ALTOS KoF meeting

Task4.1

SETTING UP SCENARIOS

October 26, 2020

Sections of the Task 4.1	
Listing of existing scenarios (realistic about land use and irrigation conversion)	All partners except IRTA and UNICA
Designing exploratory scenarios about reservoir geometry and density	
Designing new scenarios (realistic about chemical treatments, benches, land use and irrigation)	
Mixing basic scenarios	

Contributions received:

LISAH: hilly lake geometry / density and chemical treatments within Cap Bon study site,

INRGREF: land use and crop rotation within Cap Bon study site,

UCA-CESBIO: Irrigation scenarios within Tensift Catchment.

INAT: Bench modulation within Merguellil,

CESBIO and **INAT**: Land use scenarios within Merguellil as AMETHYST project outcomes,

Scenario design / LISAH

Objectives: proposing exploratory for scenarios for lake network, and realistic scenarios for land use, for (possibly) crop rotation and for chemical treatment ; possibly crossing scenarios between lake network, land use and crop rotation.

Method: for land use, accounting for general trends to be locally declined in accordance to biophysical (topography, pedological substratum) and socioeconomical drivers (farm size and property); for crop rotation, modelling the combination of individual and collective rules; for lake network, accounting for hydrographical network.

Scenario design / LISAH

Table 1.6: overview of scenario impacts along with the involved partners. WUE stands for water use efficiency.

Site	Partners	Modelling schemes	Structures to be modulated						Services				
			Land use	Reservoirs	Benches	Irrigation	Pest management	Climate	Yield & WUE	Catchment outflow	Aquifer refill	Silting	Mitigating pollution
Cap Bon	INRGREF LISAH INAT	MHYDAS & Crop model	X	X				X	X	X	X		
		SWAT	X				X	X	X	X	X	X	X

Scenario design / LISAH

Means

- Available land use scenarios from ALMIRA : for each of the 3 scenarios with global composition --> one local constitution

Partnership

- INRGREF, INAT

Scenario design / LISAH

Roadmap

- Land use : for each of the three global compositions --> several local constitution --> feasibility?
- Crop rotation : to be defined
- Pollutant : from existing land use scenarios to pesticide practice scenarios
- Various mixes to be defined.

Scenario design / LISAH

Difficulties

- Difficulty to brainstorm internally at LISAH because of the confinement and individual situation of many of the key colleagues in the project.
- Risk of rushing into action on the wrong track.
- If brainstorming with only a few people, risk of non-adherence/ incomprehension of others about the choices made.
- Postponement of the brainstorm until the resumption of activities (May-June?).
- Means postponing the recruitment of the post doc until the beginning of the school year at best, probably in the autumn.

Managing water ressources within Mediterranean agrosystems bu accounting for spatial structures and connectivities - ALTOS

KOM ALTOS-Tunisie

Actions prévues par INRGREF & collaborations

WP4: Task 4.1: Crops distribution evolution scenarios

April 20-21, 2020

Landscape evolution scenarios: projections 2040
ANR TRANSMED ALMIRA

In **Agroforestry** scenario, a large part of the crops in marginal areas is transformed into a mixture of arboriculture (fig, olive, carob, acacia) or aromatic or medicinal plants (thyme, rosemary, lavender) in association with cereal and legume crops.

In **Livestock and fodder crop extension** scenario, the region is betting on the development of meat food, with sheep meat being exported. Agricultural land is transformed into forage crops on clay soils. Part of the agricultural land is transformed into grazing areas.

In **Intensification of food legumes and cereals** scenario, the exploitation of food and cereal leguminous crops, located mainly on clay soils with steep slopes, as well as market gardening by pumping, is on the rise. The breeding is gradually abandoned.

Validated

Workshops with stakeholders

Landscape evolution scenarios: projections 2040
ANR TRANSMED ALMIRA

The LUCC model to translate the narrative scenarios in spatially explicit maps is based on one function applied directly at polygon (or farm field) grain:

The set of land uses selected for diffusion is based on expert knowledge. There is a **constraint map** for each land use, calculated on a spatial combination of geomorphological and soil characteristics variables and distance maps.

The **transition function** between land uses based on a transition matrix at the annual time step: Each year, the land use of each polygon (or farm field) of the watershed changes according to a probability given by a **transition matrix.**

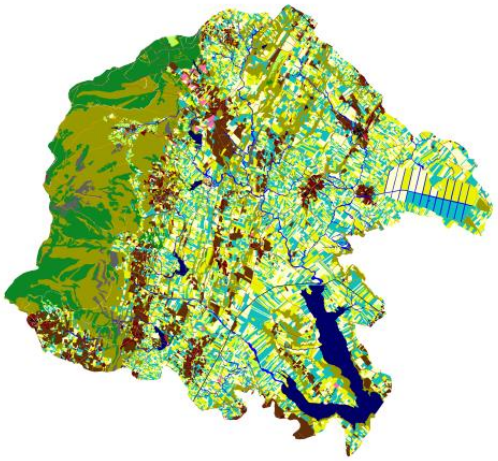
The transition and **diffusion functions** are finely estimated a priori at the annual time step to obtain, at the end of the simulation, the frequency tables from narrative scenarios aggregated at the watershed level.

