



الجمهورية التونسية
REPUBLIC OF TUNISIA



**Geospatial data and tools for natural resources
management in the drylands of Tunisia**

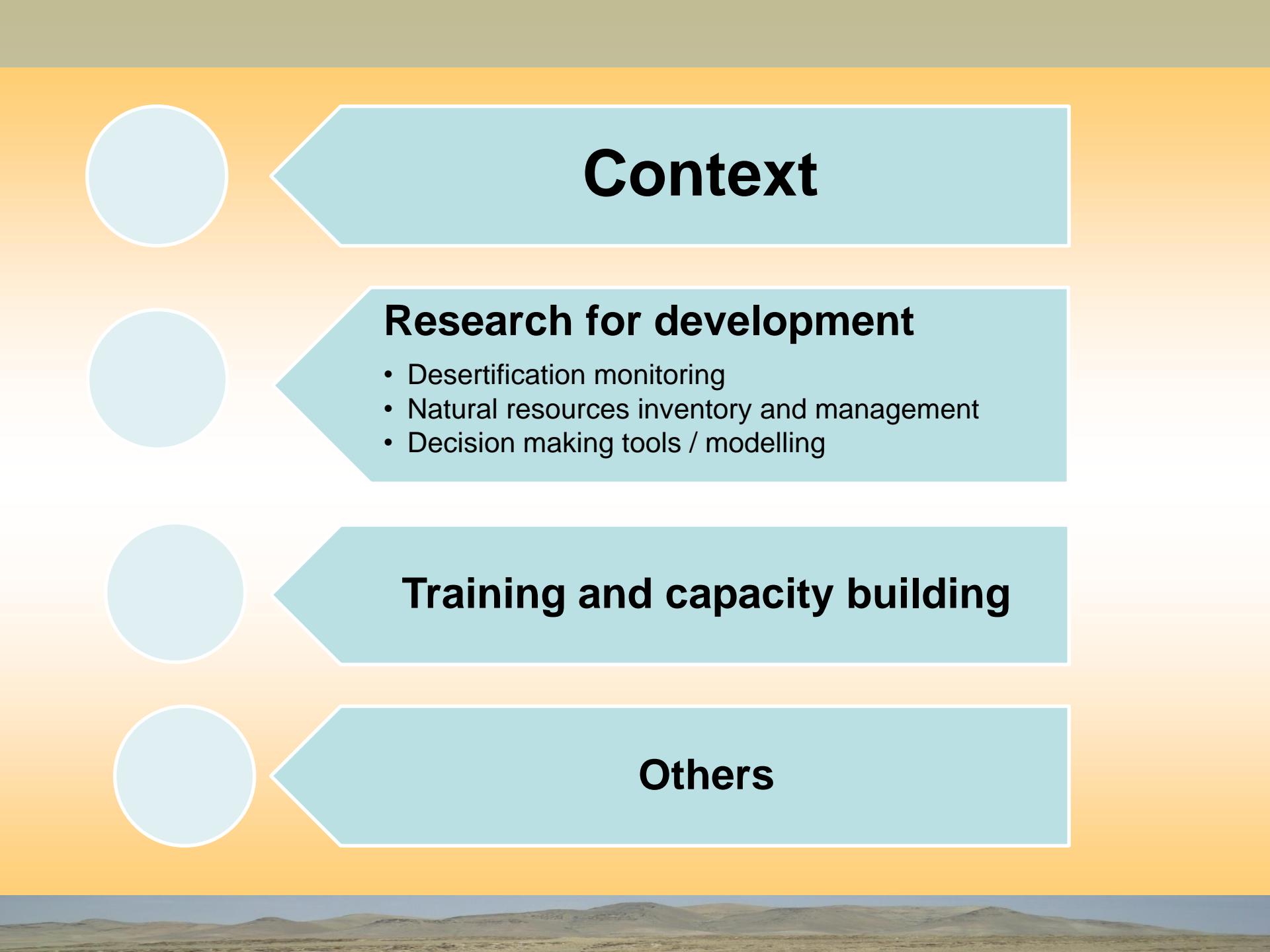
Arid Zones Research Institute (IRA), Médenine,

Tunisia

07 December 2017

Laboratoire d'Eremologie et Lutte Contre la Désertification

Unité de Télédétection et Systèmes d'Information Géographique



Context

Research for development

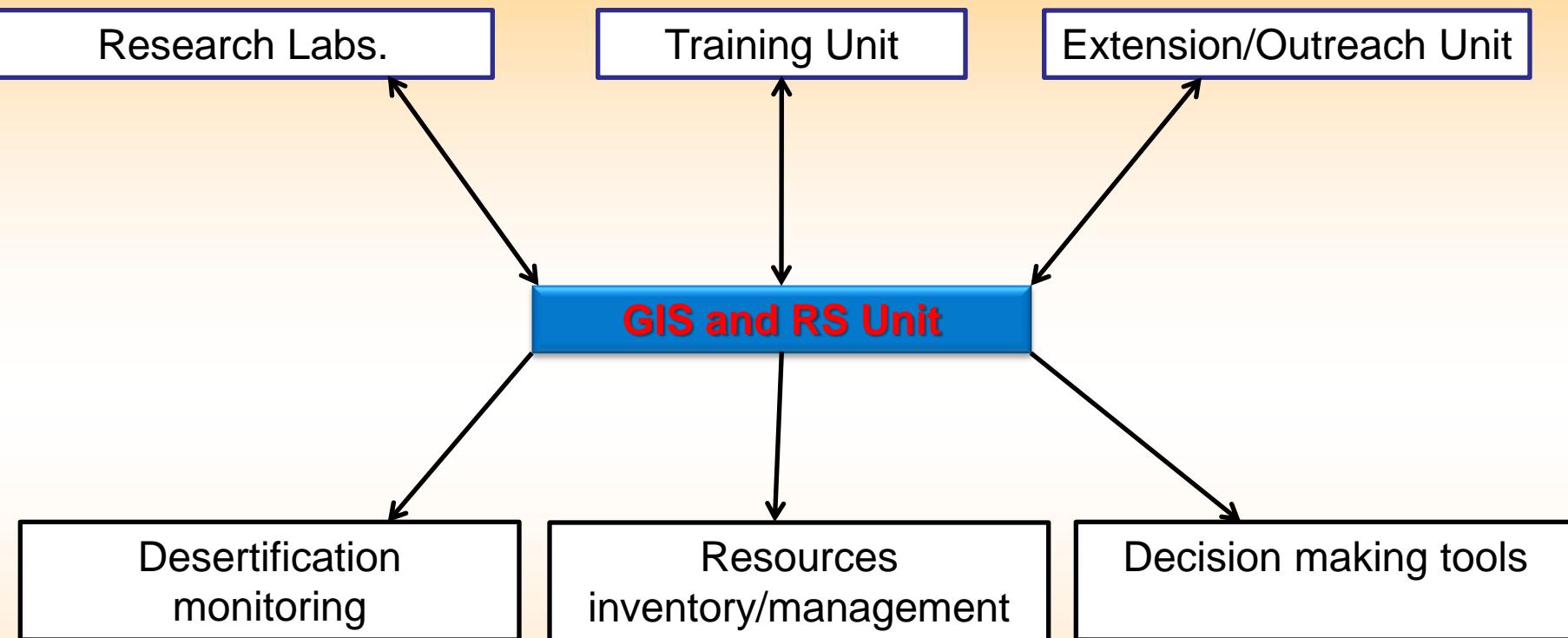
- Desertification monitoring
- Natural resources inventory and management
- Decision making tools / modelling

Training and capacity building

Others

Context

- With **scarce and fragile natural resources** and rapid socio-economic mutations, drylands in the country, which cover large areas, are faced increasingly to dynamic challenges.
- The use of **advanced technologies** has become highly demanded for **assisting decision makers**, especially in the fields of desertification monitoring and environmental modelling, for natural resources management and development both at national and local levels.



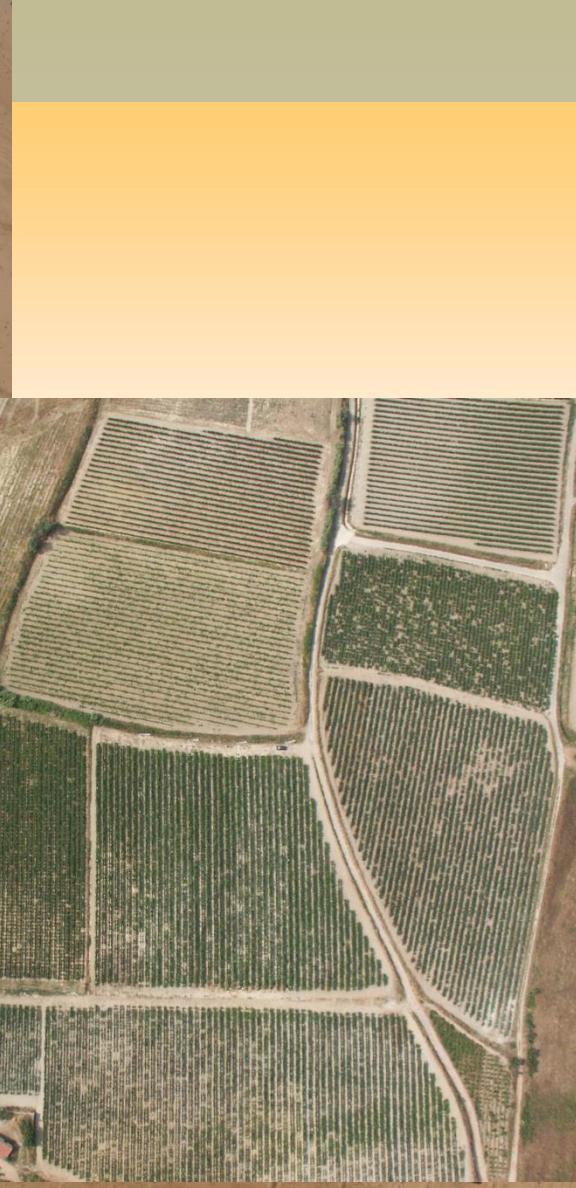
Research for development

1. MONITORING OF LAND DEGRADATION

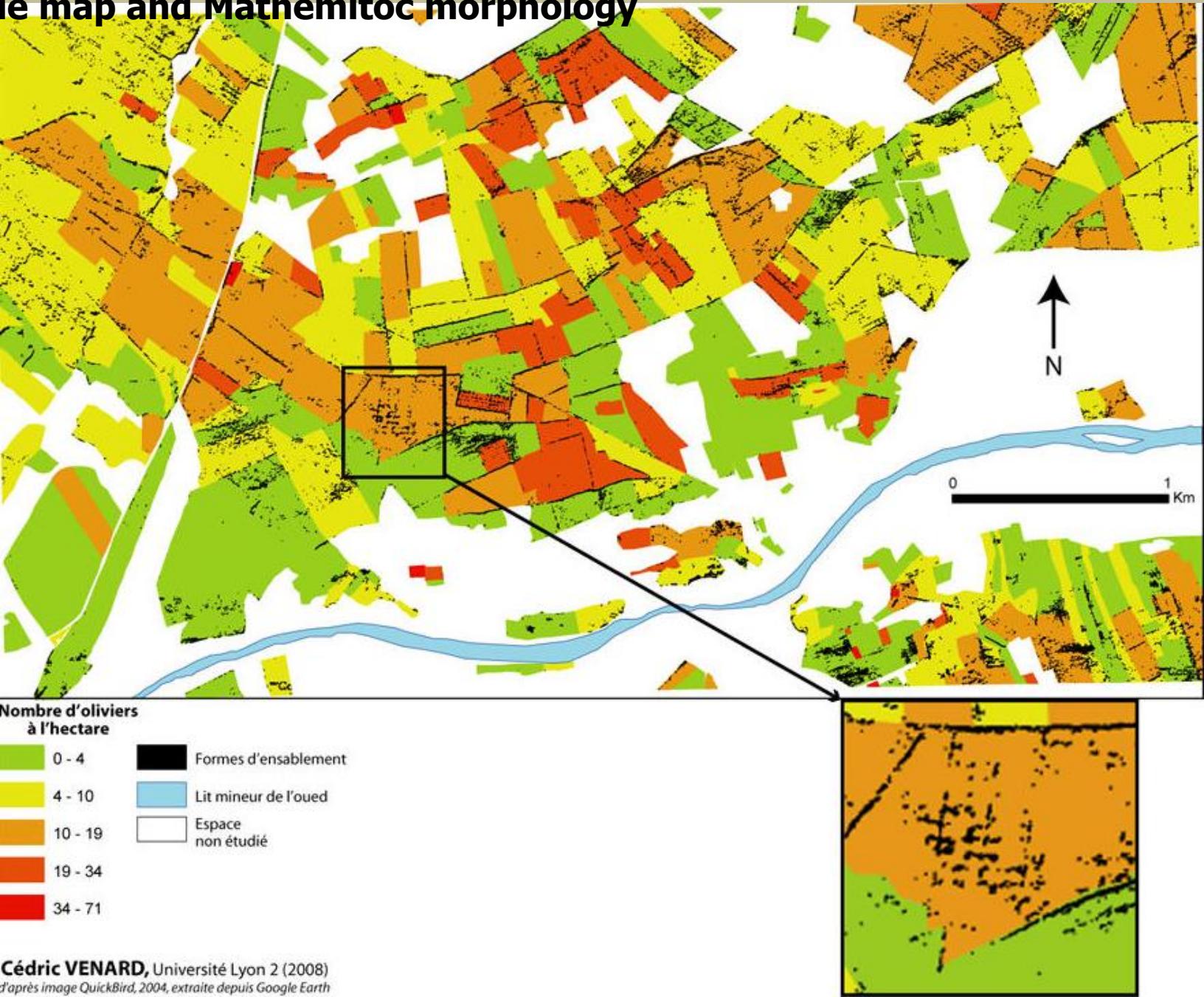
Ouerchefani et al., 2012
Venard et al. , 2010

