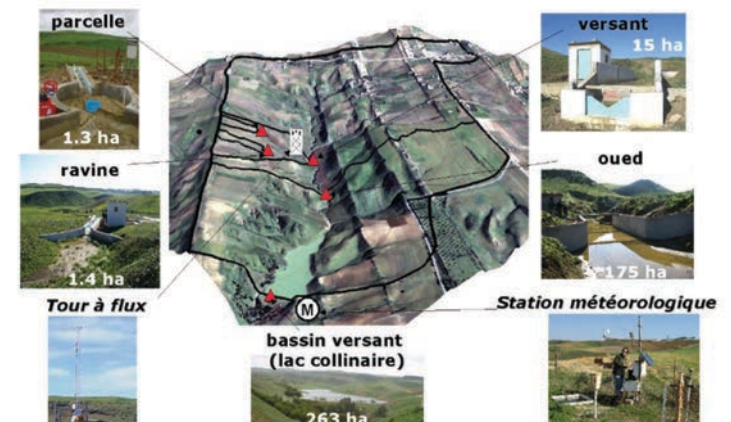
(a)

(b)

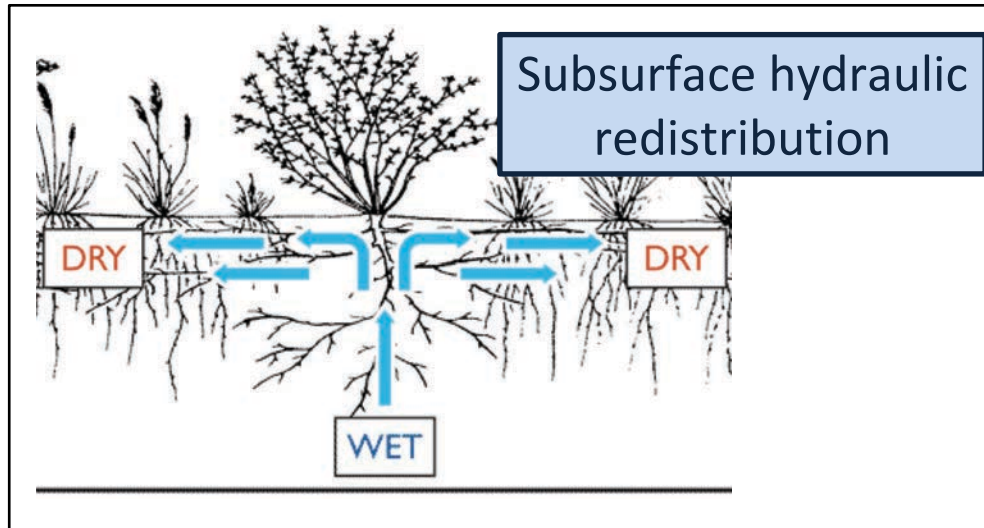
- Characterising 3D fluxes
- Component partitioning (e.g.,  $ETR=T+E$ )



