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Integrated assessment and modelling of agro-ecological practices on water flow at catchment level: what potential of the Maelia platform?

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INTERNATIONAL
SOCIETY FOR
ECOLOGICAL
MODELLING

**Adour-Garonne Catchment:
what are the effects of agro-
ecological practices?**



Integrated assessment and modelling of agro-ecological practices on water flow at catchment level: what potential of the Maelia platform?

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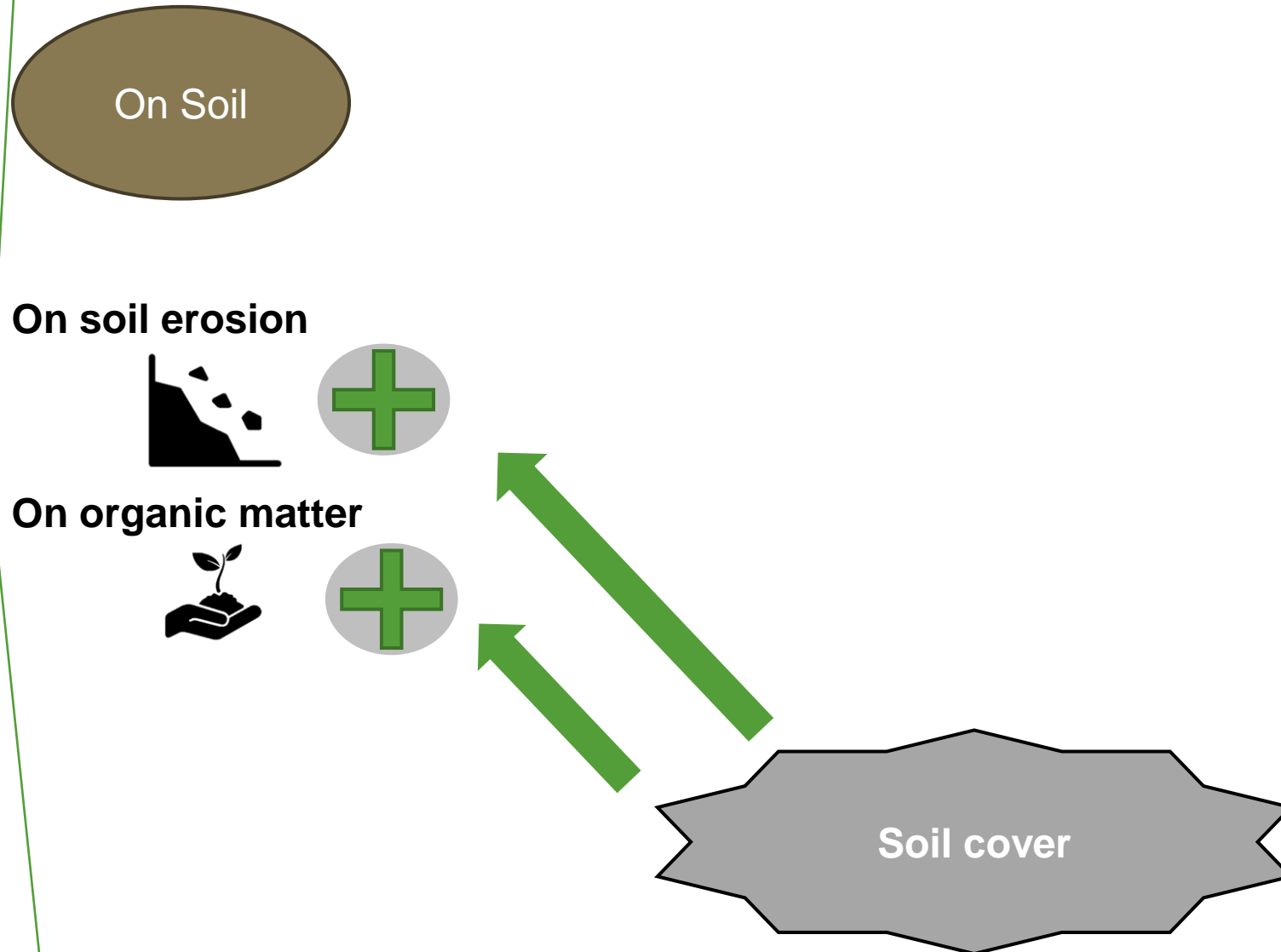
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International Society for Ecological Modelling
Global Conference 2019
1-5 October 2019 Salzburg Austria

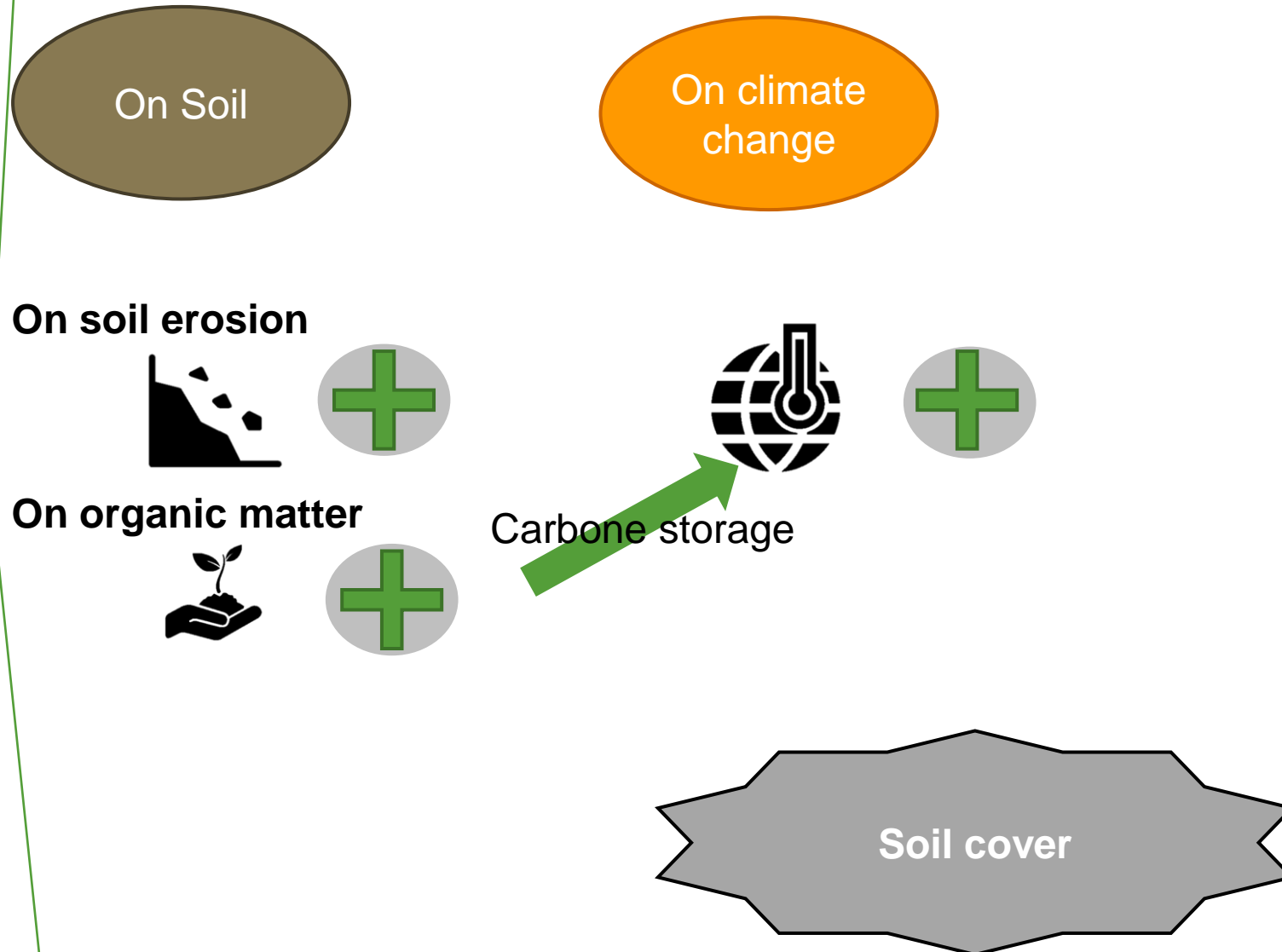
Territorial issues for the sustainability of agriculture

What are the effects of agro-ecological practices such as diversification and cover crop?