Landscape evolution scenarios: projections 2040
ANR TRANSMED ALMIRA

- ✓ **<u>Calibration of the land use model</u>** : Use of BV Kamech for BV Lebna
  - ✓ Optimal use of surveys conducted with farmers and instituions within BV.
- ✓ **Workshops**
  - ➢ Present, debate, qualitative evaluation of landscape evolution scenarios with stakeholders

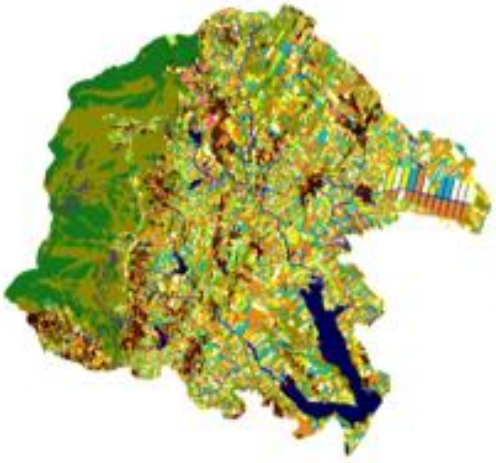
Landscape evolution scenarios: projections 2040
ANR TRANSMED ALMIRA

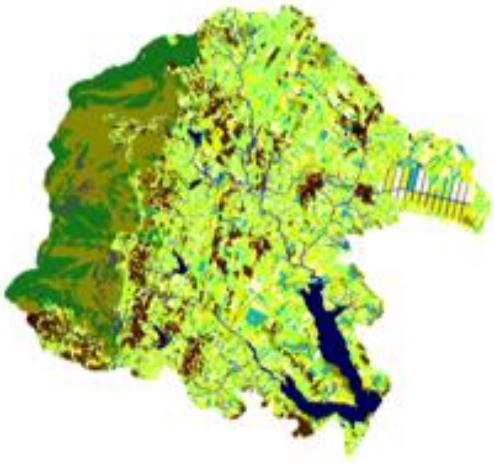
2015

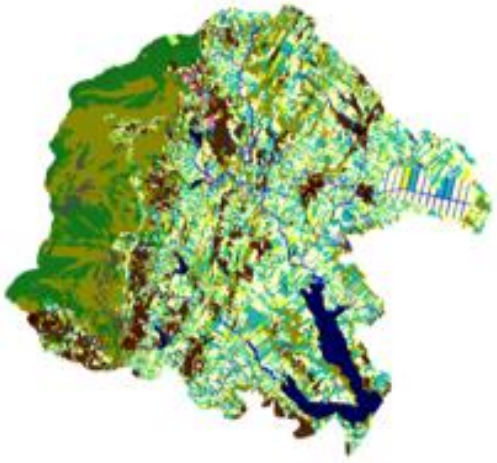


Agroforestr **Livestock and fodder** **Food legumes and**

2040







WP4: Task 4.1 : Realistic crop distribution scenarios

Take into account the spatial distribution of annual crops into aggregates of fields with the same crop type.

WP4: Task 4.1 : Realistic crop distribution scenarios

Objectif

We explored, in the context of the Lebna catchment, the decisions made by farmers about annual crop allocation within the collective contexts in which farmers operate.

Travaux 2015-2019 (LMI Naila, ANR ALMIRA)

- Characterization of landscape mosaics at the scale of watershed
- PhD (ARTS scholarship)
  - Crop allocation drivers at the field level
  - 2018-2019
  - Land tenure evolution

WP4: Task 4.1 : Realistic crop distribution scenarios

3 approaches:

1. Identification of crops clusters classified according to crops successions and individual/collective crop allocation rules (geostatsical)

2. Identification of physical linear elements of the landscape impacting the crops clusters

3. Individual or collective interviews collectives of actors to validate the identified crops distribution rules

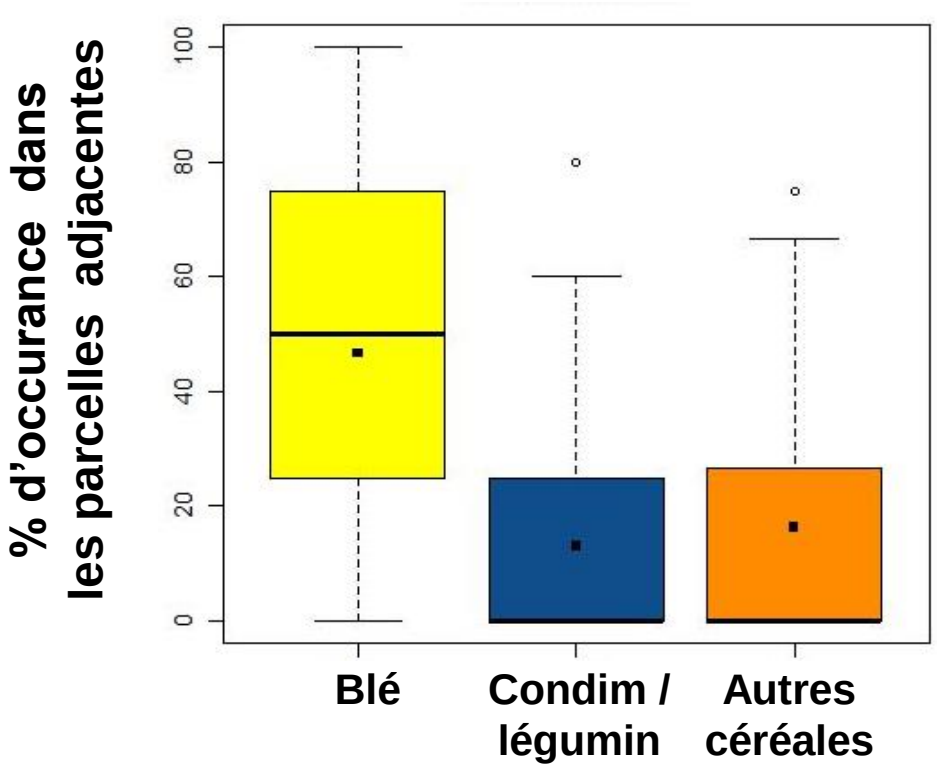
WP4: Task 4.1 : Realistic crop distribution scenarios