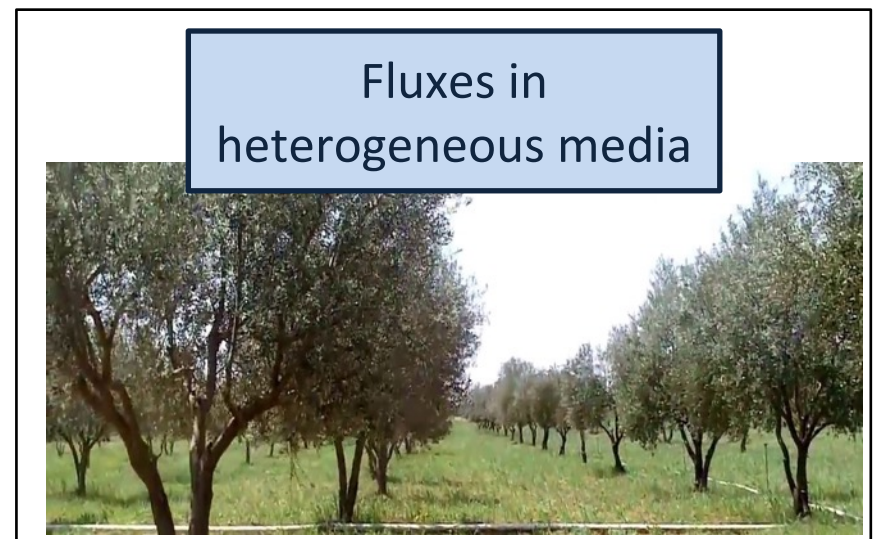
Nested hydrological measurements



# Methodological challenges in (3/6) modelling fluxes

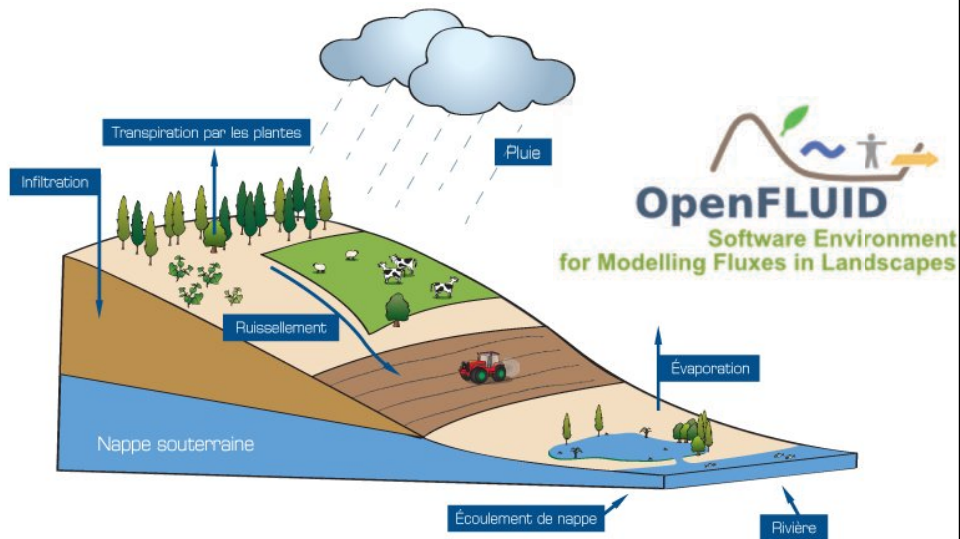


- Modelling 3D fluxes
- Setting equivalent parameterizations for 3D heterogeneous structures