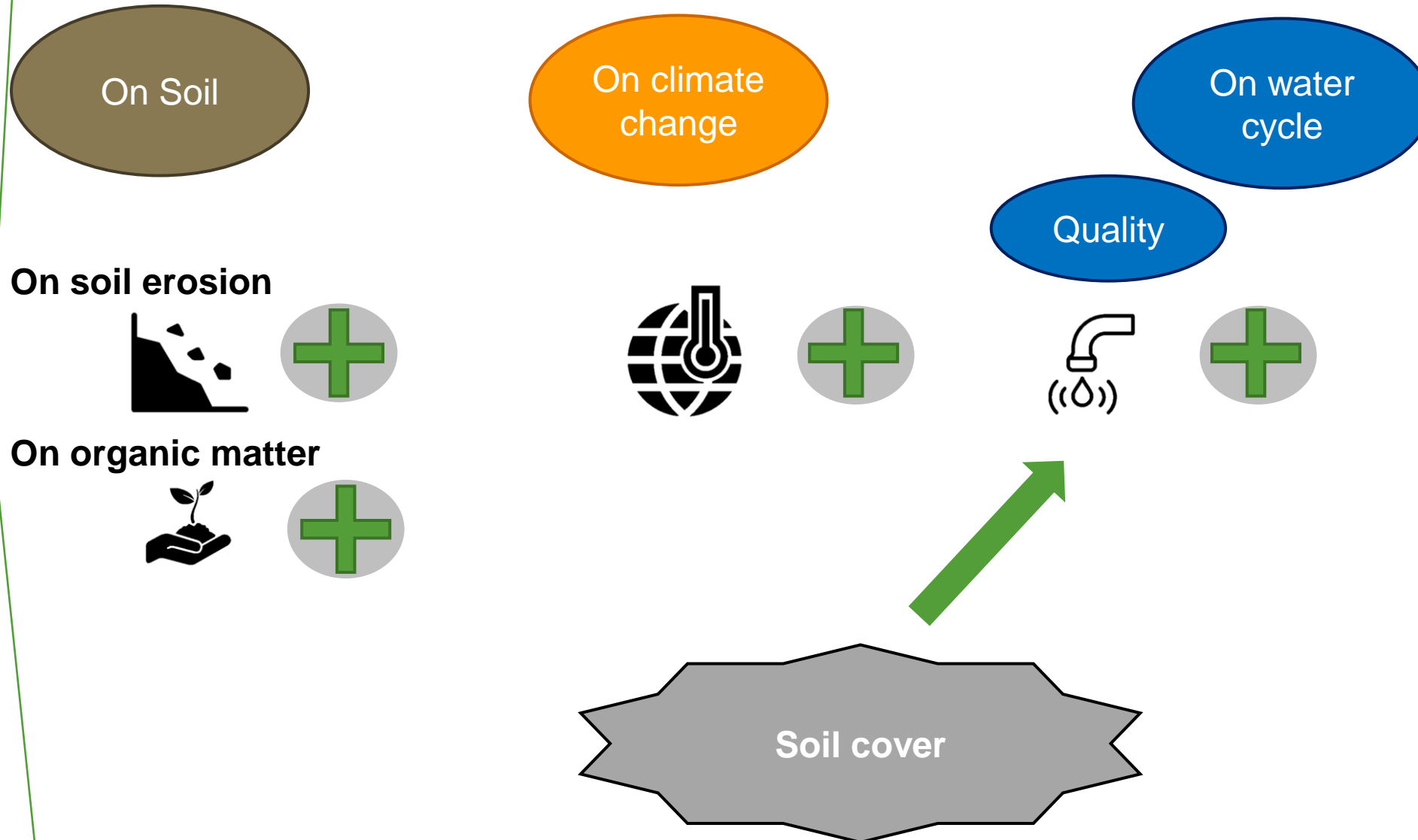
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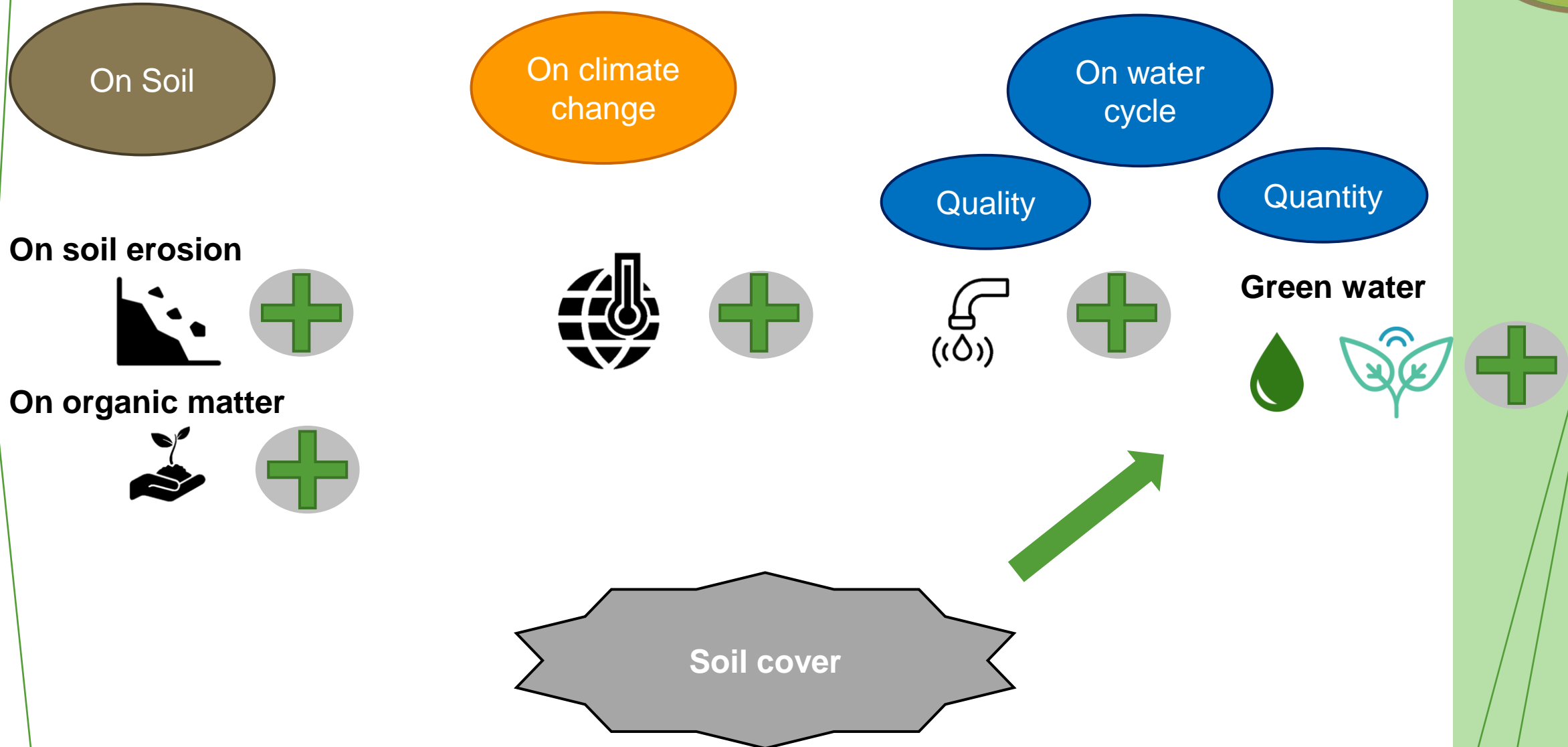
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On Soil

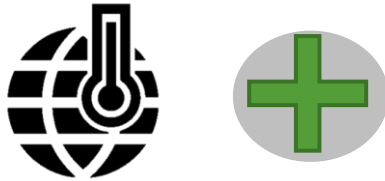
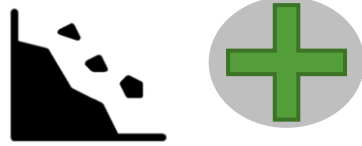
On climate change

On water cycle

Quality

Quantity

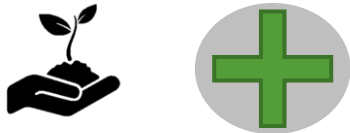
On soil erosion



Green water

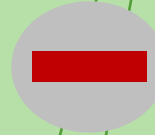
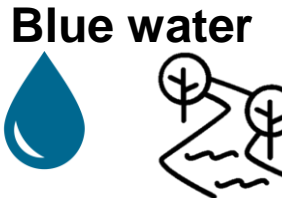