1. Collective rules of crop allocation

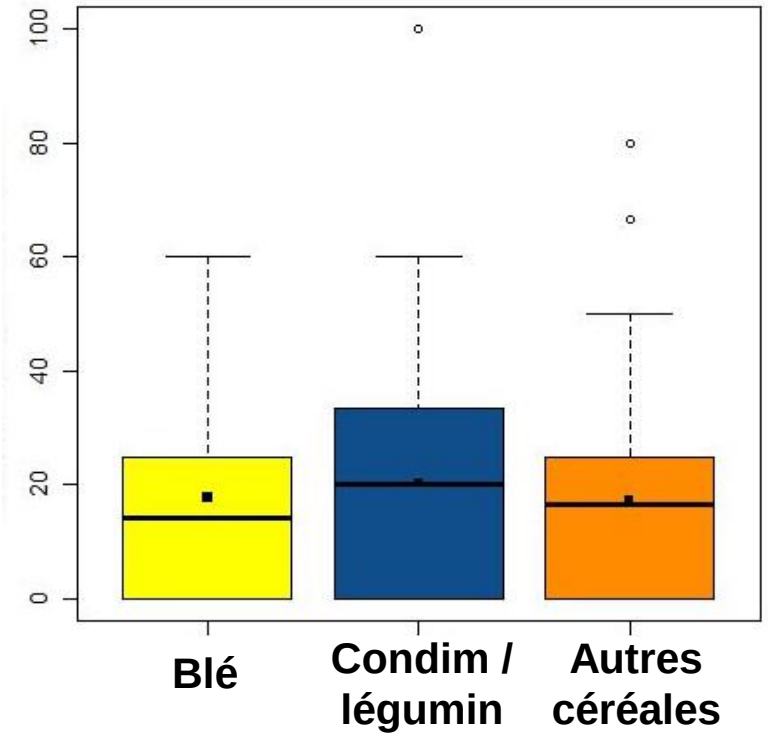
-> management of constraints related to field accessibility and free grazing after crop harvest

- Distribution of crop types depends on the crop of neighboring field and the context of the field

Isolated fields

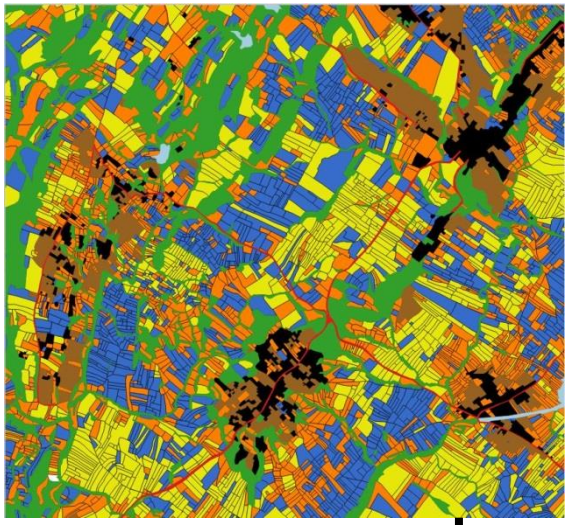


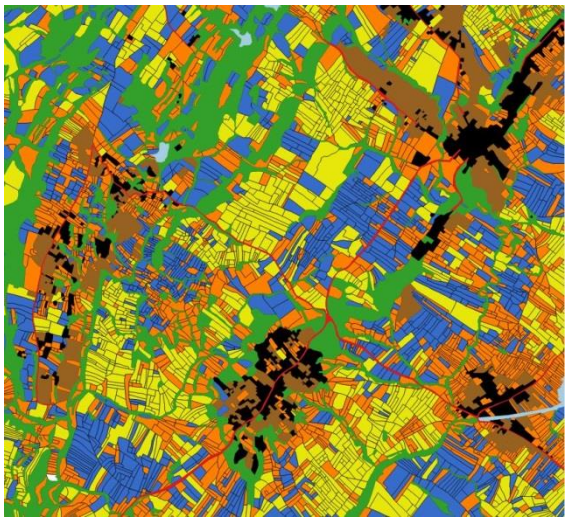
Non Isolated fields



WP4: Task 4.1 : Realistic crop distribution scenarios

Cycle 2015-2016





Cycle 2016-2017

Aggregates of fields with the same crop type

Condiments et légumineuses (CLM)

Fourrages (Four)

Blé (BL)

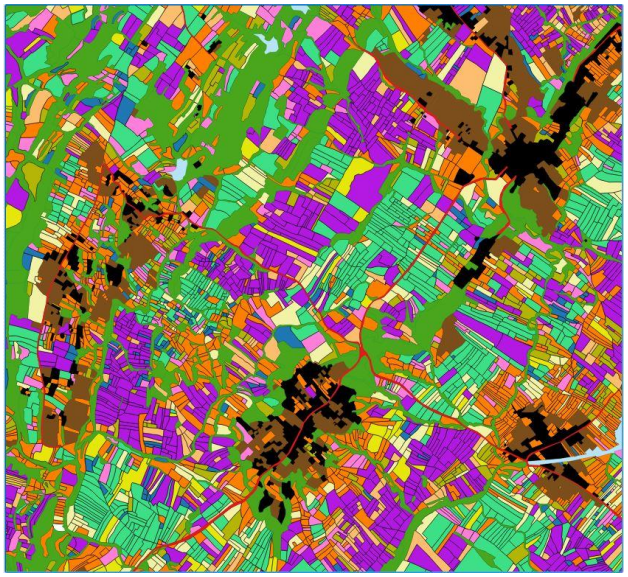
Lac

Vég. Nat.