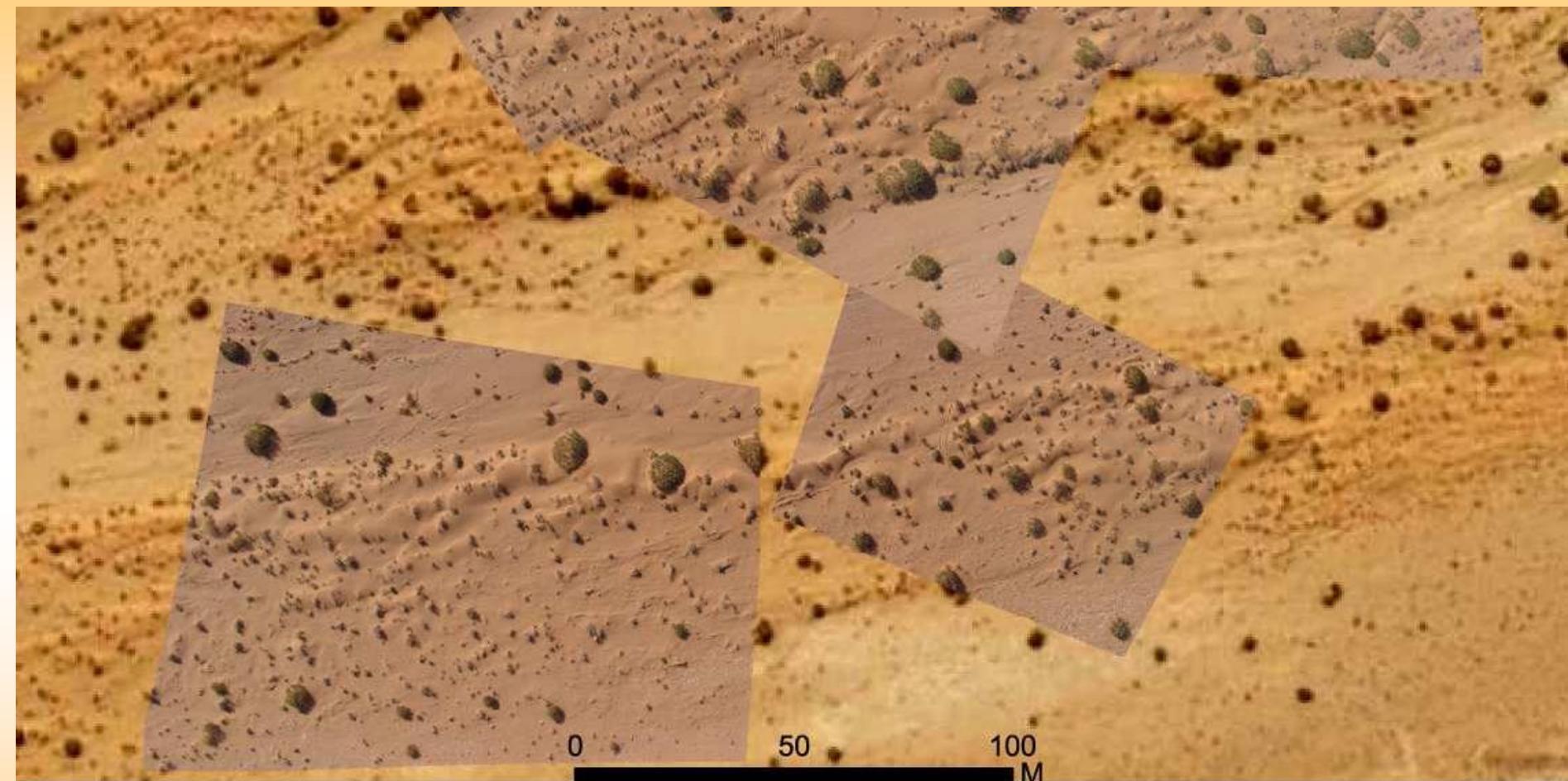
THE DRONE PIXY





Mapping olive groves and sand accumulations using google map and Mathemitoc morphology



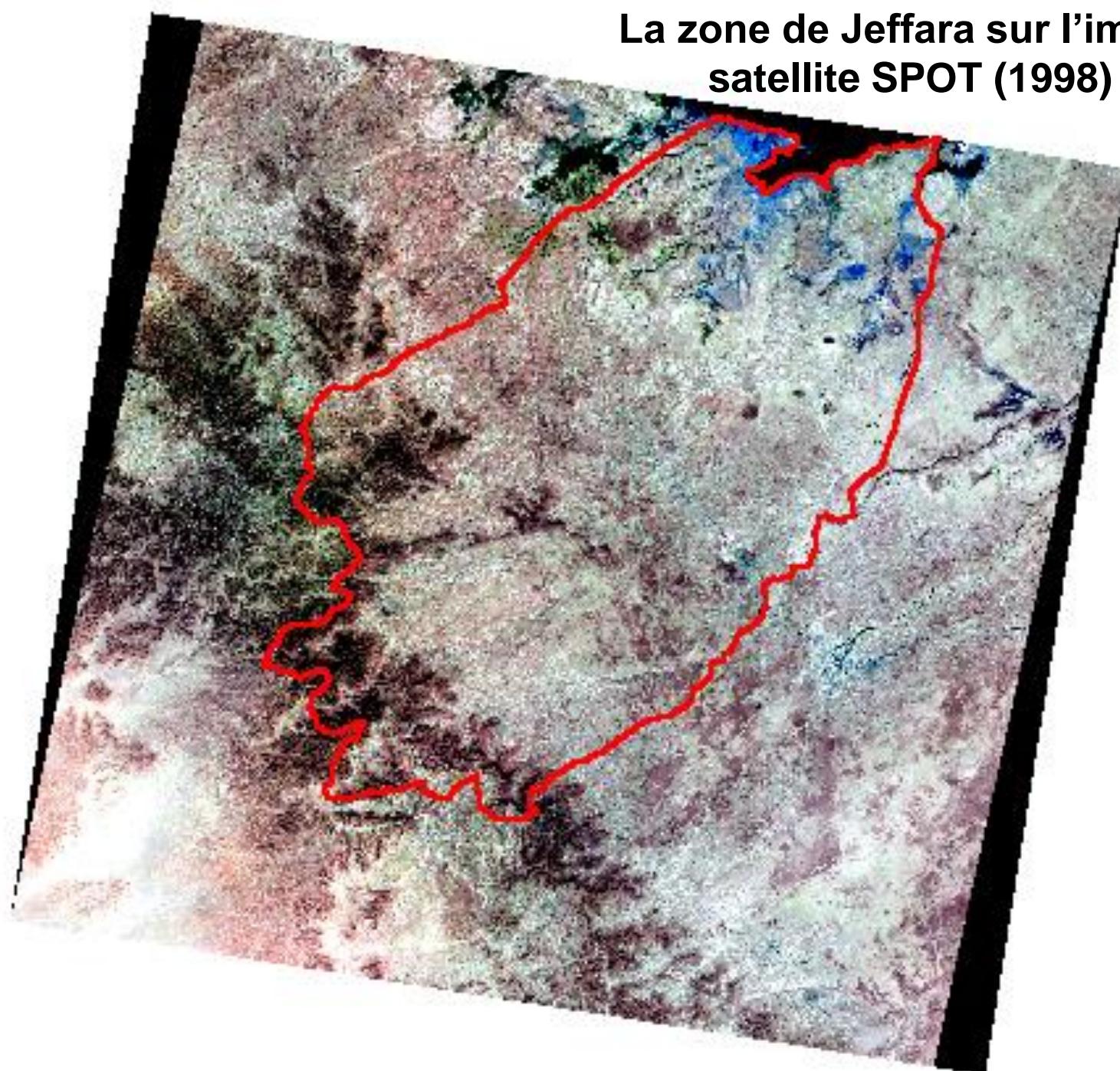


**Mosaïque des images
Google et Pixy**

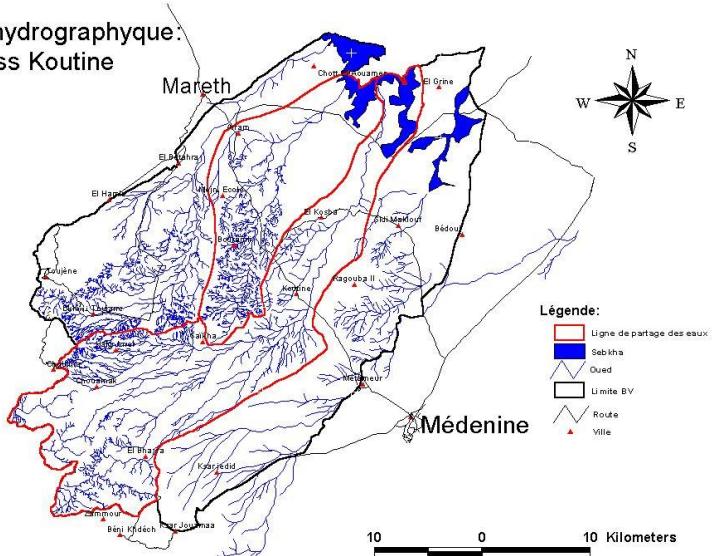
2. Application of RS and GIS techniques for natural resources inventory and management

Ouessar et al., 2006, 2009
Ouled Belgacem et al., 2006
Taamallah et al., 2003

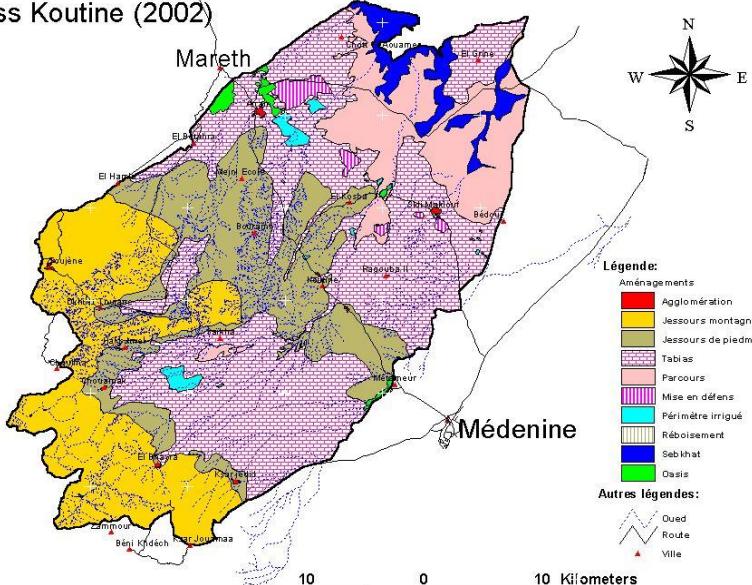
La zone de Jeffara sur l'image satellite SPOT (1998)



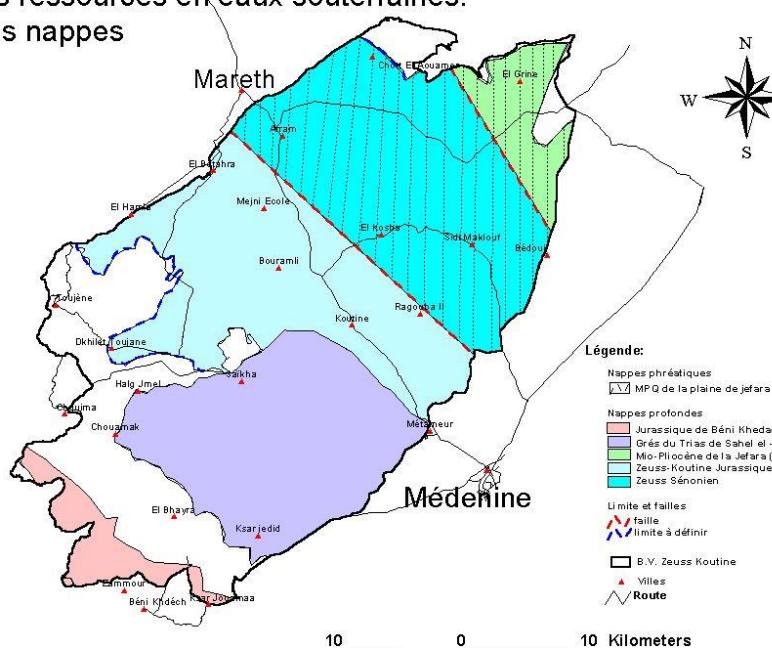
Réseau hydrographique: B.V. Zeuss Koutine



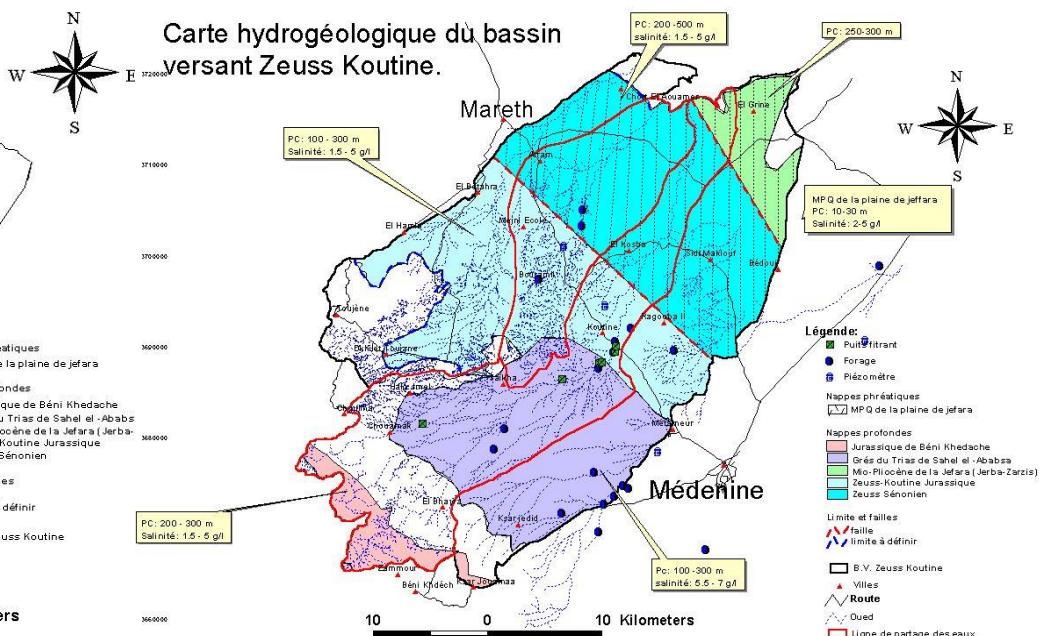
Carte des Aménagements existants: B.V. Zeuss Koutine (2002)



