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Environmental impacts of agricultural practices and Water and Soil Conservation Works : The case of the Merguellil catchment

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Introduction

Olive oil

- **At the global scale** : ➔ the continuous price increase (+ 26% between 2014 and 2015)
- **At national scale : Tunisia**

In 2015 : - Sales of olive oil reached about **800 million euros**

- the harvest of **340 thousand tons**.

- **Importance of this sector to the national economy**

Political factors
+
Terrorist attacks
↓
The decline in market services and the industrial sector

→ Economic growth was limited to 0.8%

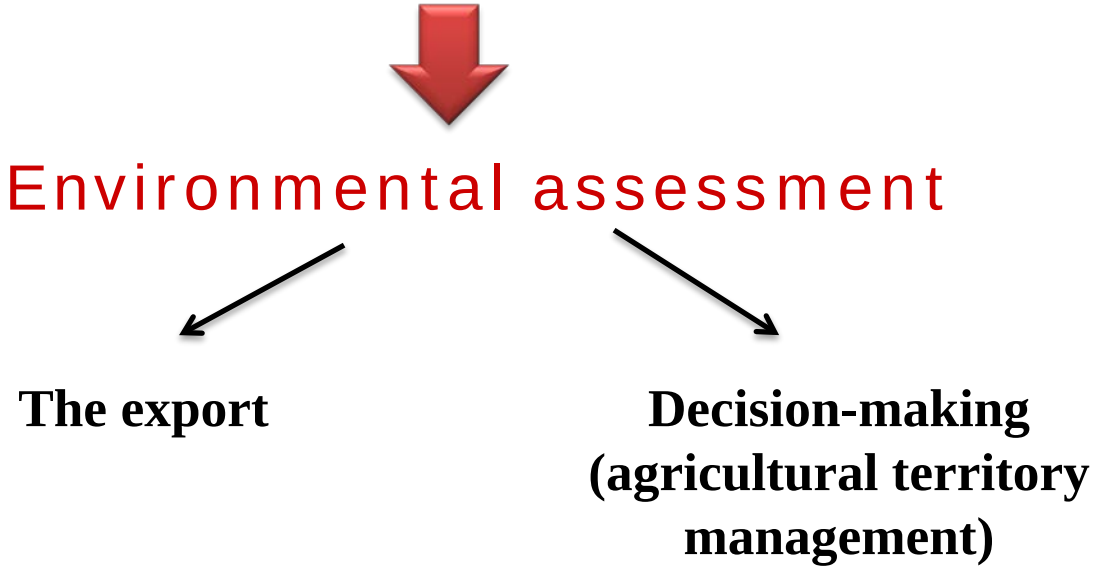
Positive thanks to the vitality of the agricultural sector
↓
An increase of 9.2% in relation to the harvest of olive oil

(Final report of central banck of Tunisia, 2015)

In Tunisia :

-Number of trees = 70 million
- Area = 1.7 million ha
- The density :

- 100 trees per ha in the North.
- 50 to 60 trees per hectare in the Center-East and West.
- 20 trees per hectare in the South.



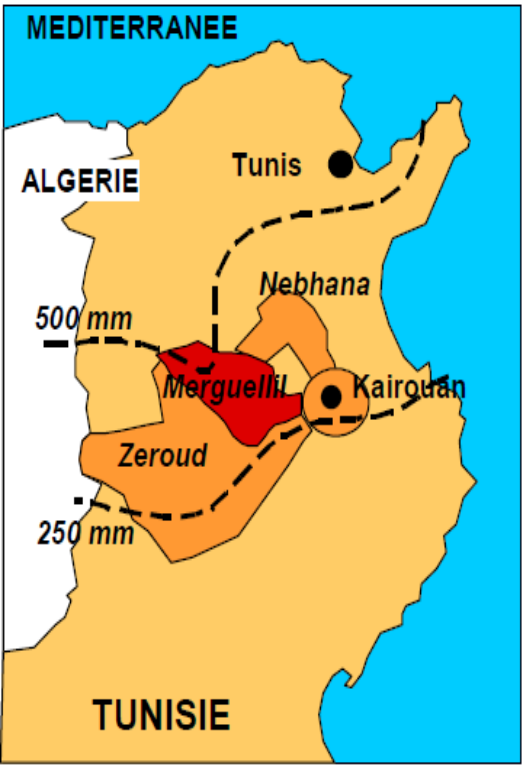
Semi-arid

Issues - “Water and Soil" resources fragile and overused

Intensive irrigated farming sytem

Water and Soil Conservation Works

Upstream of Merguellil watershed



(Cudennec et al., 2004)

Houareb dam

(Massuel S., 2013)

Overuse of aquifers

What are Water and Soil Conservation Works ?

