

### Context of the study

Project Med-Inn-Local : "Innovation and valorization of local specificities in Mediterranean uplands"  
Goal: the analysis of fast and profound mutations that Mediterranean countries are facing and more specifically uplands of areas greatly influenced by globalization (1).  
Resilience of rural territories when confronted with changes.

Supervised by Institut de Recherche pour le Développement, UMR GRED, Montpellier & Faculté des Lettres et des Sciences Sociales, Agadir

### Issues & Methods

Study under various viewpoints :

- technics
- economic
- social
- institutional
- historical

Tools and methods :

- literature research
- historical research at the French Center of Diplomatic Archives
- collective & individual interviews
- flow measurements
- base map

To which extent is the water management system in the Tiout Oasis a source of tension between agriculture and tourism?

### Characteristics of the Tiout Oasis

#### Facts & Figures

- part of the Souss basin, an area of 16200 km<sup>2</sup> (Fig. 1)
- 3848 inhabitants
- 440 ha cultivated area
- hydraulic heritage: 2 water storage basins, 2 khettaras
- valorization (argan, tourism)
- a divided landscape (Fig. 2)

Figure 1: An oasis highly connected within a contrasted area

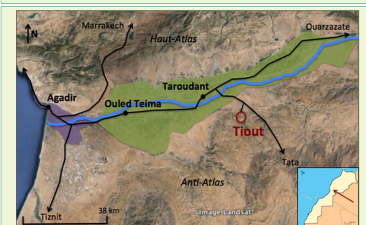
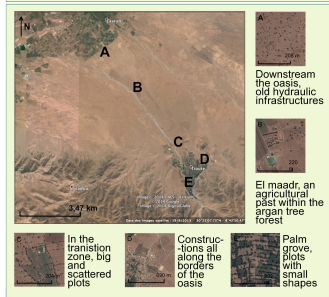


Figure 2: Different areas showing a temporal evolution



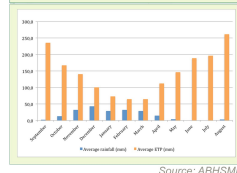
### Climate & water resources

- in a semi-arid area (Fig. 3)
- high ETP emphasized by the *chergui*
- 2 main watercourses: the River Tiout and the River Khazmet
- a very irregular hydraulic pattern
- o dangerous flooding

Need for irrigation

The great proportion of limestone in the surrounding mountains allows important underground flows. One of them is currently the only water resource for the oasis. A thick canal network allows irrigation within the palm grove and the transition zone.

Figure 3: Rainfall/ETP diagram



### History and evolution of the oasis

It is impossible to date Tiout's creation but its Kasbah was built at the time of the dynasty of Saâdiens (1511 – 1659), just like Taroudant's fortifications. This dynasty led Taroudant to its height, stimulating its economy and most probably Tiout's as well.

Some elements show that both agriculture and irrigation were different in the past:

- Importance of sugarcane
- *Khettaras*
- Water rights for farmers

Figure 4: Evolution and adaptability of the oasis while facing changes

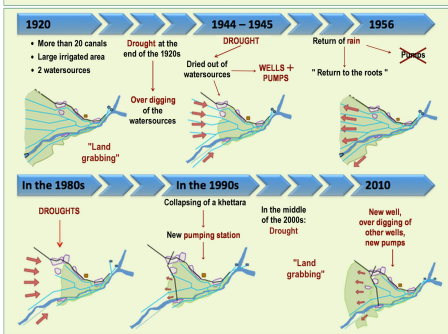
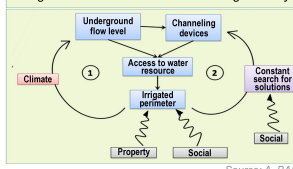


Figure 5: Factors of evolution through history



Twice in the past, some "land grabbing" occurred:  
- under French Protectorate, when religious and political actors took lands in exchange for food  
- in the 2000s, when wealthy and/or influential families started to cultivate "uncultivated" lands.

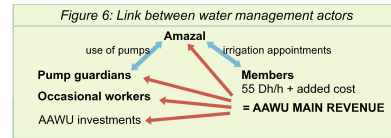
### Water management in the Tiout Oasis

Created in 1990, the Association of Agricultural Water Users (AAWU) gives a legal framework to water management. Users are responsible for technical and accounting management. The elected committee presents annual results during a general assembly, where farmers can suggest new projects and ideas.