Carte des ressources en eaux souterraines: Limite des nappes

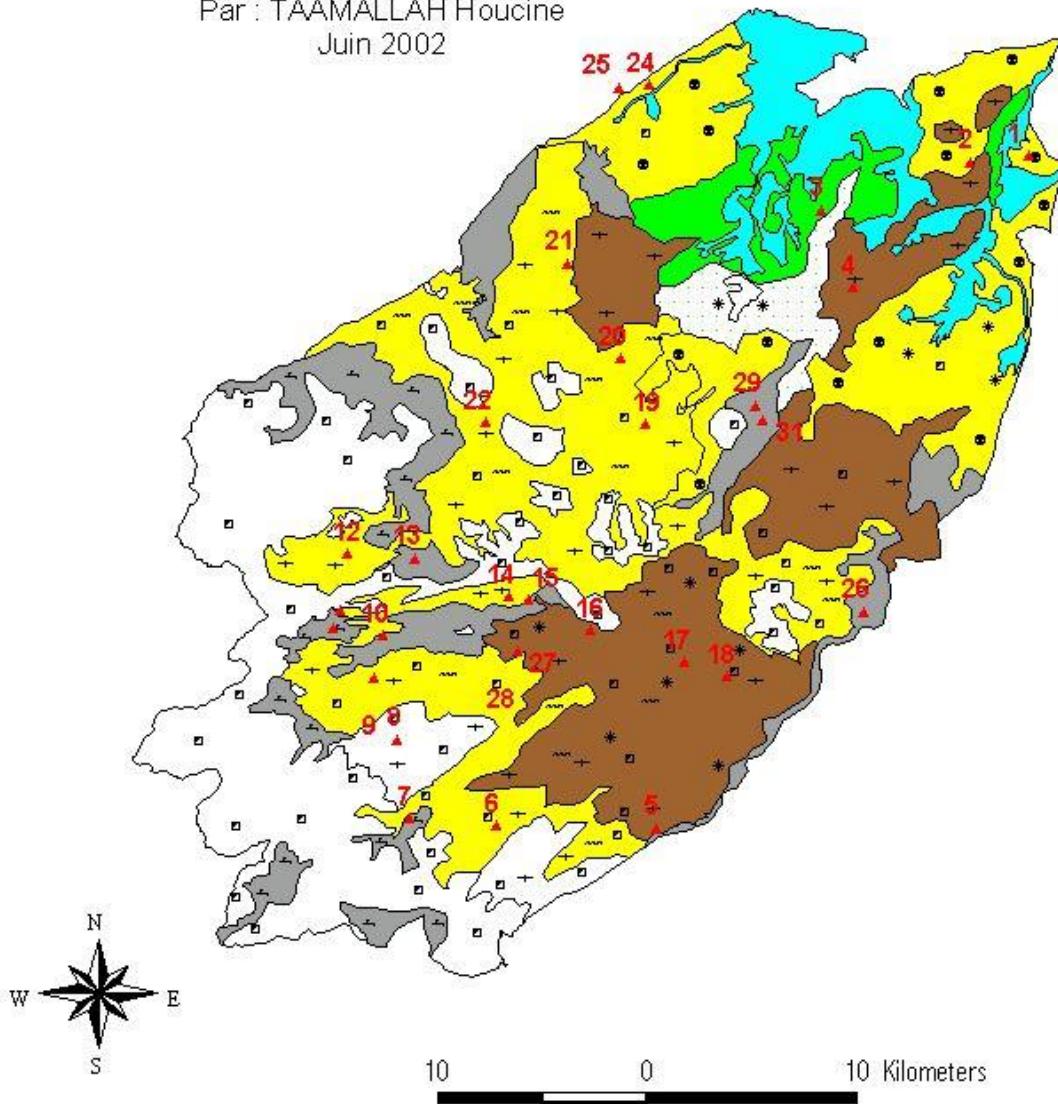


Carte hydrogéologique du bassin versant Zeuss Koutine.



CARTE PEDOLOGIQUE DU BASSIN VERSANT ZEUSS-KOUTINE

Par : TAAMALLAH Houcine
Juin 2002



LEGENDES

Sols Minéraux Bruts

□ d'Erosion Hydrique

Sols peu Evolus

□ d'Erosion Hydrique

□ d'Apport Hydrique

△ d'Apport Eolien

Sols Calcimagnésiques

■ Rendzines Calcaires

○ Rendzines Gypseuses

Sols Isohumiques

■ Bruns Calcaires tronqués sur Coûtes Calcaires

Sols Hydromorphes

■ à saturation continue ou temporaire avec le caractère d'Halomorphie

Sols Halomorphes

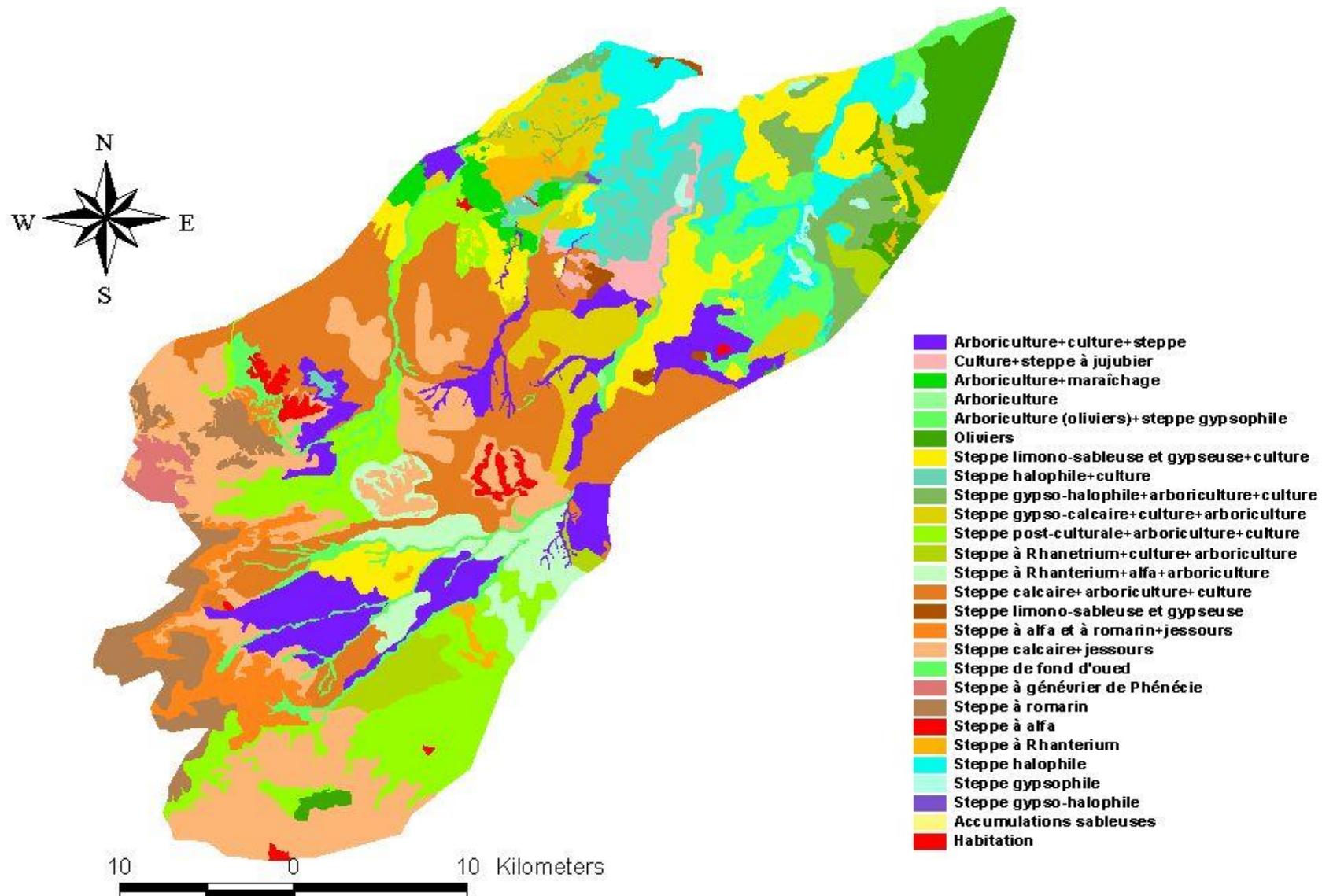
■ à caractère Hydromorphe

□ Salins

Autres Legends

- Voile Eolian
- * Micro-Nebkas
- Cailloux à la surface
- Croûte calcaire
- Croûte gypseuse
- Apport Eolian
- ▲ Profil pédologique

Carte d'occupation des terres: état 2002

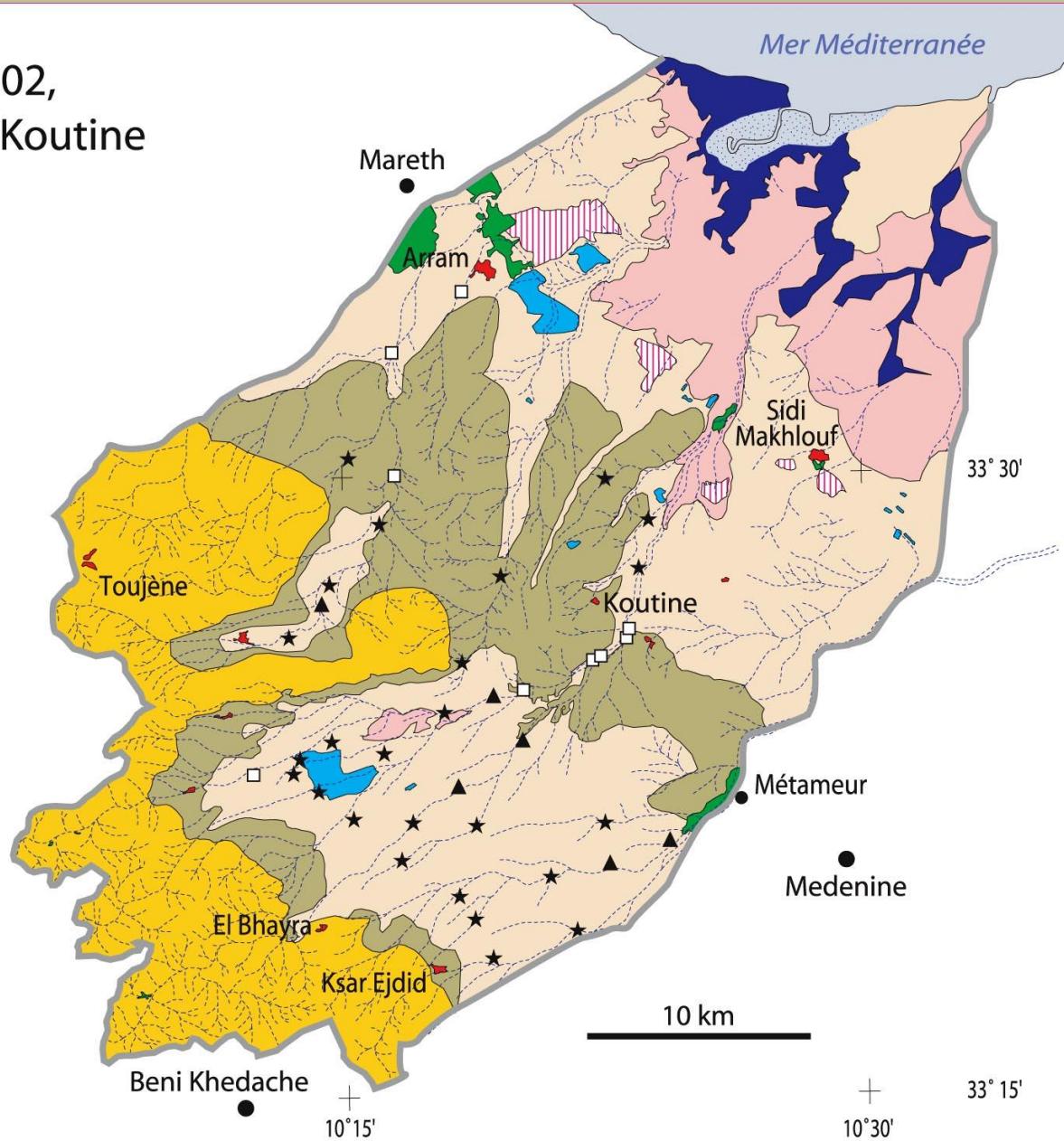


Aménagements CES, état 2002, dans le bassin versant de Zeuss - Koutine

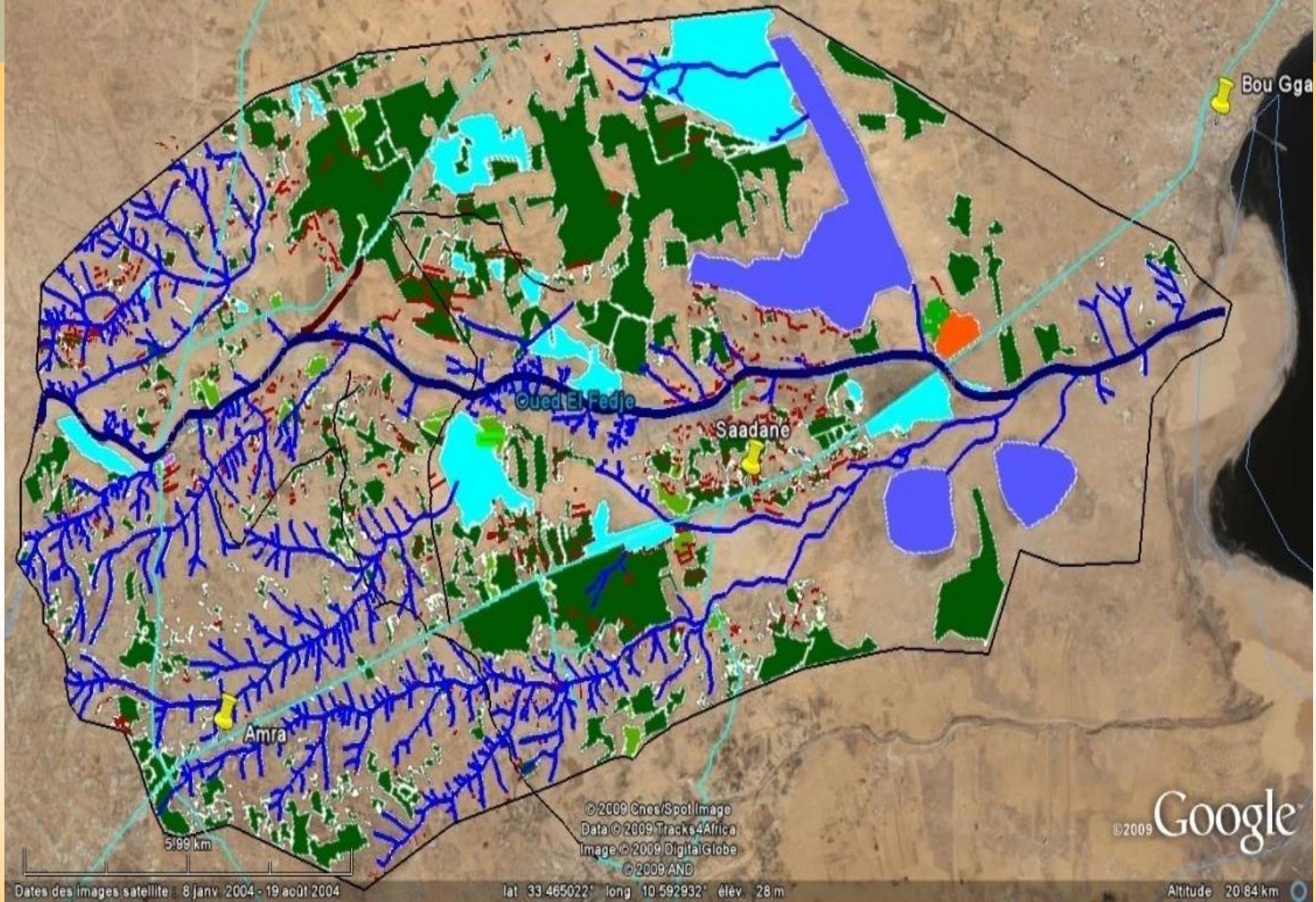
- agglomération
- jessour montagneux
- jessour de piémont
- tabia
- parcours
- mise en défens
- périmètre irrigué
- oasis
- reboisement
- sebkha

