

Integrating stakeholder-based Fuzzy Cognitive Maps for understanding water systems in the Mediterranean

Futures of European Waters
Pre-conference: SCENES water scenarios
23rd March 2011

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OUTLINE

1. Water issues in the Mediterranean
2. The SCENES Process in the Mediterranean PAs
3. The integration process and the Mediterranean FCM
4. Conclusions



1. Water issues in the Mediterranean region



1. Water issues in the Mediterranean

MEDITERRANEAN COUNTRIES: 3 Sub-regions

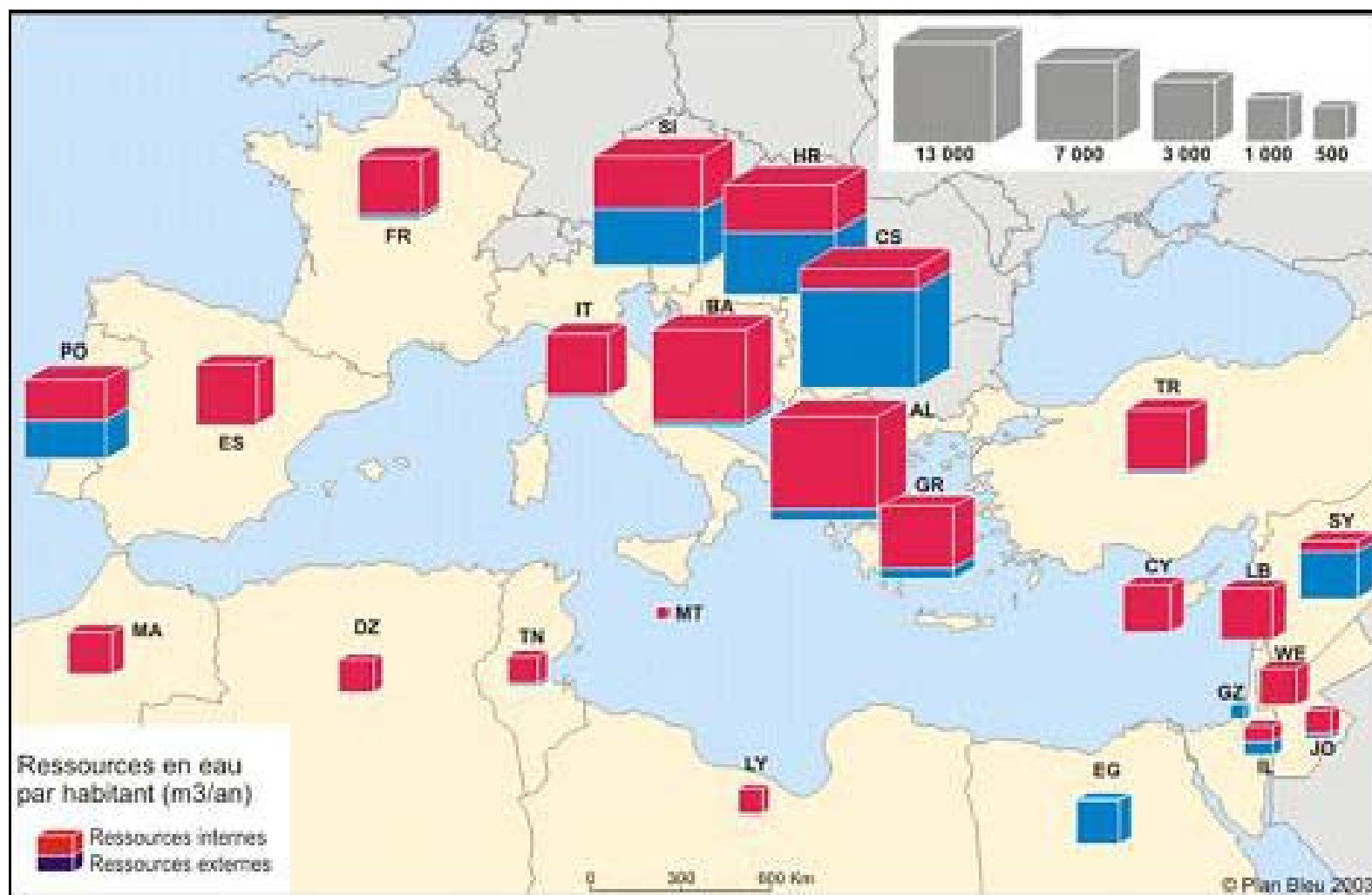
- **MEDITERRANEAN BASIN:** 25 countries with distinctive demographic and socio-economic features: varied pressure on water resources
- Mediterranean **climate:** mild winters, long and dry summers, high irregularity of precipitations

- **Sub-regions:**

North	{	72% water resources in the region low population growth stable water demand moderate pressure on water resources
East	{	23% water resources in the region
South and South-East	{	5% water resources in the region high demographic pressure increasing demand for water

1. Water issues in the Mediterranean

PER CAPITA WATER RESOURCES IN THE MEDITERRANEAN REGION (m³/year)