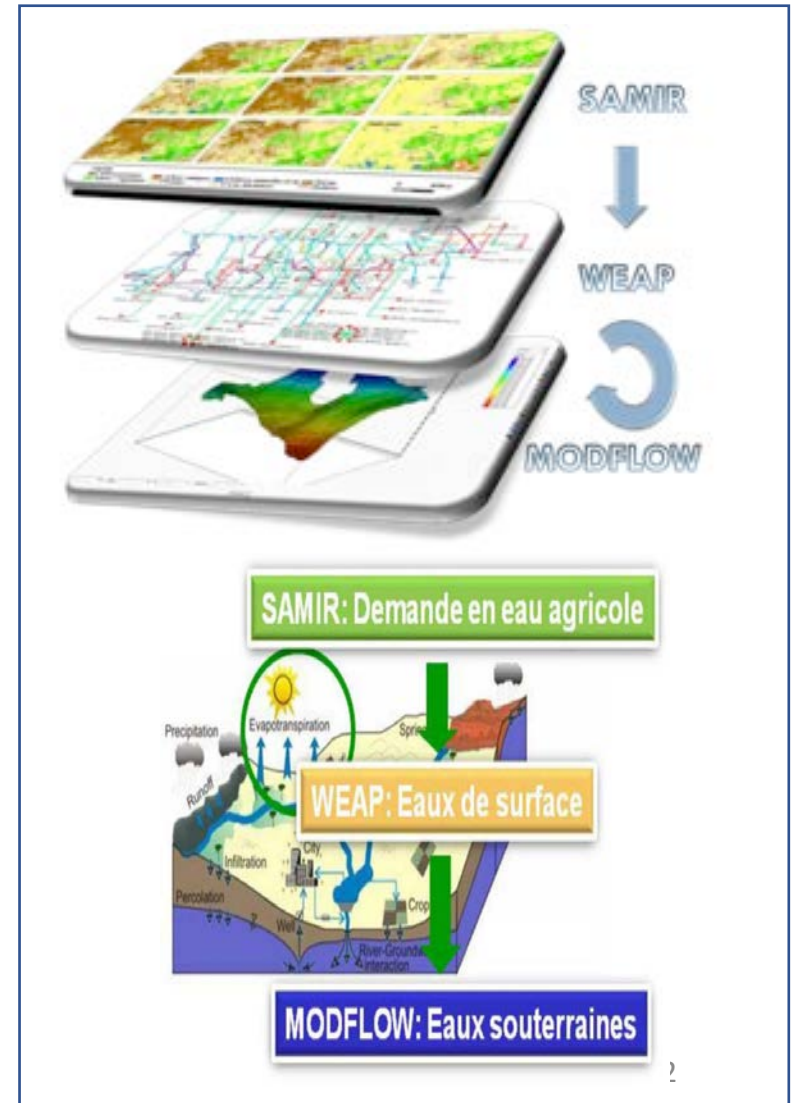


# Methodological challenges in (4/6) integrated modelling

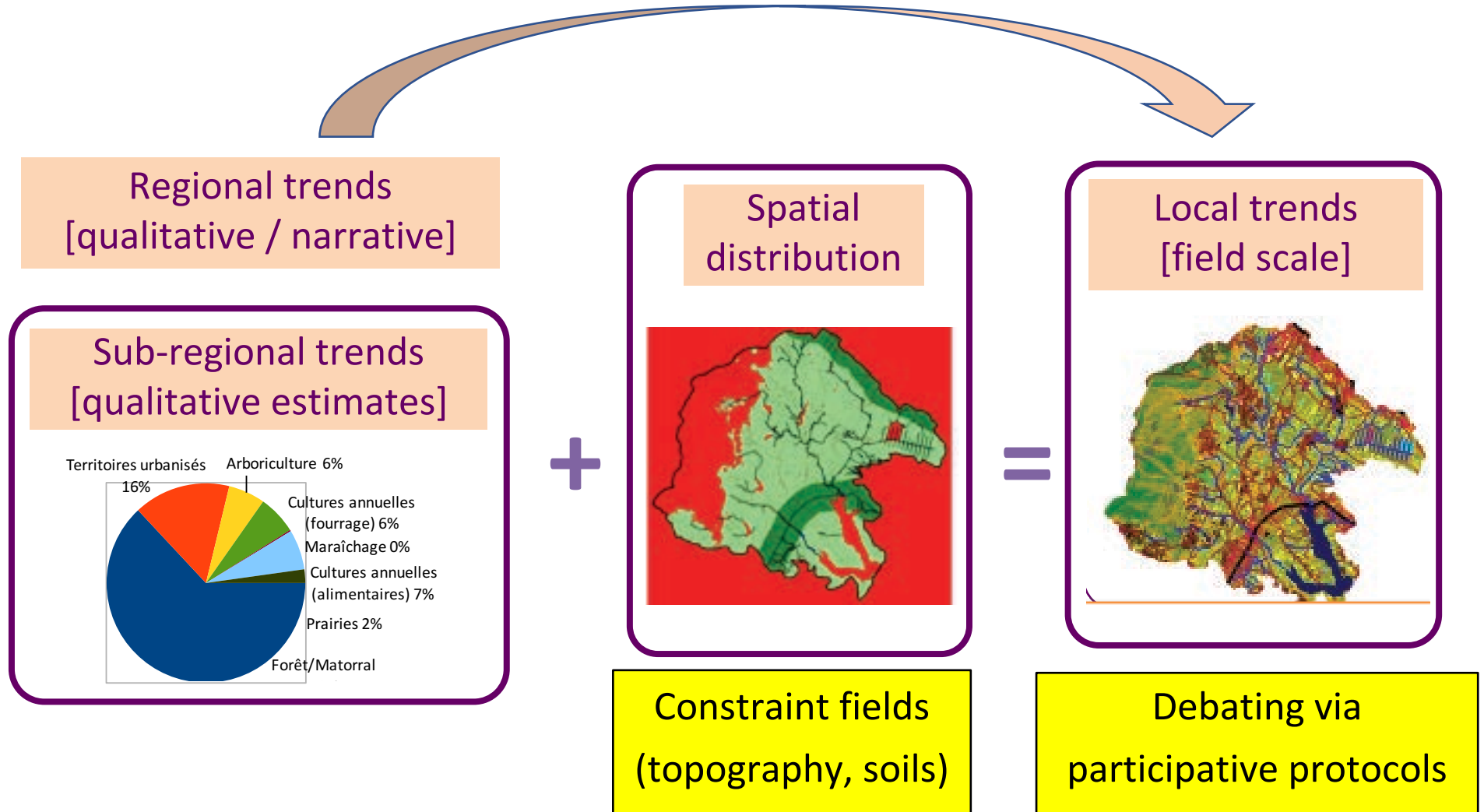
## Hydrological cycle + crop functioning



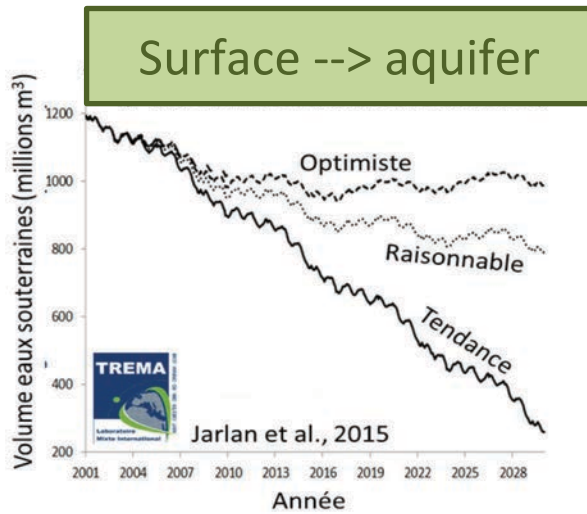
- Coupling 3D fluxes
- Consistent descriptions of compartments and processes



# Methodological challenges (5/6) in scenarios setting



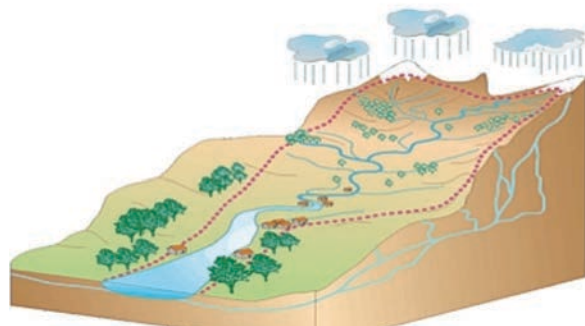
# Methodological challenges in (6/6) scenario assessment