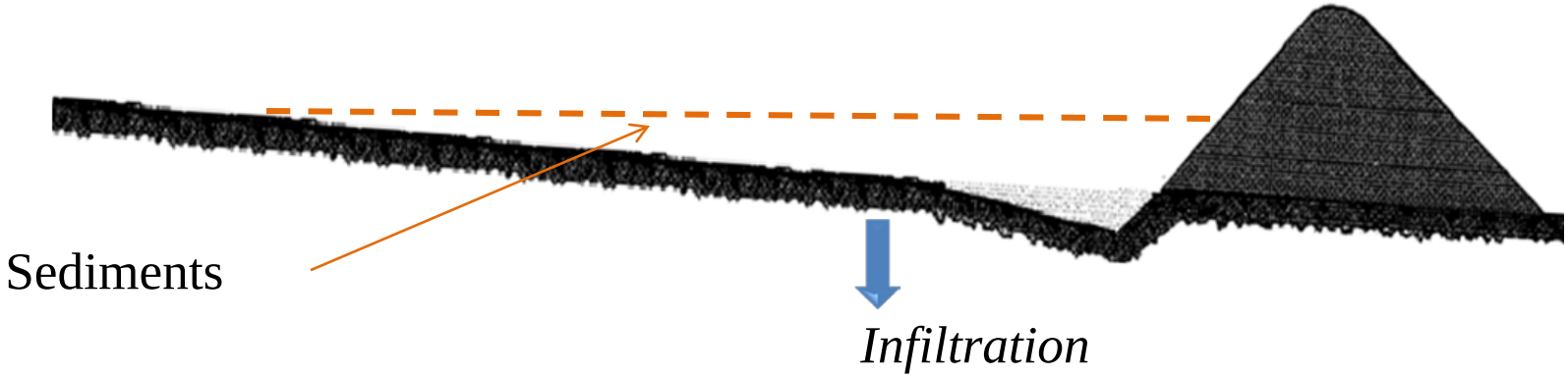
Contour ridges

Terraces

Hillside reservoirs

Gabion

The contour ridges



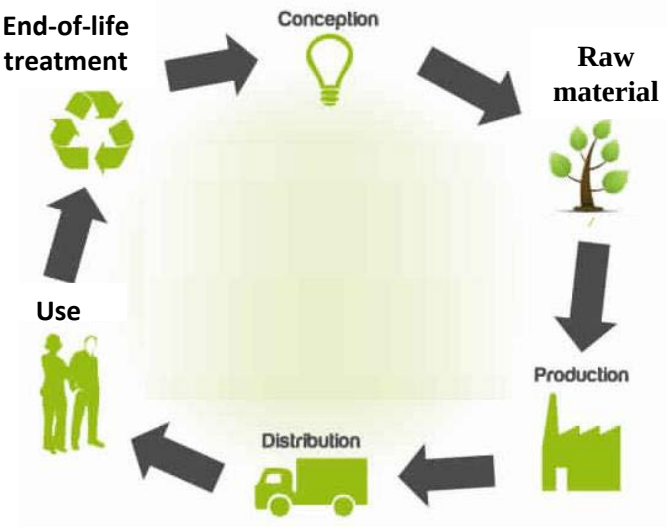
Objectives of the contour ridges :

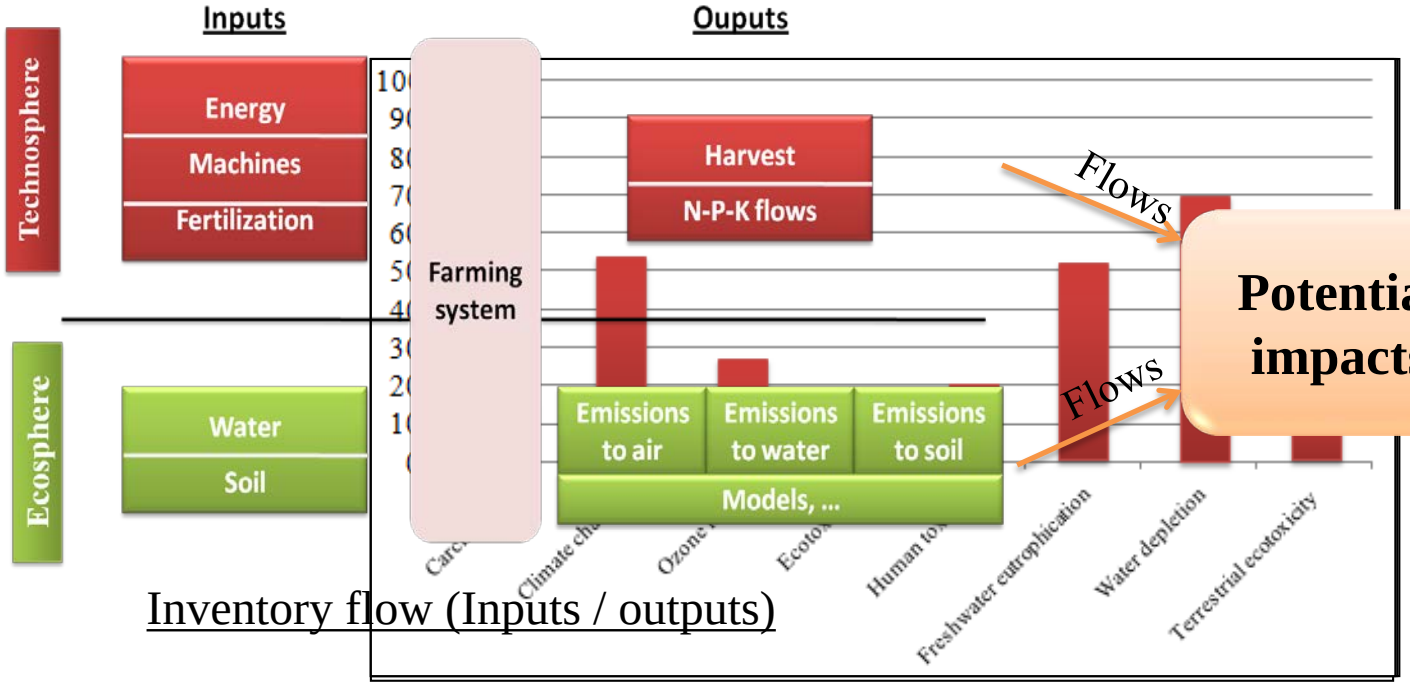
- Protect against erosion and soil quality degradation.
- Increase local infiltration and recharge of the aquifer.