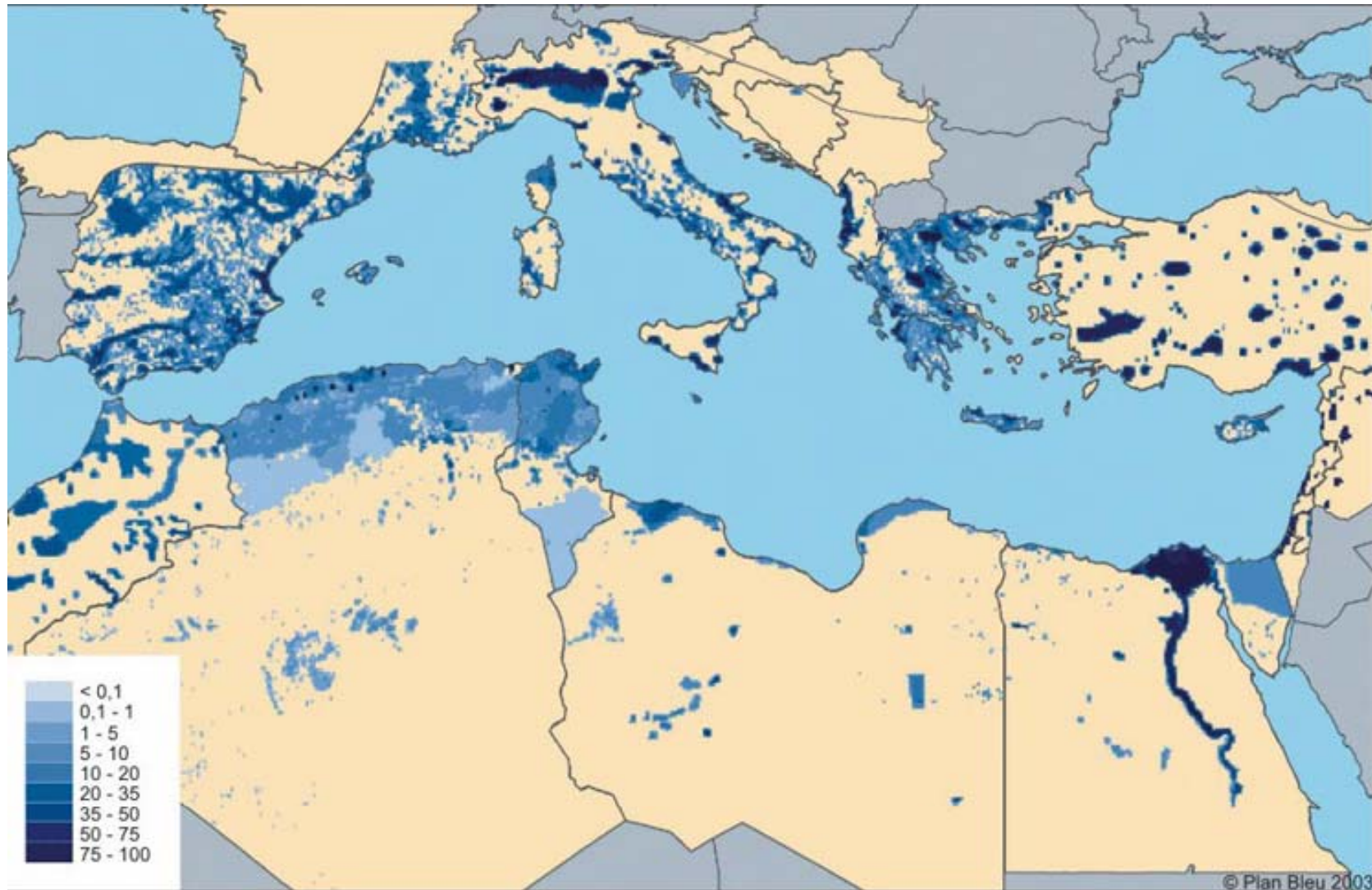


Source: Plan Bleu (2003)



1. Water issues in the Mediterranean

IRRIGATED LANDS IN THE MEDITERRANEAN REGION (%)