- puit filtrant
- ▲ ouvrage d'épandage
- ★ ouvrage de recharge

- limite de la zone d'étude
- - - - - oued
- ville



M. OUESSAR, M. BOUFELGHA,
A. OUDED BELGACEM, H. YAHYAOUI
IRA Medenine, CRDA Medenine, 2002

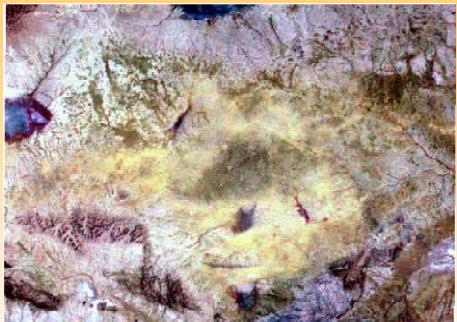


Mapping combating desertification works using google images

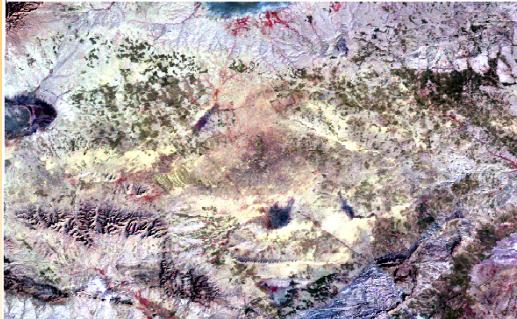
3. MONITORING OF ECOSYSTEMS

Ouled Belgacem et al., 2006
De Boever et al., 2016
Van Colie et al., 2016

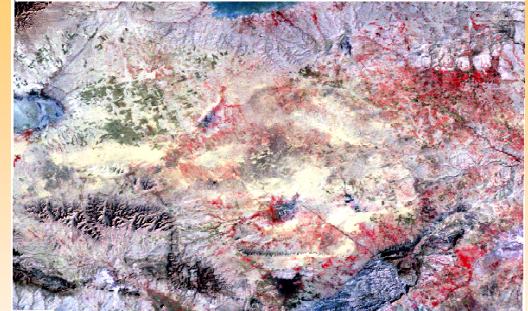
Menzel Habib



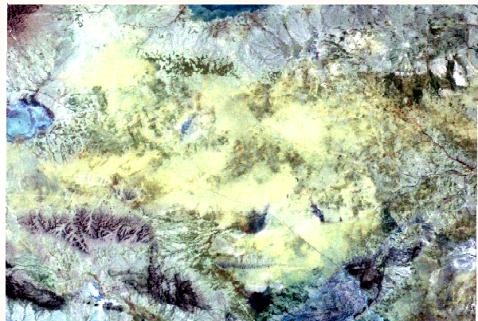
1972



1975

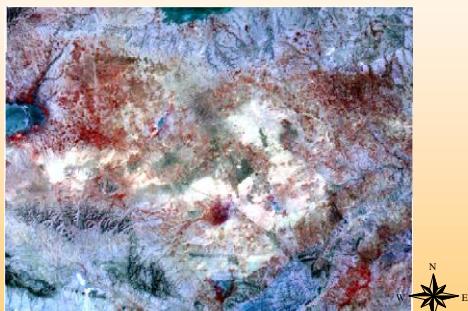


1978



1981

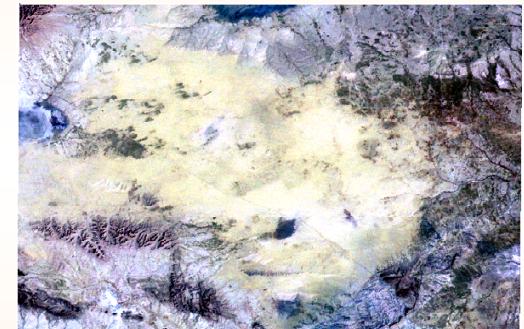
Image satellitaire de la zone prise en 1993



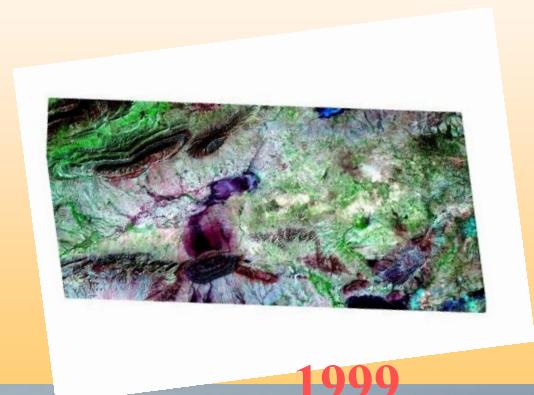
1993



1996

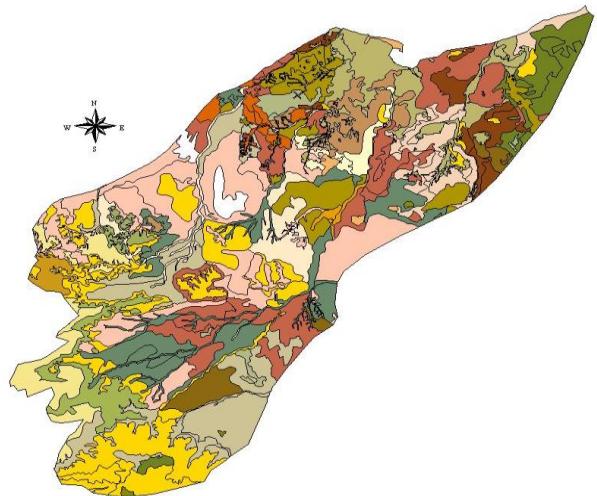


1991

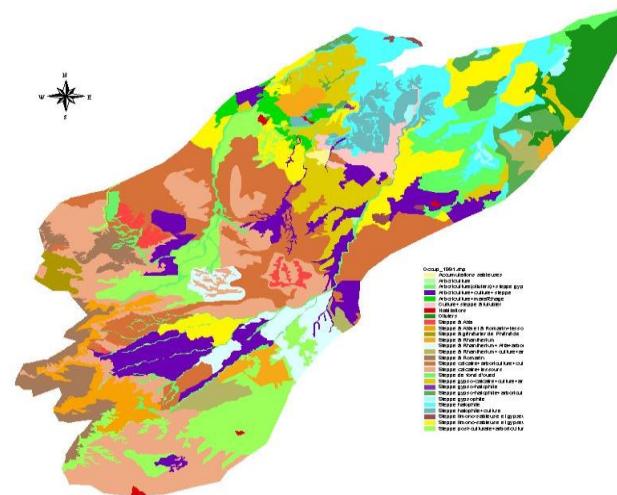


1999

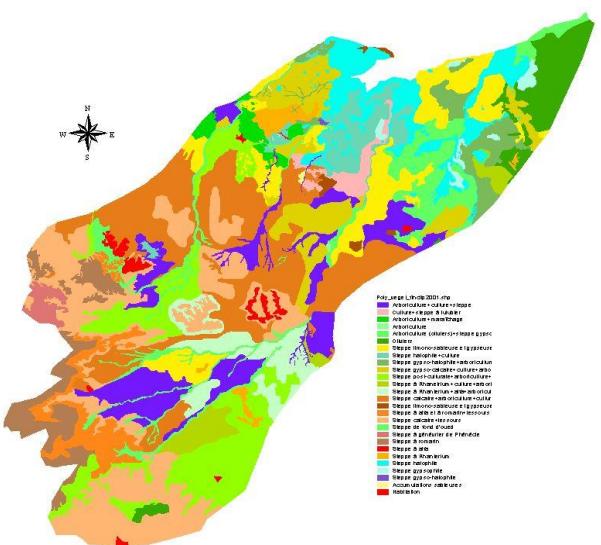
Jeffara



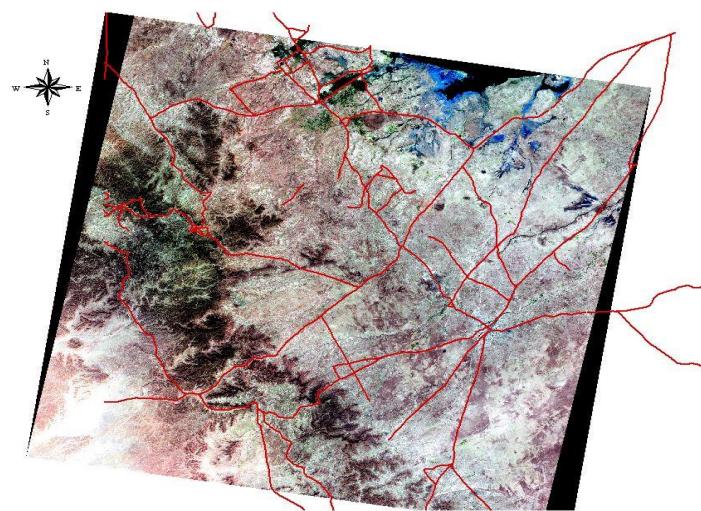
1972



1992



2002

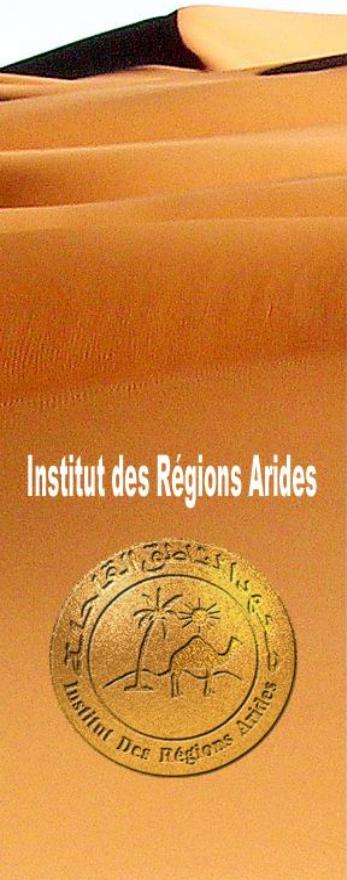


1998

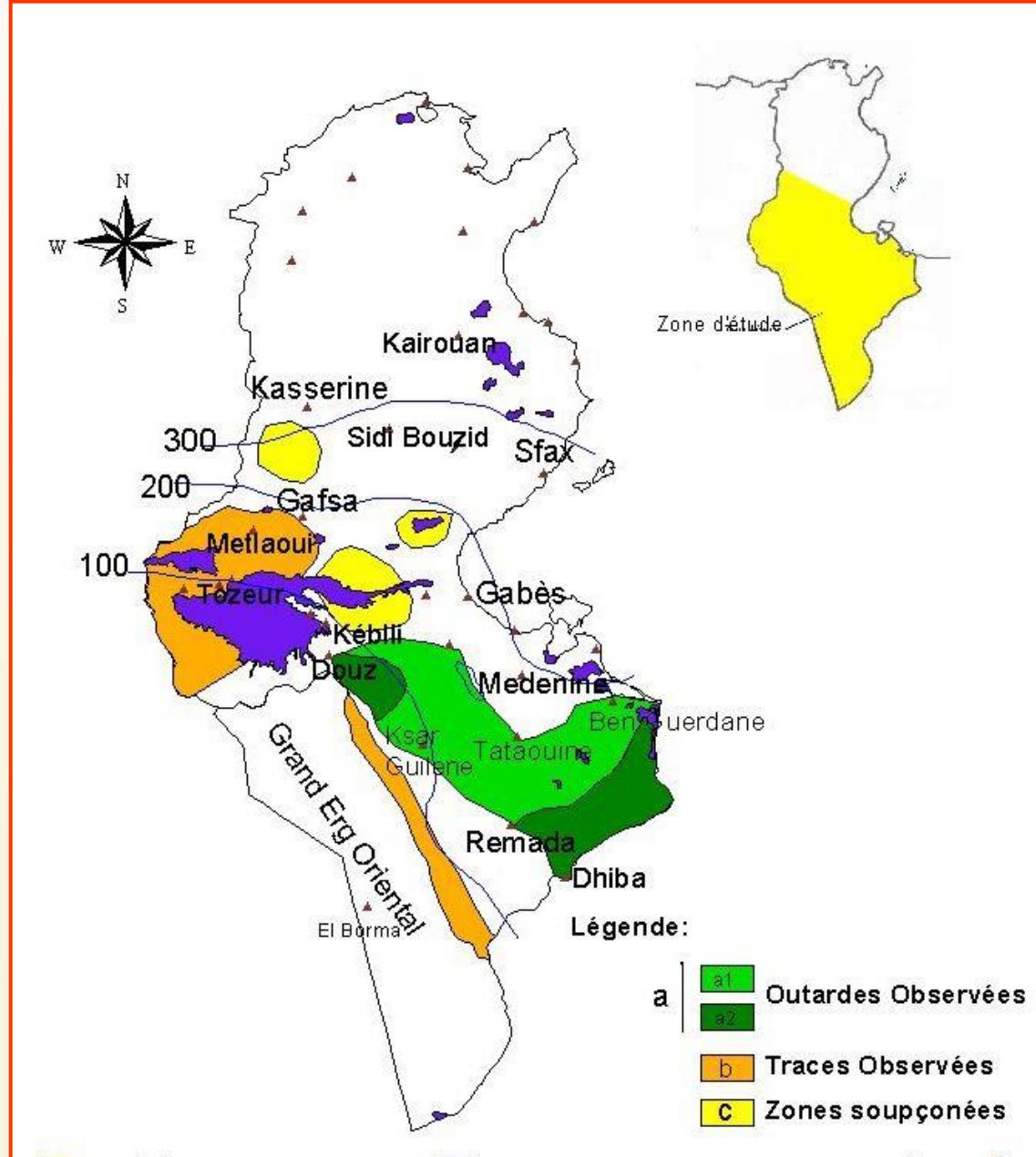
Houbara monitoring in the Saharan regions

Chammem et al.
(2013)