What is Life Cycle Assessment (LCA) ?

- Global approach
- Evaluate potential impacts

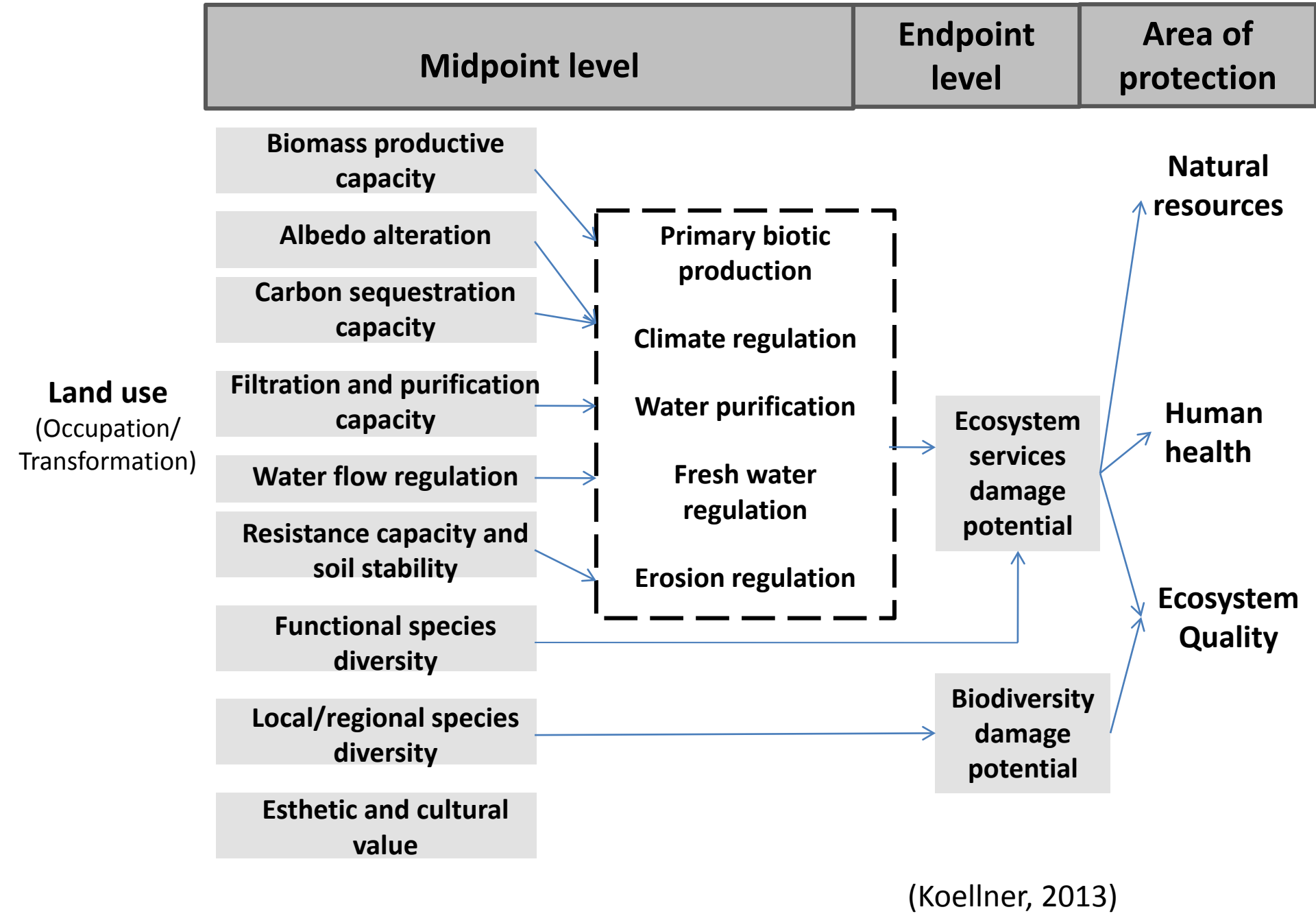
« **From cradle to grave** »





-Climate change
- Eutrophication
- Ecotoxicity,
- Water depletion

Inventory flow (Inputs / outputs)



(Koellner, 2013)

Objectives of the study

Environmental assessment by LCA :
- of farming systems
- In a semi-arid territory (Merguelil, Tunisia)
- with few data available
- with water & soil conservation works (contour ridges)

How to realize an LCA of farming systems with a limited availability of data (case of southern countries)?