Numerical simulations

Impact assessment

Numerical simulations

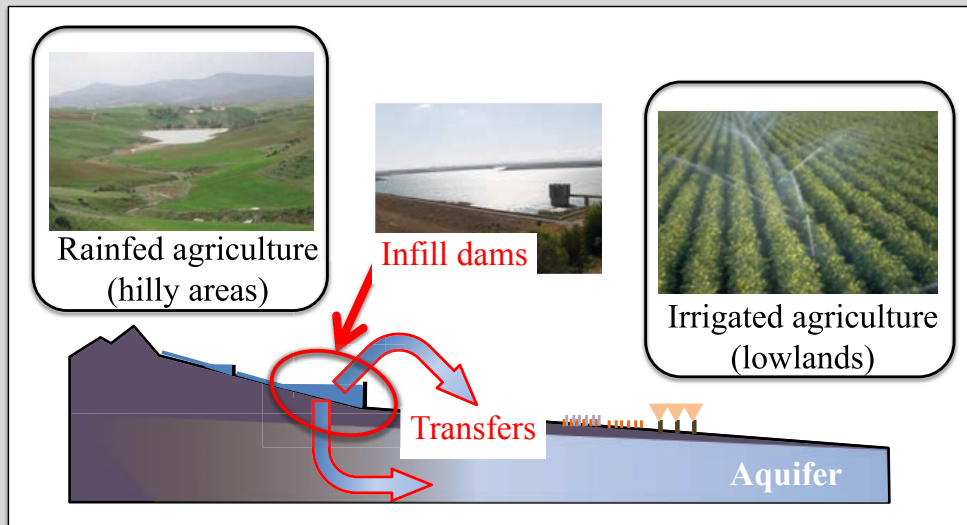
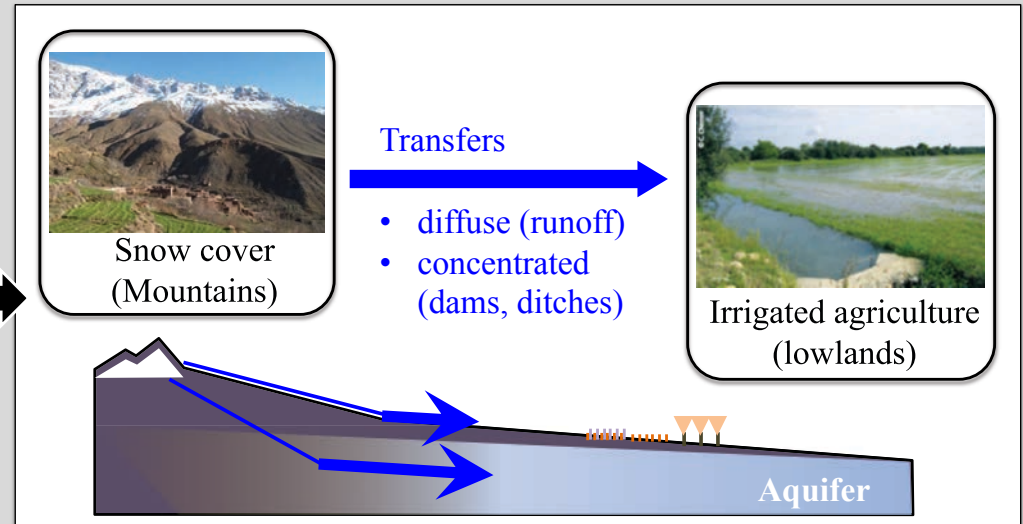
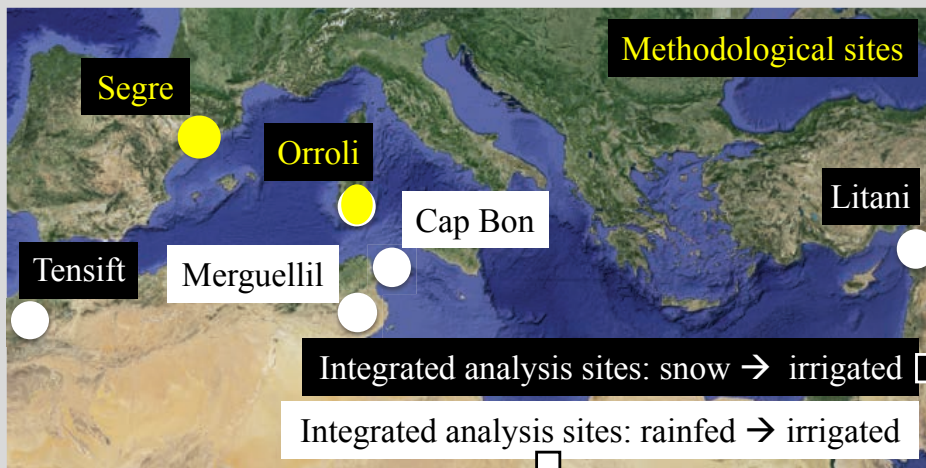


Participative protocols  
Antagonist requirements

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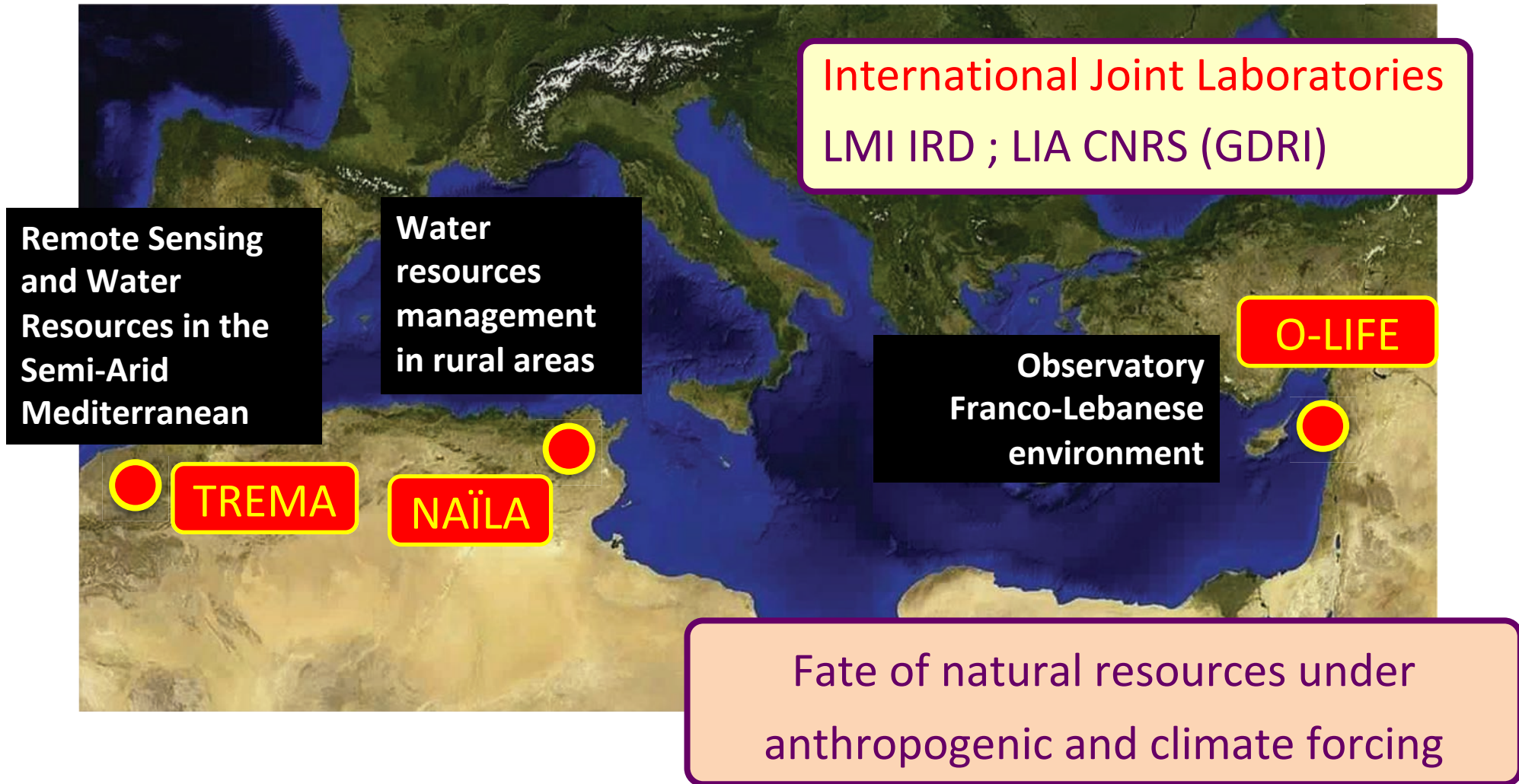
# ALTOS: 6 study sites