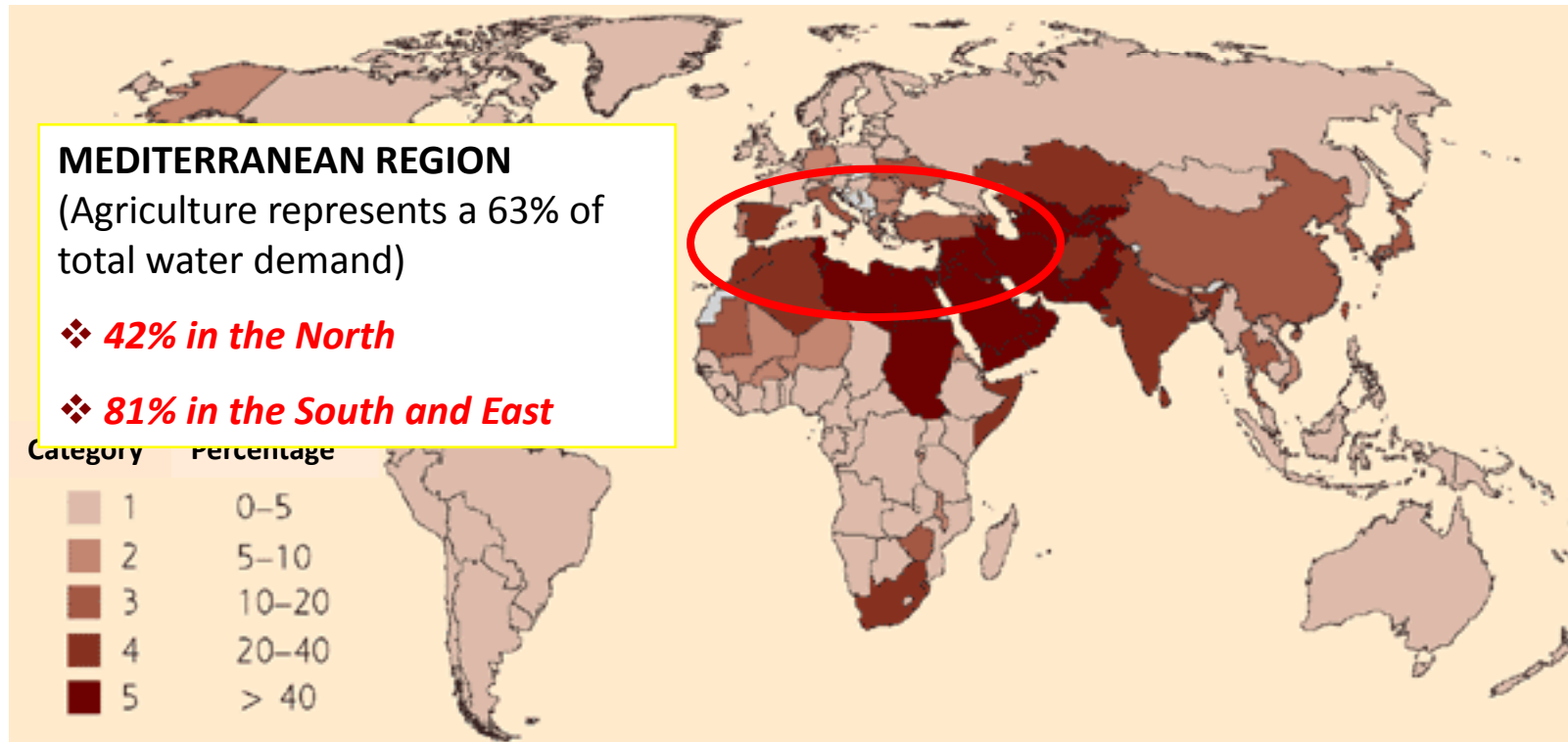


© Plan Bleu 2003

Source : FAO

Water and agriculture

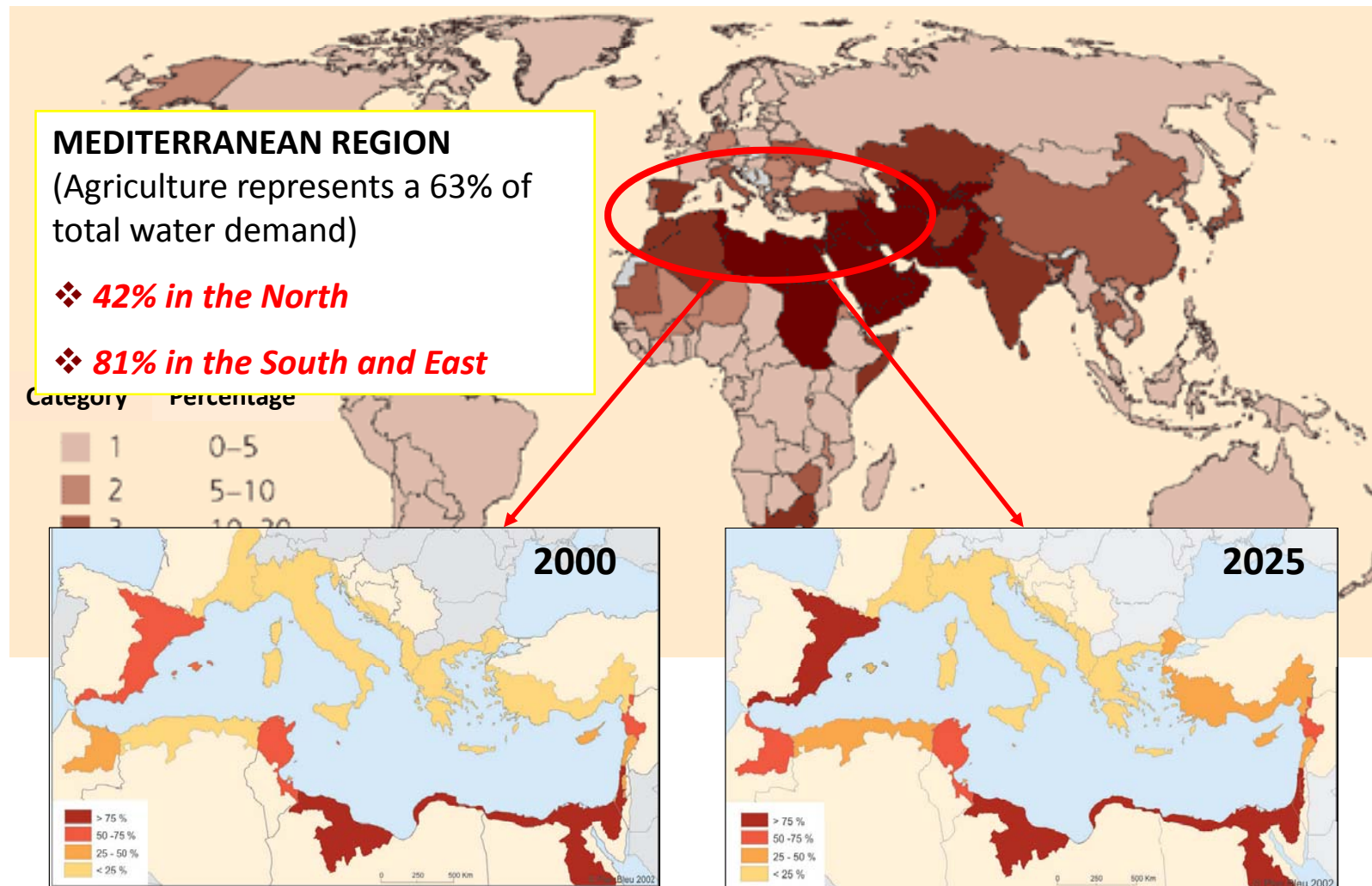
% Agriculture water withdrawals as percentage of renewable water resources



Source: FAO, 2002

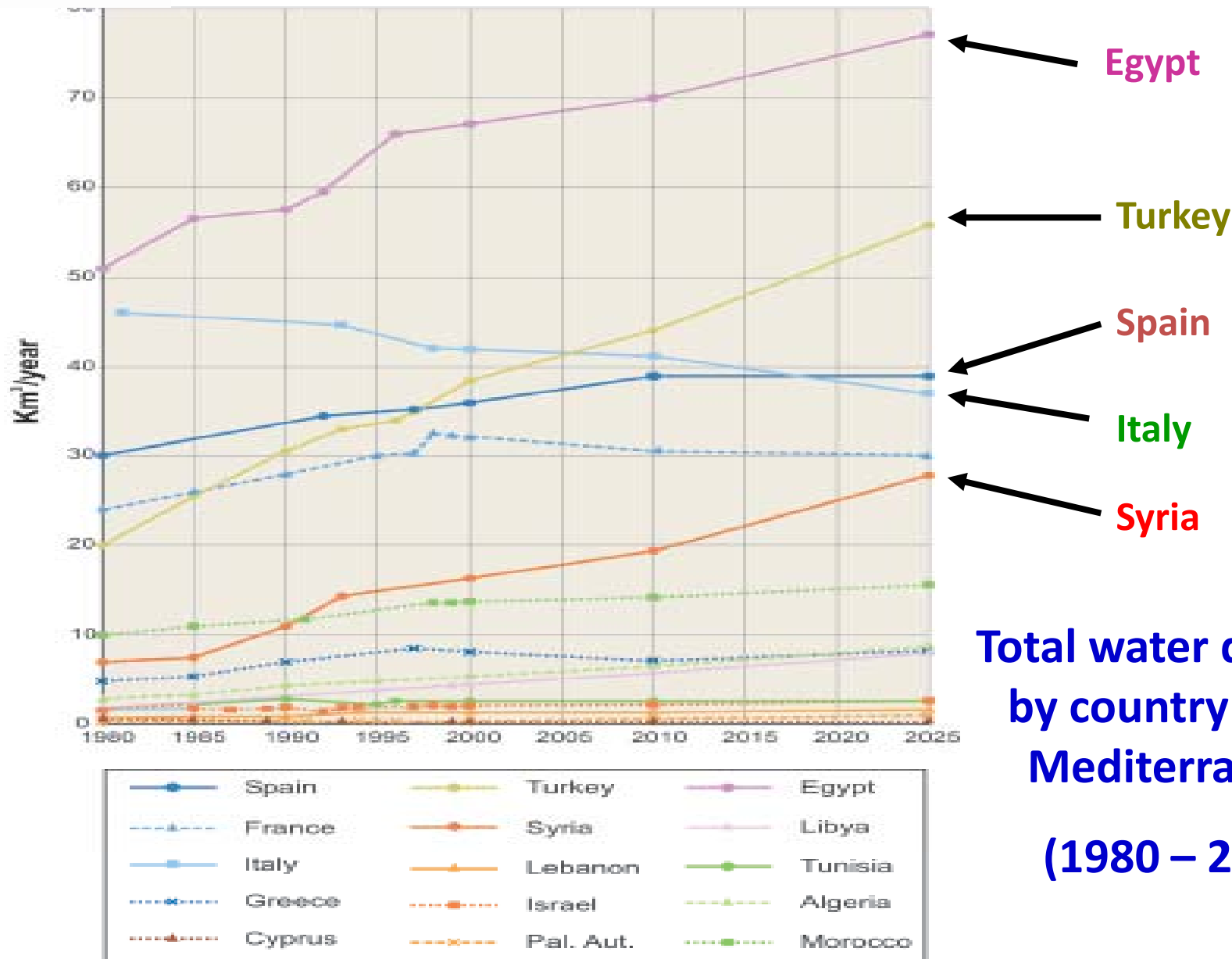
Water and agriculture

% Agriculture water withdrawals as percentage of renewable water resources





1. Water issues in the Mediterranean





2. The SCENES process



2. The SCENES Process



Guadiana (Spain)