Can we use the results of LCA into decision making?

Strategy

Combine

LCA

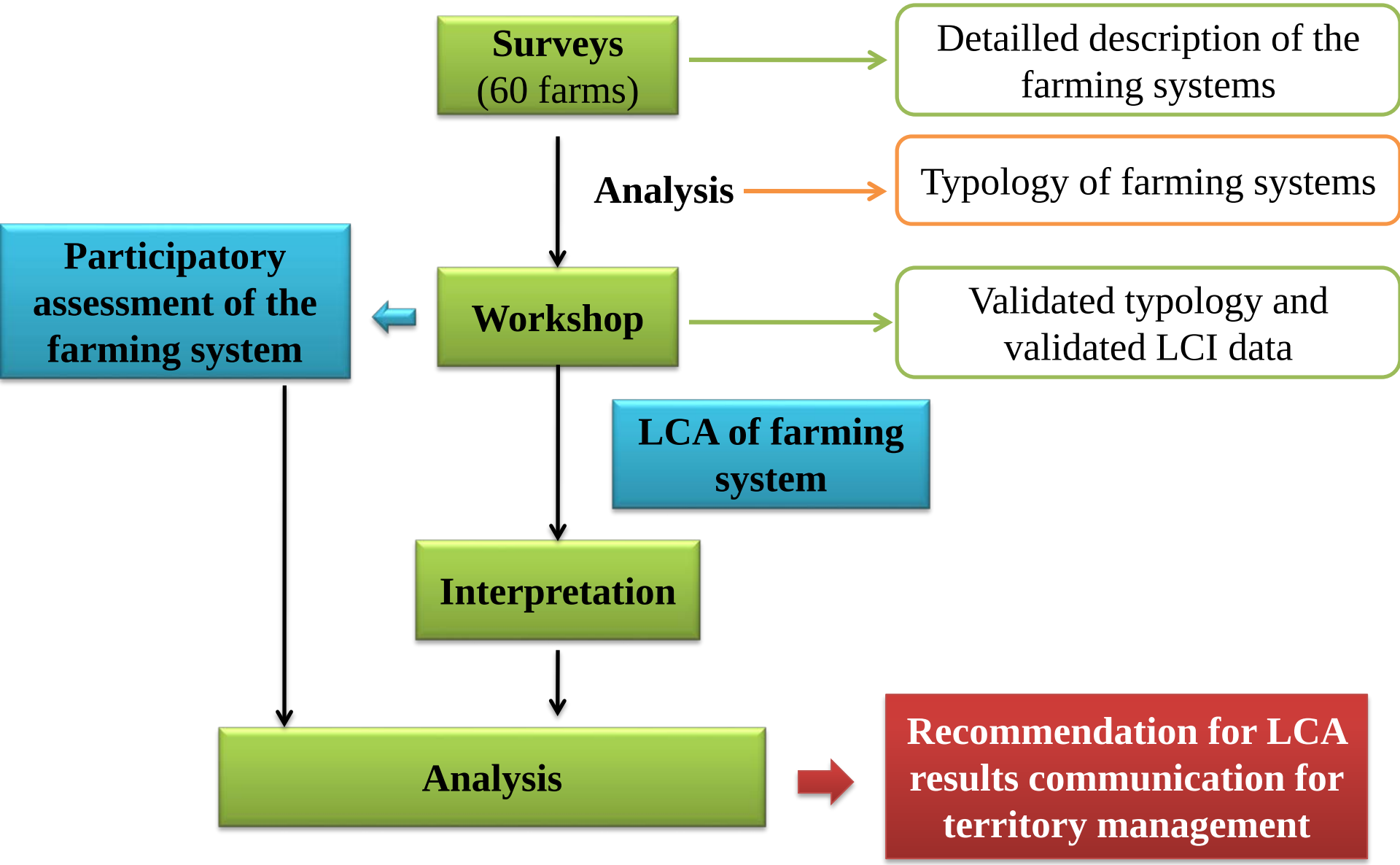
+

Participatory approach

(Surveys + participatory workshops)