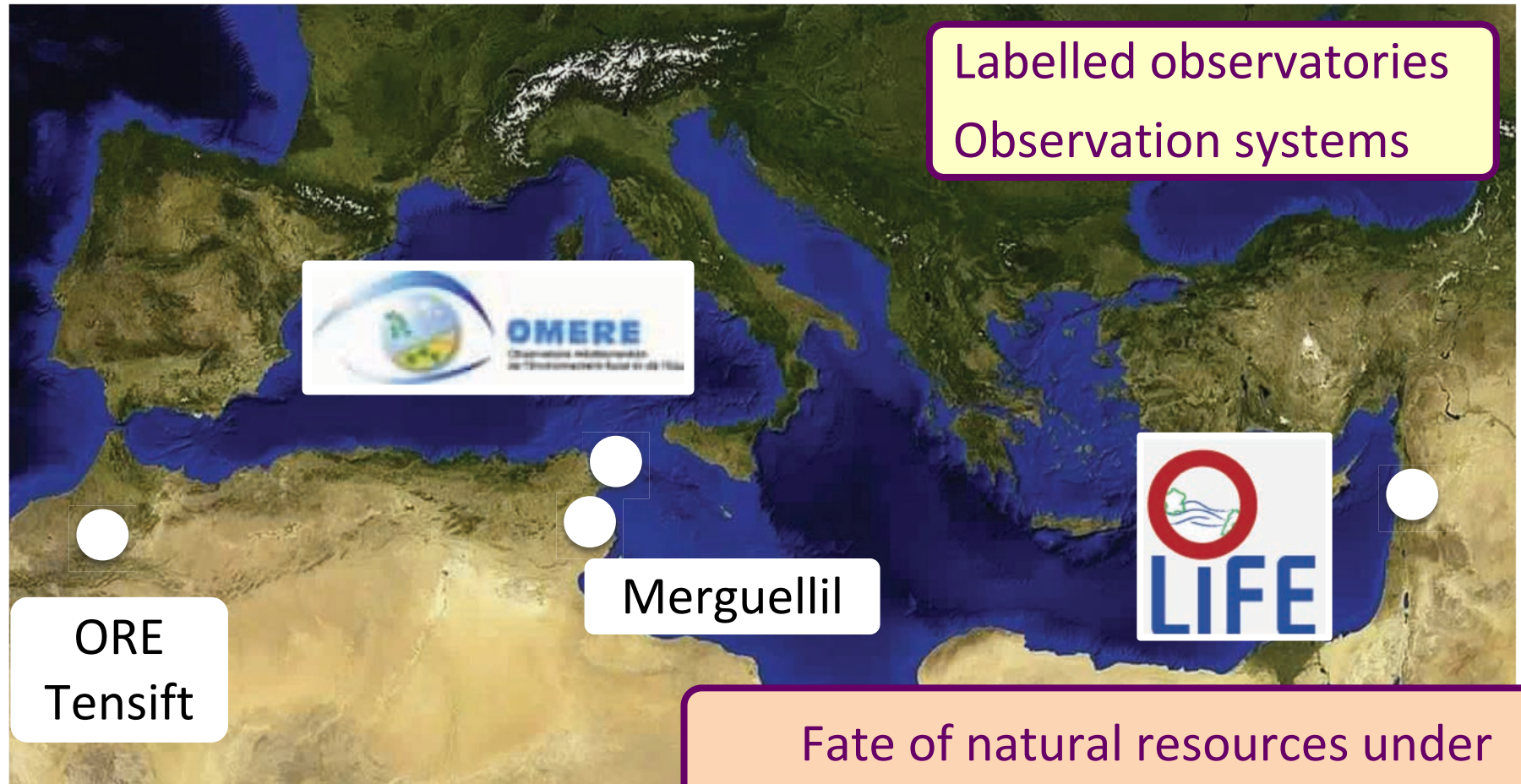
Hydrological upstream - downstream  
Ecosystem gradients



