Democratic and Popular Republic of Algeria

Ministry of Agriculture and Rural Development

National Institute of Soils, Irrigation and Drainage

# Soil resources and sustainable soil management in Algeria

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# Summary

## Introduction

## 1. The status of soil resources in Algeria

1.1. Overview of the geography of Algeria
1.2. Agricultural land resources and statistics
1.3. Current knowledge of soil resources in Algeria

## 2. Needs and priorities to promote sustainable soil management

2.1. Main problems facing sustainable soil management in Algeria
2.2. Actions to improve natural resources management

## Conclusion

# Introduction

Knowledge of soil resources is **critical** for decision maker.

Classification (type)
Distribution (localization)
Fertility (physico-chemical properties)
Potential, Aptitude (to specific crops)
Land cover … etc.

Government
Researchers
Institutions
Technicians
Farmers, managers

It helps
- improve natural resources management;
- better plan agricultural development actions;
- intervene where appropriate to improve productivity, preserve natural resources and estimate yields … etc
- Cadastral applications.

# Introduction

How much do we **know** about soil resources in Algeria ?

**National** land cover map (INSID, 2011)

Agricultural land classification initiative (INSID, **ongoing**)
Covers about 660 000 ha using a scale of 1/20 000

Other Soil Studies (ANRH, 1963-2004)

Scale 1/100 000 ~ 5.3m ha
Scale 1/50 000 ~ 1.7m ha
Scale 1/20 000 ~ 0.8m ha
Scale 1/10 000 ~ 70 000 ha

| | |
|---|---|
| Algeria | 238m ha |
| Tot. Ag. Area | 42.9m ha (18%) |
| Used Ag. Area | 8.5m ha (20%) |

Land zoning map North Algeria (INSID, 2002)

Soil map North Algeria (Durant, 1954)

# Introduction

The available data is mostly **old** and does not cover the entire territory of the country.

The **heterogeneity** of the available data in terms of **classification system** and **scale** or **resolution** poses a huge problem when integrating it into a national GIS.

# Introduction

**Challenges & priorities** for sustainable soil management

**Natural factors**

Erosion, Desertification, Salinity, Loss of soil fertility … etc.

**Human factor**

Urbanization, pollution, bad agricultural practices … etc.

The main priority of the government is to reach **food security**.

# The status of soil resources in Algeria

# 1.1. Overview of the geography of Algeria

**Localization** in North Africa

Surrounded by 7 countries

1200 km of seafront

Area 2.38m km²

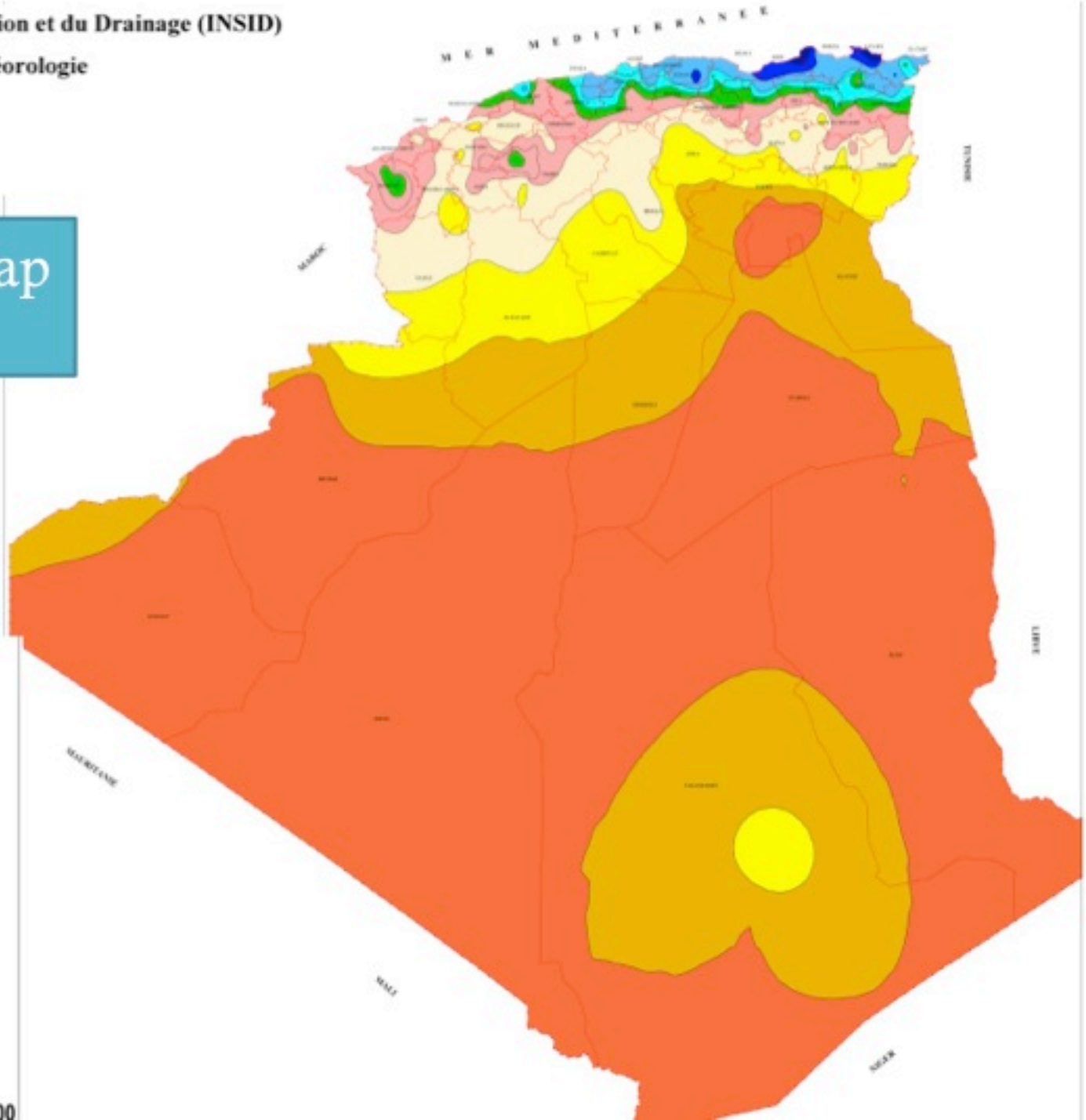
Three classes or types of climate

- **Mediterranean** climate (Coastal zones and northern mountains)
- **Semiarid** climate (Highlands)
- **Arid** climate (Sahara Desert)

Institut National des Sols de l'Irrigation et du Drainage (INSID)