With all stakeholders

- Methodology -



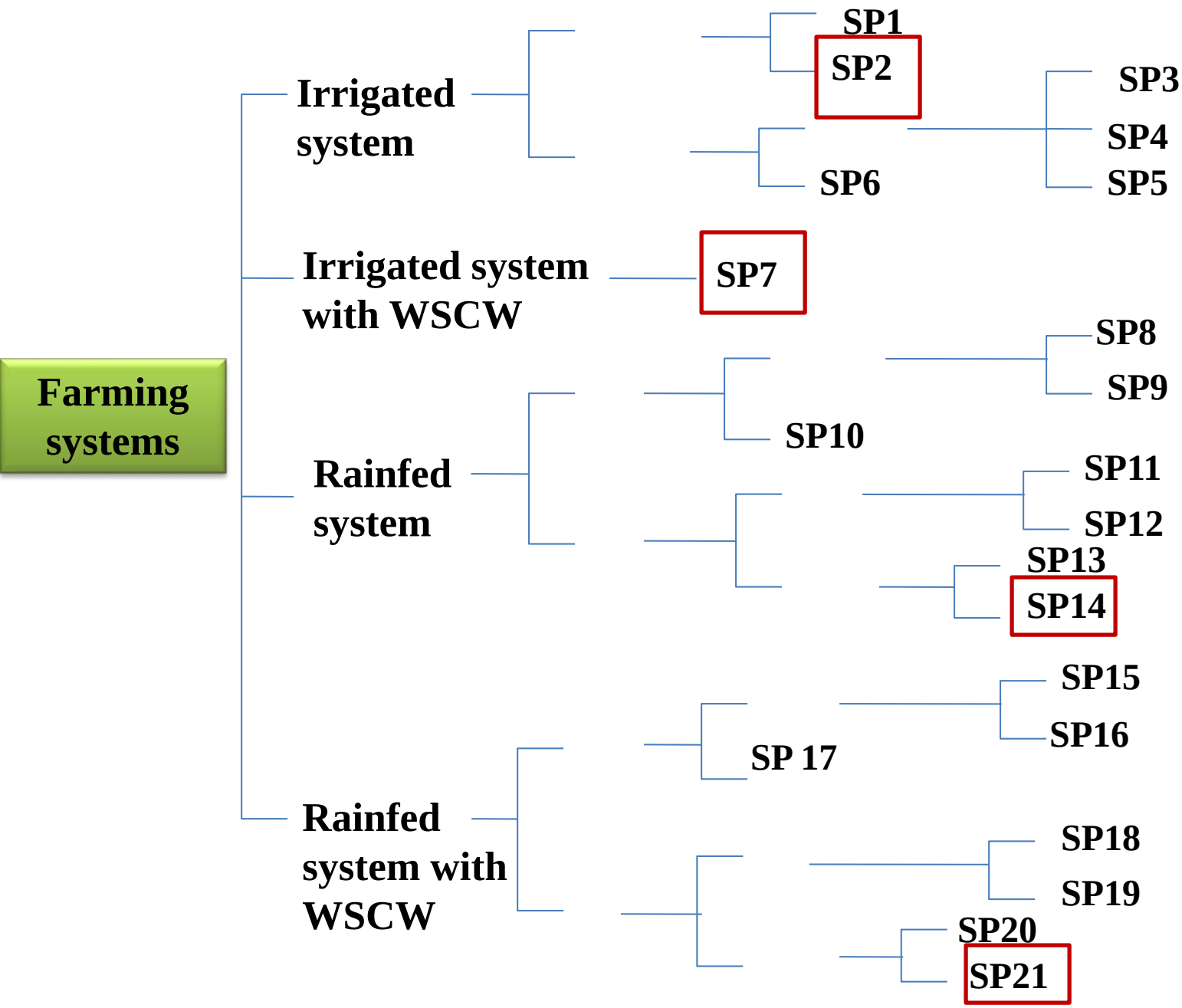
Part 1
Participatory diagnosis of the territory
- Typology of farming systems
- The territory functioning

	Irrigated olive	Rainfed olive
Crop system	Polyculture (associeted to abricot)	Monoculture
Production (kg olive per ha)	9282	2142
Oil yield (litre per ha)	1061	816
Farm practices	-Organic fertilizer -Mineral fertilizer - Tillage - Irrigation	-No intarant - Tillage
WSCW	Irrigation system	- Very widespread