On organic matter



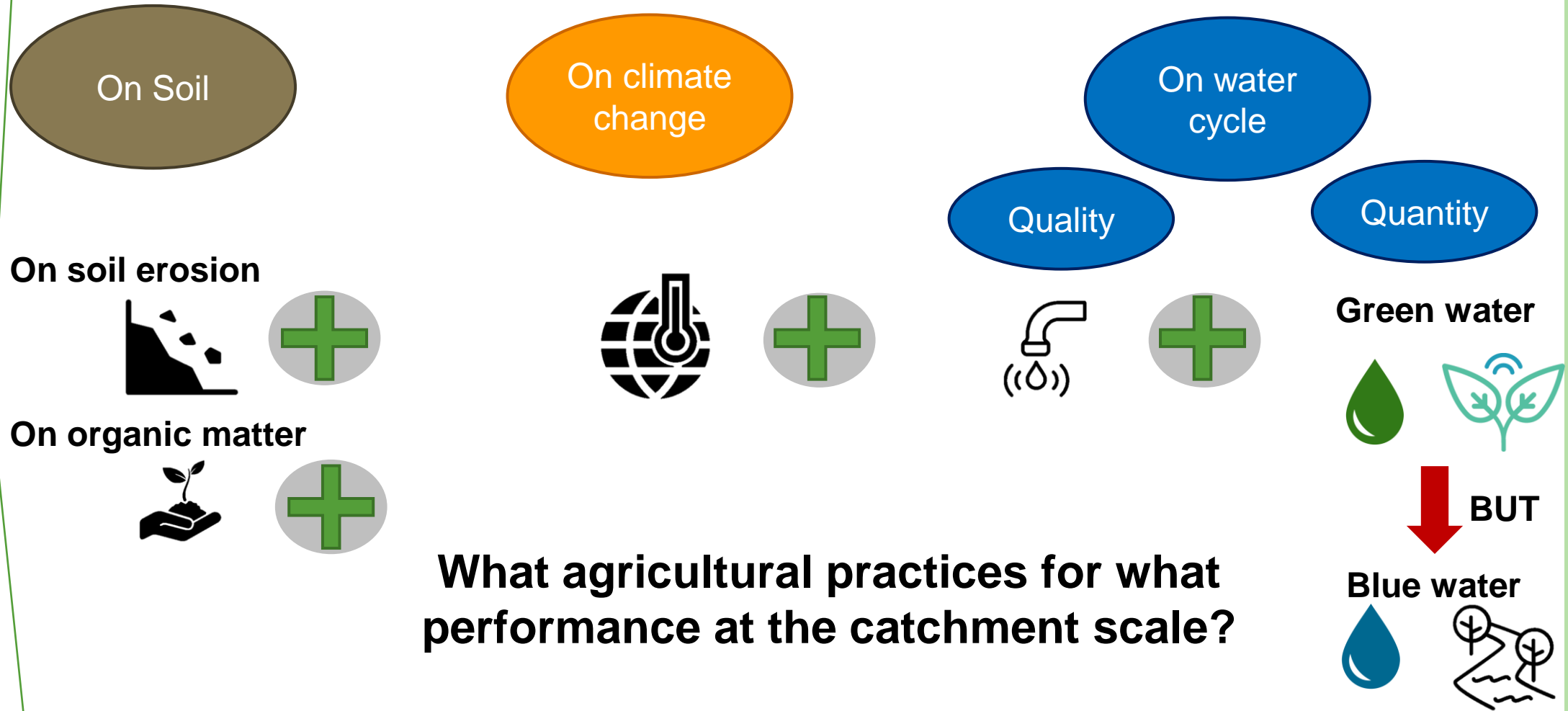
Soil cover

BUT



Territorial issues for the sustainability of agriculture

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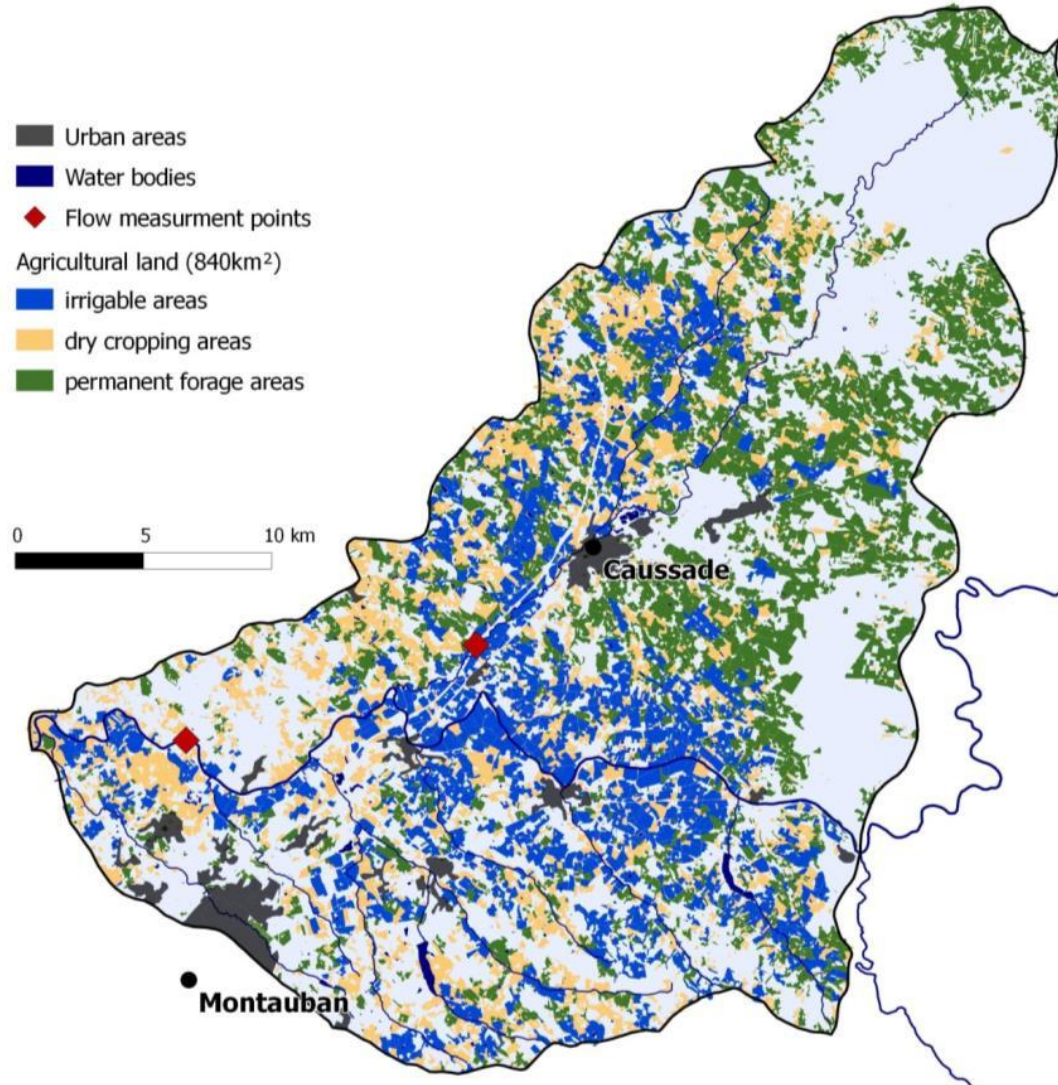
What agricultural practices for what performance at the catchment scale?

What are the impacts of soil cover in a catchment affected by water shortages?