# ALTOS: assets / international joint laboratories



# ALTOS: environmental observatories



# ALTOS: previous projects

MISTRALS SICMED (M, T)	MTC	P	Monitoring and modelling tools for structures and functioning.
ANR DIGISOL-HYMED (T)		P	Remote sensing methods for mapping soil properties.
EU RISE REC (M, F)		P	Multi-sensor methods for monitoring soil moisture.
ANR AMETHYST (M + T, 2014 - 2018)		P	Integrated analysis: coevolutions of water uses and resources.
FP7-AFRICA-2010 EAU4Food (M + T, 2011-2015).			Participative seminars about practices for increasing irrigated farming food production.
ANR ALMIRA (M + T, 2014 - 2018)		C	Integrated analysis: impacts of land use changes on yield & hydro-erosive fluxes.
ARIMNet 2 VIANA (T + L, 2018 - 2020)		C	Land use related to adoption of agroecological solutions for small irrigated farming.
ERANET-MED CHAAMS (T + M + L, 2019 - 2021)		C	Past & current trends on land use & water governance. Process model calibration.
SAGESSE (M, 2016-2019)		C	Design of decision support systems for water resource management.
Irrig-Bekaa (L, 2016-2019)		C	Methods for quantifying water use by irrigated crops.
CNES / THEIA Sentinel-2 (T, 2016 - 2020)		C	Availability of Sentinel-2 data over Tunisia once pre-processed by French Space Agency.
MISTRALS HighLandDEM (T, 2017 - 2018)		C	Methodologies for producing high spatial resolution DEM.
H2020 VISCA (S, 2017- 2019)		C	Modelling vineyards phenological trend under climate change.

Datasets

Ongoing Experiments

Processing methods

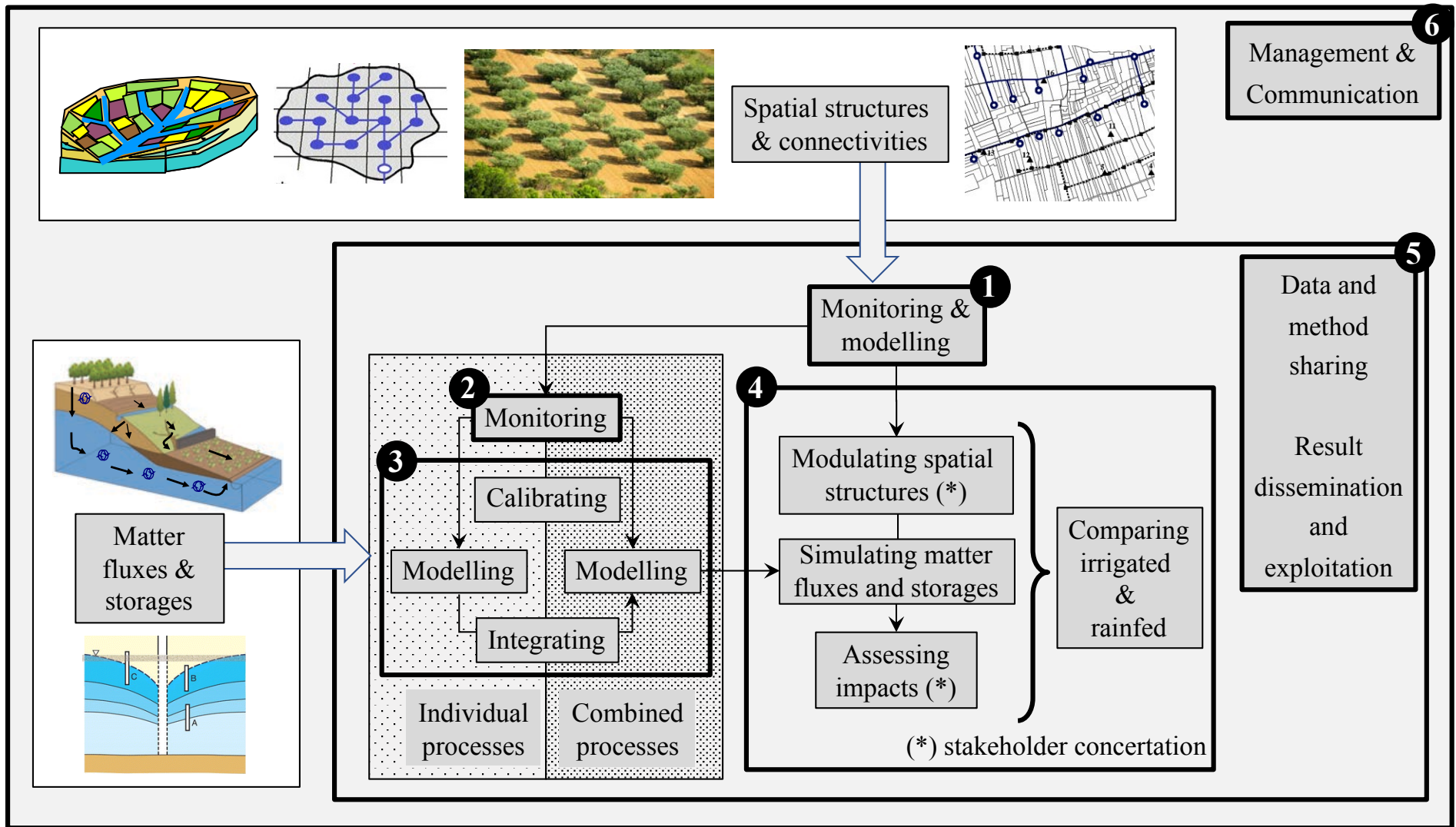
Models

Integrated analysis

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# ALTOS: activity structuration