- Agricultural dev. vs. Env. conservation
- Groundwater (upper Guadiana) and surface water (middle Guadiana)
- Low effectiveness of groundwater **management** and **control**
- Technical and policy challenges:** efficiency and cost recovery (WFD)



Candelaro (Italy)

- Water Stress**, land use change (intensive agriculture as main practice in the area)
- Agricultural uses vs. urban uses
- Pressure on groundwater and land use as a consequence of **overexploitation** for irrigation use and **seawater intrusion**



2. The SCENES Process



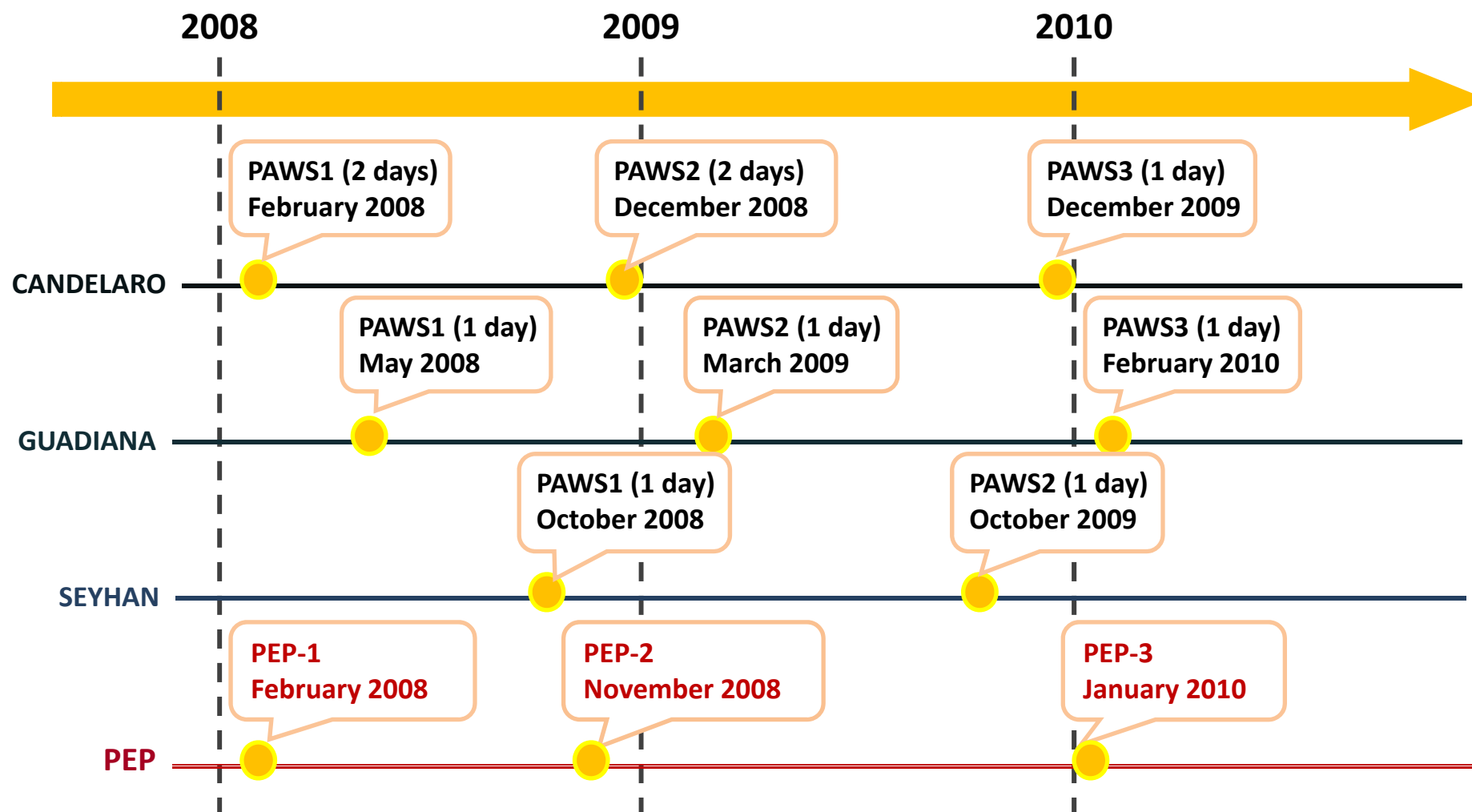
Seyhan (Turkey)

- Excessive water use for irrigation with poor irrigation technology (96% gravity)
- Rapid urban development
- Water quality problems



2. The SCENES Process

TIMELINE OF THE MEDITERRANEAN MEETINGS





2. The SCENES Process

	Identification of main issues	Present	Future	Robust strategies
Guadiana	Brainstorming Card technique Spidergrams	FCMs Dynamic analysis	FCMs Dynamic analysis Storylines	Backcasting
Candelaro	Brainstorming Card technique Spidergrams	FCMs Dynamic analysis	Collages Storylines FCMs Dynamic analysis	Backcasting
Seyhan	Brainstorming Spidergrams	FCMs Dynamic analysis	FCMs Dynamic analysis Timelines (for desirable futures)	Backcasting



2. The SCENES Process

SH groups involved:

- the River Basin Authority (RBA)
- Regional administrations (agriculture, environment, water departments)
- Institutions in charge of operation, management and maintenance of the hydraulic infrastructures. Irrigation communities.
- Farmer unions
- Environmental associations
- Research institutes and universities which are mainly involved in assessing water management sustainability.



2. The SCENES Process

Main issues in the Mediterranean PAs

CLUSTERS	GUADIANA	CANDELARO	SEYHAN
POLICY	<ul style="list-style-type: none"> - Current water and agriculture - Coordination - Enforcement 	<div>POLICY / INSTITUTIONAL COORDINATION</div>	
ECONOMIC	<ul style="list-style-type: none"> - Agriculture production effects - Eco. instruments for w. demand 	<ul style="list-style-type: none"> - Water cost 	<ul style="list-style-type: none"> - Water demand - Water supply - Irrigation water price
ENVIRONMENT	<ul style="list-style-type: none"> - Water scarcity - Droughts - Env. Sustainability - Groundwater overexploitation 	<ul style="list-style-type: none"> - Water scarcity (availability, gap supply/demand) - Groundwater overexploitation - Water quality 	<ul style="list-style-type: none"> - Impacts of climate change - Water pollution - Sustainable water management - Soil degradation
TECHNICAL	<ul style="list-style-type: none"> - Technology - Data and inf. transparency 	<ul style="list-style-type: none"> - Water conservation agronomic techniques - Reuse of wastewater 	<ul style="list-style-type: none"> - Water delivery losses - Irrigation infrastructure - Water efficiency - Use of ground water
SOCIAL	<ul style="list-style-type: none"> - Rural population stability - Culture of w. use 	<ul style="list-style-type: none"> - Social dynamics 	<ul style="list-style-type: none"> - Impact of increasing urbanization