Département d'Agrométéorologie

# Precipitation Map 1986-2005

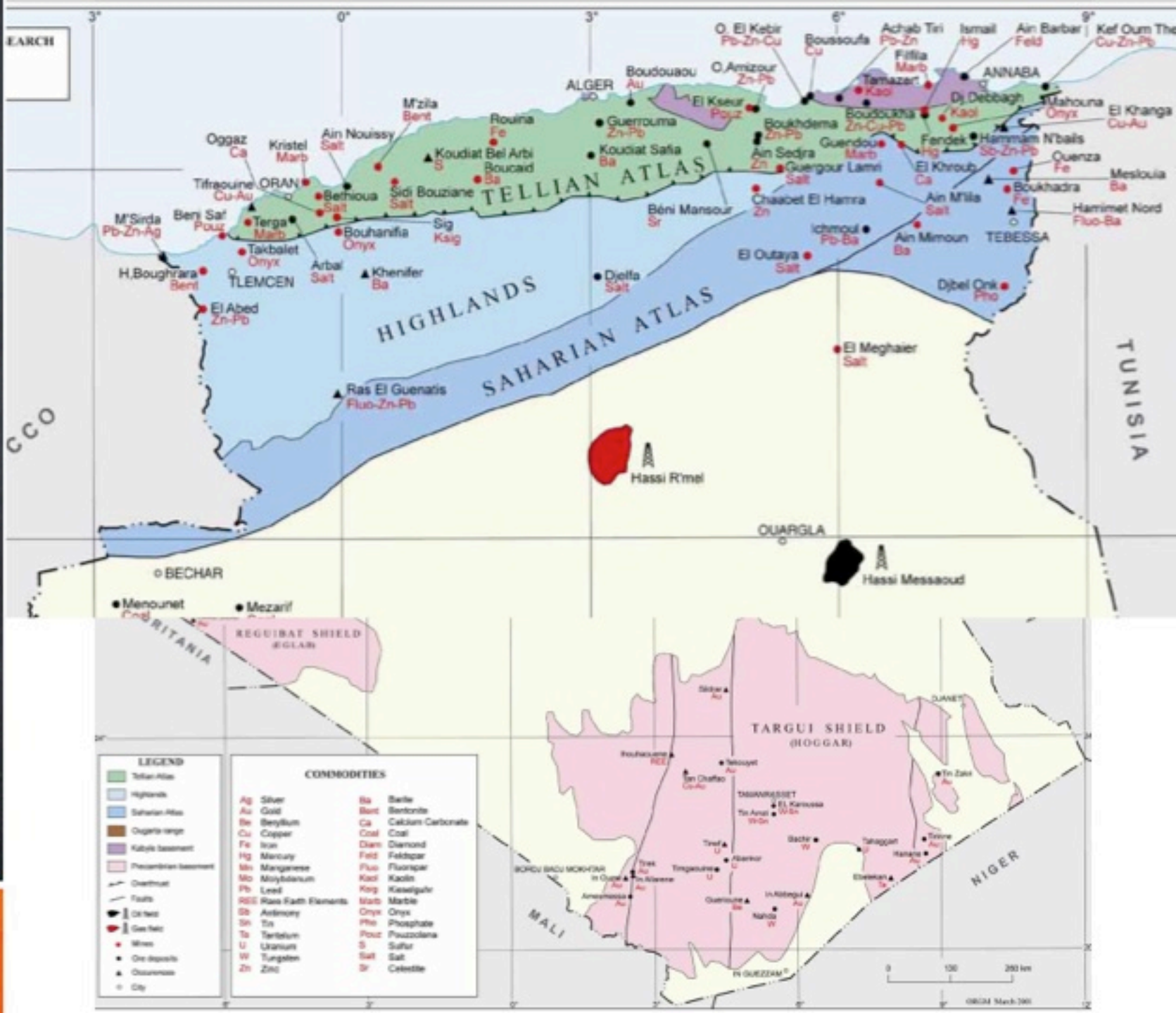


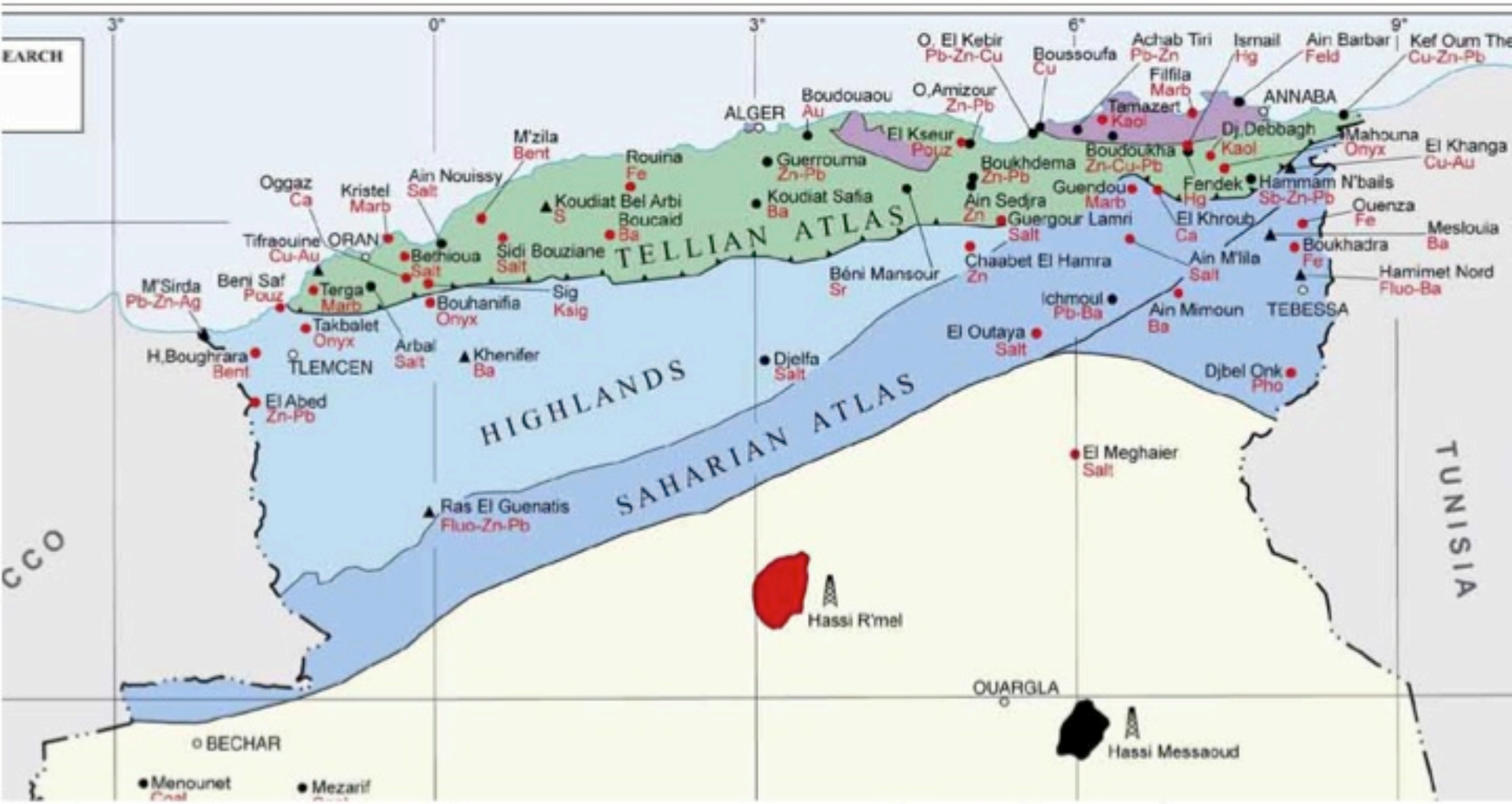

**LEGENDE**

- Pluviométrie inférieure à 50 mm.
- Pluviométrie comprise entre 50 et 100 mm.
- Pluviométrie comprise entre 100 et 200 mm.
- Pluviométrie comprise entre 200 et 300 mm.
- Pluviométrie comprise entre 300 et 400 mm.
- Pluviométrie comprise entre 400 et 500 mm.
- Pluviométrie comprise entre 500 et 600 mm.
- Pluviométrie comprise entre 600 et 800 mm.
- Pluviométrie comprise entre 800 et 1000 mm.
- Pluviométrie supérieure à 1000 mm.
- Limite wilaya
- Limite frontière

Echelle : 1/ 2 400 000

# The topography of Algeria




EARCH
3°
0°
3°
6°
9°
ALGER
O. El Kebir
Pb-Zn-Cu
Boussoufa
Cu
Achab Tiri
Pb-Zn
Ismail
Hg
Ain Barbar
Feld
Kef Oum The
Cu-Zn-Pb
Filfila
Marb
ANNABA
Tamazert
Kaol
Dj.Debbagh
Kaol
Mahouna
Onyx
El Khanga
Cu-Au
Boudouaou
Au
O.Amizour
Zn-Pb
El Kseur
Pouz
Boudoukha
Zn-Cu-Pb
Boukhdema
Zn-Pb
Guerrouma
Zn-Pb
Rouina
Fe
M'zila
Bent
Ain Nouissy
Salt
Oggaz
Ca
Kristel
Marb
Koudiat Bel Arbi
S
Boucaid
Ba
Koudiat Safia
Ba
Ain Sedjra
Zn
Guergour Lamri
Salt
Guendou
Marb
Fendek
Hg
Hammam N'bails
Sb-Zn-Pb
Ouenza
Fe
Meslouia
Ba
El Khroub
Ca
Boukhadra
Fe
Hamimet Nord
Fluo-Ba
TELLIAN ATLAS
Tifraouine
Cu-Au
ORAN
Berhoua
Salt
Sidi Bouziane
Salt
Chaabet El Hamra
Zn
Béni Mansour
Sr
Ain M'lila
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M'Sirda
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Beni Saf
Pouz
Terga
Marb
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Takbalet
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Khenifer
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El Abed
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HIGHLANDS
SAHARIAN ATLAS
El Meghaier
Salt
Ras El Guenatis
Fluo-Zn-Pb
TUNISIA
CCO
Hassi R'mel
OUARGLA
BECHAR
Hassi Messaoud
Menounet
Mezarif

# 1.2. Agricultural land resources and statistics

## Land distribution

| Occupation | | | | Surface (ha) | Percentage [1] | Percentage [2] |
|---|---|---|---|---|---|---|
| Total Agricultural Area | Used Agricultural Area | Cultivated Land | Herbaceous crops | 4 452 185 | 10,4 % | |
| | | | Fallow land | 3 044 388 | 7,1 % | |
| | | Permanent Crops | Orchards | 865 146 | 2,0 % | |
| | | | Vineyards | 73 430 | 0,2 % | |
| | | | Natural prairies | 26 626 | 0,1 % | |
| | | Total Used Agricultural Area | | 8 461 775 | 19,7 % | |
| | Pasturage | | | 32 969 435 | 76,9 % | |
| | Non-productive Agricultural Land | | | 1 458 095 | 3,4 % | |
| Total Agricultural Area | | | | 42 889 305 | 100,0 % | 18,0 % |
| Other | Steppe | | | 2 498 085 | | 1,0 % |
| | Forests | | | 4 273 670 | | 1,8 % |
| | Non Agricultural Land | | | 188 513 040 | | 79,1 % |
| Total area of the country | | | | 238 174 100 | | 100,0 % |