Study Site

Irrigated catchment of downstream Aveyron



Main issues

- Water deficit
- Pollution
- Erosion

840 km²,
40 000 ha UAA,
1150 farms
18 000 fields
≈ 34 % irrigated



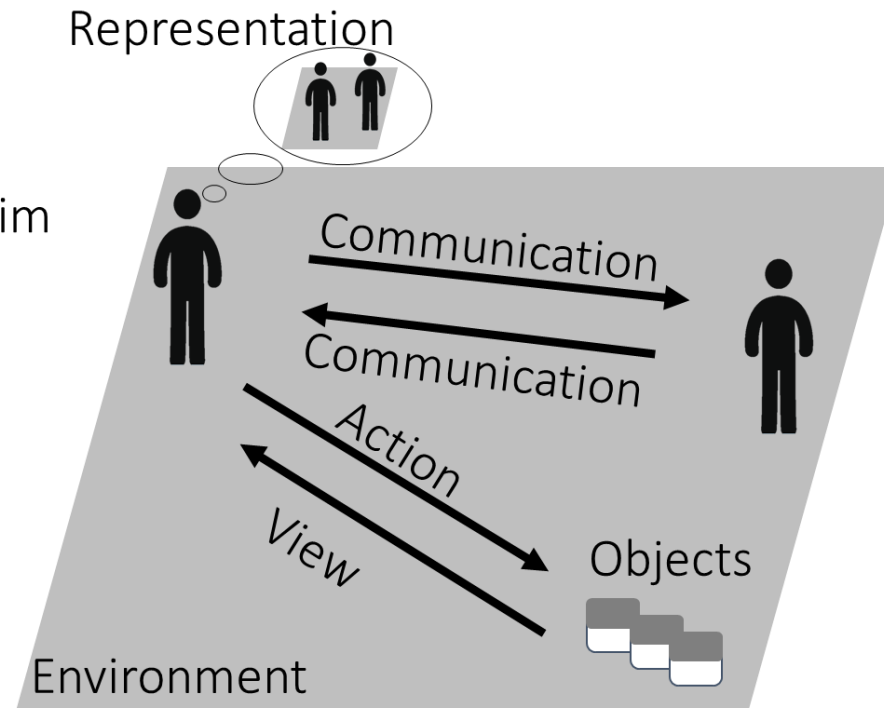
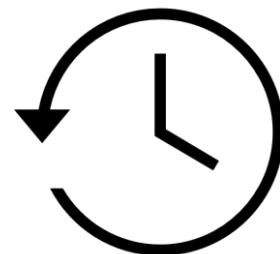
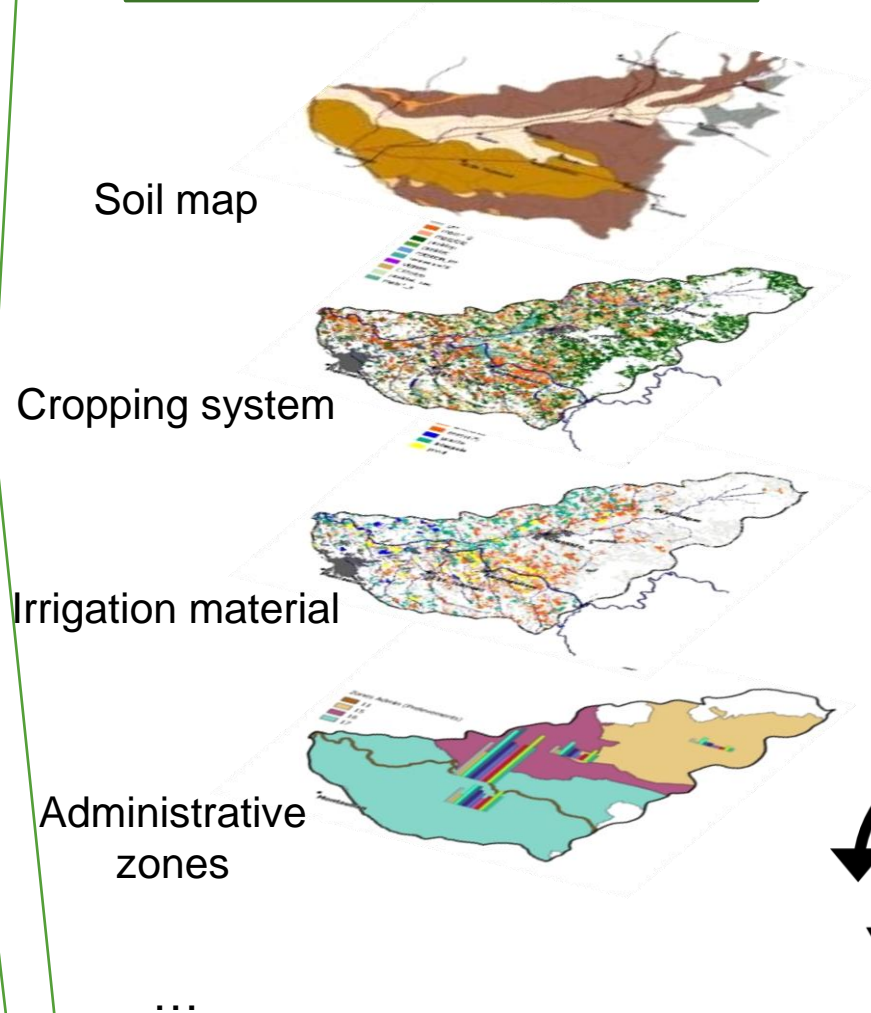
MAELIA

Modelling of socio-Agro-Ecological systems for Landscape Integrated Assessment



GIS
Description of system

Agent based System



Dynamics

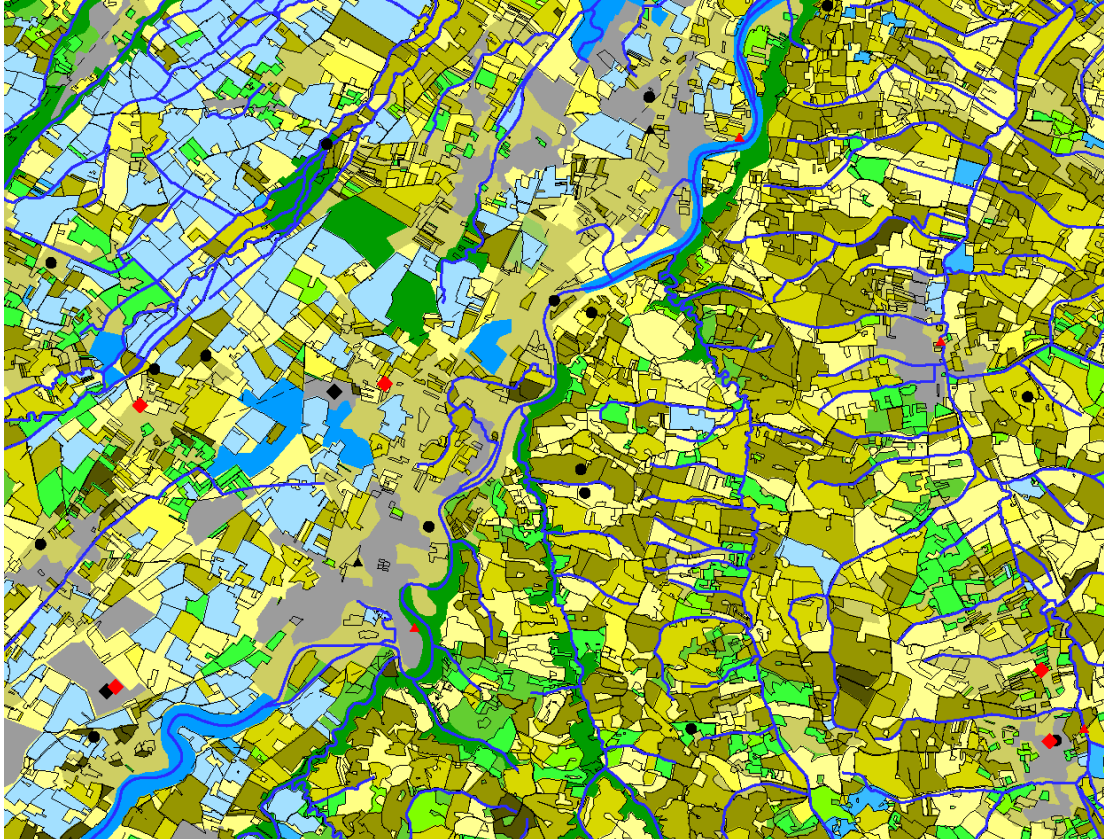


MAELIA

Modelling of socio-Agro-Ecological systems for Landscape Integrated Assessment



High resolution (plot)