2. The SCENES Process

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ECONOMIC	<div style="border: 2px solid red; padding: 10px; text-align: center;"> ECONOMIC INSTRUMENTS / WATER PRICES / COSTS </div>		
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WATER SCARCITY AND OVEREXPLOITATION



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creasing



3. The integration process and the Mediterranean FCM

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Based on the paper:

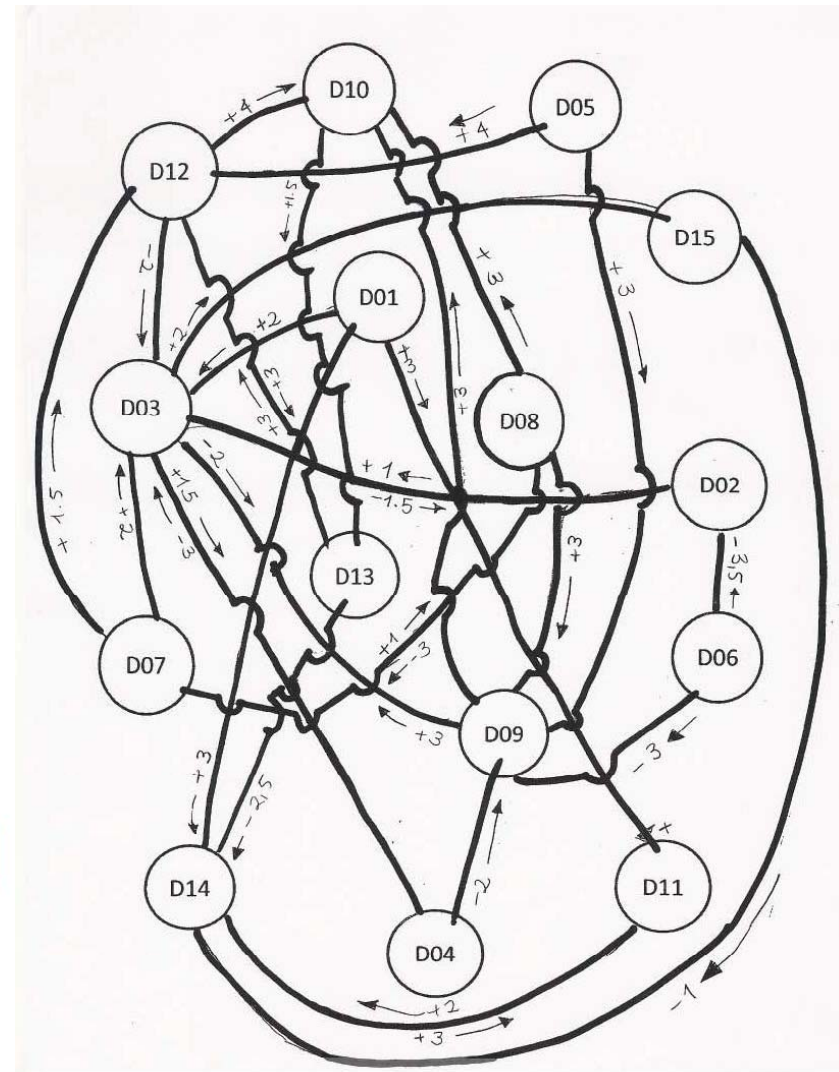
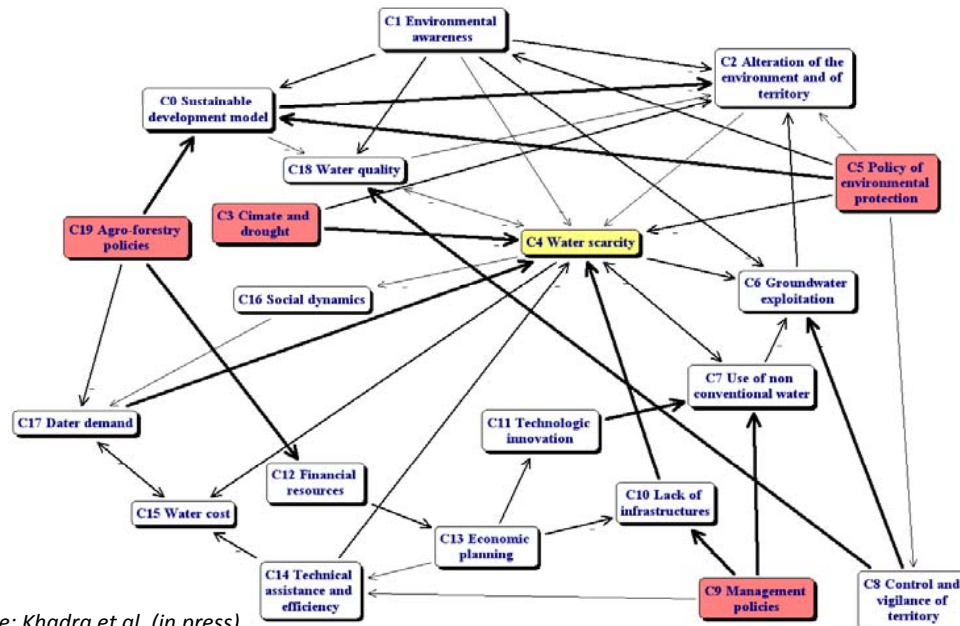
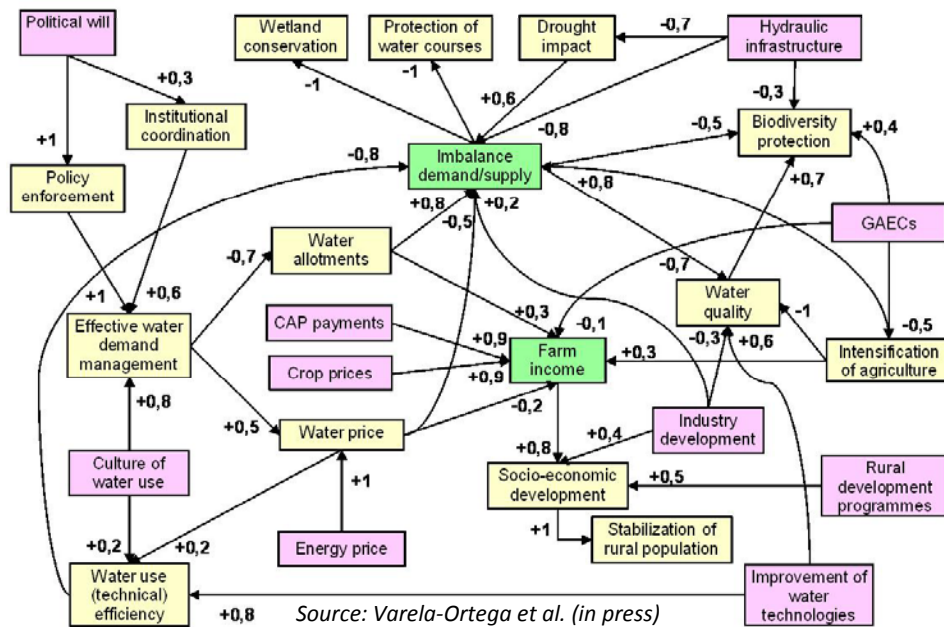
“FCMs as common base for linking participatory products and models”

by Van Vliet, M.; Flörke, M.; Varela-Ortega, C.; Cakmak, E. H.; Khadra, R.;
Esteve, P.; D'Agostino, D.; Dudu, H.; Bärlund, I and Kok, K.