Percentage [1]: Percentage of the Total Agricultural Area

Percentage [2]: Percentage of the total area of the country

Source Stats MADR 2013

# 1.3. Current knowledge of soil resources in Algeria

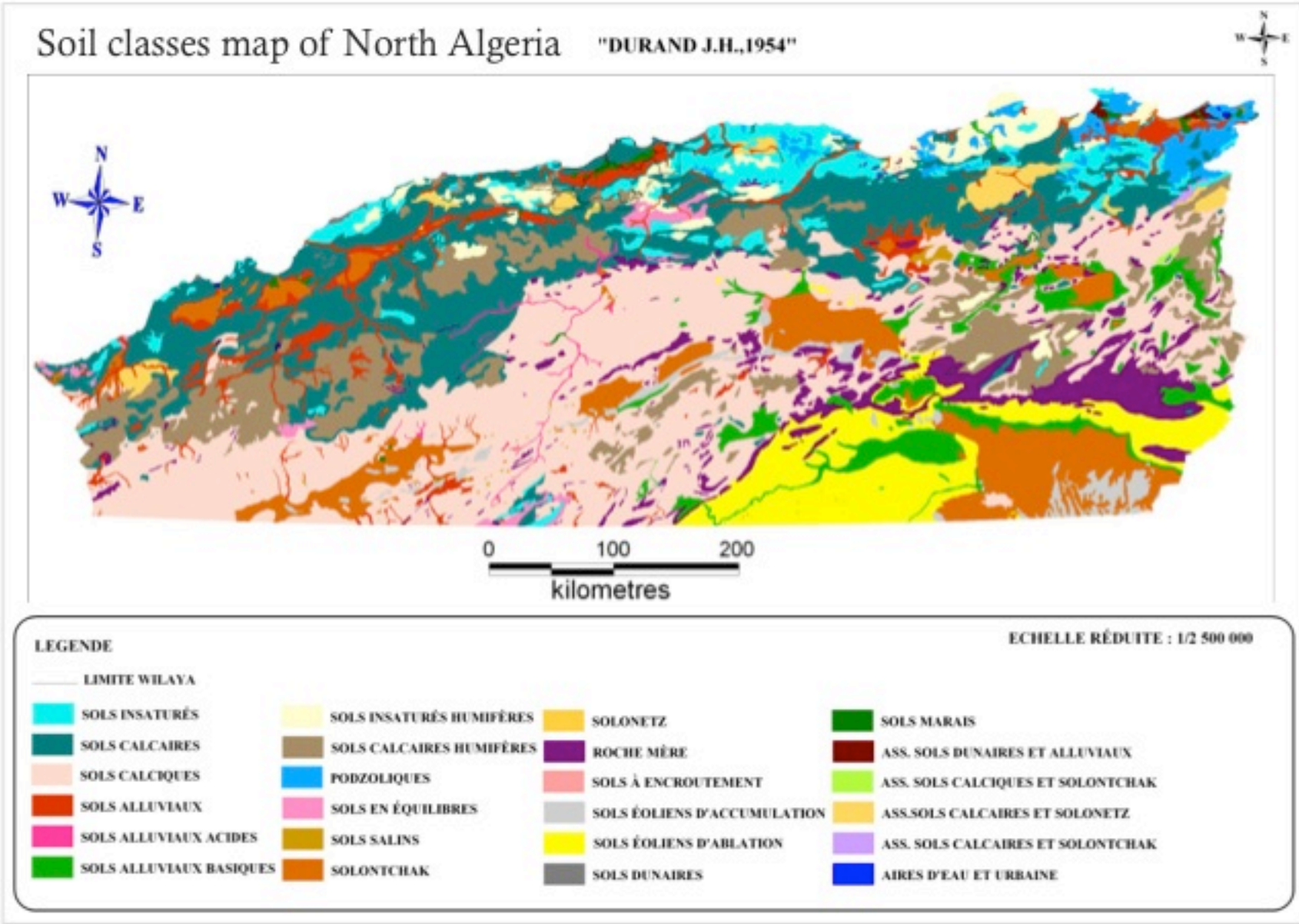
The **soil classification map** covers North Algeria and has been a reference for many other studies.

The study was conducted by **J. H. Durand** and published in **1954**.

The author used a scale of **1/2 500 000**. Suitable for **regional management** but not as much if we need detailed information.

The soils were classified according to the French system **CPCS**.

# 1.3. Current knowledge of soil resources in Algeria



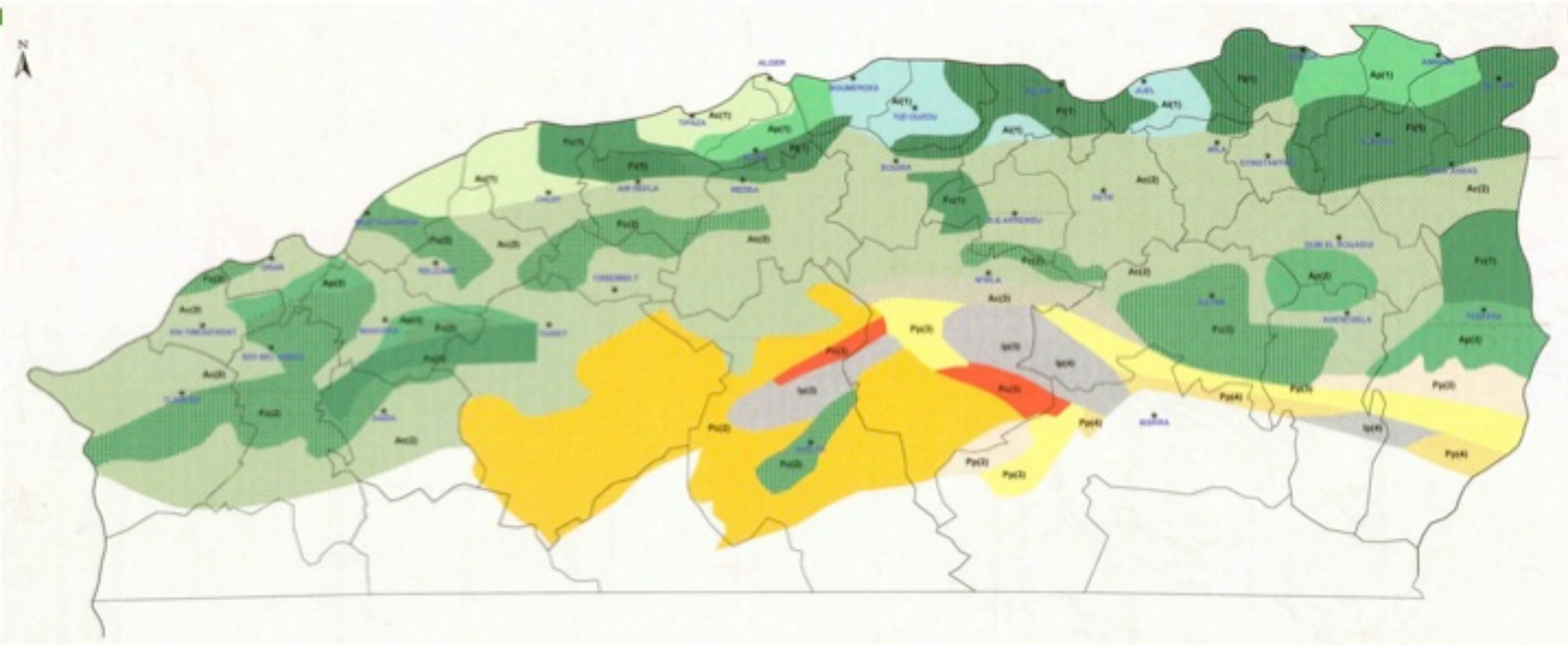
# 1.3. Current knowledge of soil resources in Algeria

- The **agricultural land zoning** map of North Algeria was realized by the National institute of soils, irrigation and drainage (**INSID**) at a scale of **1/1 000 000**.

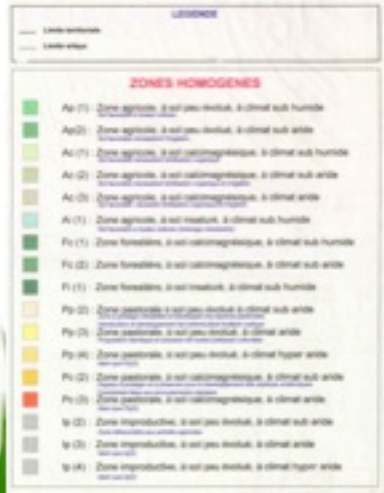
It combines **three layers** of data:

- soil map of North Algeria (Durant, 1954);
- climate data (ONM), and
- land occupation data.