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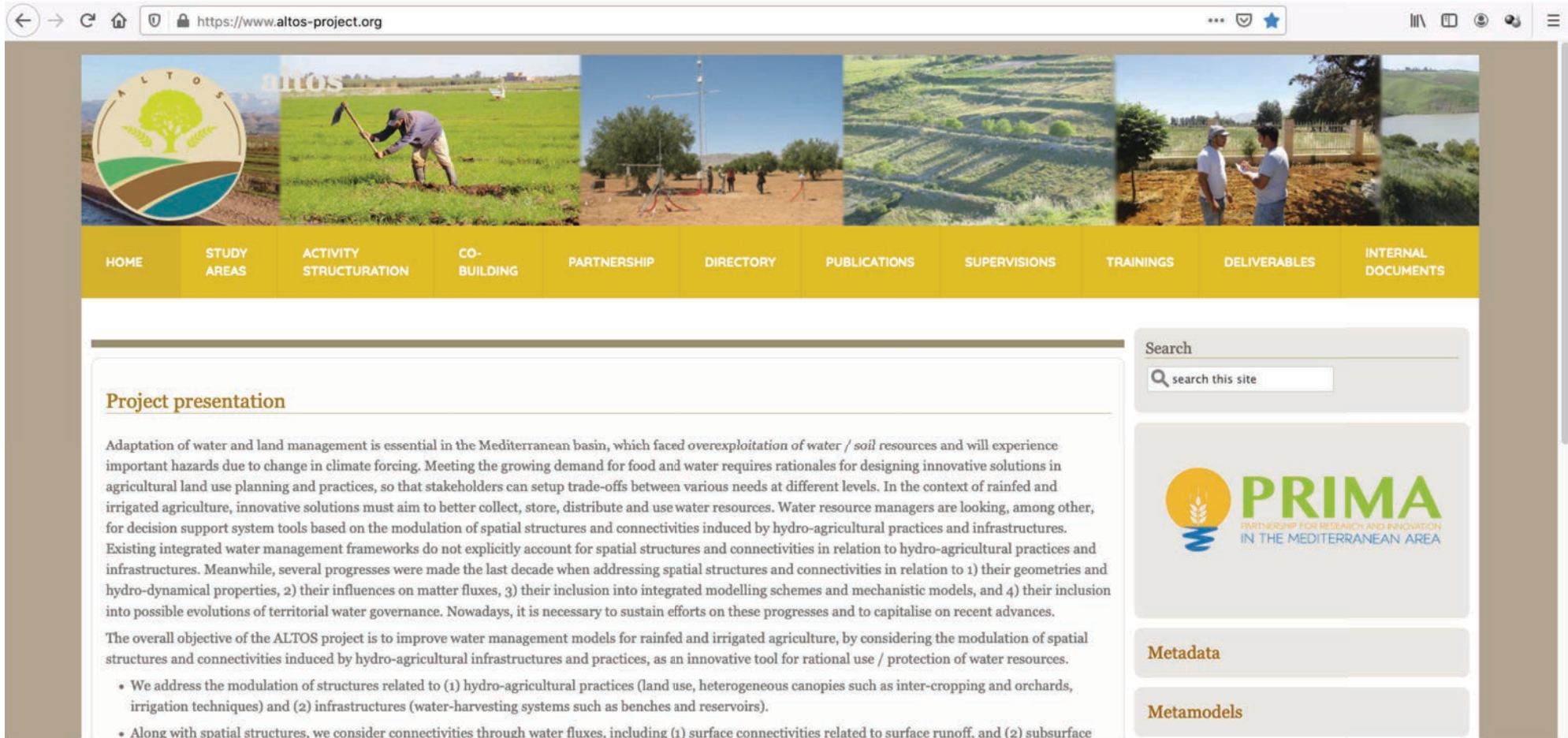
# ALTOS: Result dissemination and exploitation

Table 2.3 (to be continued). Panel of specific actions to be conducted for transferring ALTOS outcomes towards targeted stakeholders.

Targeted audience→	National directorates (link with ministries)	Regional directorates (link with governorates and farmers)	Farmer / water user associations.	Engineering offices	Academics	NGOs and think tanks	National and international organisations	
Products ↓								
Monitoring protocols (WP1 & WP2)	<ul style="list-style-type: none"> <li>• Databases and technical reports about                             <ul style="list-style-type: none"> <li>○ infrastructures (reservoir geometries, soil maps);</li> <li>○ fluxes and storages (aquifer levels, reservoir filling, chemical contents).</li> </ul> </li> <li>• Trainings on monitoring systems setup with observatories.</li> </ul>							Databases for count reports on climate change
Data processing algorithms (WP1 & WP2)	<ul style="list-style-type: none"> <li>• Trainings.</li> <li>• User manuals.</li> <li>• GITHUB platforms.</li> <li>• Support to get started.</li> </ul>			<ul style="list-style-type: none"> <li>• Trainings.</li> <li>• User manuals.</li> <li>• GITHUB platforms.</li> </ul>	<ul style="list-style-type: none"> <li>• Publications.</li> <li>• Online databases / user manuals &amp; GITHUB platforms.</li> <li>• Advanced trainings.</li> </ul>			
Open source models (WP3)								
Simulation tools (WP3)								