Dynamics

Ecological processes

Crop model : AqYield

Hydrological model : SWAT ®

Decision-making processes

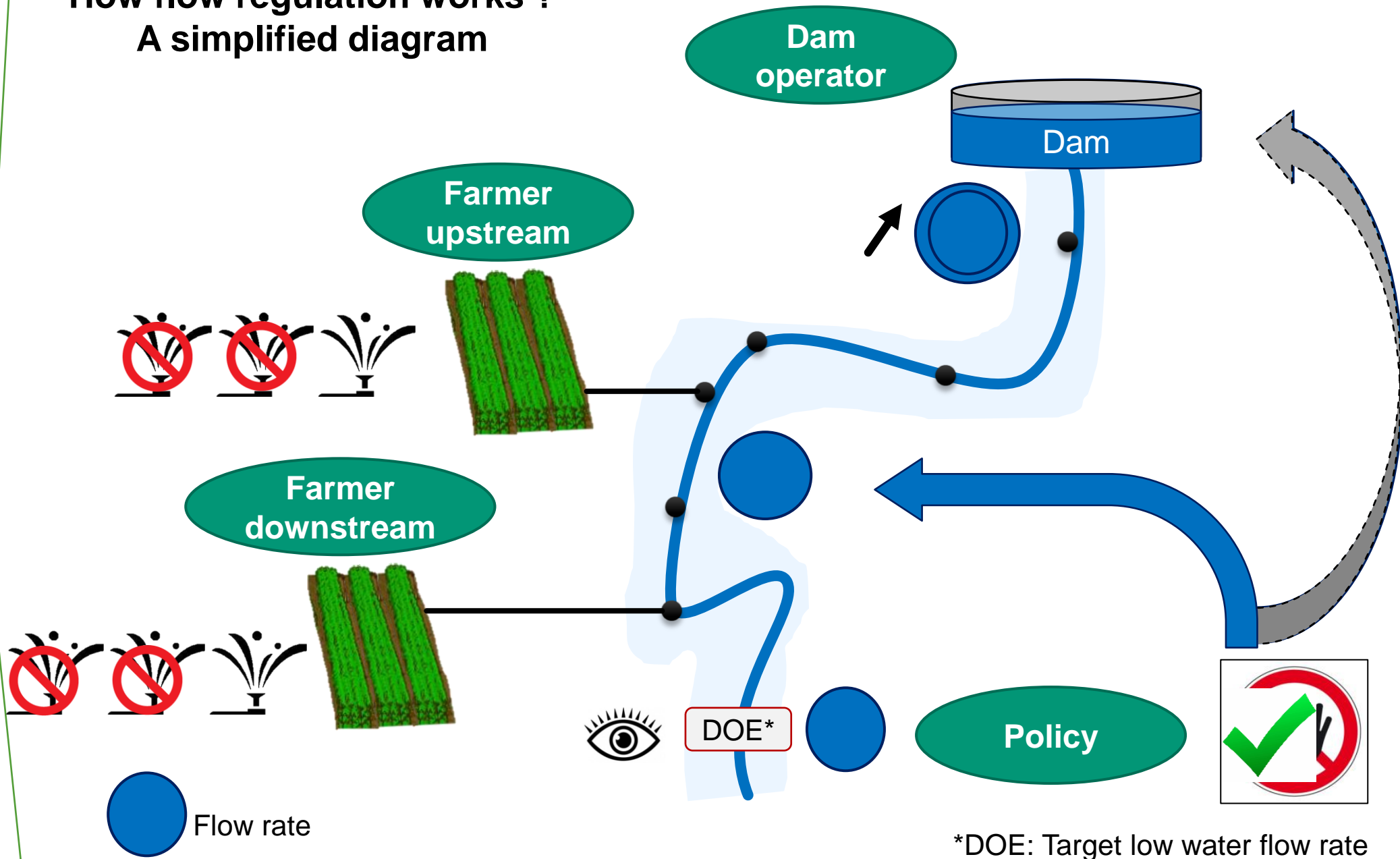
Farmer

Stakeholders

Water policy

MAELIA coordinator: Olivier Therond, INRA
Olivier.therond@inra.fr

How flow regulation works ? A simplified diagram



*DOE: Target low water flow rate



MAELIA

Modelling of socio-Agro-Ecological systems for Landscape Integrated Assessment



► Decision Making

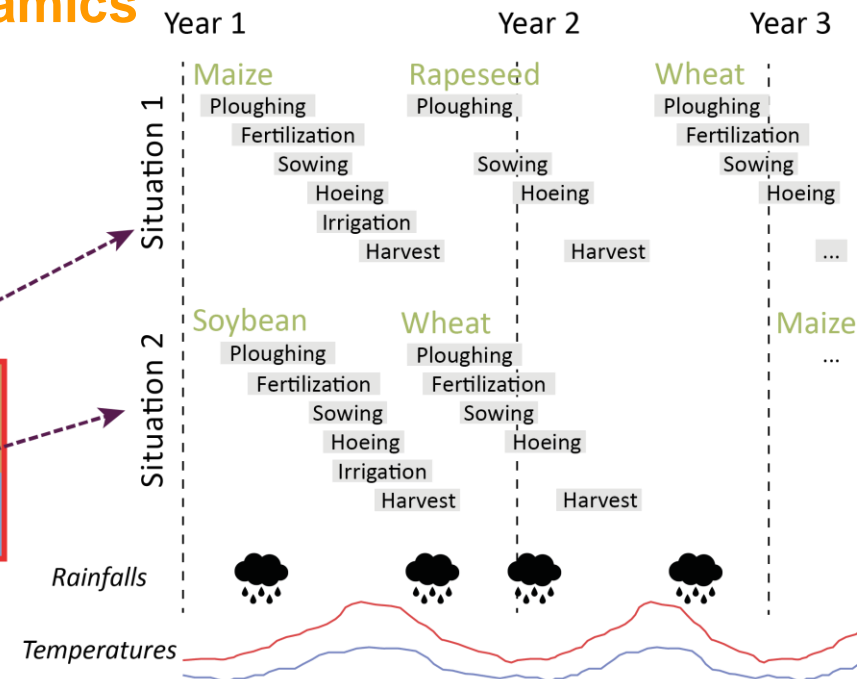
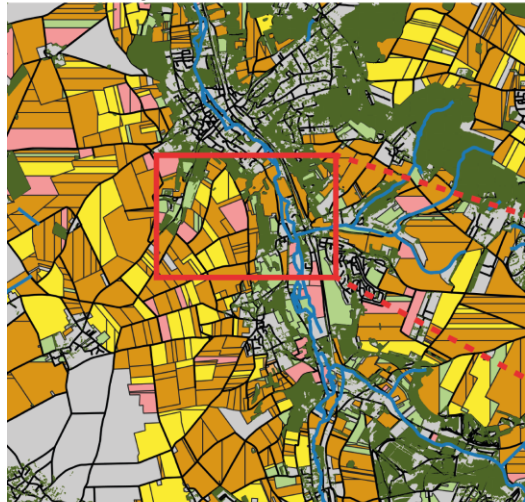
Decision rules for triggering of technical operations :

Heuristic decision rules (nested **IF THEN** rules)