# 1.3. Current knowledge of soil resources in Algeria



- The agricultural land zoning map. (scale 1/1 000 000



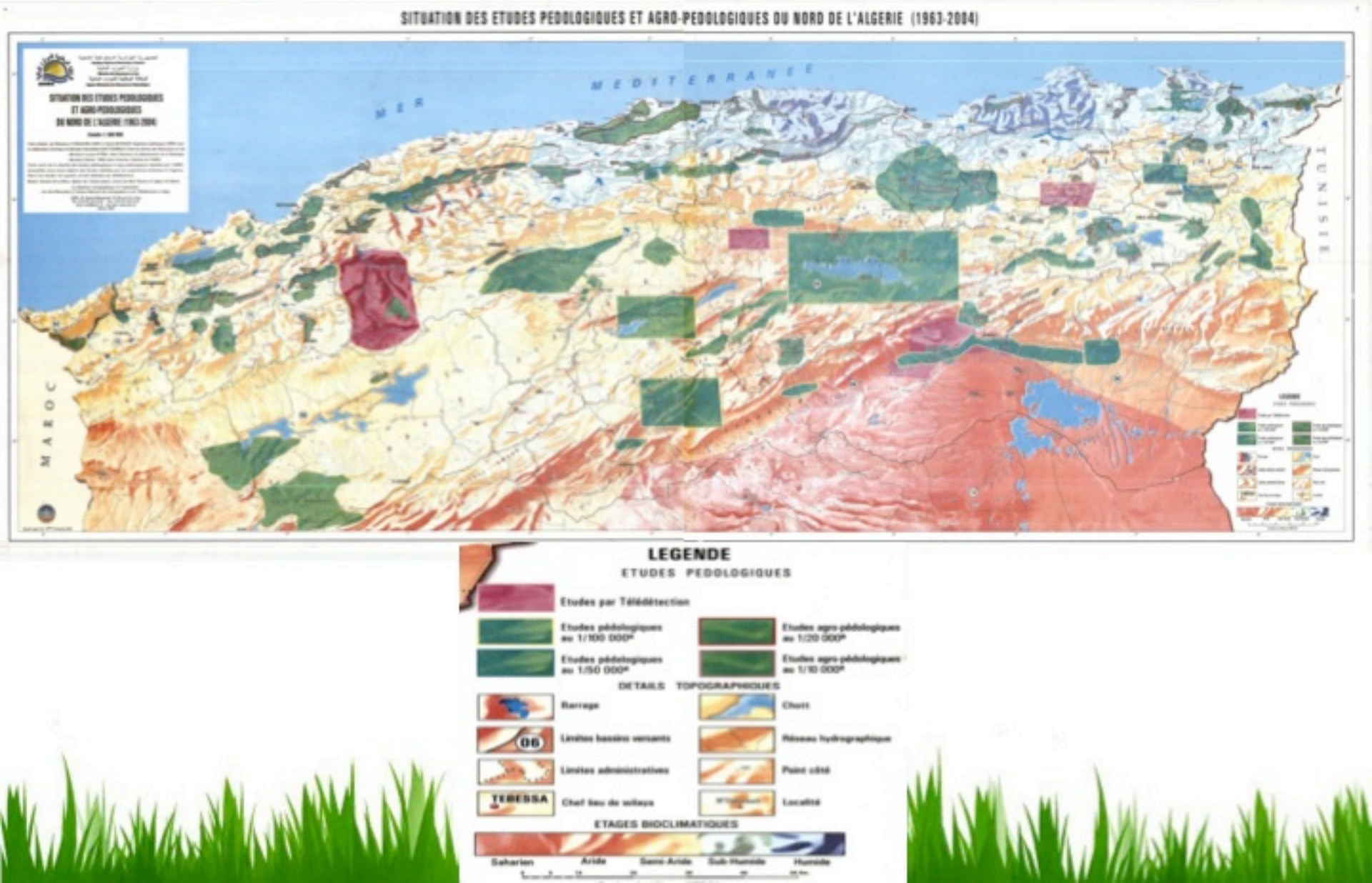
# 1.3. Current knowledge of soil resources in Algeria

- The National Agency of water resources (**ANRH**) conducted many soil studies between 1963 and 2004 to support agricultural land development using **irrigation**.

There are approximately 220 soil studies that combine soil **physico-chemical properties**, **geomorphologic features** and **climatic parameters**.

The soils are then classified in **five categories** depending on their **ability** for **irrigation**.

# 1.3. Current knowledge of soil resources in Algeria



# 1.3. Current knowledge of soil resources in Algeria

The agricultural land classification initiative was implemented to **categorize** soils according to their **agricultural potential** (or suitability).

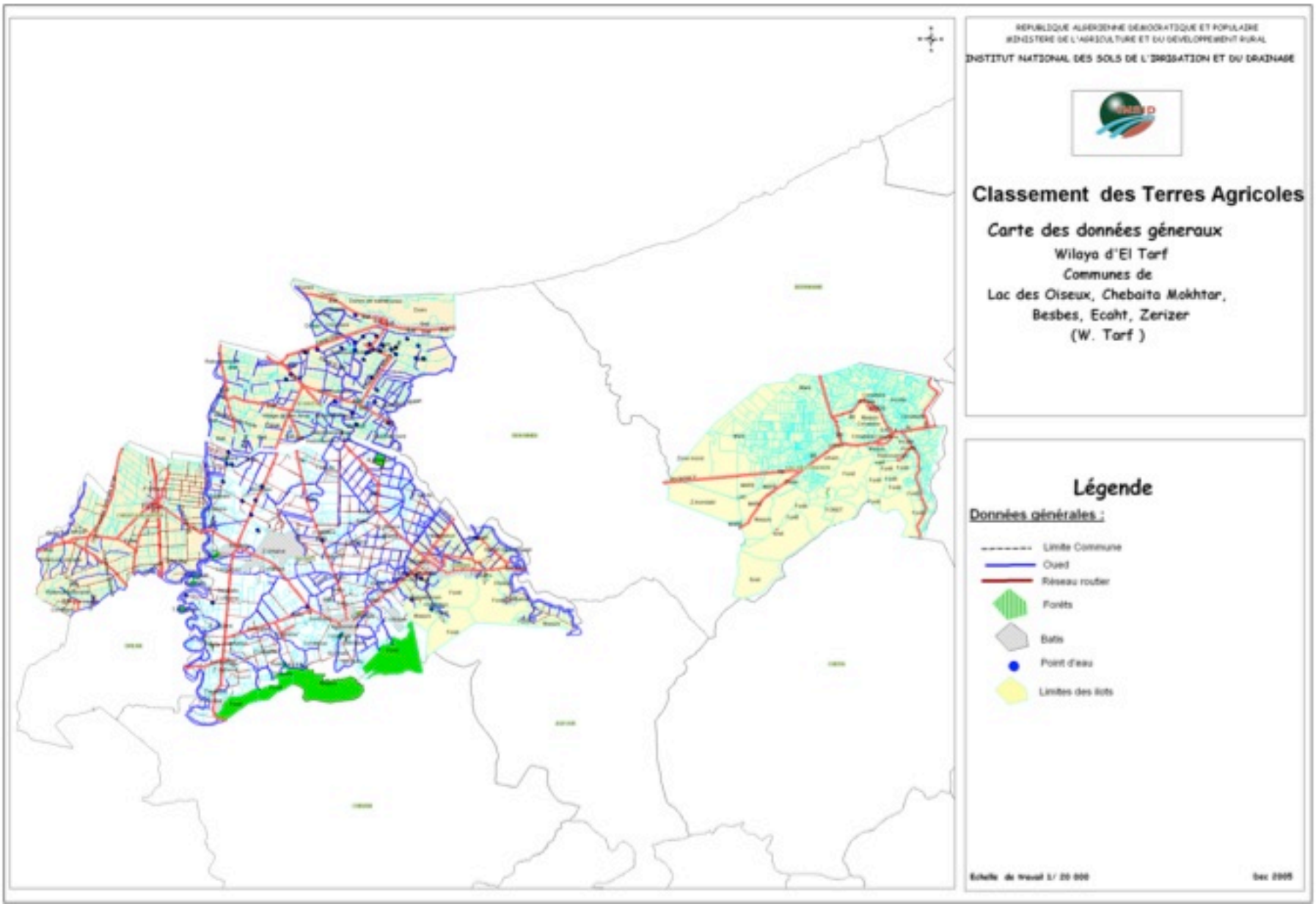
This project aims to cover over **8m ha**, which corresponds to the used agricultural area in Algeria. A total area of **660 000ha** has already been mapped and integrated into a GIS.

The methodology used in this project is inspired from the **mixed approach** of the FAO to determine land suitability.

Land value determination combines **soil properties**, **environmental conditions** as well as its **socioeconomic value**.