Urbain

Route

Aggregates of fields with the same crop successions



Successions dominantes

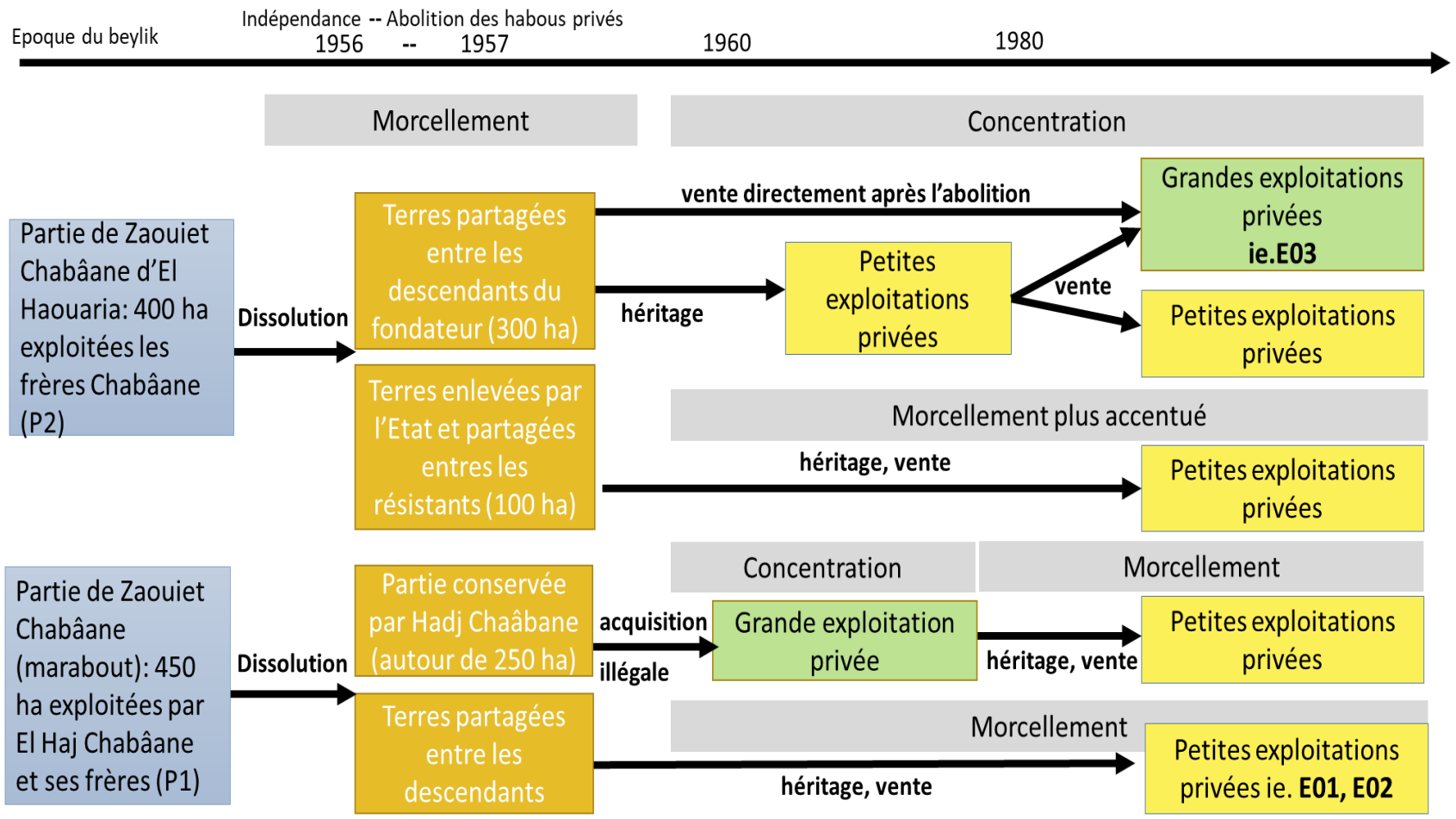
CLM / BL

BL / CLM

Four / Four

WP4: Task 4.1 : Realistic crop distribution scenarios

Trajectoires d'évolution foncières des terres dans la zone collinaire



Perspectives

2020-2021

- Characterize the clusters of crops at the landscape scale
  - *Geostatistics, images classification 2019-2020, 2020-21*
  - *Identification of physical linear elements of the landscape impacting the crops clusters*
  - *Publications*
- Characterize the impact of land tenure
- Individual or collective interviews collectives of actors to validate the identified crops distribution rules
- Present, debate, qualitative evaluation of landscape evolution scenarios with stakeholders

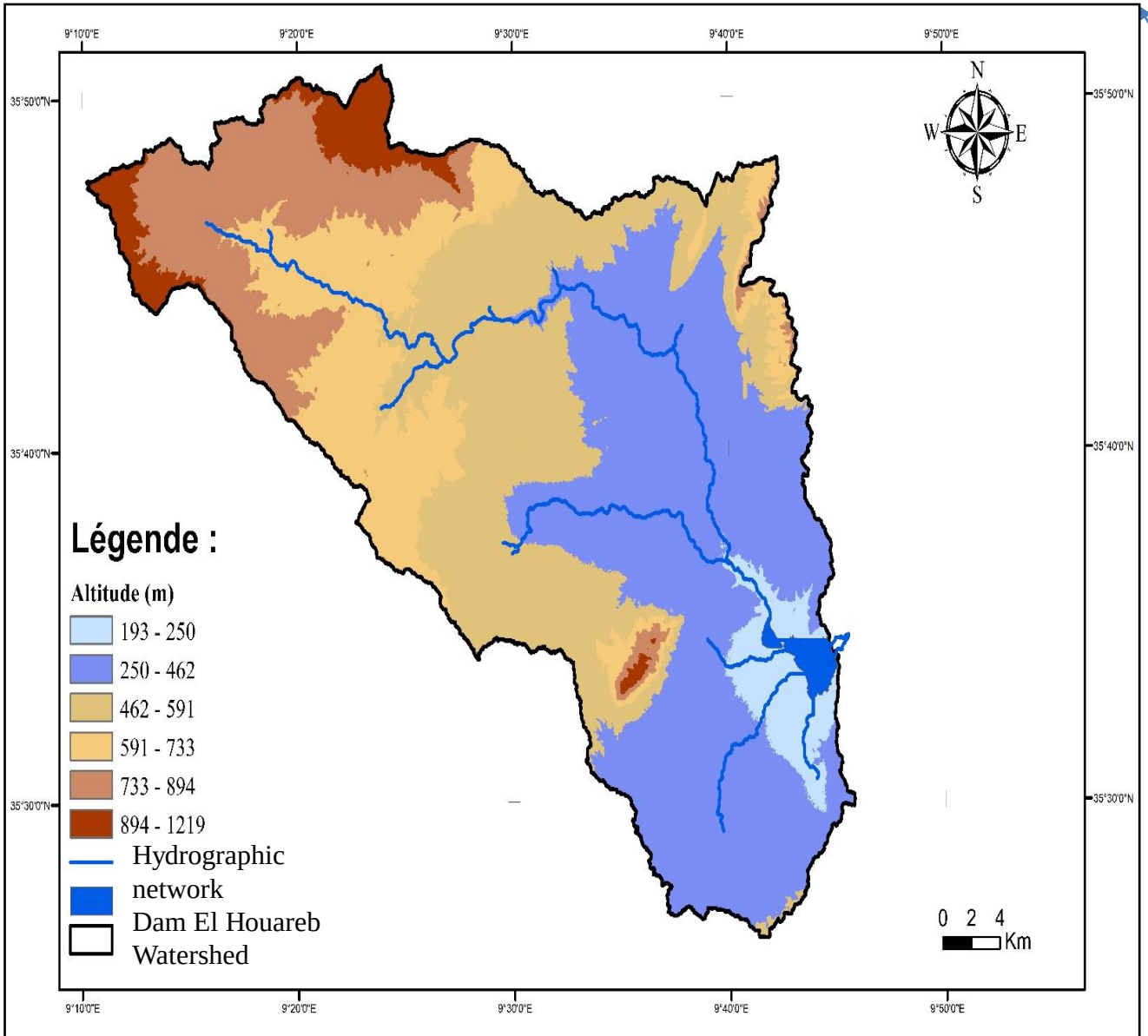
Task 4.1: designing scenarios (leader: UCAM)