➔ **IF** soil humidity < 0.8 & temperature >25C **THEN** harvest

► Each field → cropping system → own dynamics

Territory

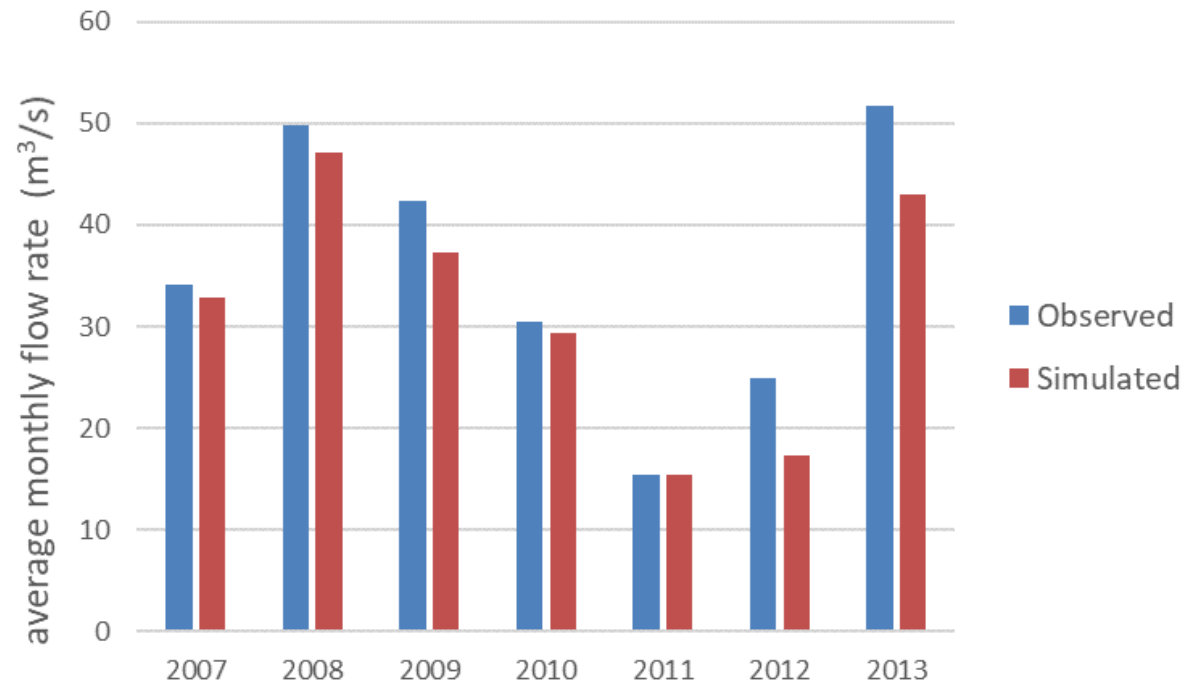


Set of scenarios



Benchmark

- Simulation of farm practices
- The Maelia platform is able to reproduce the behaviour of the stakeholders



Set of scenarios

Benchmark

Maximizing
irrigation efficiency



- BaU (current practices) + irrigation according to the plant's needs



Set of scenarios

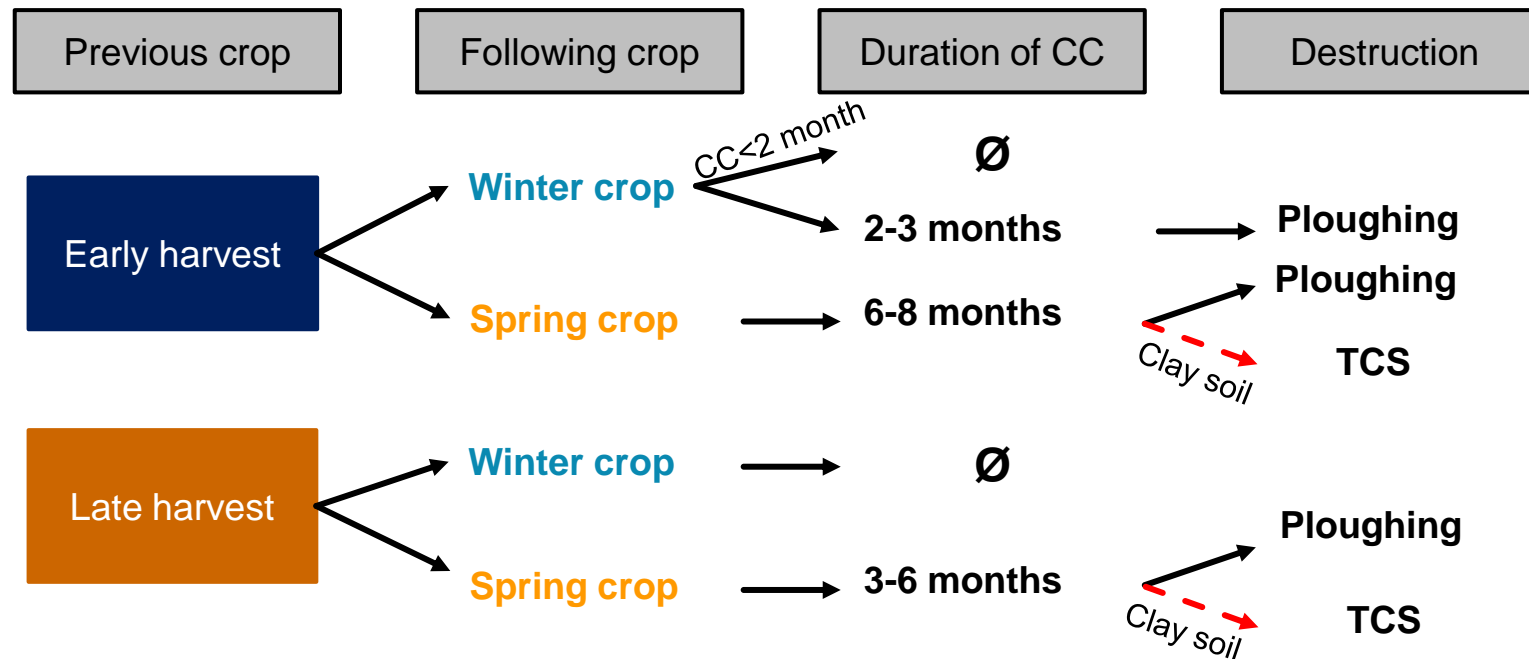


Benchmark

Maximizing irrigation efficiency

Cover crop (CC)

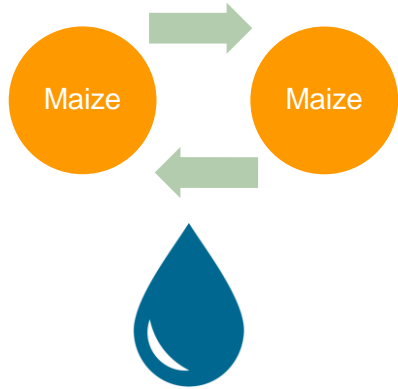
- Add cover crop according to the decision tree



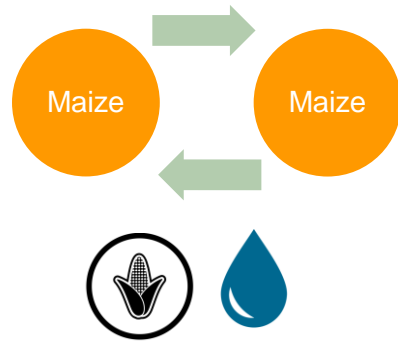
Set of scenarios



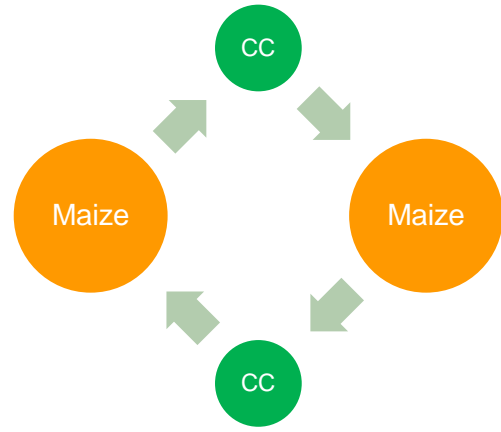
Benchmark



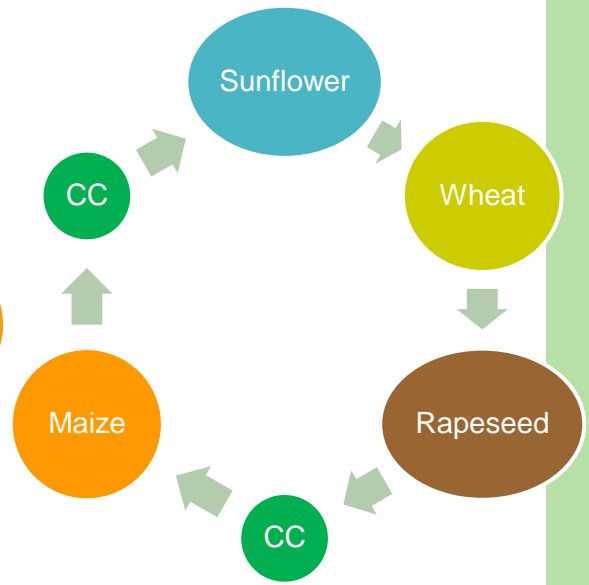
Maximizing irrigation efficiency



Cover crop (CC)