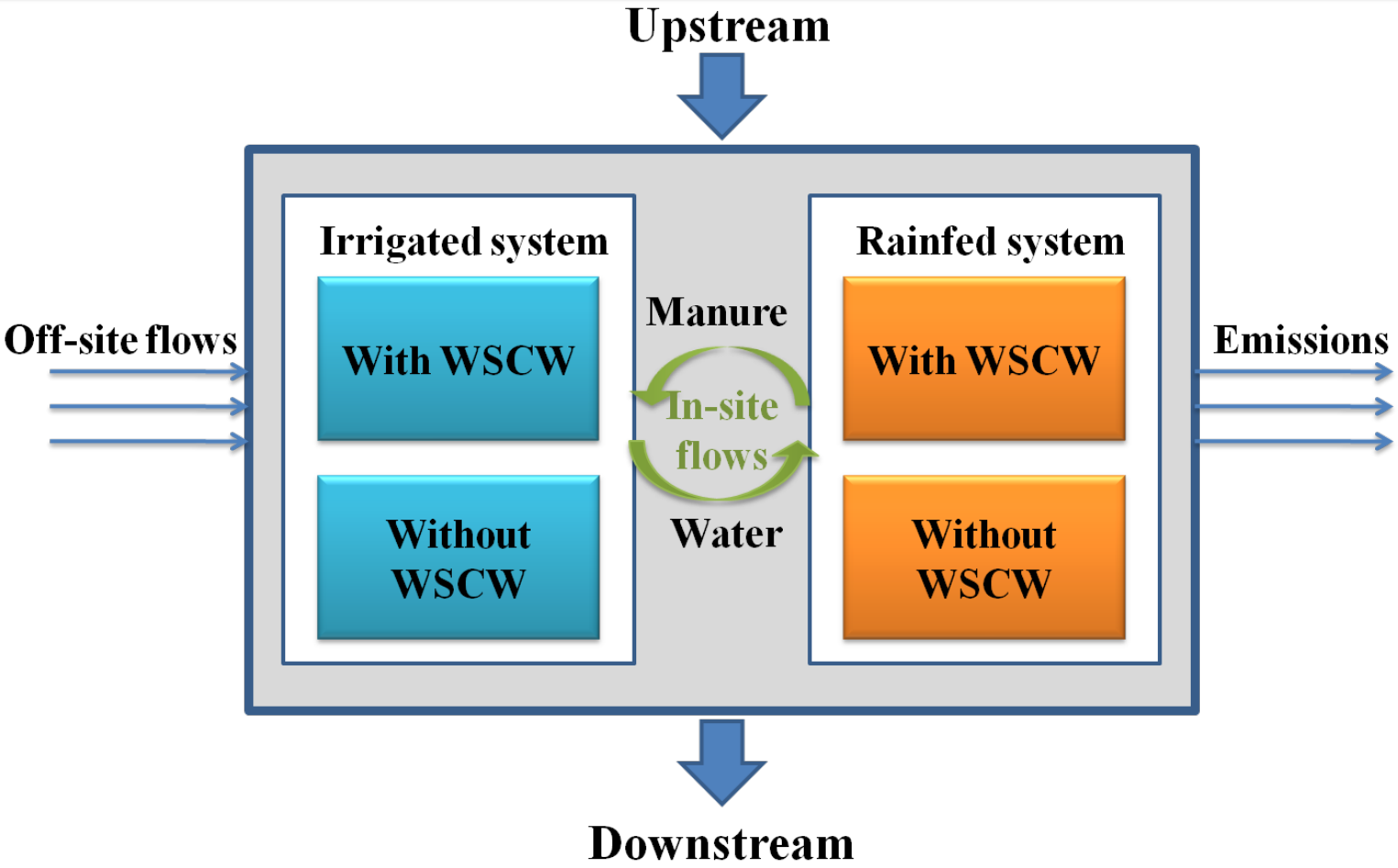
- **Characteristics of the apricot :**

  - Cultivate only in irrigated
  - Local market
  - Requires a lot of agricultural practices
  - Culture sensitive to lack of water

1. Typology of farming systems



▪ The territory functioning : Conceptual model of the territory compliant with LCA