PI : Aouissi Jalel

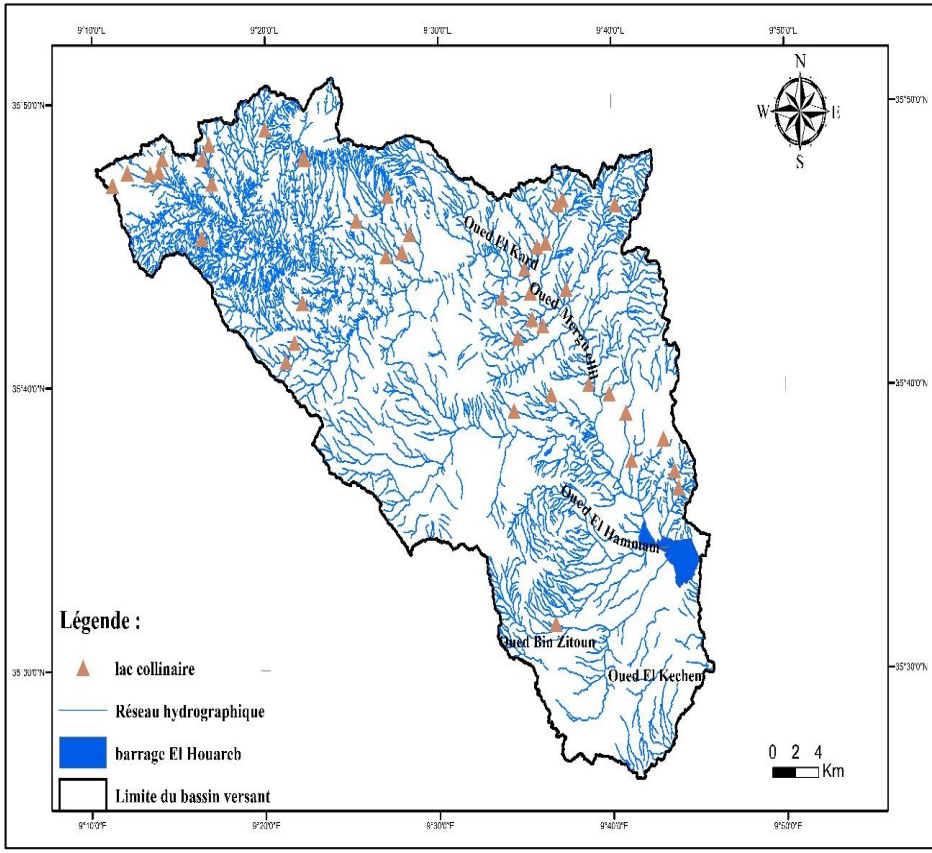
Zohra Lili Chabaane, Sihem Benabdallah, Zeineib Kassouk, Ines Oueslati, Hanene Chaabane, Adel Zghibi

Bench modulation within upstream Merguellil, to be designed via participative seminars with stakeholders.

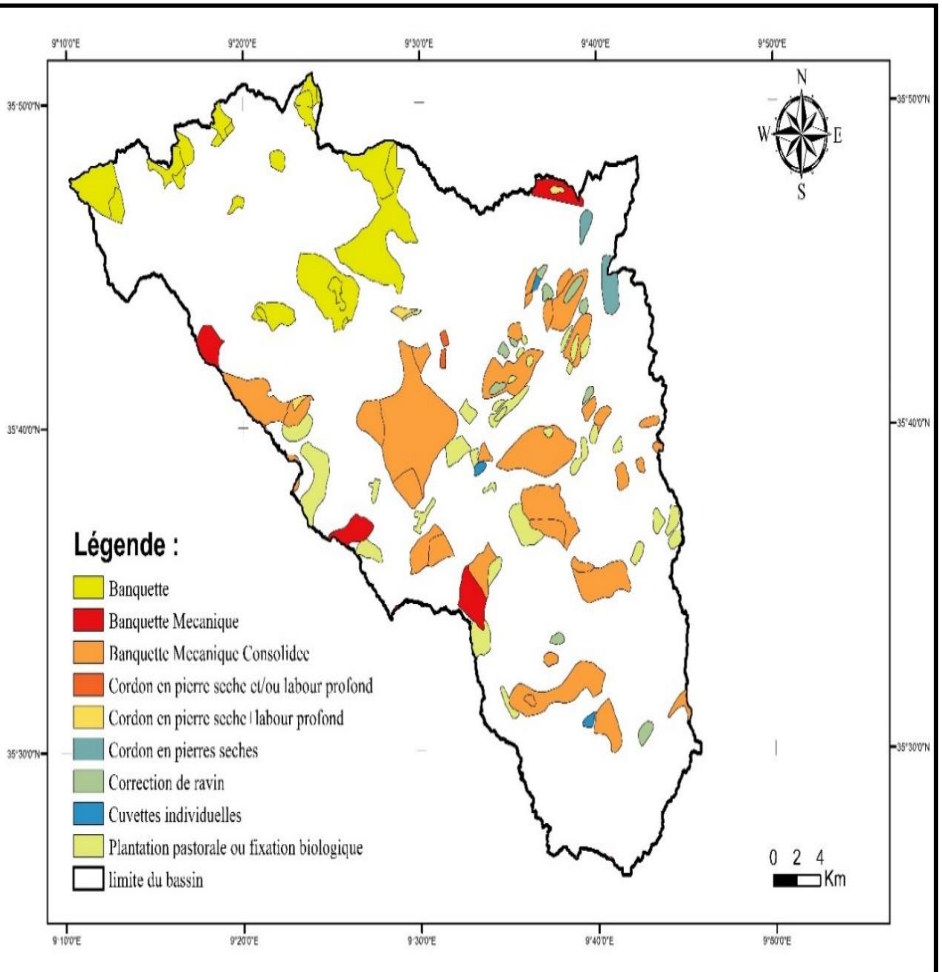
Study area : Upstream Merguellil (Area = 1200 km2)