The scale of study is **1/20 000**

# 1.3. Current knowledge of soil resources in Algeria



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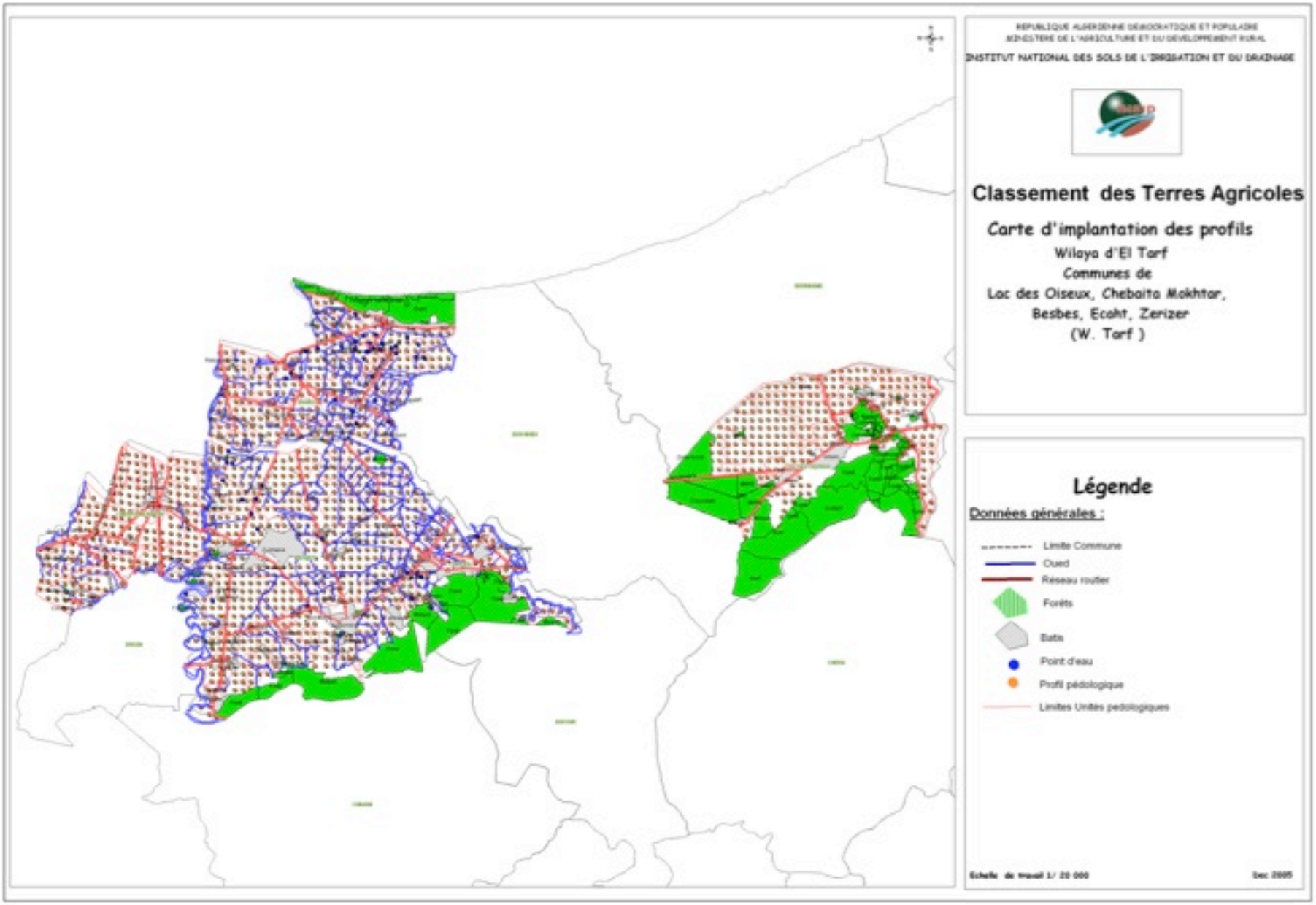

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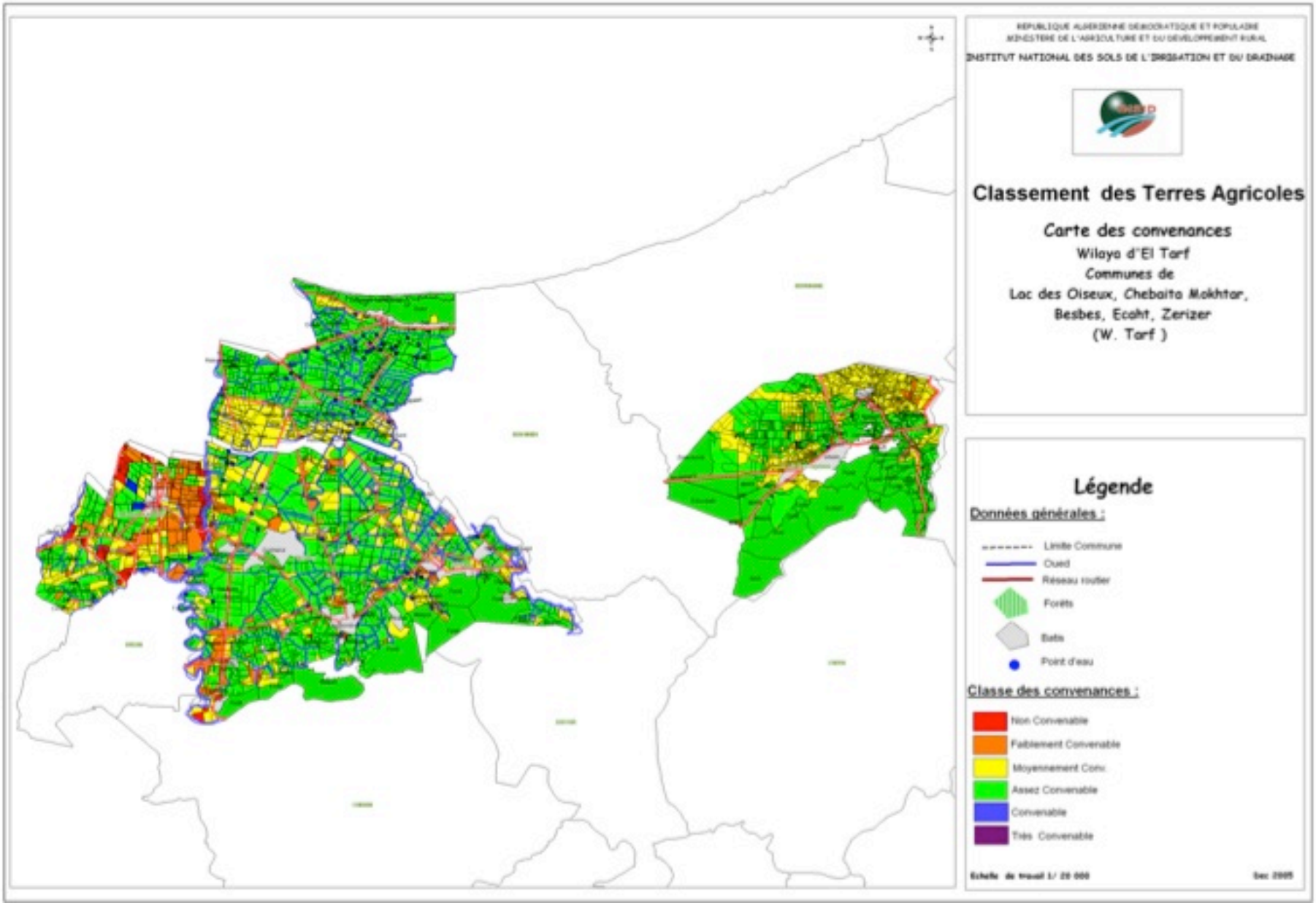


# 1.3. Current knowledge of soil resources in Algeria

- The Land Cover Map of Algeria, a **precious tool** for decision makers.

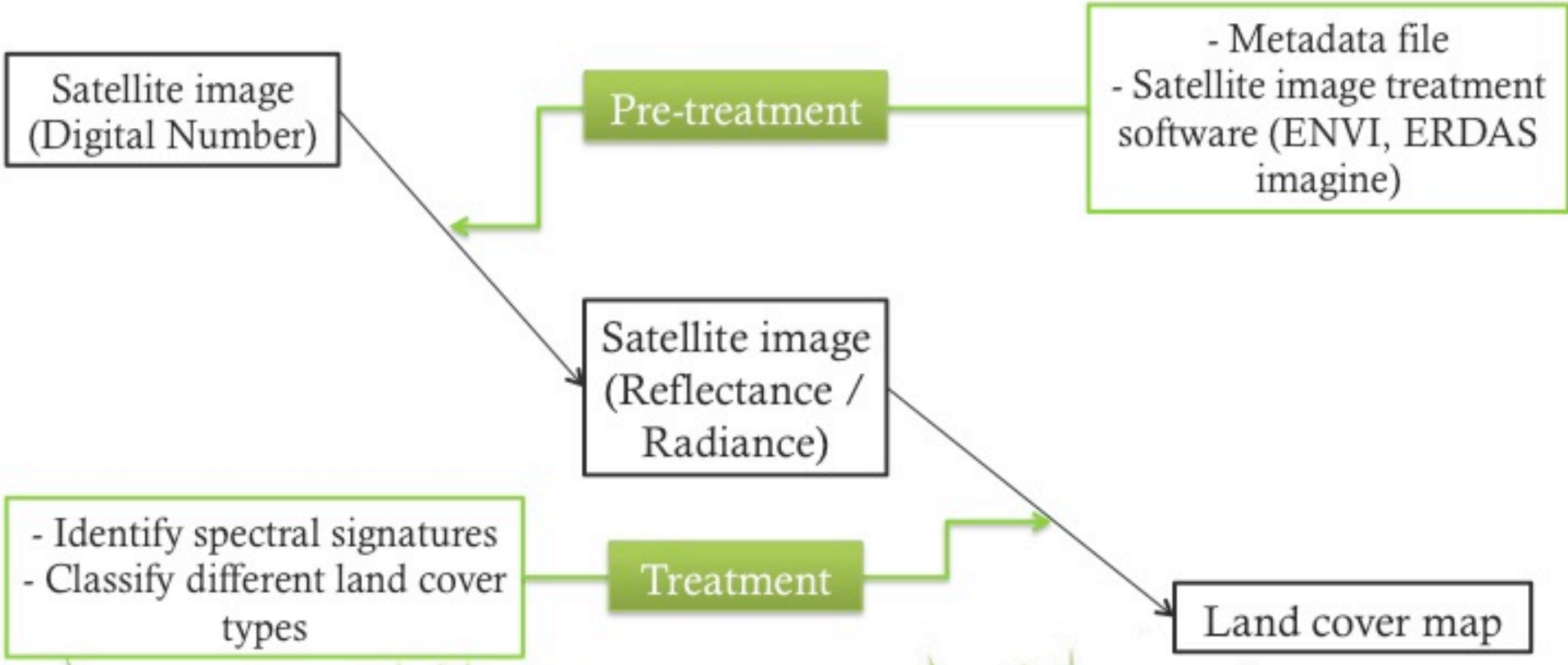
- It filled a gap of information and covered urgent needs to implement the MADR program "**revitalization of the agricultural and rural sector**" (2009)