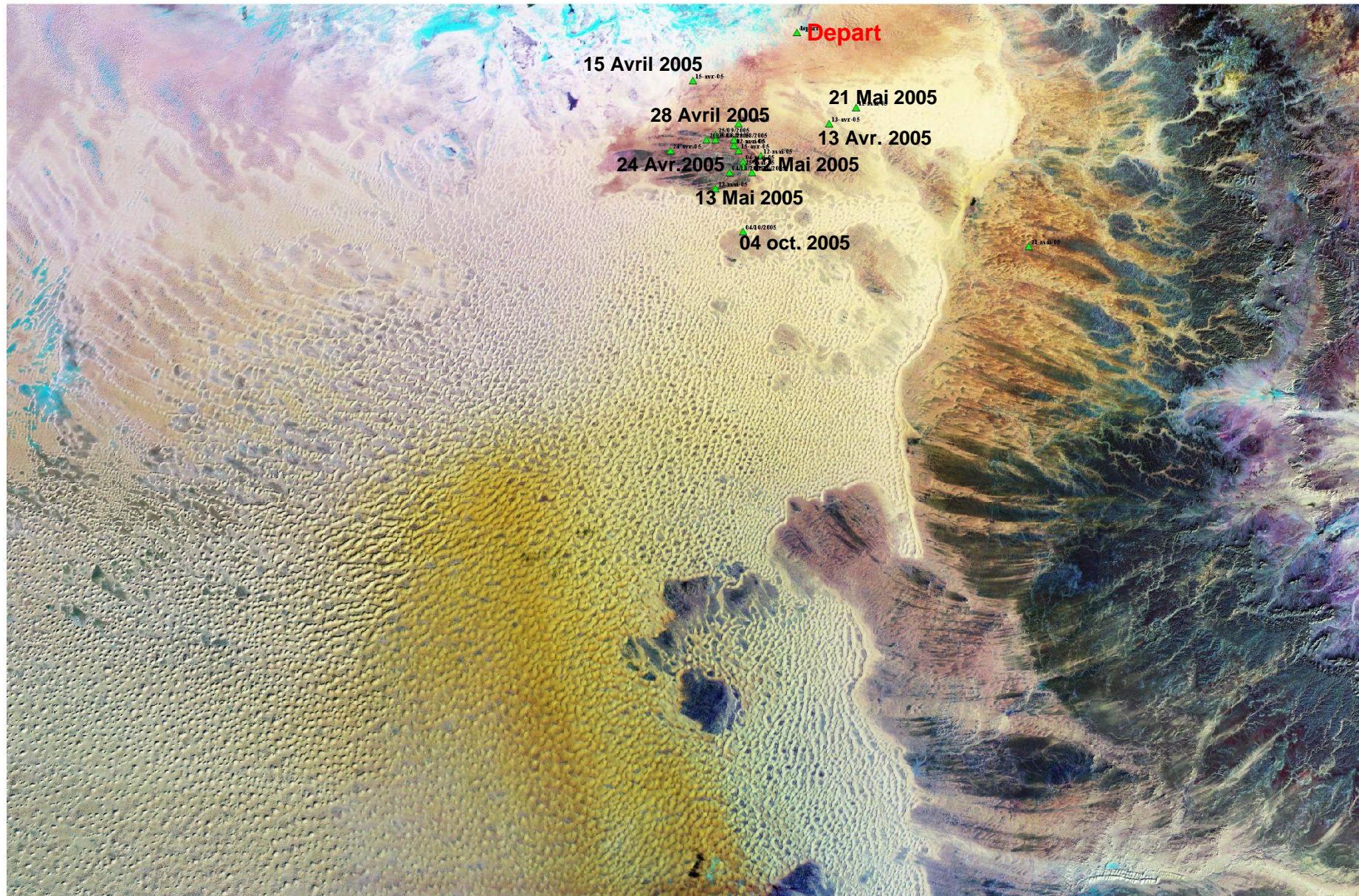
Institut des Régions Arides



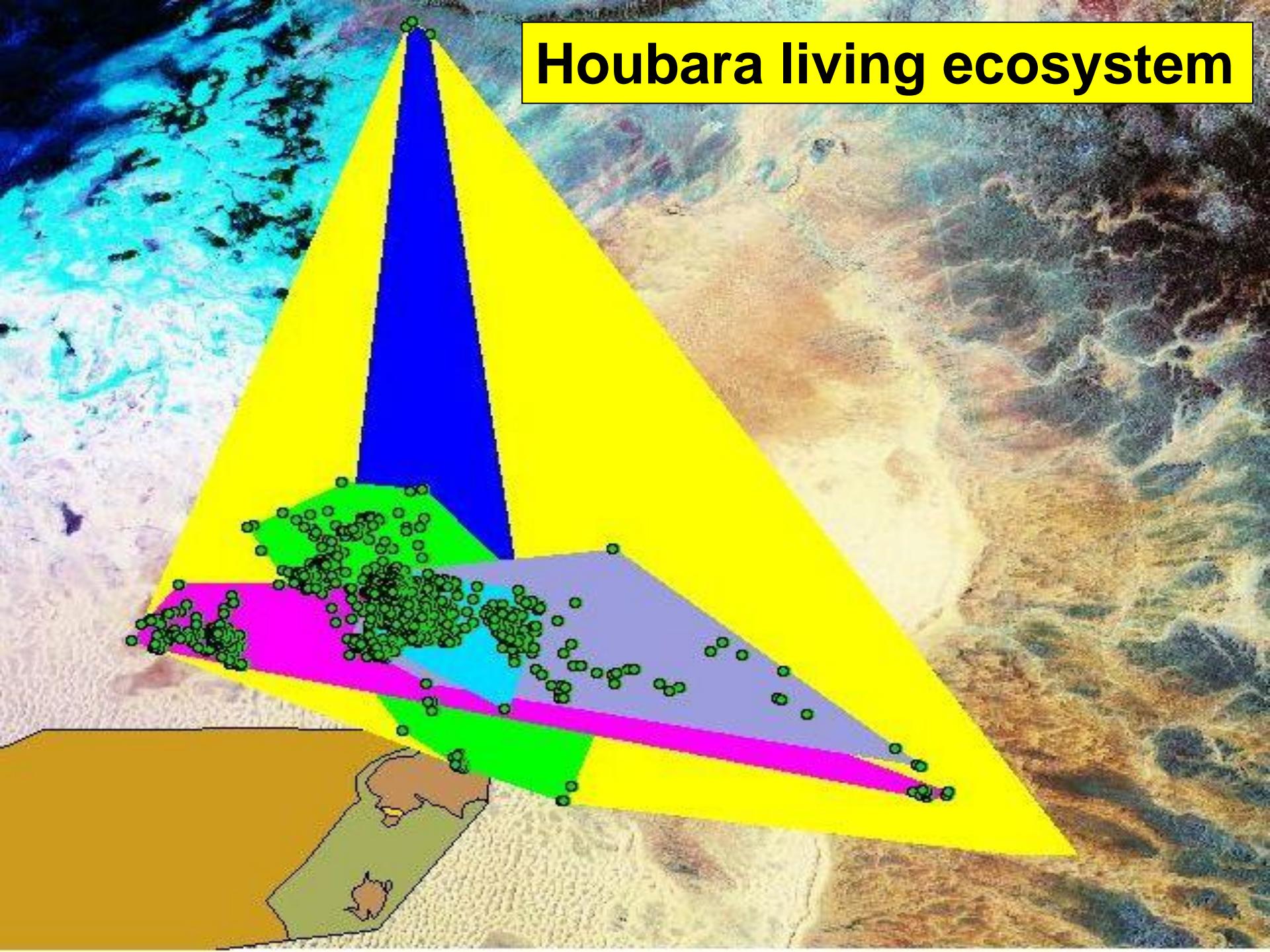


4/4/08

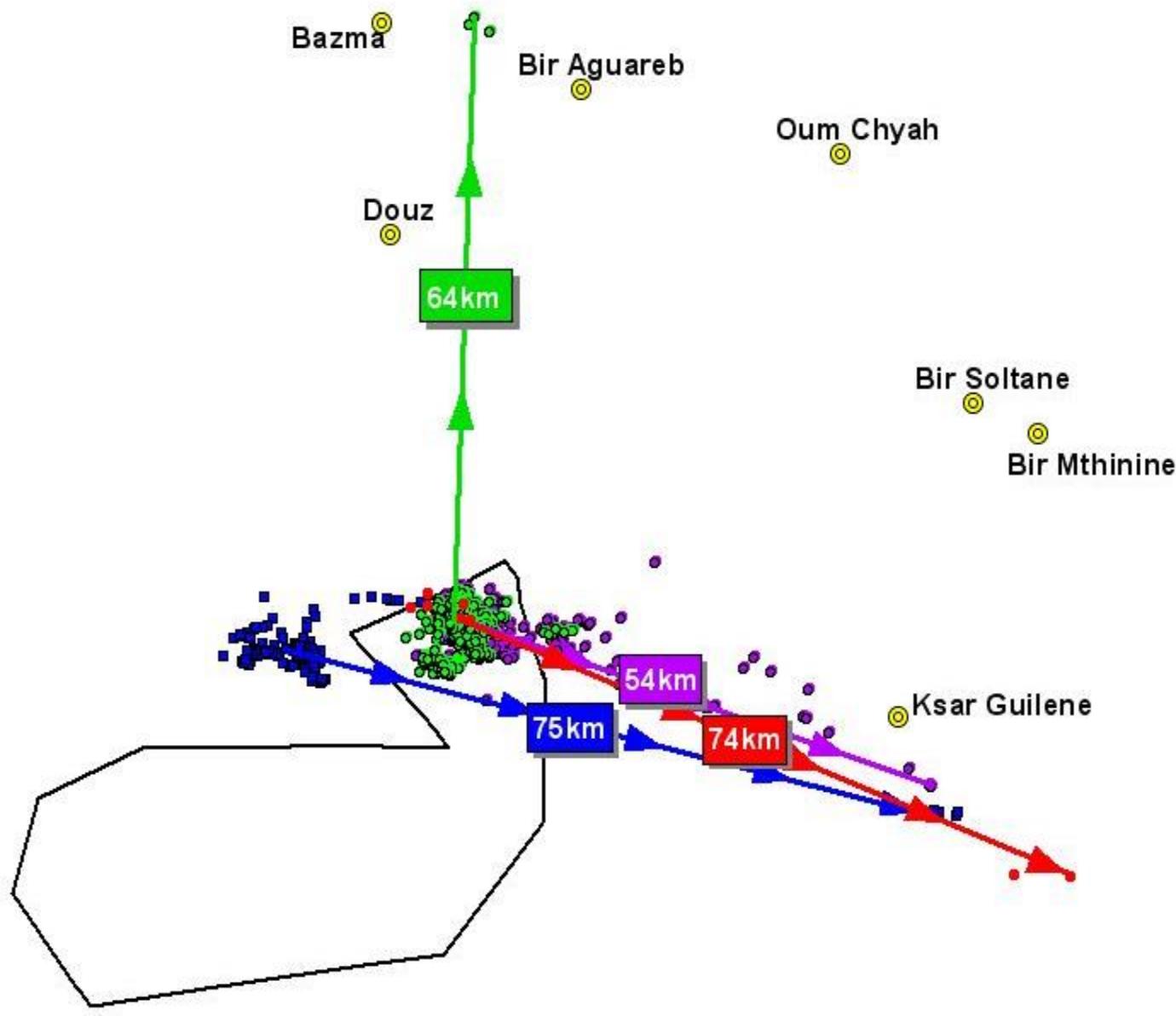




Houbara living ecosystem



Houbara mouvement in the Saharan regions of Tunisia

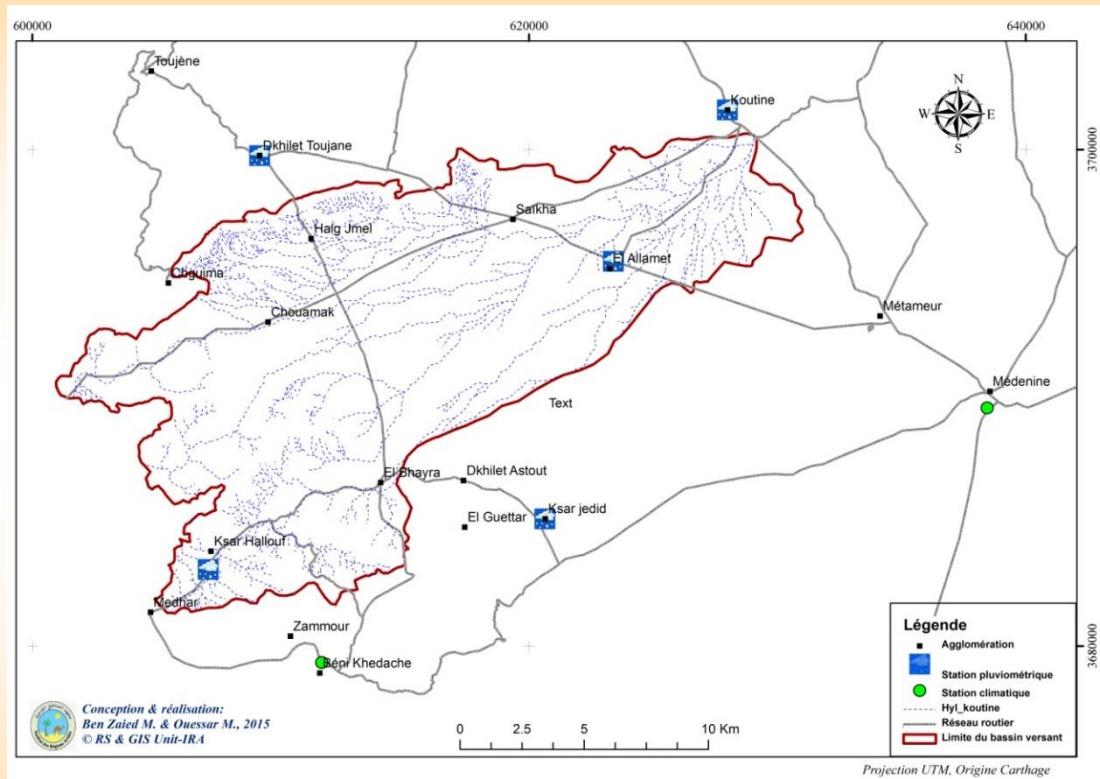


4. Spatial and temporal variation of rainfall data

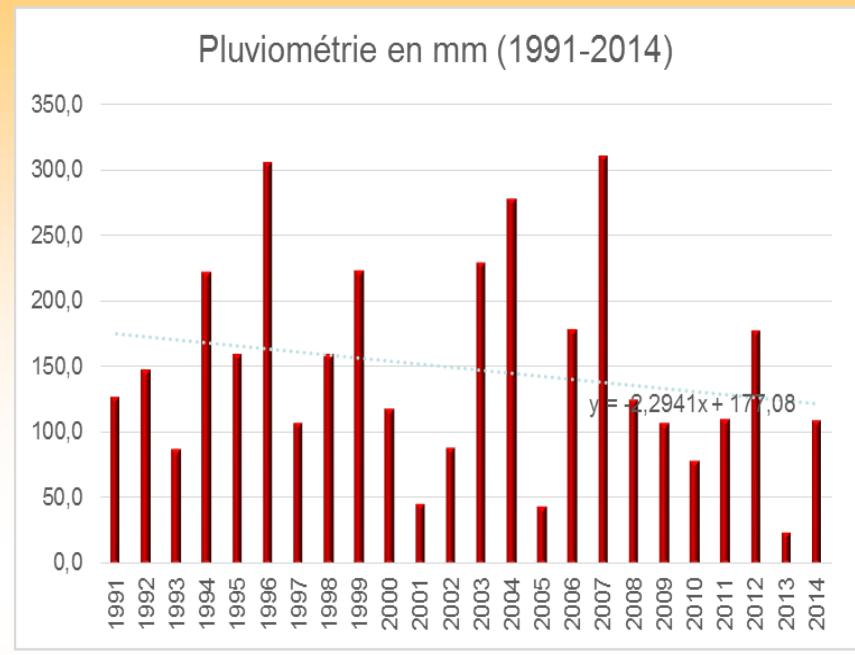
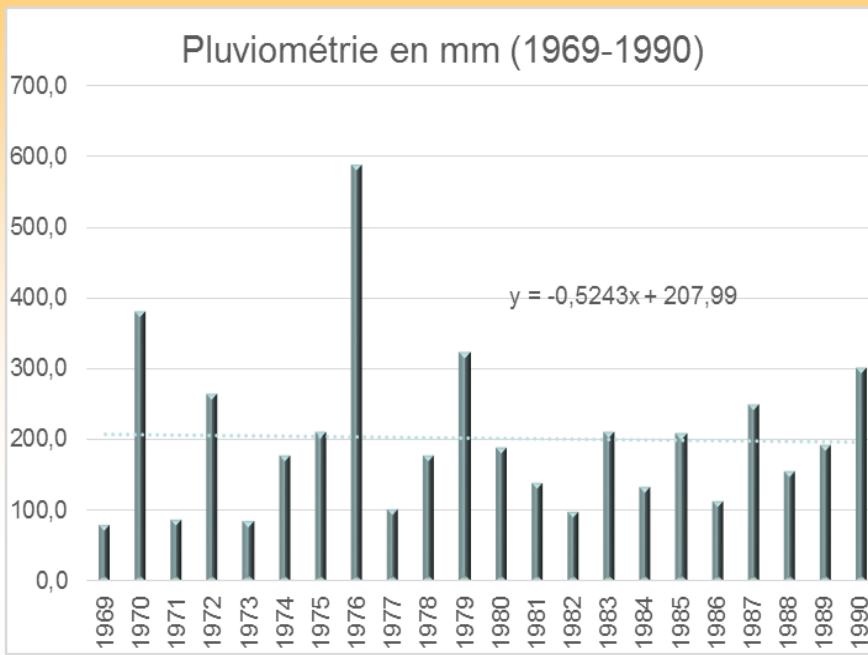
Rainfall data analyses