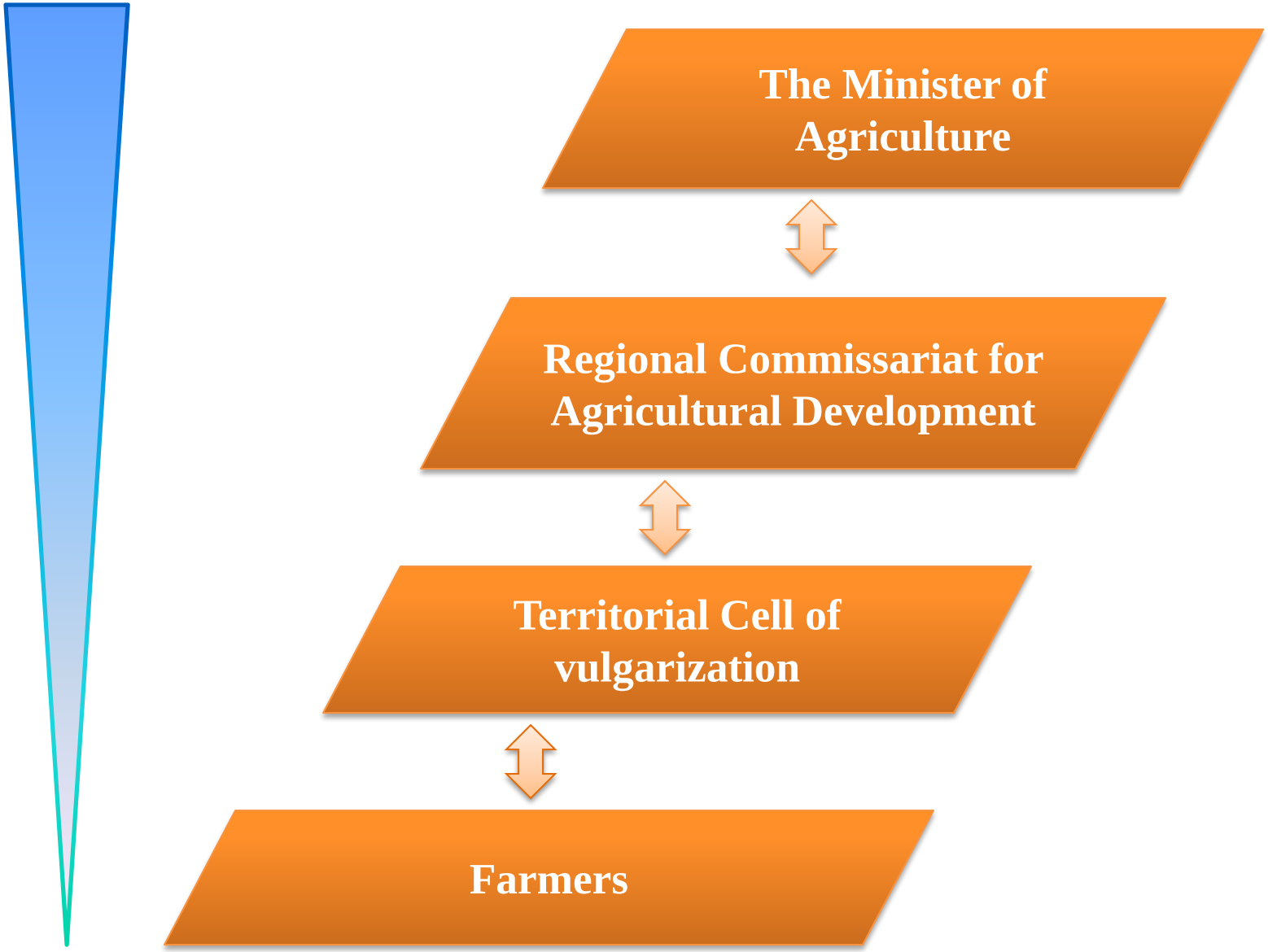
Off-site flows (outside the territory) : flows associated to machinery, external inputs and diesel production.

In-Site flows (inside the territory) : flows associated to the use of machinery and inputs and the production of internal inputs.

Part 2
Environmental assessment of farming systems
- Participatory assessment with stakeholders
- Environmental Assessment by LCA

Participatory assessment with stakeholders

Les différents catégories d'acteurs intervenant au niveau du territoire :



▪ Participatory assessment with stakeholders

Workshop 1 | **Workshop 2** | **Workshop 3** | **Workshop 4**

Local stakeholders (farmers)

Local stakeholders (Territorial Cell)

Regional stakeholders

National stakeholders (Ministries of Agriculture)

Workshop 5

	Positive impacts	Negative impacts
Irrigated system	Better living standards	Large amount of inputs.
Irrigated system with WSCW	Better living standards Less water withdrawals (irrigation with basins)	Large amount of inputs Ridge contours are obstacles for tillage (the cost)
Rainfed system	Manure production Very few inputs	Requires a lot of tillage Erosion Low efficiency
Rainfed system with WSCW	Water and sediment retention Manure production Very few inputs	Ridge contours are obstacles for tillage (the cost) Limited sediment and water downstream flows Low efficiency

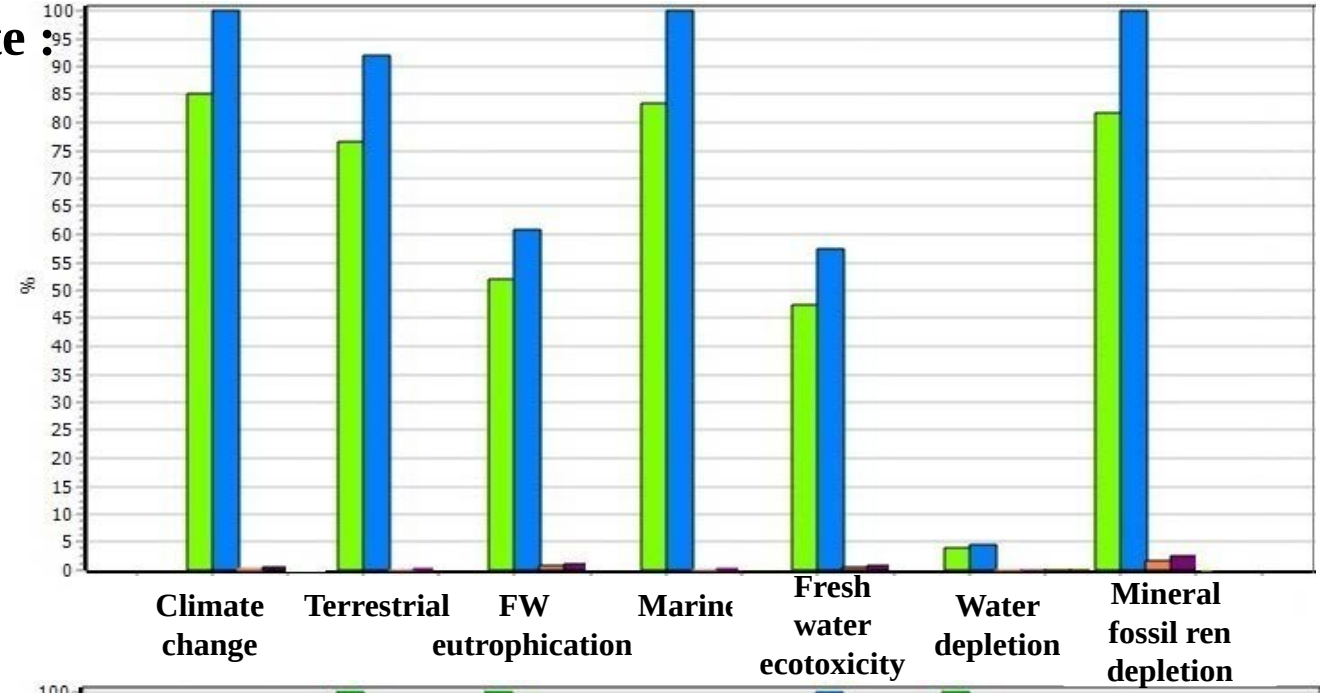
▪ Environmental Assessment of farming systems by LCA