Submitted to Environmental Modelling & Software



3. The integration process and the Mediterranean FCM





3. The integration process and the Mediterranean FCM

Why to up-scale?

... A good basis for aggregation:

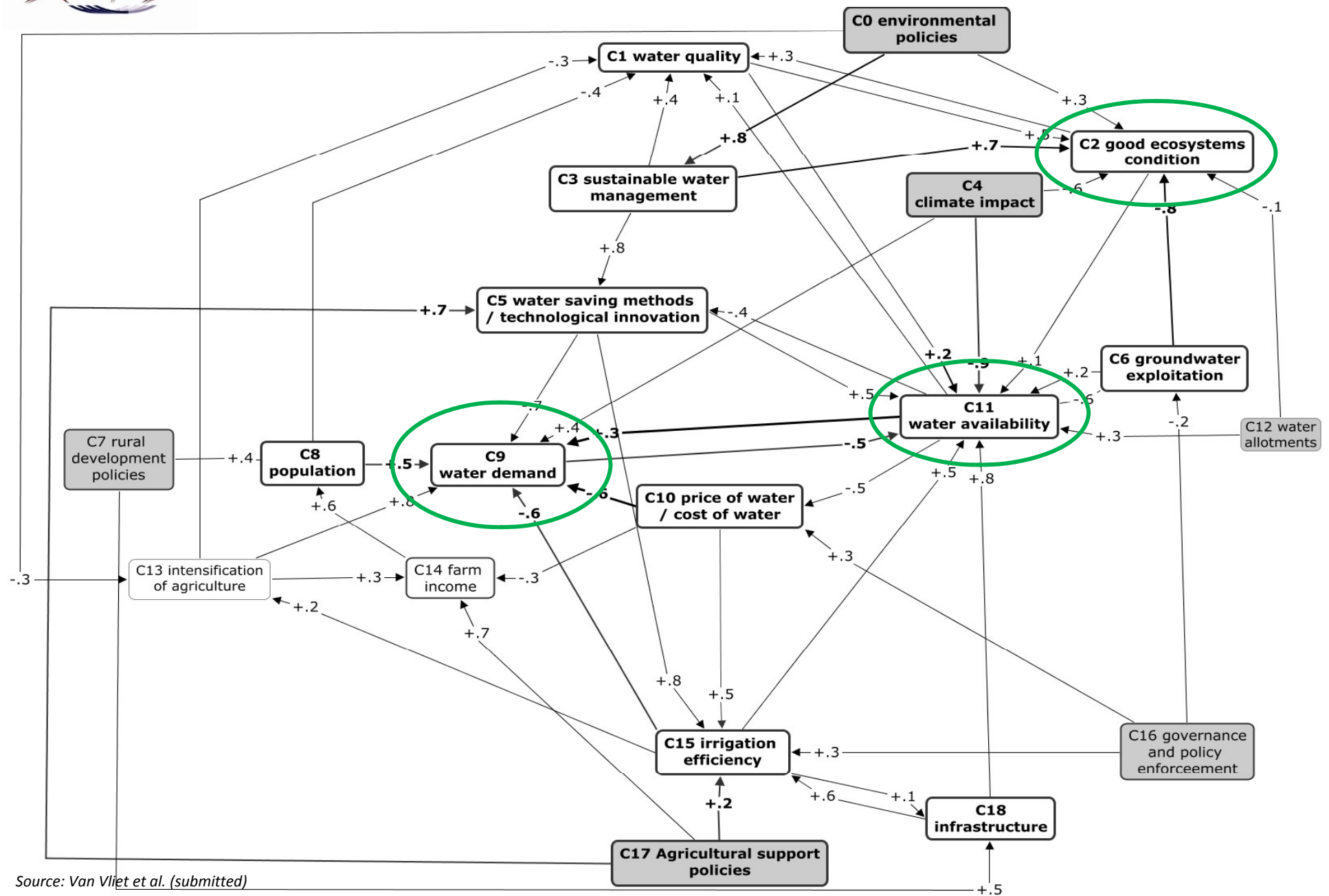
- The three FCM are **stakeholder-driven**
- They are **representative of other basins** within the same country having the same vocation
- Many **common issues** were identified

... Different institutional and socio-economic contexts, common water problems:

- Although there are divergences between the Mediterranean basins and countries the water system functioning is very similar
- Similar physical characteristics and similar uses of water (irrigation...)
→ common view on **future water scenarios** and **management approaches**



3. The integration process and the Mediterranean FCM



Source: Van Vliet et al. (submitted)



3. The integration process and the Mediterranean FCM

FCM-SH	Seyhan	Guadiana	Candelaro
<i>Present in three Pilot Areas</i>			
Environmental policies	sustainable water management	CAP environmental requirements protection of water courses	Water Framework Directive
Sustainable water management	sustainable water management	wetland conservation culture of water use water demand management	sustainable rural development model environmental awareness
Groundwater exploitation	use of groundwater	imbalance demand/supply	groundwater exploitation
Water quality	water pollution	water quality	water quality
Good ecosystem condition	soil degradation	wetland conservation biodiversity protection	alteration of environment and of territory
Climate impact	impacts of climate change	drought impact	climate and drought



3. The integration process and the Mediterranean FCM

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Water demand	water demand	imbalance demand/supply	water demand
Water price	irrigation water price	water price	water cost
Water availability	water supply irrigation water use	imbalance demand/supply	water scarcity
Irrigation efficiency	irrigation efficiency	water use efficiency	technical assistance and efficiency
Water saving methods	use of water-saving methods	improvement of water technologies	technologic innovation use of non conventional water
Infrastructure	water delivery losses irrigation infrastructure	hydraulic infrastructure	lack of infrastructure
Agricultural support policies	agricultural support policies	Common Agricultural Policy payments	Common Agricultural Policy
Population	impact of increasing urbanization	stabilization of rural population	socio-economic dynamics



3. The integration process and the Mediterranean FCM

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3. The integration process and the Mediterranean FCM