- This is the first study that provides a **synoptic view** of the entire country.

- All the information are integrated into a Geographic Information System (GIS) → **compatibility** with other data.

# 1.3. Current knowledge of soil resources in Algeria

- The methodology is based on **remote sensing** data and Ground Control Points (**GCPs**) for verification.



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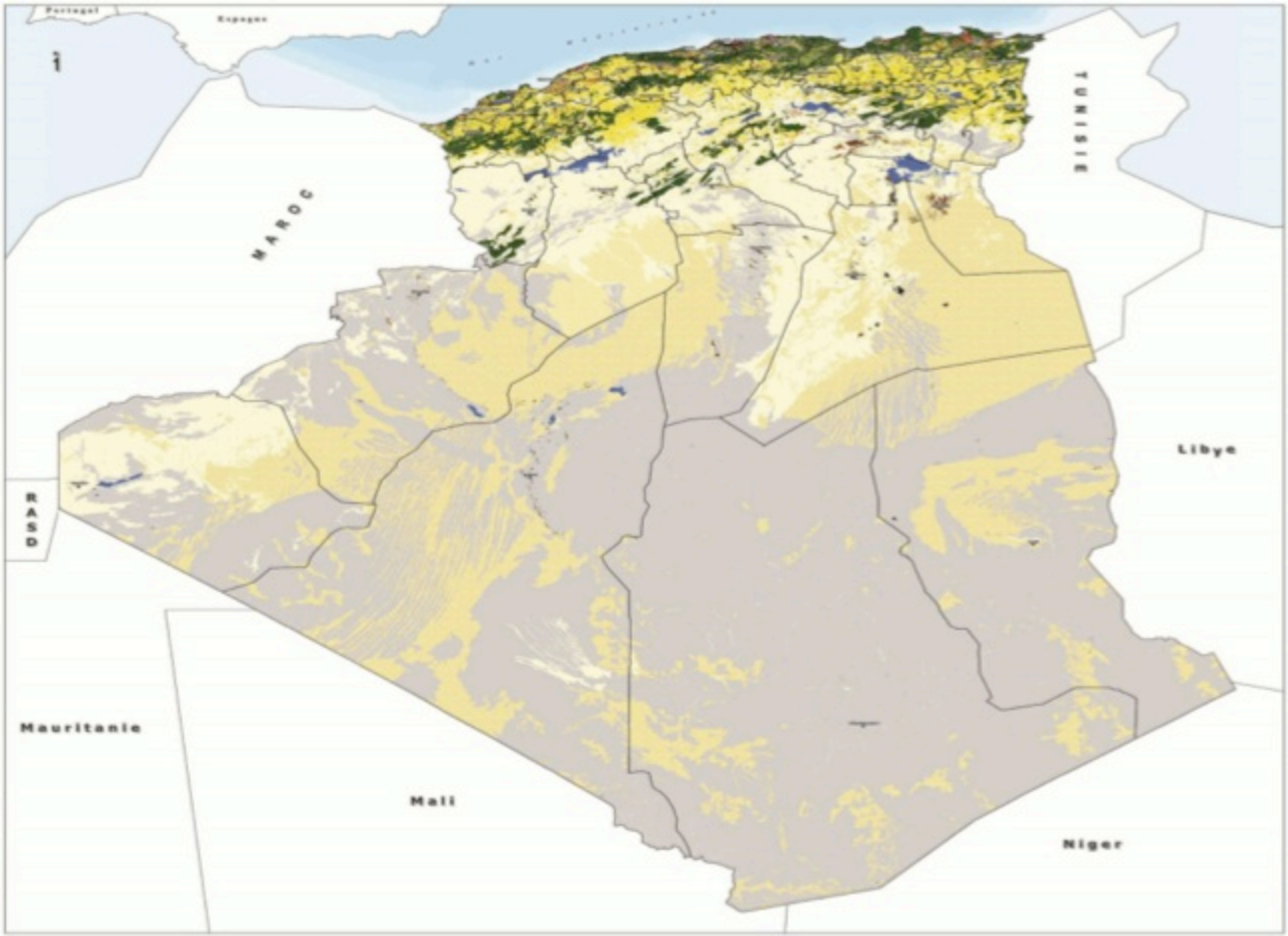

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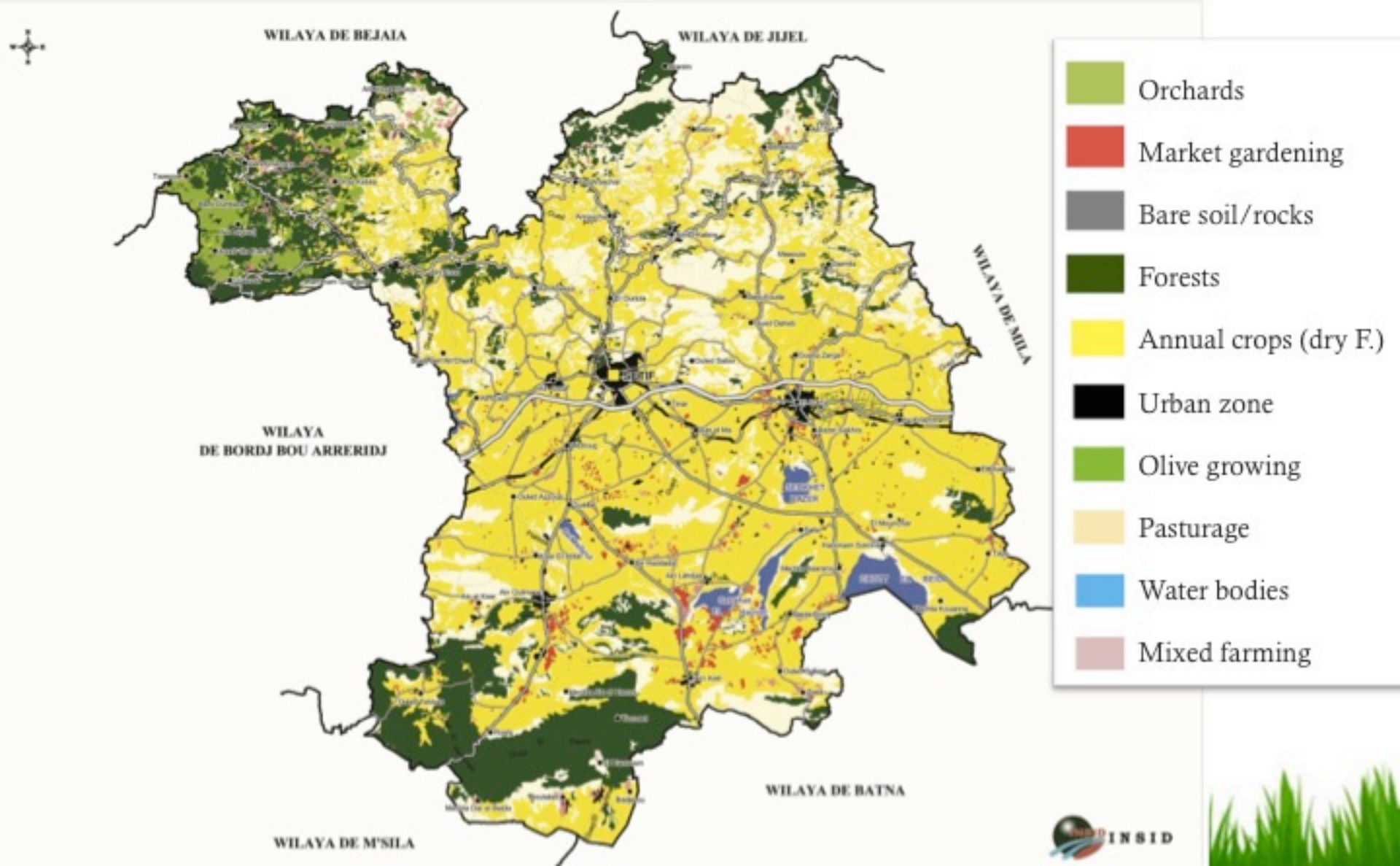