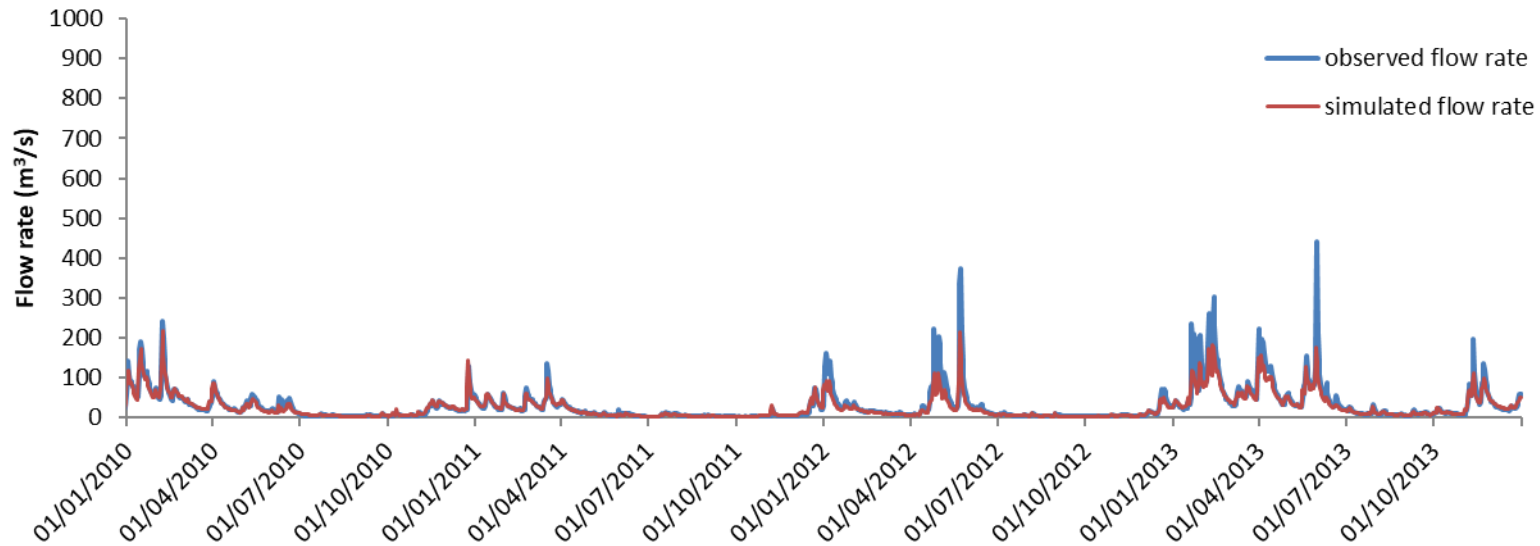
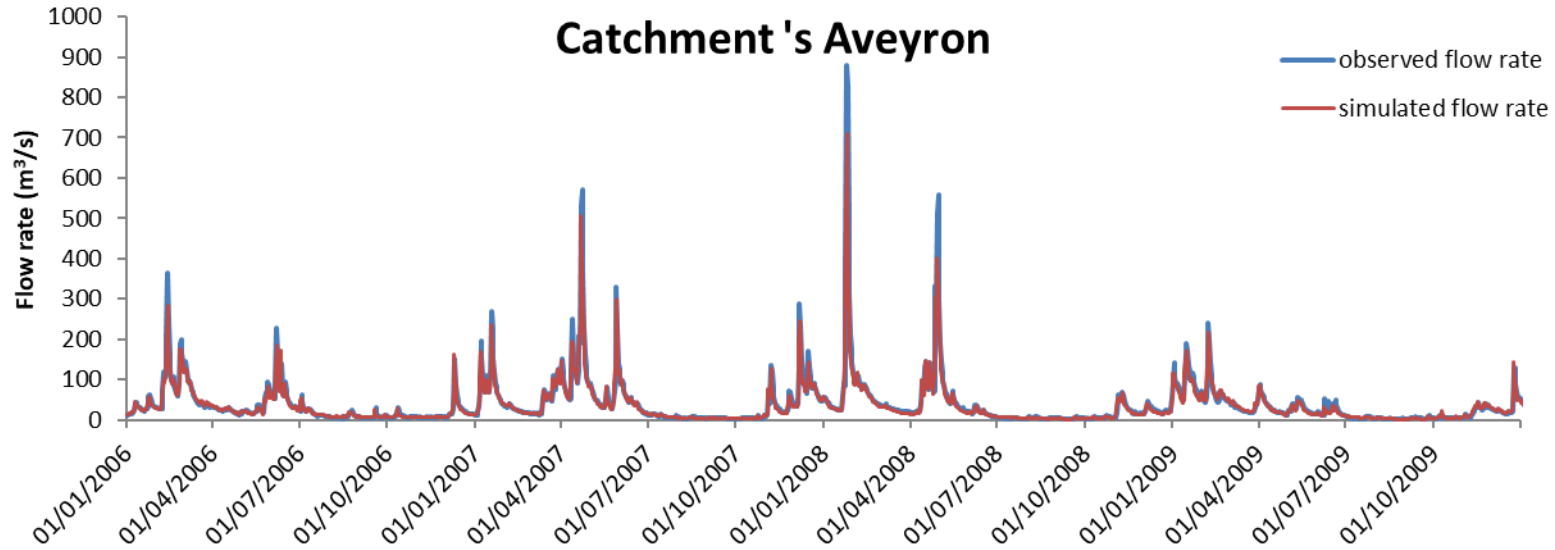