FCM-SH	Seyhan	Guadiana	Candelaro
<i>Present in two Pilot Areas</i>			
Rural development policies		rural development programs	sustainable rural development model financial resources
Farm income		farm income socio-economic development	socio-economic dynamics
Governance		political will policy enforcement institutional coordination	economic planning local management policies control and vigilance of territory
<i>Present in one Pilot Area</i>			
Water allotments		water allotments	
Intensification of agriculture		intensification of agriculture	

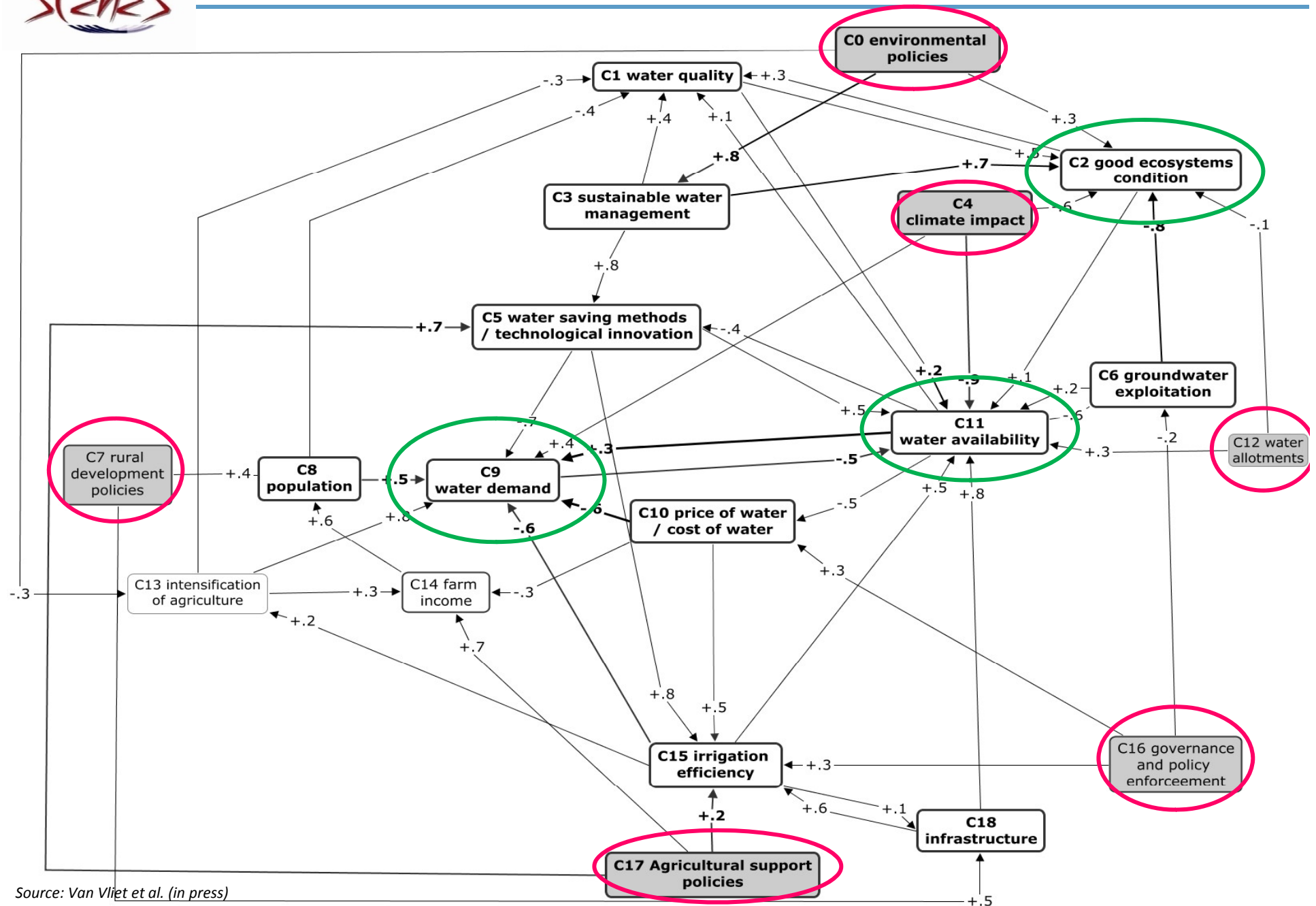


3. The integration process and the Mediterranean FCM

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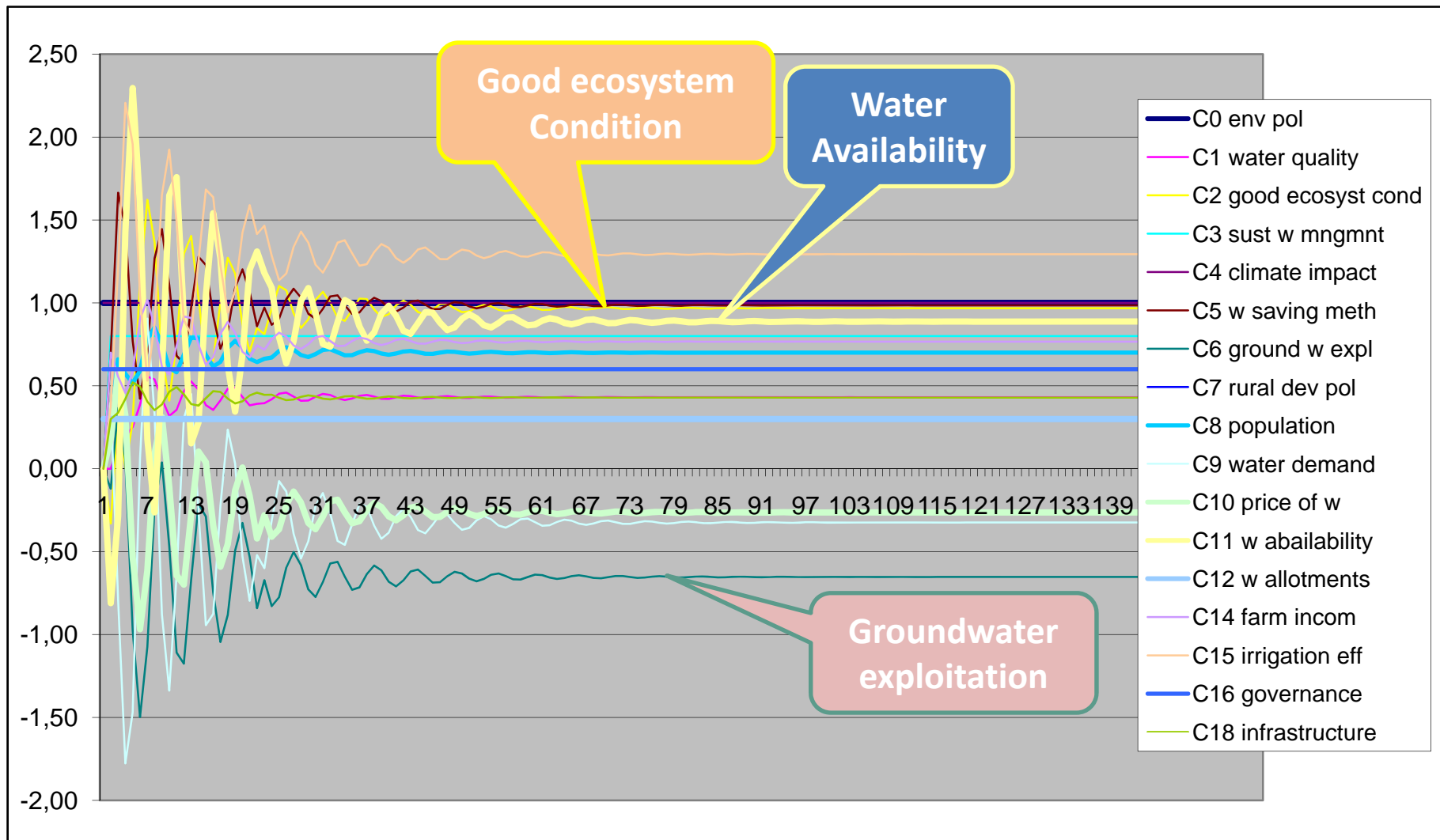