## 1.3.

| Land cover | Area (ha) | Percentage |
|---|---|---|
| *Agriculture* | | |
| Olive growing | 18 161 | 2.72 |
| Orchards | 2 225 | 0.33 |
| Mixed farming | 6 763 | 1.01 |
| Market gardening | 9 377 | 1.41 |
| Annual crops (dry farming) | 356 842 | 53.49 |
| **Used Agricultural Area** | **393 368** | **58.96** |
| Pasturage | 135 706 | 20.34 |
| Forests | 113 265 | 16.98 |
| **Total Agricultural Area** | **642 339** | **96.29** |
| Bare soil/Rocks | 636 | 0.1 |
| Water bodies | 10 983 | 1.65 |
| Urban zone | 13 194 | 1.98 |
| **Total Area of the State** | **667 150** | **100** |


# Needs and priorities to promote sustainable soil management

The **durability** of the agricultural production; the **maintenance** of soil fertility and the **protection** of land against degradation all depend on land use systems.

# 2.1. Main problems facing sustainable soil management

## Soil Erosion

Soil erosion caused over time important agricultural land **degradation** and rendered useless vast areas of the most fertile soils in Algeria

In fact, 45% of the Tellian zones (**~12m ha**) are affected by erosion (Chebbani *et al.*, 1999)

Erosion amounts and frequencies in Algeria are among the **highest** in the world. Demmak (1982) estimates soil erosion between 2000 and 4000 Tons/km2/year.

# 2.1. Main problems facing sustainable soil management

# 2.1. Main problems facing sustainable soil management

## Desertification

It is either caused by drastic changes in **climatic conditions** for a relatively long period of time, or due to the action of man and his cattle (intensive grazing).

The **steppe** is affected the most by man induced desertification. Vegetation cover is reduced to a **critical** limit in these dry areas.

# 2.1. Main problems facing sustainable soil management

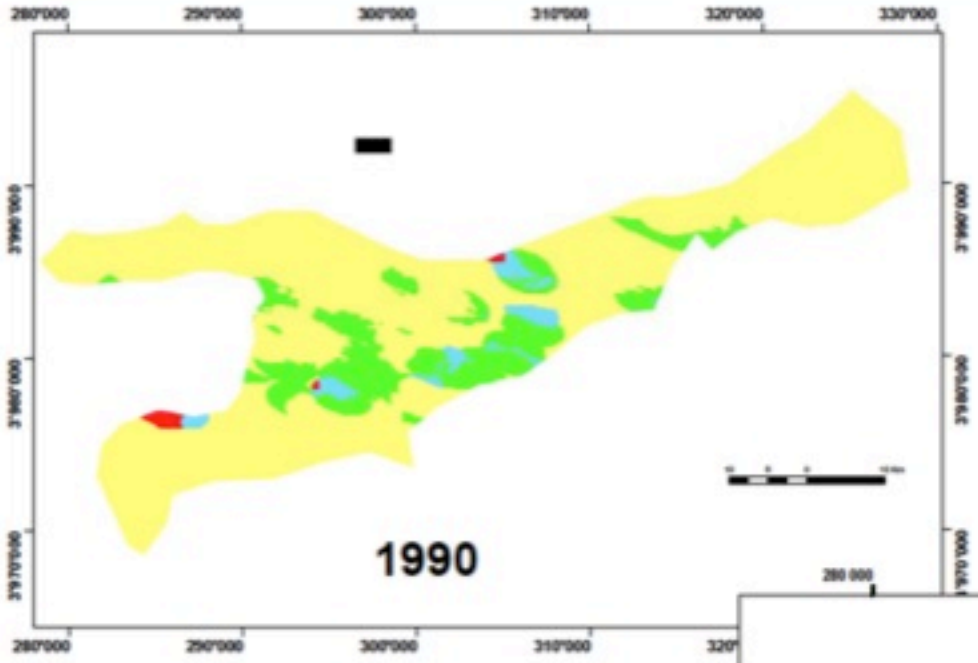
## Salinity

Soil salinity is a **common problem** in the **western** and **southern** regions of Algeria.

Using groundwater for irrigation had its consequences on the degradation of soil quality in these regions.

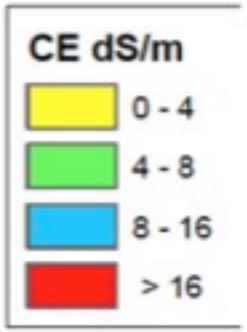
Irrigated agricultural areas have shown an increase of **salinity** and/or **sodicity** at various rates.

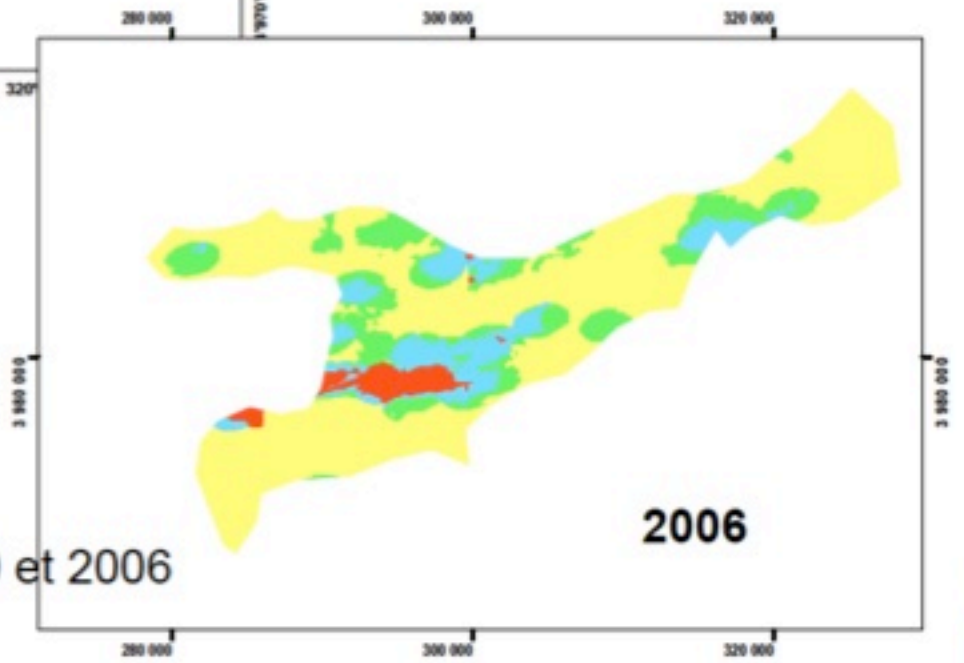
# 2.1. Main problems facing sustainable soil management




| Classe | 1990 | 2006 |
|---|---|---|
| <4 | 86.52 | 83.0 |
| 4 - 8 | 7.90 | 9.37 |
| 8 - 16 | 4.14 | 5.76 |
| > 16 | 1.44 | 1.88 |

Total Area 30 000 ha




Evolution of salinity in 1990 et 2006
the "Bas Chelif" area

# 2.1. Main problems facing sustainable soil management

## Loss of soil fertility

Intensive agriculture and monoculture regime provoke long term losses of soil fertility.