Rotation diversification



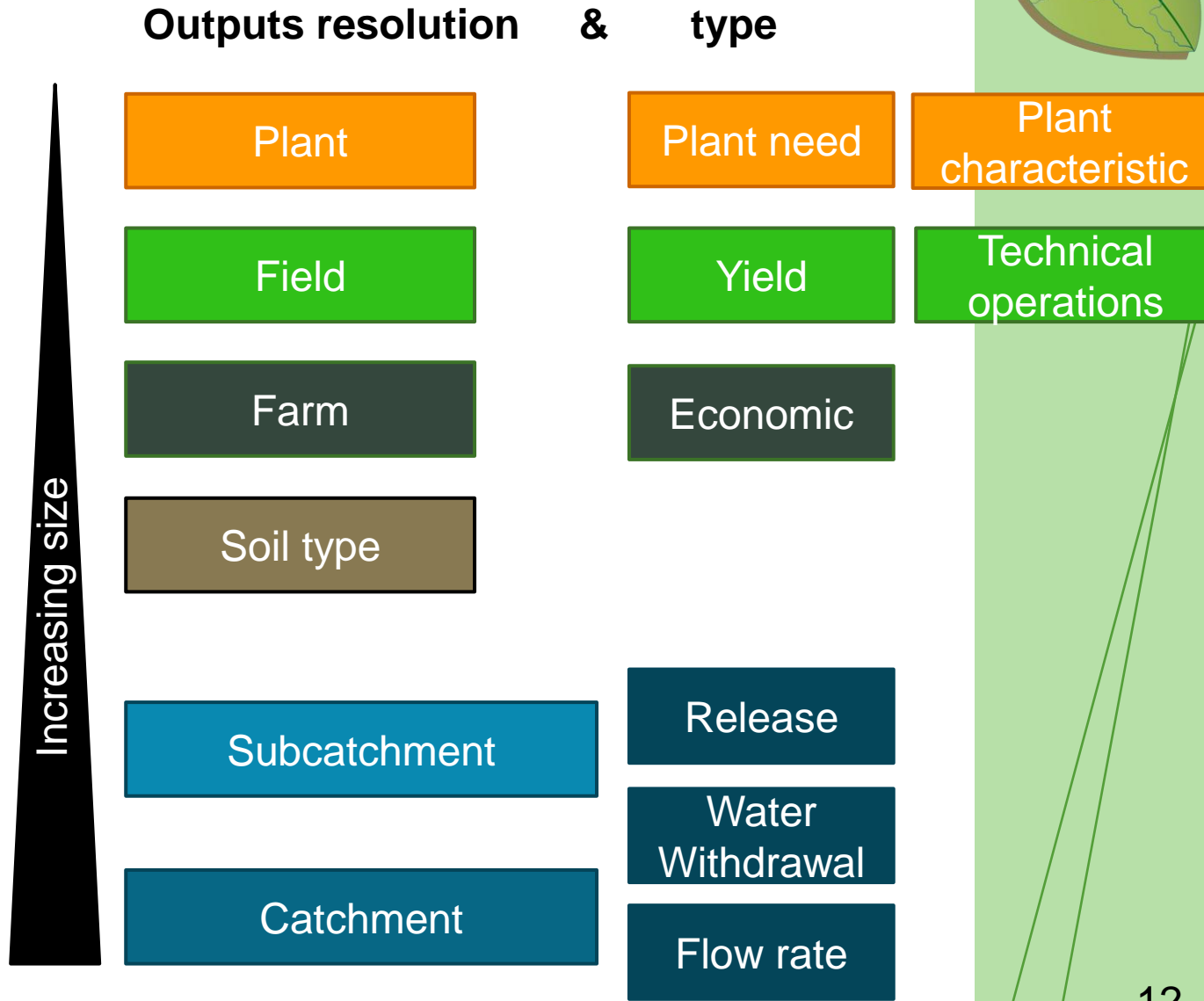
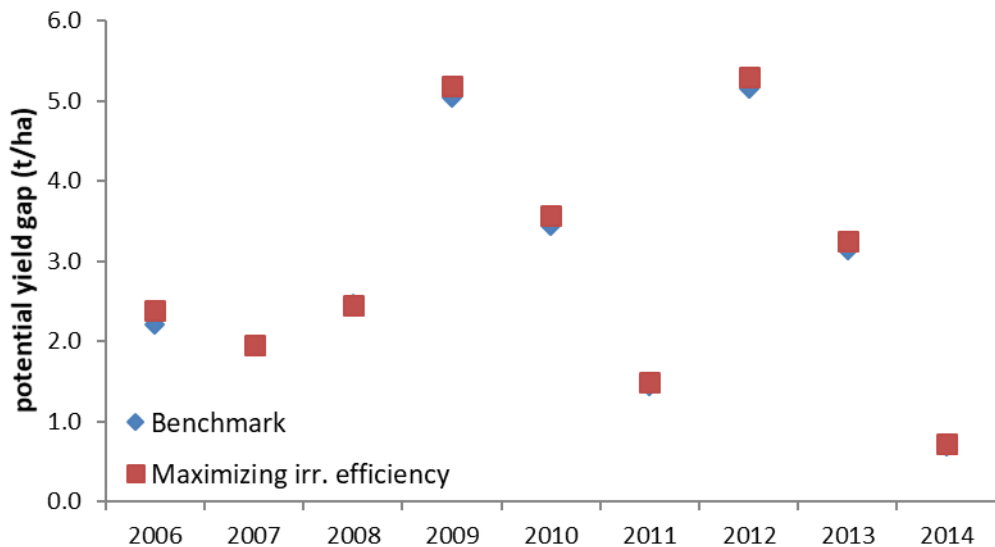
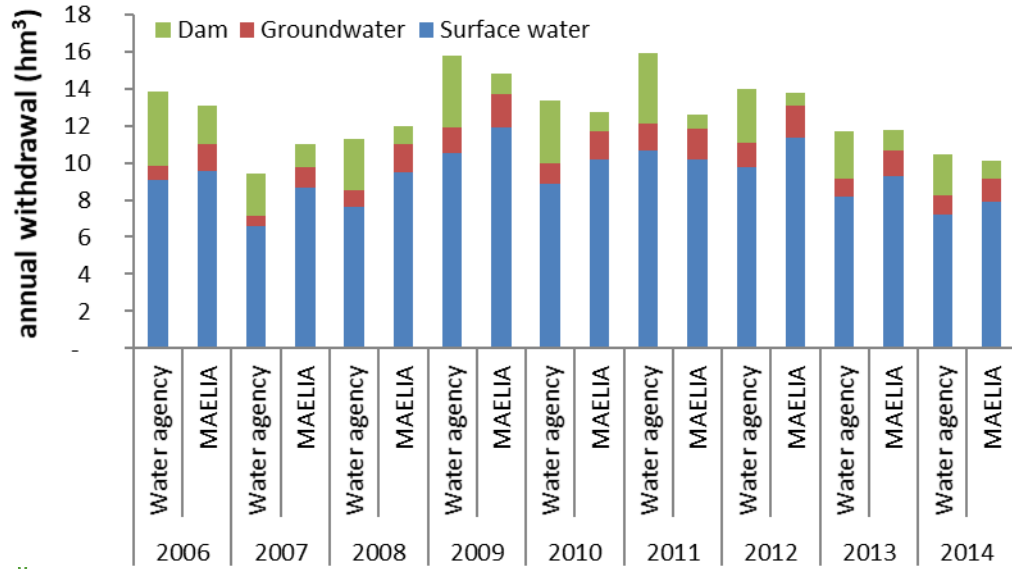


Analysed outputs : hydrological impacts of agricultural practices



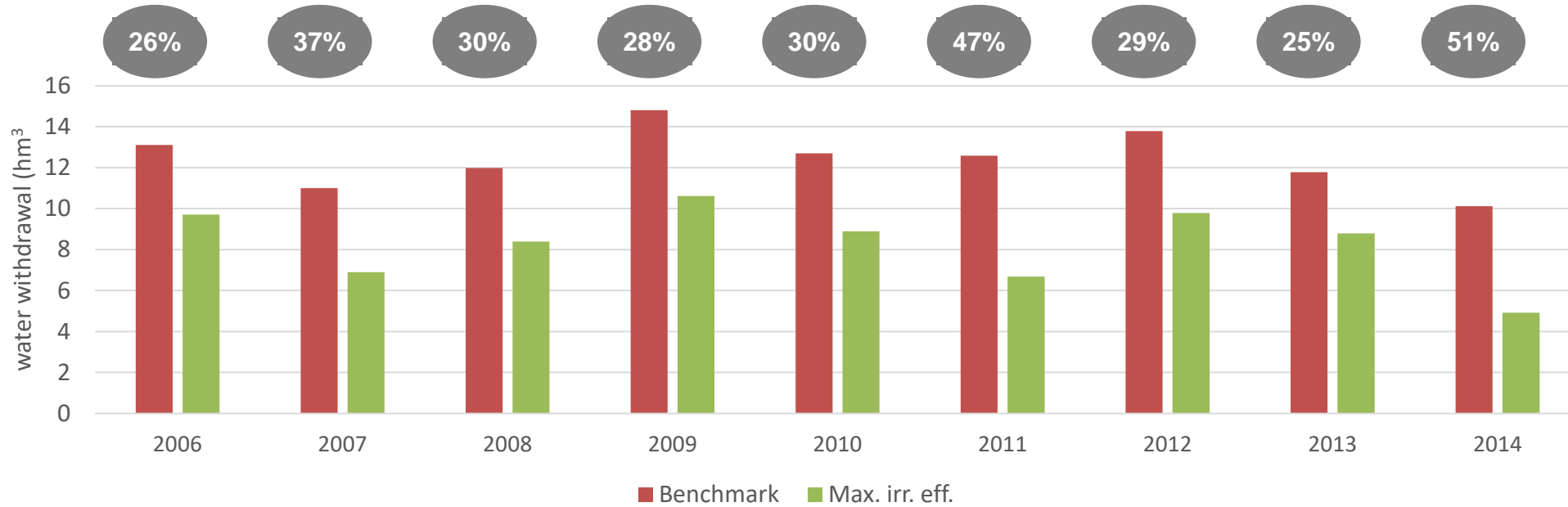


Outputs of Agricultural syst. : practices, yields, economics





Scenario : Irrigation optimisation



Difference of water withdrawal between Benchmark & maximizing irrigation efficiency scenarios

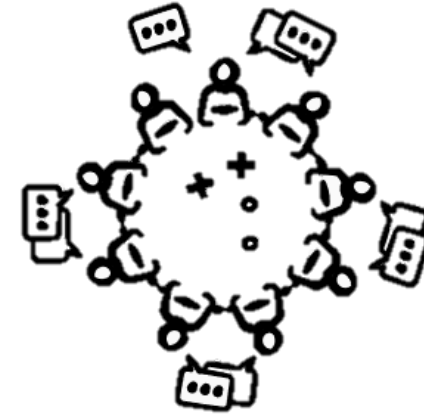
34%

Potential gain on total withdrawals through maximizing irrigation efficiency

Project perspectives

- ❖ Co-design of scenarios with experts
- ❖ Simulation for assessment on
 - water
 - soil and CC issues
- ❖ Water agency issue :

Should agro-ecological practices in deficit catchment be supported?



Thanks you for your attention

<http://maelia-platform.inra.fr>



• Les BIOS du Gers •
Le Groupement des Agriculteurs Biologiques et Biodynamiques



Conclusion perspectives of MAELIA toward an Integrated Assessment and Modelling of agricultural landscape