Source: Van Vliet et al. (in press)



3. The integration process and the Mediterranean FCM

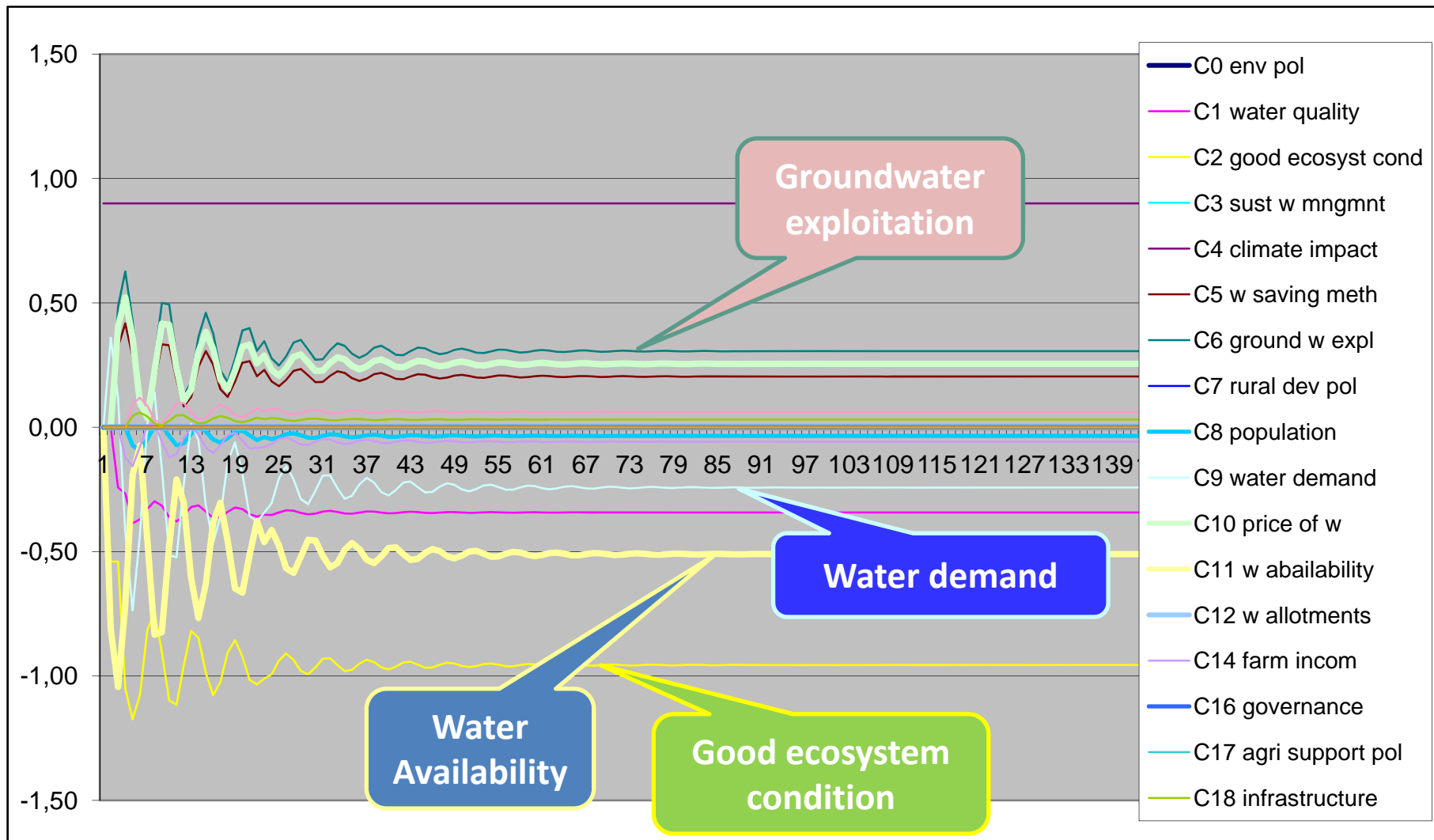
Dynamic analysis → all drivers together





3. The integration process and the Mediterranean FCM

Dynamic analysis → climate change impact





4. Conclusions

4. Conclusions



5. Conclusions

COMMON ELEMENTS

- Central elements in Guadiana, Candelaro and Seyhan relate to **water quantity/availability**: water demand in Seyhan, unmet demand in the case of Guadiana and water scarcity in Candelaro
- External drivers relate to **policy/management** issues (water price, management policies, political will, CAP, etc.), **technology** development (hydraulic infrastructures and irrigation techniques) and **climate** issues (climate change, droughts, etc.)
- Relevance of **groundwater overexploitation**

AND DIFFERENCES

- Candelaro SH recognize the **need for local institutions** to link the EU policy level (WFD) with the local level
- Guadiana: high WFD-consciousness and strong public participation for RBMP . Combination of **bottom-up SH-PP and top-down** policy signals
- Seyhan: Lesser policy constraints. Water **quality** , **technological** and **population** pressures are key issues



5. Conclusions

- FCMs, both **individual and aggregated**, are valuable tools as they can represent the Mediterranean water system, reflect **SH visions** and can also illustrate **models** and be enriched with models
- Integration into one FCM showed that, despite some differences, there are many and relevant **common elements** in the three basins. From a total of 19 variables:
 - 14 were present in the three PA FCMs
 - 3 variables were only present in **Candelaro and Guadiana** FCMs: farm income, rural dev. policies and governance (strongly **determined by EU policies**)
 - 2 variables only present in the **Guadiana FCM**: more specification on water allocation and agriculture, **high SH knowledge**
- Common elements belong to policy, technological, environmental and socio-economic dimensions

GRACIAS
GRAZIE
TESEKKURLER
MERCI