Table 1: Distribution rules, between "water turn" and "on demand"

	Theoretical rules	In practice ...
Water & Land	Married (3 hours/ha)	Variations
Water turn	17 days 1 irrigation/canal upstream to downstream	17 to 27 days, changes > 1 irrigation/canal
Exchanges	Yes	No
Price	55 Dh/hour 55 L/s	The further you irrigate, the more expensive

Source: A. BARBE



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### Problems within the AAWU

- a lack of communication with farmers
- a lack of transparency on finances
- an association that plays favorites

### Typology of agricultural productions

The land characteristics allow different agricultural possibilities (Table 2). It is also important to consider that a third of the lands are for rent and that inheritance rules are responsible for micro plots scattered all over the oasis.

Thus, to make a living from agriculture, there is a need for:

- Land/Trees
- Water
- Workforce
- (Money)

Otherwise ...

- Multiple job holding
- Look for a lucrative job
- Give up on agriculture
- Emigration

Table 2: Agricultural productions related to specific areas

WATER RESOURCES	Zone 1	Zone 2	Zone 3 & 4	Zone 5
AAWU	15 mn to 2 hrs	AAWU Drinking water	Private basins (AAWU water)	Rainfall
CROPS	Annual crops (wheat, maize, barley, alfalfa) Family consumption To feed animals Cereals → income Olives, dates	Few market gardening (squashes, beans, turnips) Family consumption	Jordan or plantations (potatoes, watermelons, beans) Wide range of crops, mostly potential crops Family consumption Wholesales (plantations)	Market gardening (potatoes, watermelons, beans) thanks to pumps and drip irrigation Some perennial crops Wholesales
LAND FEATURES & PROPERTY	Small plots (average 0,15 ha) ++ Trees, living plots Location/property < 1 ha	Agreements between landowner and owners of nearby houses Property	Large plots (around 1 ha) - Trees Property	Large plots (0,5 – 3 ha) Forester estate
WORKERS	Family, <i>touiza</i>	++ Family	Employees	Family
COMMENTS	- Lucrative Secondary activity	Improve living conditions	Secondary activity (Jordan)	++ Lucrative Random

Source: A. BARBE

Influential and powerful landowners in the Zone 3 have understood the conditions to make a living from agriculture. They actually have more water than others, they have "grabbed" lands and threaten farmers around their lands ...

### Tourism in Tiout

- Different types of tourism (Table 3)
- Various facilities
- 15 – 20 touristic guides
- Touristic guides = farmers
- Up to 4000 Dh/month
- Donkey rental
- Random activity
- Source of pollution/damages
- Facilities: one major owner

Table 3: Types of tourism and profit for local economy

Mass tourism	Family tourism	"National" tourism
Oct / May Foreign tourists Day trips Low profit	Oct / May Foreign tourists Longer stays High profit	++ in summer Moroccan tourists, Day off the city +/- profit

Source: A. BARBE

### Drip irrigation as a solution ?

Agency of the Souss-Massa Draa Hydraulic Basin 2008

Goal: Conversion of gravity-fed irrigation to drip irrigation

After a diagnosis phase, they set up 3 evolution scenarios. They chose the best one for economic improvements (Table 4), implying the following change:

- in cereals and alfalfa surfaces
- in fodder maize surfaces
- development of market gardening
- keeping perennial crops
- improving agricultural technics

Table 4: Economic evolution

Economic parameter	Current situation	Chosen scenario
Average agricultural value (Dh/ha)	3000	9200
Average water use (m <sup>3</sup> /ha)	5400	4000
Agricultural water valorization (Dh/m <sup>3</sup> )	0,79	2,3

Source: ABHSM

Future changes:

- New drilling site
- New basin for water pressure
- Water price: 1 dh/m<sup>3</sup>

### Analysis of the situation

#### Inconsistency of the study

- Data, quality of interviews
- Water savings / new drilling site
- Preserving landscape / water pipes
- Use of inputs

#### Potential impacts on agriculture

- Increased labor (alfalfa → maize)
- High concurrency for market gardening (plain of Souss)
- Not obvious increase of income (loss of trees, water price, water consumption)

Who would really take benefit from drip irrigation project ?

#### Challenges behind the project

- Limit of this conversion: Amensouss
- Unanimous support:
  - Few interested landowners: right bank (lack of water), downstream perimeter, influential/powerful
  - Few expectations for others (land issues)
- Conflicts with tourism:
  - Powerful people: not large guesthouses
  - But tourism: better living conditions

A solution for few inhabitants with a risk of paramount changes

### Conceivable solutions for evolution perspectives

#### Institutions

- To prohibit working for the AAWU and the city committee
- To create: a powerful farmer association a tourism management association (tax, "water tour")

#### Facilities

- To convert only a part of the oasis
- To promote gravity-fed irrigation in Zone 1 only
- To use drip irrigation in Zones 3 & 4

#### Agriculture

- To promote market gardening (family consumption, restaurants)
- To use "abandoned" lands in a "collective" way
- To give a new start for palm trees (tourism)