Knowledge management strategy  
Data management plan

# ALTOS: Result dissemination and exploitation



The screenshot shows the website <https://www.altos-project.org>. The header features a navigation menu with the following items: HOME, STUDY AREAS, ACTIVITY STRUCTURATION, CO-BUILDING, PARTNERSHIP, DIRECTORY, PUBLICATIONS, SUPERVISIONS, TRAININGS, DELIVERABLES, and INTERNAL DOCUMENTS. The main content area is titled "Project presentation" and contains the following text:

Adaptation of water and land management is essential in the Mediterranean basin, which faced *overexploitation of water / soil* resources and will experience important hazards due to change in climate forcing. Meeting the growing demand for food and water requires rationales for designing innovative solutions in agricultural land use planning and practices, so that stakeholders can setup trade-offs between various needs at different levels. In the context of rainfed and irrigated agriculture, innovative solutions must aim to better collect, store, distribute and use water resources. Water resource managers are looking, among other, for decision support system tools based on the modulation of spatial structures and connectivities induced by hydro-agricultural practices and infrastructures. Existing integrated water management frameworks do not explicitly account for spatial structures and connectivities in relation to hydro-agricultural practices and infrastructures. Meanwhile, several progresses were made the last decade when addressing spatial structures and connectivities in relation to 1) their geometries and hydro-dynamical properties, 2) their influences on matter fluxes, 3) their inclusion into integrated modelling schemes and mechanistic models, and 4) their inclusion into possible evolutions of territorial water governance. Nowadays, it is necessary to sustain efforts on these progresses and to capitalise on recent advances.

The overall objective of the ALTOS project is to improve water management models for rainfed and irrigated agriculture, by considering the modulation of spatial structures and connectivities induced by hydro-agricultural infrastructures and practices, as an innovative tool for rational use / protection of water resources.

- We address the modulation of structures related to (1) hydro-agricultural practices (land use, heterogeneous canopies such as inter-cropping and orchards, irrigation techniques) and (2) infrastructures (water-harvesting systems such as benches and reservoirs).
- Along with spatial structures, we consider connectivities through water fluxes, including (1) surface connectivities related to surface runoff, and (2) subsurface

On the right side of the page, there is a search bar with the text "Search" and "search this site". Below the search bar, there are three sections: "PRIMA PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA", "Metadata", and "Metamodels".



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# ALTOS KOM: deliverables and milestones

## Deliverables & milestones

- Knowledge (KMS, DMP)
- Reports
- Meetings
- Datasets
- Modeling schemes
- Scenarios
- Publications
- Participative seminars
- Training materials
- Policy briefs

List of deliverables and milestones across WP1 to WP6					
Month	Item	Topic	WP	Lead	Remarks
<del>2</del>	<del>D5.1.2</del>	<del>Modelling workshops (1/3)</del>	<del>5</del>	<del>GNRS-L</del>	<del>R / CO</del>
2 (15)	MS6.1	Kick-off meeting [Progress/closure meeting]?	6	MB	KOM minutes
3 (3)	MS6.2	Monitoring board meetings (1/7)	6	MB	Meeting minutes
3 (10)	D6.2.1	Communication plan	6	LISAH	R / CO
4 (6)	D6.2.2	Project web site	6	LISAH	DEC / PU
4 (14)	MS5.1	Mobility plan	5	LISAH	Validated by the MB
6 (9)	MS6.2	Monitoring board meetings (2/7)	6	MB	Meeting minutes
6 (16)	D5.2.1	Knowledge management strategy including a data management plan to be updated (1/3)	5	INRGREF	R / CO
<del>6</del>	<del>D5.1.1</del>	<del>Metadata and metamodels (1/3)</del>	<del>5</del>	<del>GNRS-L</del>	<del>DEC / PU</del>
12 (18)	MS6.2	Monitoring board meetings (3/7)	6	MB	Meeting minutes
15 (20)	D1.1.1	Dataset from Task 1.1	1	IRTA	OTHER / CO
15 (26)	D1.2.1	Dataset from Task 1.2	1	<del>LARS</del> LISAH	OTHER / CO
15	D2.1.1	Dataset from Task 2.1	2	CERTE	OTHER / CO
15 (24)	D2.2.1	Dataset from Task 2.2	2	CESBIO	OTHER / CO
15	D3.1.1	Modeling progresses	3	UNICA	R / CO
<del>18</del>	<del>D5.1.1</del>	<del>Metadata and metamodels (2/3)</del>	<del>5</del>	<del>GNRS-L</del>	<del>DEC / PU</del>
<del>18</del>	<del>D5.1.2</del>	<del>Modelling workshops (2/3)</del>	<del>5</del>	<del>GNRS-L</del>	<del>R / CO</del>
18	D5.2.1	Knowledge management strategy including a data management plan to be updated (2/3)	5	INRGREF	R / CO
18	D6.1.1	Mid-term report	6	LISAH	R / CO
18	MS6.2	Monitoring board meetings (4/7)	6	MB	Meeting minutes
18	MS1	Database update	1	MB	Data available and validated by the MB.
18	MS2	Database update	2	MB	Data available and validated by the MB.
18	MS5.3	Materials for training sessions (1/2)	5	MB	Material repository available for trainers

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## ALTOS: governance

- **MT** (leader + PM): monitoring work progress with regard to deliverable and milestone calendar, interacting with PRIMA office about ALTOS progresses and difficulties.
- **MB** (**MT** + **partner representatives** + **task leaders**): monitoring strategic steering, make arbitrations and final decisions if necessary.