Observed periods

Station	Période d'observation
Beni Khedache	1969-2015
Ksar hallouf	1969-2015
Ksar Jedid	1969-2015
Toujane Dkhila	1969-2015
Alamat	1969-2015
Koutine	1969-2015
Mednine	1969-2015

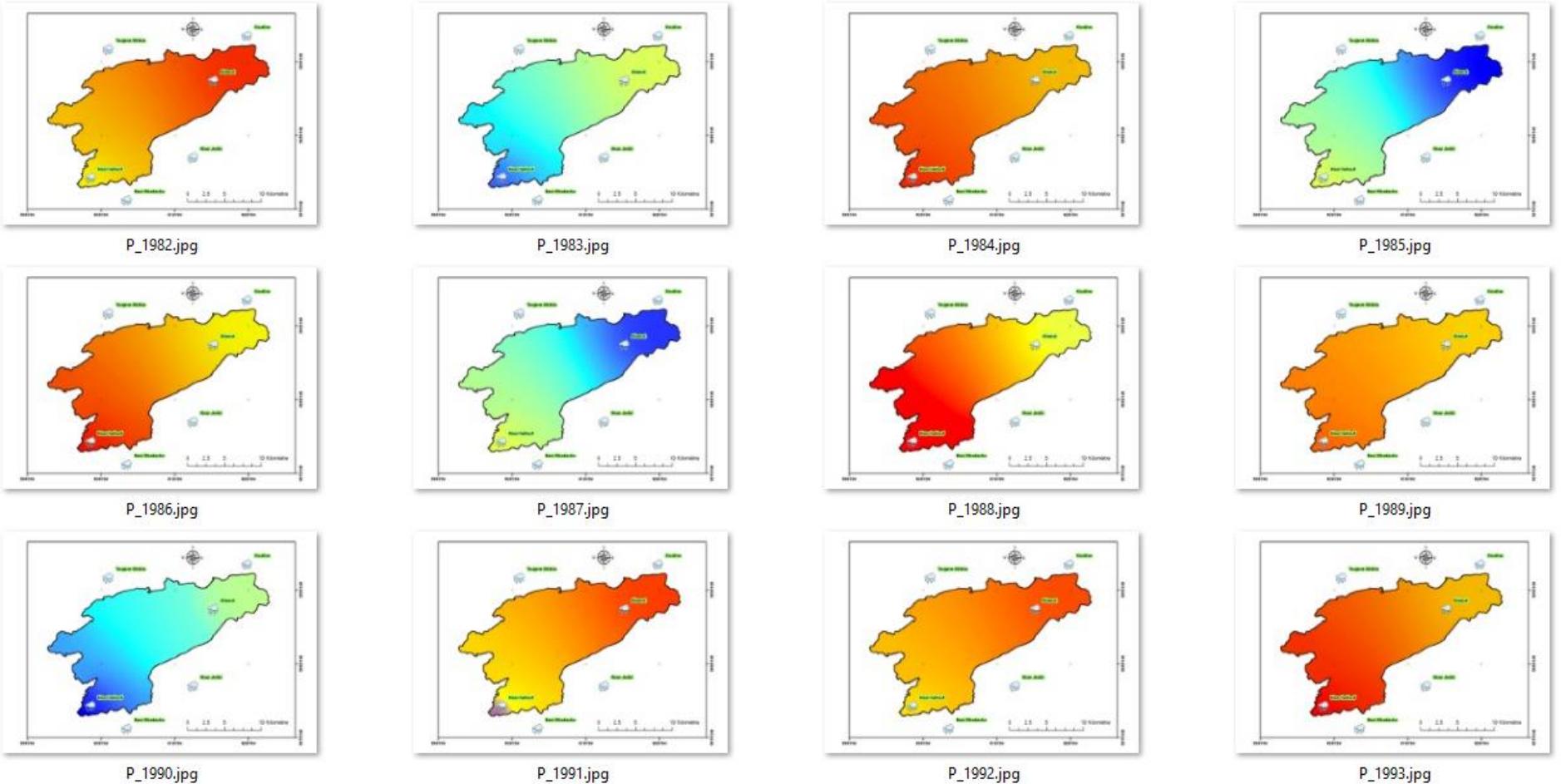


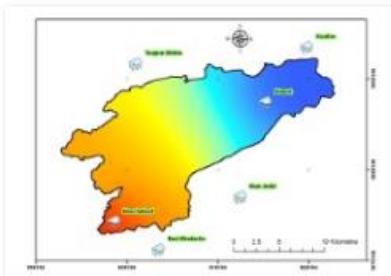
Rainfall data analyses



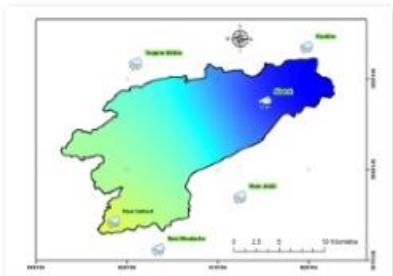
- Très forte variabilité interannuelle de la pluviométrie totale, allant de 24 à 587 mm.
- la tendance linéaire de la période 1969-2015 indique une tendance à la baisse de -2,1 mm/an.
- La comparaison entre le deux périodes montre des réductions significatives des précipitations avec des tendances linéaires de -0,5 et -2,3 mm/an.

Variation spatiale des données pluviométrique

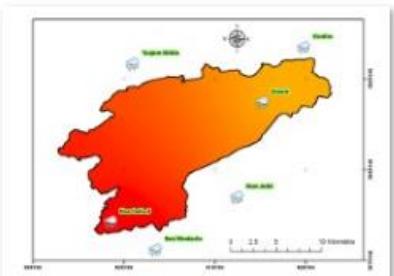




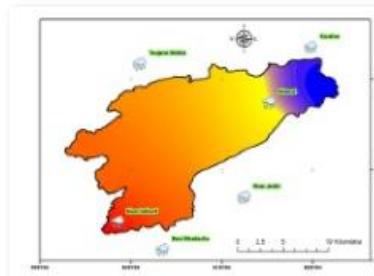
P_2006.jpg



P_2007.jpg



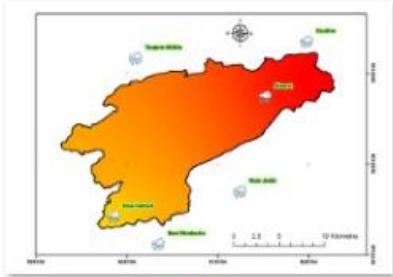
P_2008.jpg



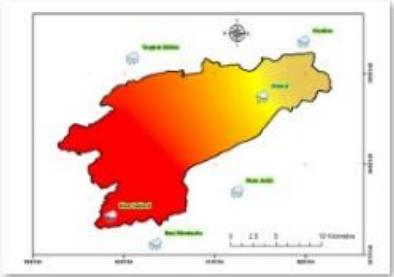
P_2009.jpg



P_2010.jpg



P_2011.jpg



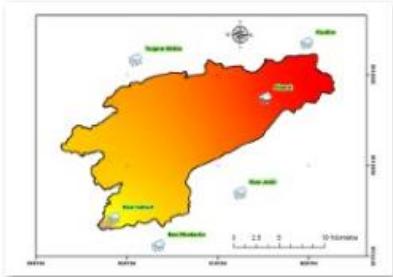
P_2012.jpg



P_2013.jpg



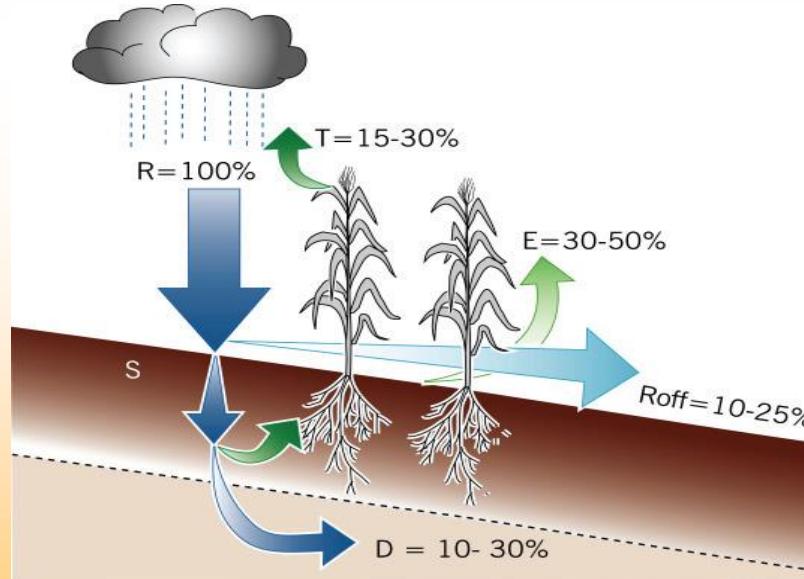
P_2014.jpg

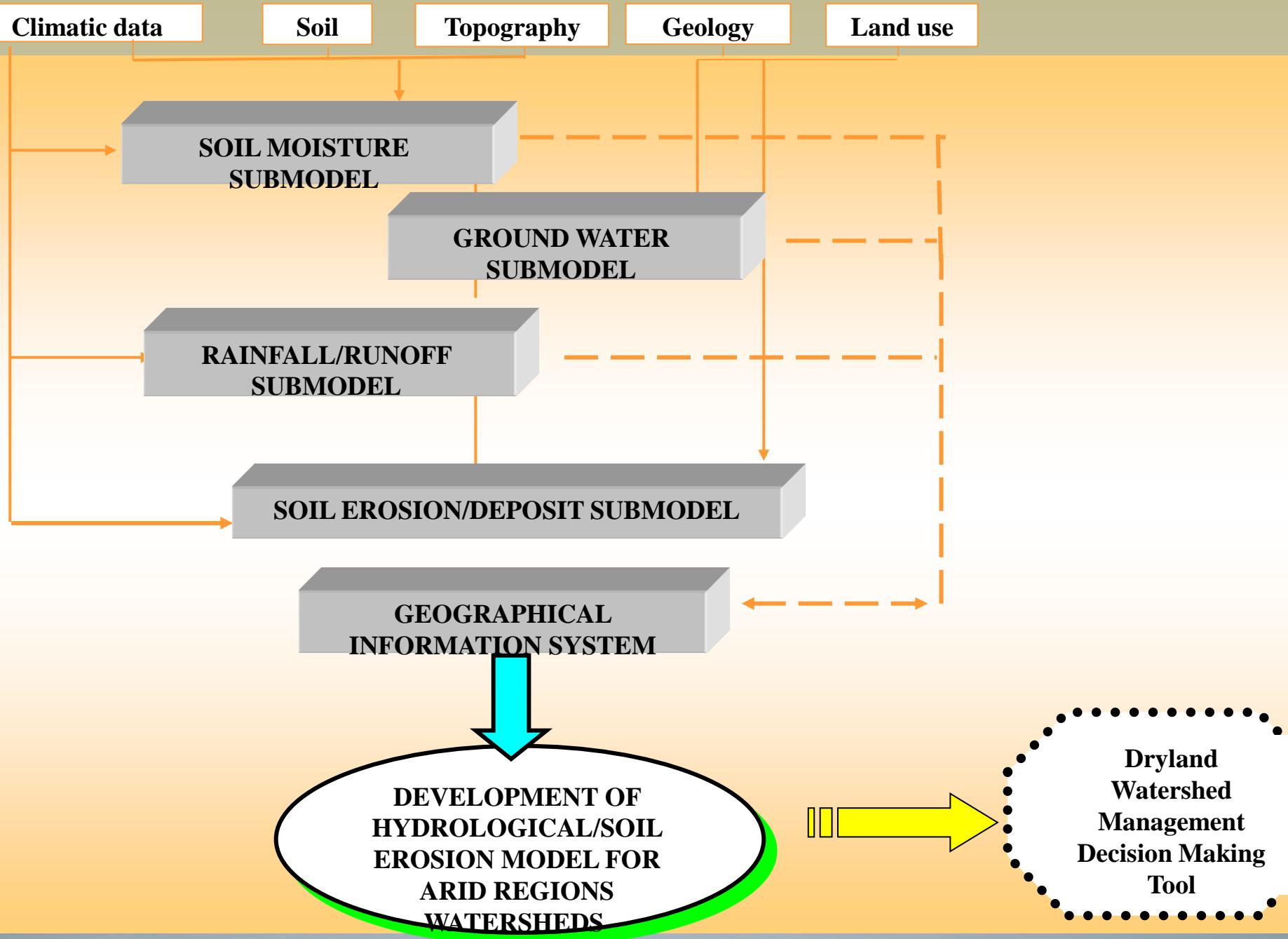


P_2015.jpg

La variation spatiale de précipitation est de direction Est – ouest,
La répartition spatiale de la pluviométrie est inférieure à la moyenne annuelle dans
60% des cas,