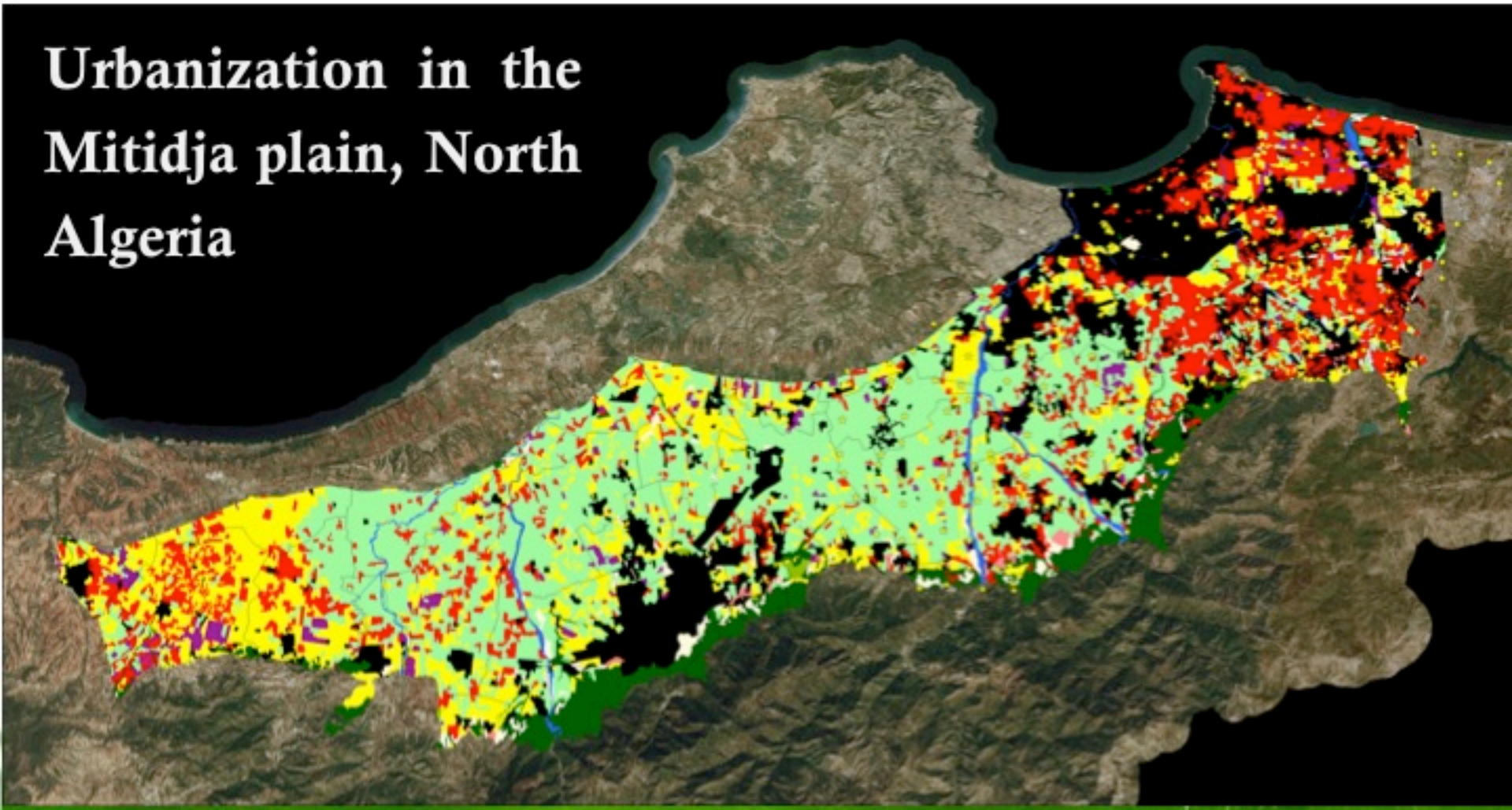
Important surfaces in Algeria are affected to cereal production and are cultivated under a **monoculture** regime and a **2 year rotation** consisting of **Cereal/Fallow** (usually mechanical)

# 2.1. Main problems facing sustainable soil management

## Pollution

# 2.1. Main problems facing sustainable soil management

## Urbanization



# 2.1. Main problems facing sustainable soil management

## Bad agricultural practices

# 2.2. Actions to improve natural resources management

## Solutions to soil erosion

Biologic solutions (Tree plantations)

# 2.2. Actions to improve natural resources management

## Solutions to soil erosion

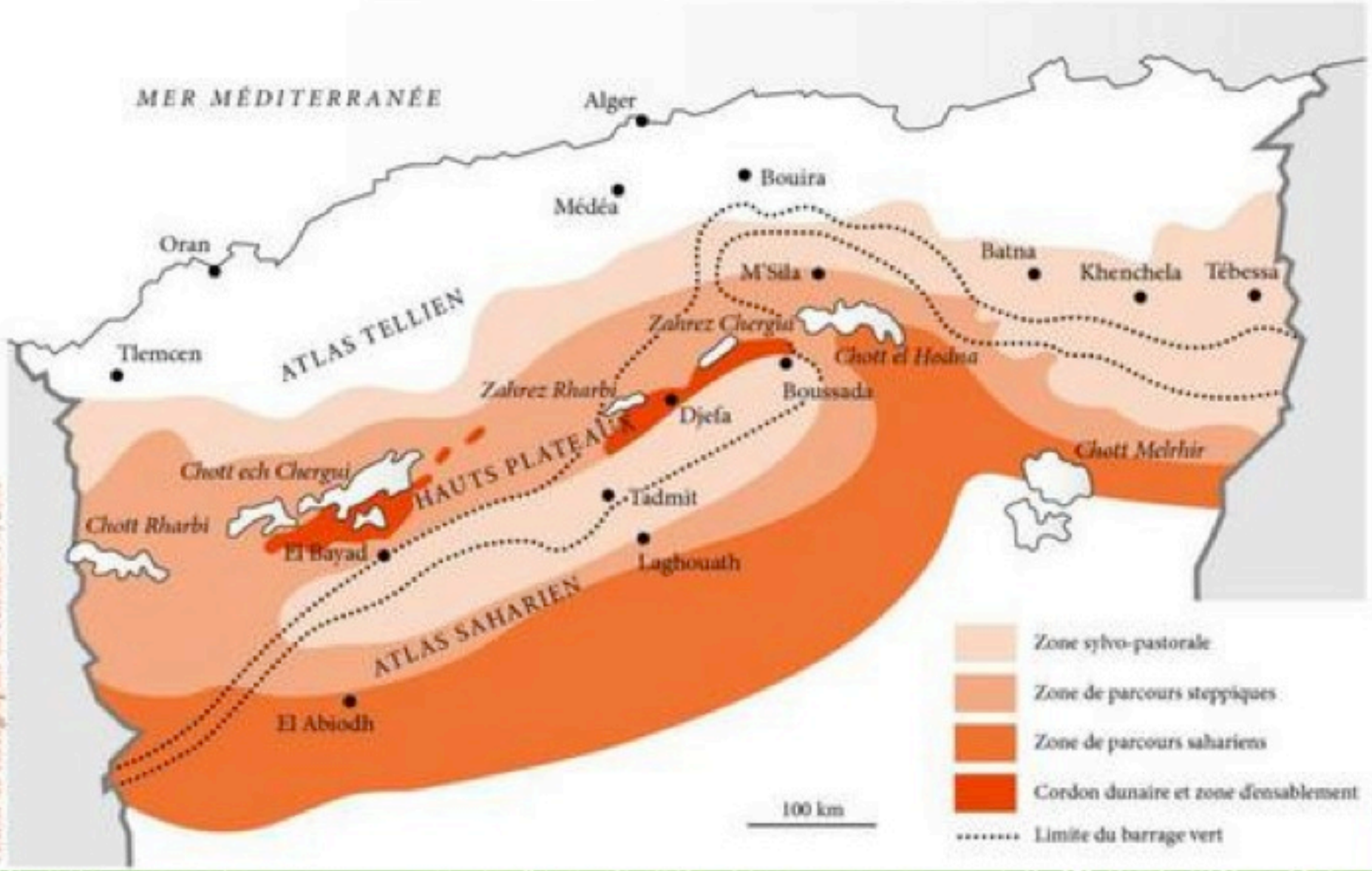
Mechanical solutions (Rock barrier)

# 2.2. Actions to improve natural resources management

Considerable efforts have been made by the Algerian government to expand irrigated areas. However, additional efforts must be made to master irrigation techniques and improve their efficiency.

| Speculations | 1990 | 1995 | 1999 | 2003 |
|---|---|---|---|---|
| Market gardening. | 172 820 | 189 200 | 194 280 | 239 111 |
| Orchards | 151 180 | 157 420 | 182 530 | 248 504 |
| Industrial crops | 9 730 | 19 480 | 26 500 | 20 483 |
| Cereals | 25 750 | 48 250 | 73 310 | 120 396 |
| Vineyards | 5 610 | 2 250 | 2 640 | 4 789 |
| Total | 365 090 | 416 600 | 479 260 | 633 283 |

# 2.2. Actions to improve natural resources management



# 2.2. Actions to improve natural resources management

The ministry of agriculture and rural development (MADR) has dedicated an entire program for "**Capacity development**".

**Technical and research institutes** are all involved in this program. Activities include but are not limited to national and regional events (seminars, workshops …); farmer advisory groups, technical assistance, field trials, farmer field schools … etc.

# Conclusion

Today, The agricultural sector **does not have** a **base document** that contains accurate information on **soil potential** in Algeria. However, the government is investing heavily to fill this gap of information. The "**Revitalization of the agricultural and rural sector**" is a massive program of the MADR that focuses on many fields.

# Conclusion

- Intensification of cereal production (to cover at least 70% National needs)
- Supplement irrigation for cereals (to help stabilize cereal production and reduce the effects of aridity)
- Development of market gardening products (mainly Potato)
- Development of dry legumes
- Economic water management program (to identify the best management plan for water resources)

# Conclusion

- To **modernize** our agriculture, increase yields;

- To preserve our agricultural land against all forms of degradation;

- To better plan agricultural land development actions and find opportunities to expand the used agricultural area.

The Algerian government has also **invested** in international cooperation and **promoted** the agricultural investments through a multitude of formulas for financial aids for farmers.


Thank you