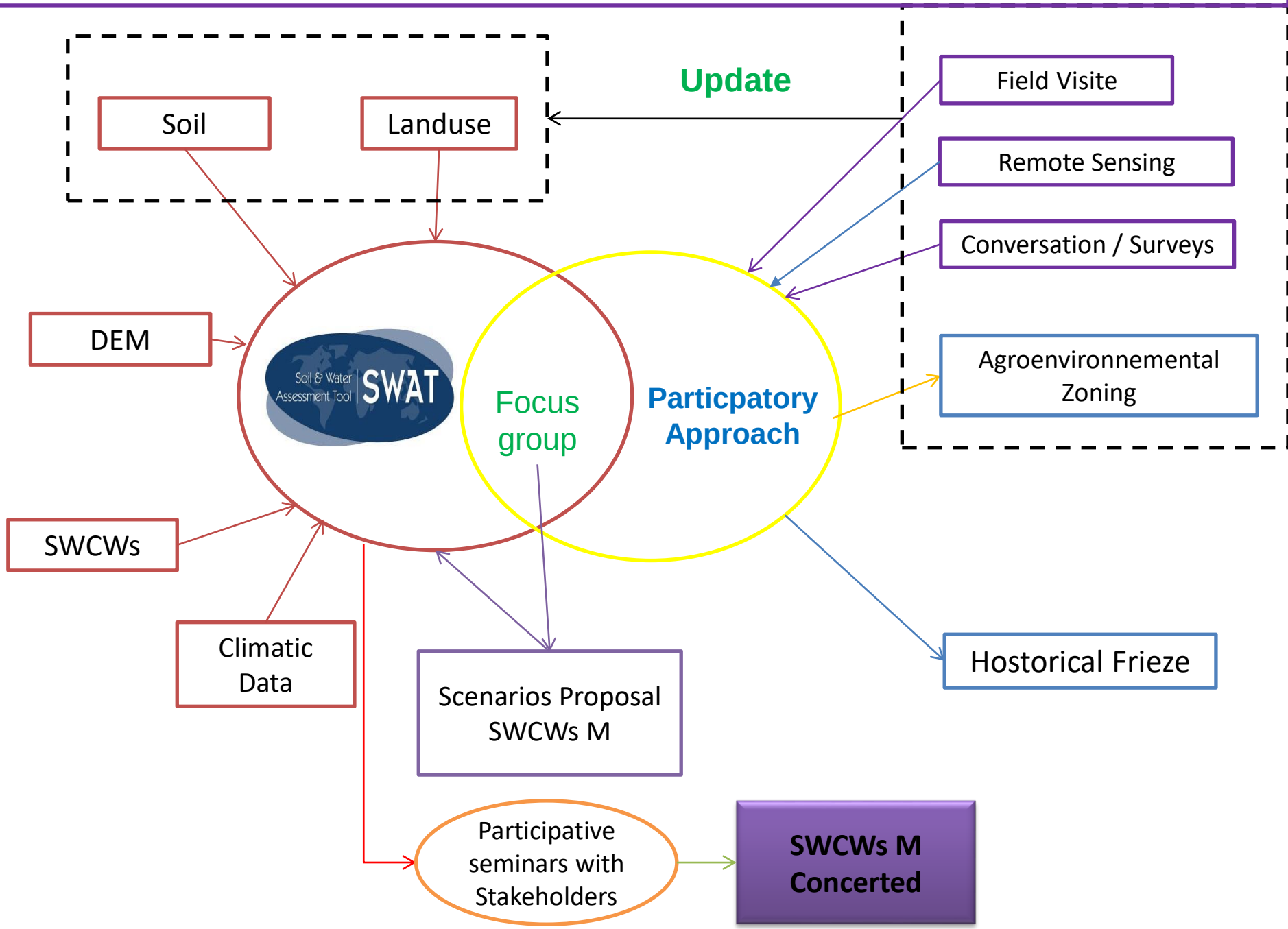
Pond in the Merguellil Watershed



Soil Water Conservation Works (SWCWs)



Task 4.1 Designing scenarios for an Agro-hydrological modelling



Task 4.1 designing scenarios for an Agro-hydrological model

- Climate scenarios

➢ Construction a precipitation dataset scenarios input (WP1: Climate variability) ➔ to be used for SWAT model on the upstream part of the Merguellil basin

➢ Possibility to Study of climate change uncertainty on flow and sediment yield

➡ **Collaboration with Julie Carreau from HSM**

- Scenarios of spatial structure modulations (Landuse)