System boundaries : **from crop installation to farm gate.**
Functional unit : 1 ha
ILCD method
Midpoints :

- Climate change,
- Eutrophication,
- Ecotoxicity,
- Water depletion
- Mineral, fossil and renewable resources depletion

In-site and off-site comparison

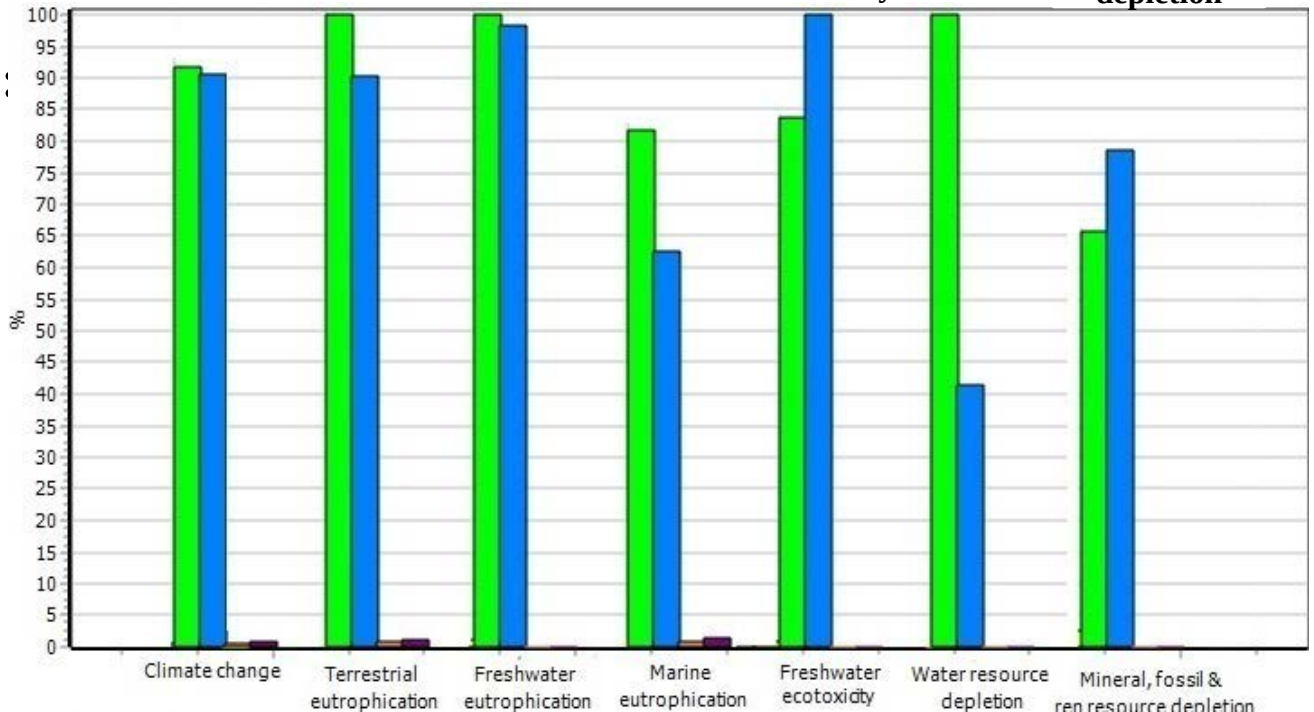
Off-site :



Legend :

- Irrigated system without WSCW
- Irrigated system with WSCW
- Rainfed system without WSCW
- Irrigated system with WSCW

In-site :



How to realize an LCA of farming systems with a limited availability of data (case of southern countries)?

- Developed methodology based on participatory approach.
  - Important field surveys work.
  - Validation with stakeholders is a very important step.

How to use the results of LCA into decision making?

- Need of links between LCA results and stakeholder perception.
- Need to integrate positive impacts of WSCW : local and spatialized assessment is required