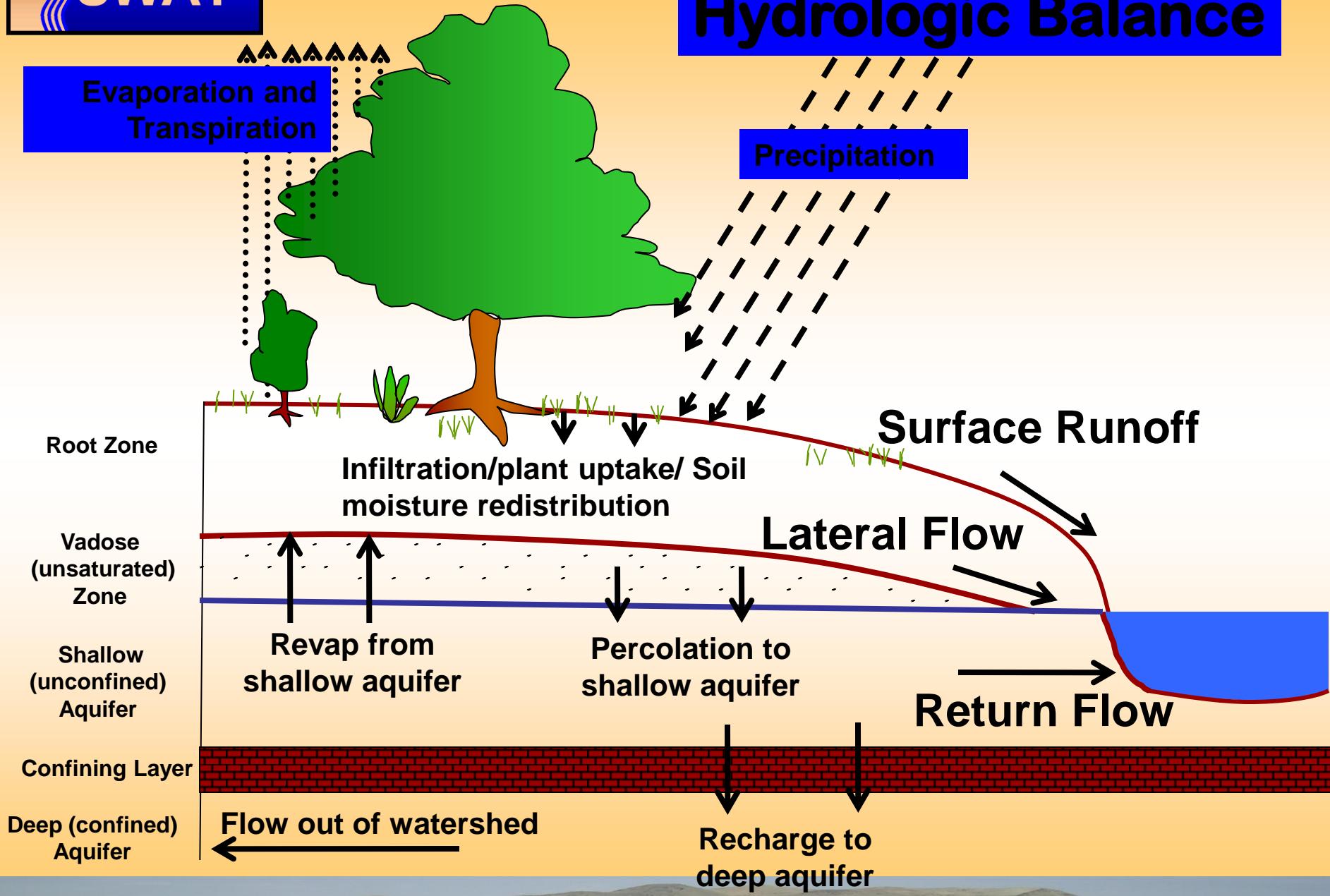
5. WATERSHED MODELLING AND IMPACT ASSESSMENT

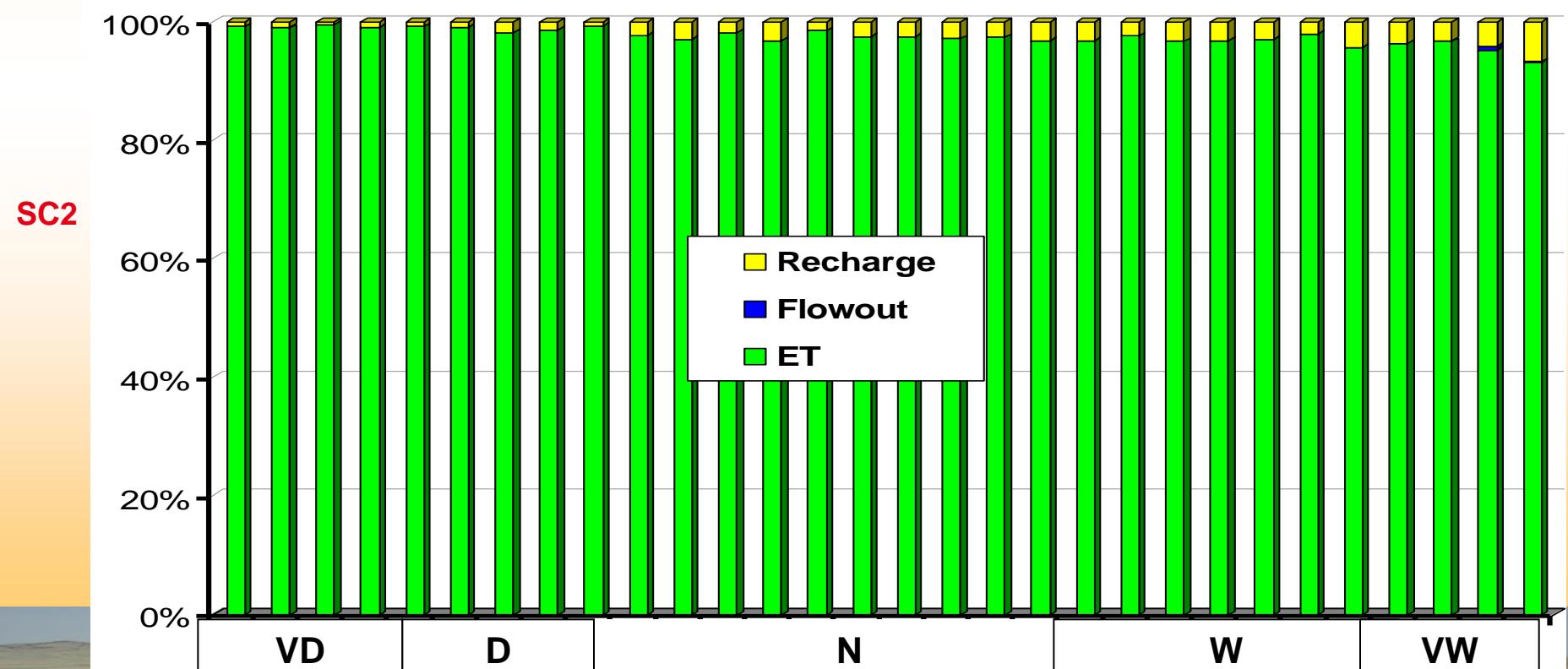
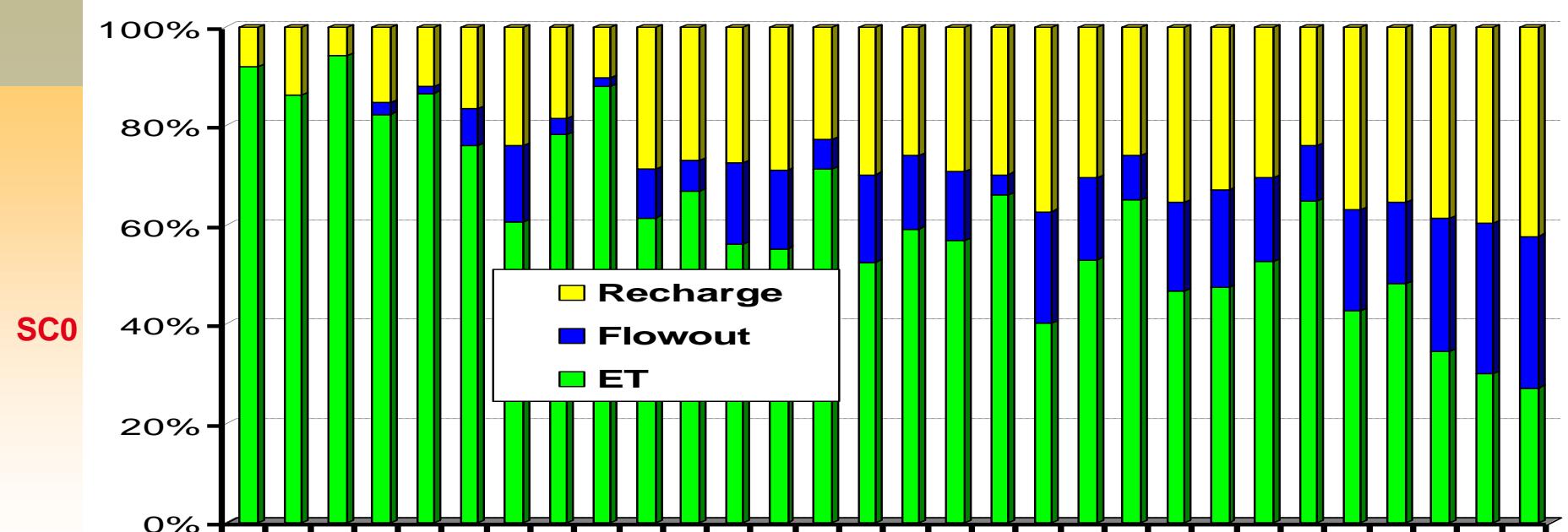




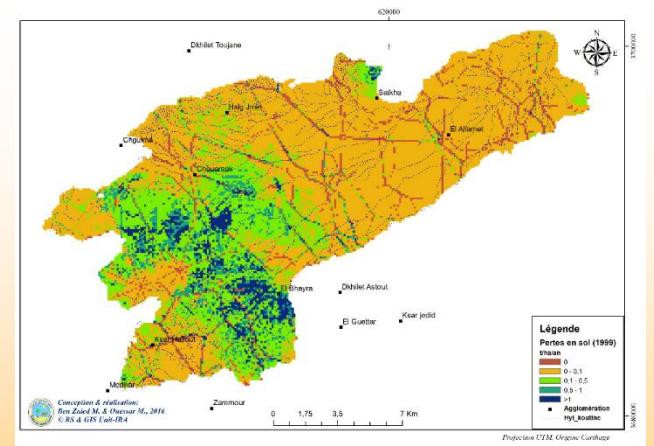
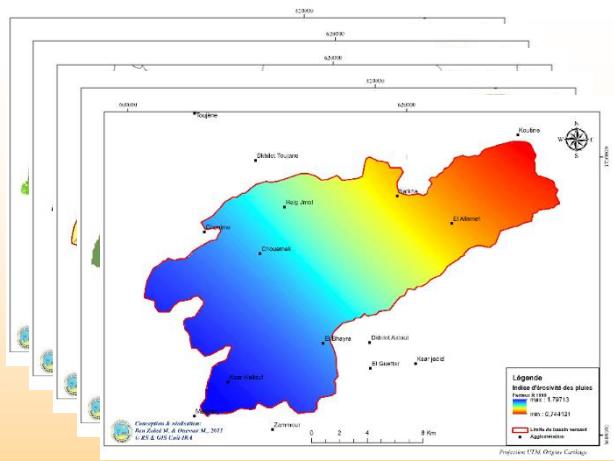
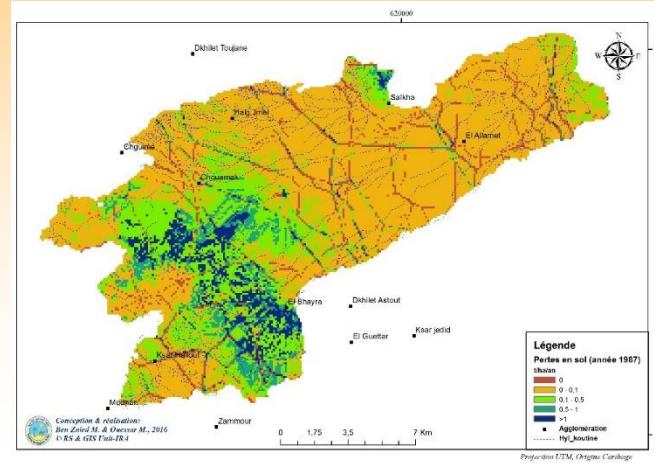
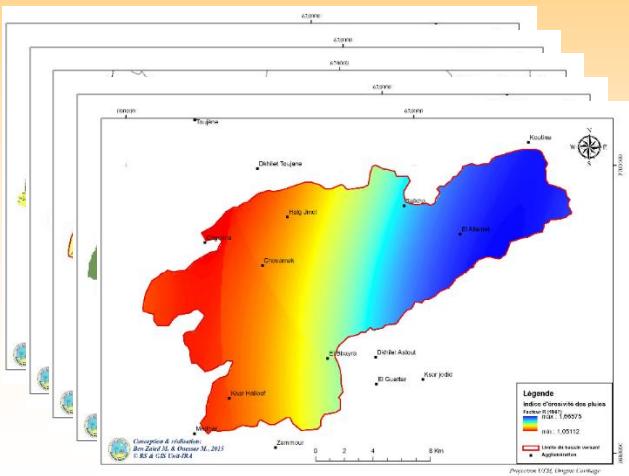