Land use change scenarios for an agro-hydrological model

- Change from rainfed to irrigated land (due to climate change) (Historic and multi temporal Land-use maps)
- Difference case of agroforestry area augmentation (olive trees extension) and non agroforestry system (only market crops) or only cereals (seasonal and interanual Land-use map)
- mutation to agroecologic practices (living the soil on not till) or Minimum tillage (tillage map and period);
- All scenarios will be approved within the stakeholder workshop

Workforce:

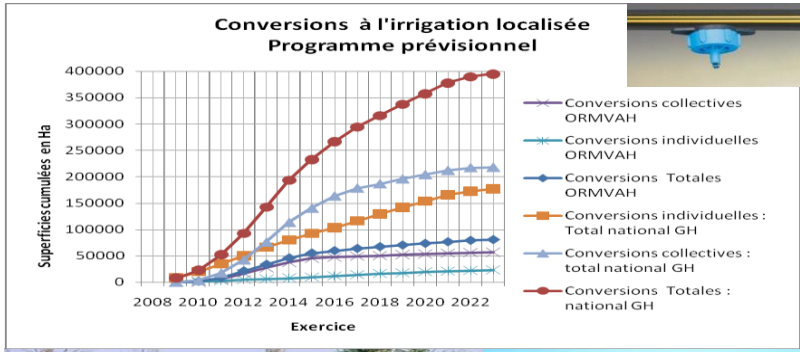
PhD student : Ines Gharnouki started in February 2020
Contract engineering in process
Study area Merguellil

UCA Irrigation conversion: flood ➡ drip

➢ The PNEEI is a program initiated by the Ministry of Moroccan Agriculture (over 15 years), would cover an area of 550.000 ha nationwide. It is essentially based on the conversion of existing irrigation techniques, which are not very efficient in terms of water use, to drip irrigation.

➢ The PNEEI will focus on carrying out a range of activities: collective modernizations, individual modernizations, agricultural development, strengthening of technical support, support measures ...

➢ In Tensift catchment, the total area to be converted is about 80.600 ha, including 57.100 ha of collective conversions and 23.500 ha of individual conversions. Driven by ORMVAH and ABHT.



AMETHYST result, the trend scenario is the most probable:

1. drip conversion,
2. extension of irrigated areas by pumping,
3. intensification of arboriculture,
4. abandonment of cereals irrigation in favor of market gardening of trees,
5. development of urban and tourism areas.

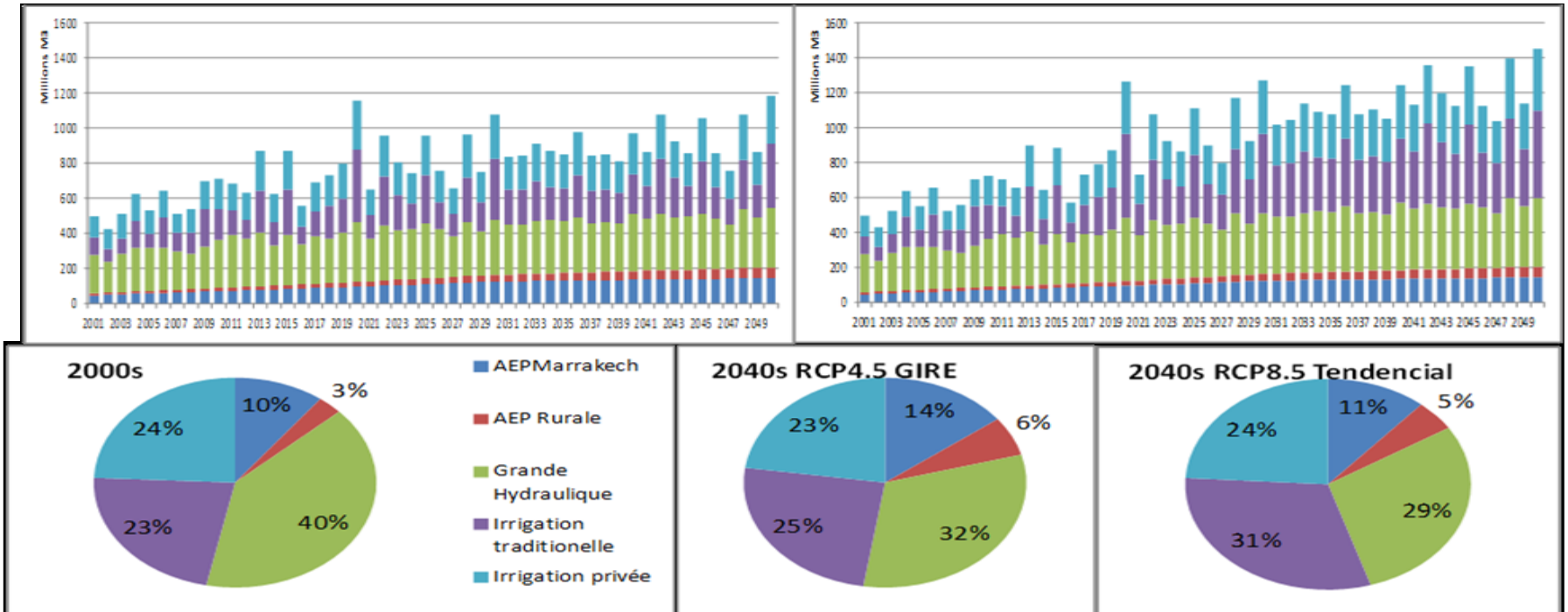
Irrigation conversion: flood ➡ drip

Main Objectives:

1. Analysis of the **impact of this dynamic** on the balance between water supply and demand,

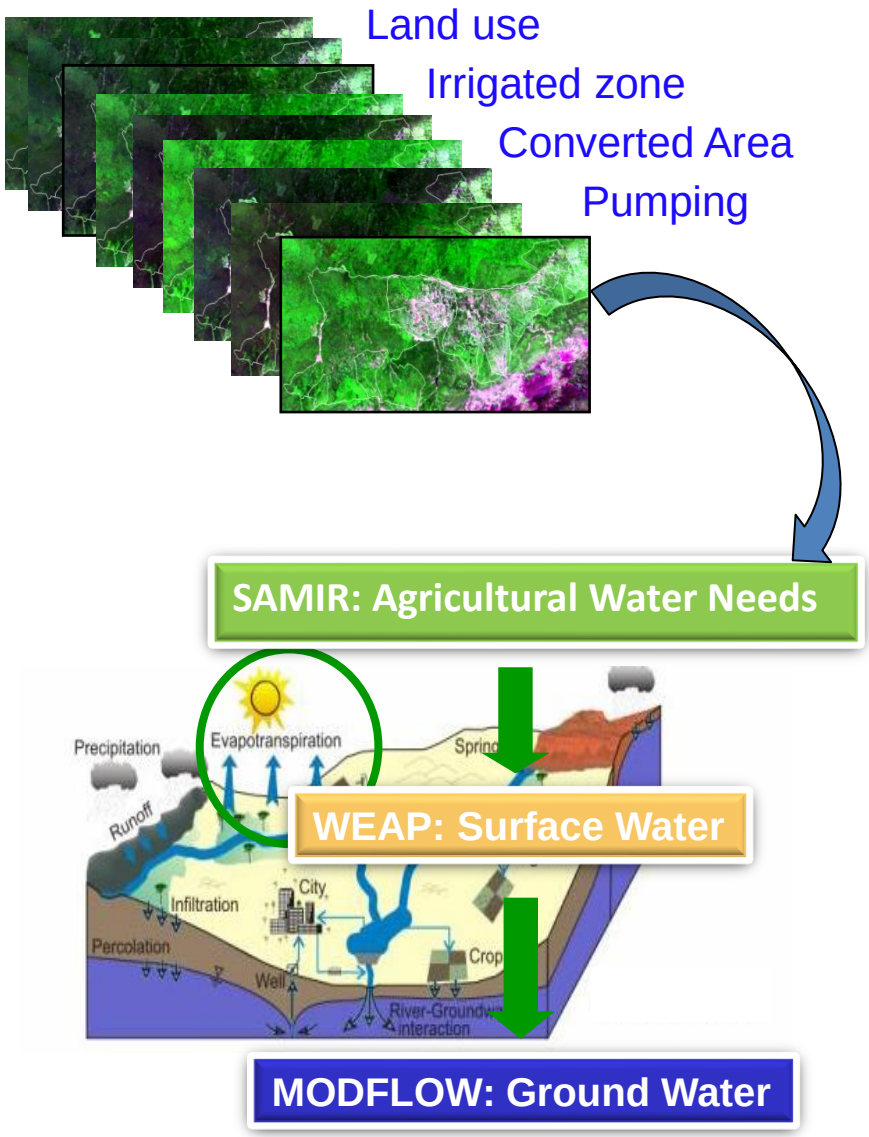
2. Analysis of the **impact of conversion to localized irrigation** on preserving grounwater,

3. Development of **scenarios for water resources evolution** and **proposals for possible readiustment measures of trend scenario.**



UCA INTEGRATED MODELLING & SCENARIOS

with a conceptual basis, SAMIR-WEAP-MODFLOW



- Multi-institutional group for setting up scenarios (UCA, CESBIO, ABHT, ORMVAH),
- Update of the water modelling system (SAMIR-WEAP-MODFLOW) until 2019.
- *In progress:* projection of current trajectories based on narrative and quantitative approaches.

Tools :

- Numerical modeling, time series analyses, participative workshops.

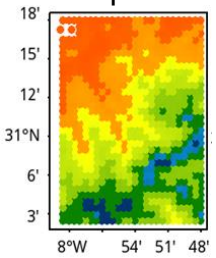
UCA INTEGRATED MODELLING & SCENARIOS

with Mechanistic basis, SAFRAN-ISBA-MODCOU (?)

The main goal:

- Setting up this tool,
- Scenarios of joint evolutions of water resources and uses and comparison with SAMIR-Weap-MODFLOW (?)

Température

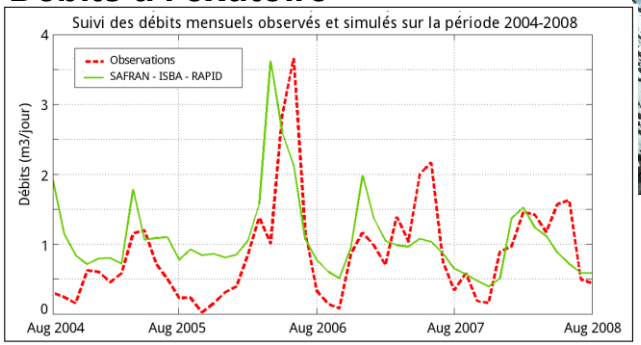


Forçage météo
(ré-analyse SAFRAN)
Quintana-Segui et al., 2008

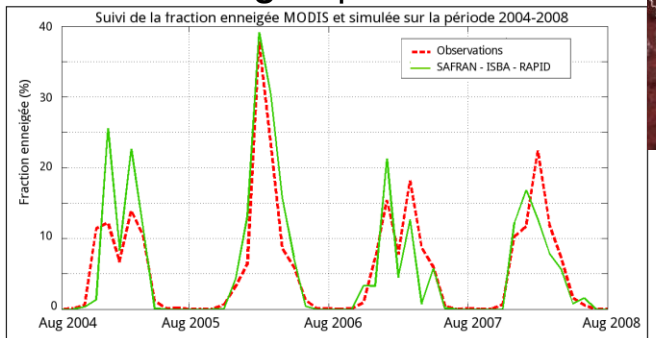
Modèle SVAT et neige
(ISBA et ISBA-ES)
Noilhan et Mahfouf, 1996

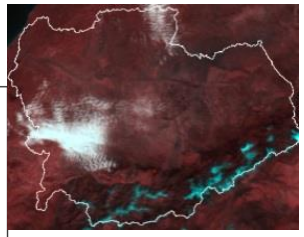
MODCOU
(routage)
David et al., 2011

Débits à l'exutoire



Surface enneigée: produits MODIS





PhD: Ahmed Moucha