Hydrologic Balance



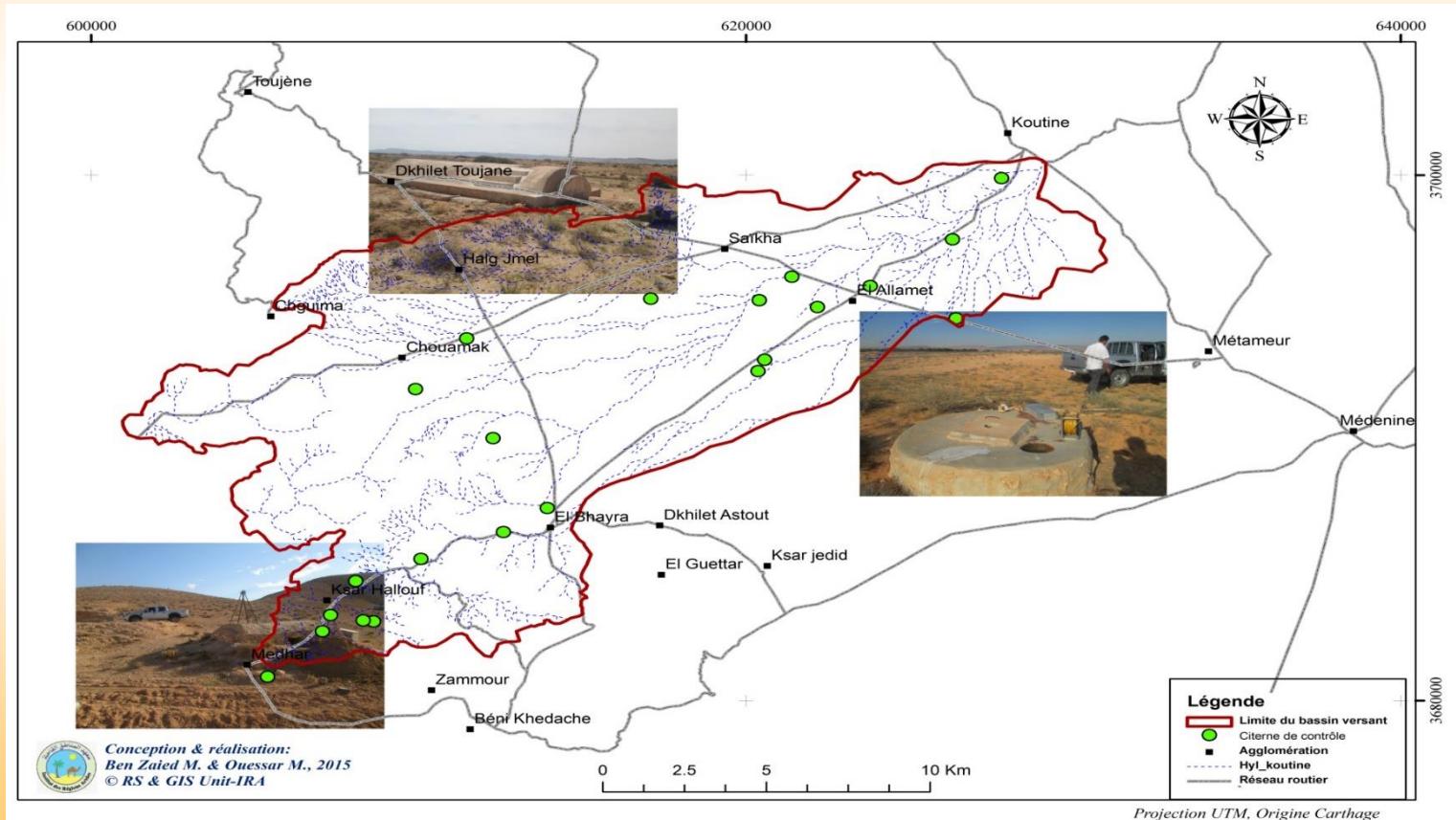


Soil Erosion

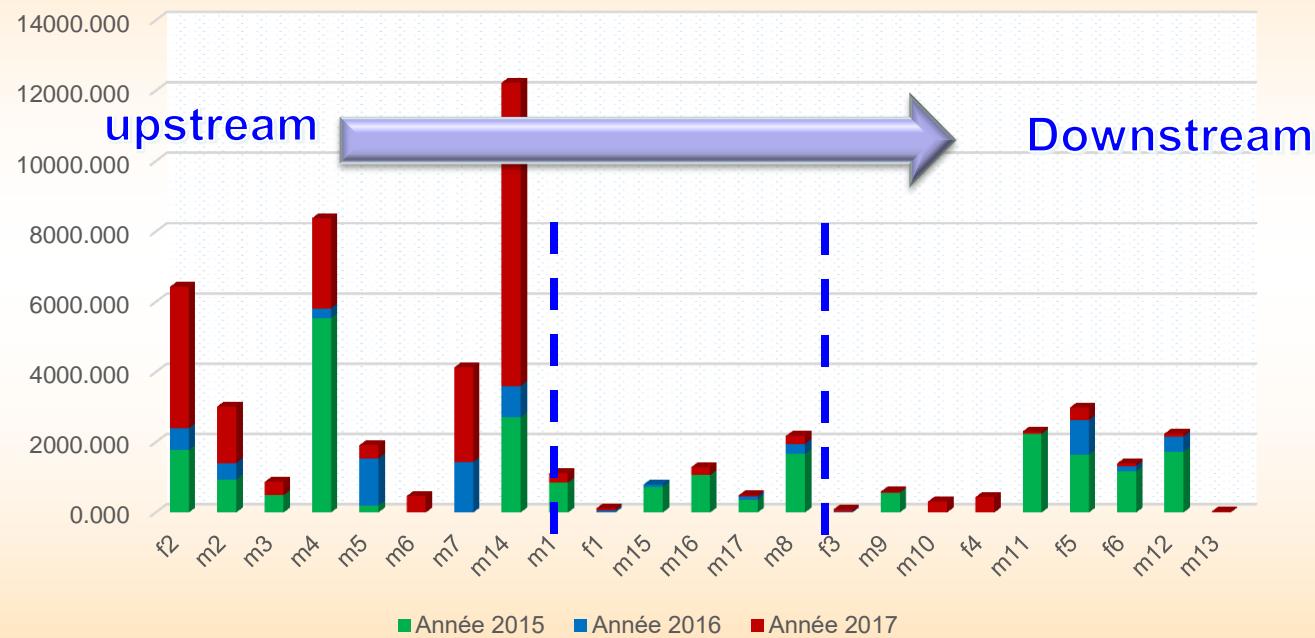


Validation des cartes thématiques

Un inventaire annuelle est conduit sur une vingtaine des citerne (17 Majel et 6 Fesguia) qui ont été sélectionnées pour le suivi de dépôt solide dans le bassin de décantation aussi la mesure de caractéristique de l'impluvium



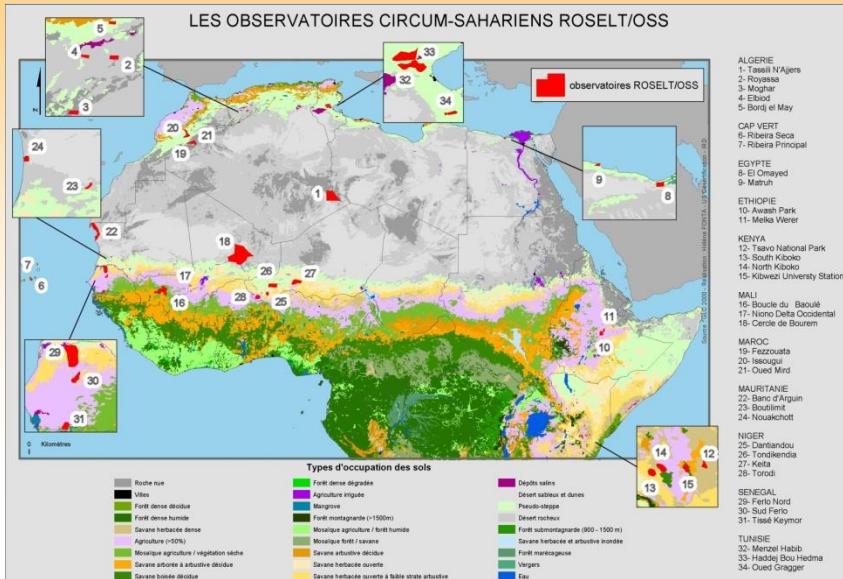
Annual Variation of sediment (kg/ha)



6. Integrated environmental and socio-economic modeling for desertification monitoring and assessment

Sghaier et al. (2006)
Fetoui, 2011

Surveillance Network

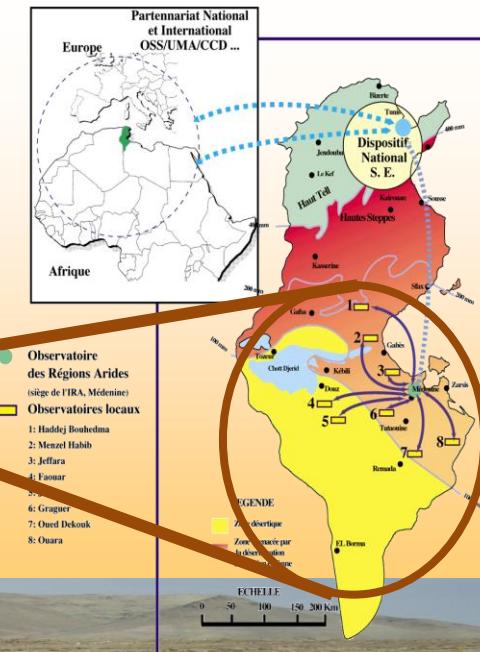


**Observatoire des
Zones Arides pour le
Développement
Durable**
OZADD
(IRA, Tunisie)

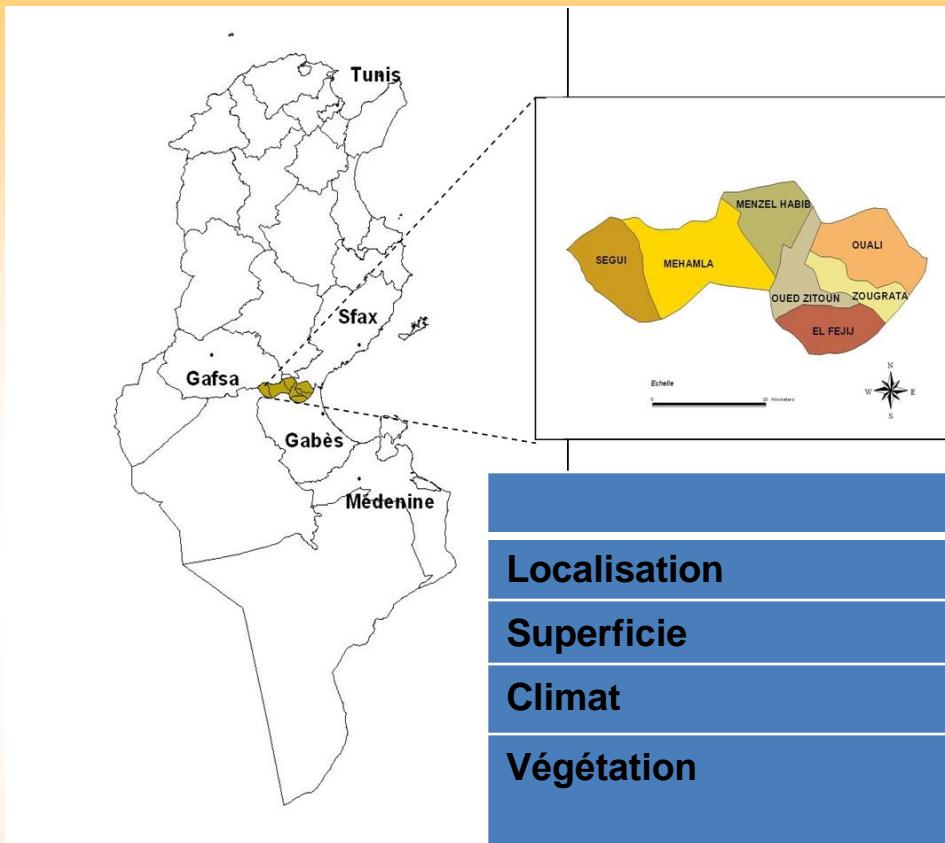
**Réseau d'Observatoires
de Surveillance
Ecologique à Long
Terme (ROSELT)**

**de l'Observatoire du
Sahara et du Sahel
(OSS)**

ROSELT / OSS



OBSERVATOIRE DE MENZEL HABIB (Central Tunisia)

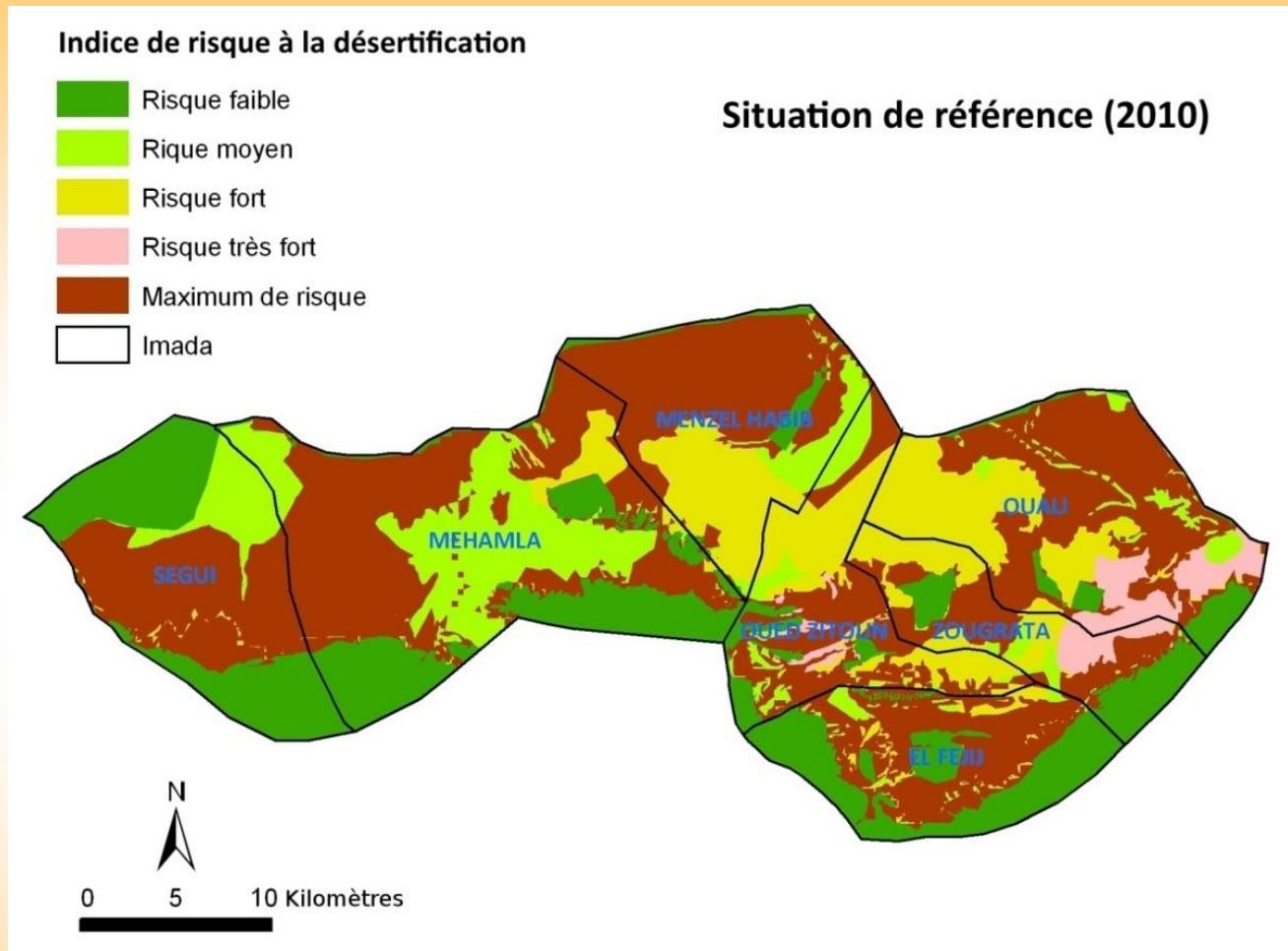


Observatoire OZADD

Observatoire ROSELT/OSS

O. Menzel Habib	
Localisation	Basses plaines orientales
Superficie	100 000 ha
Climat	Méd. Aride inf. à hiver doux
Végétation	Steppes chaméphytes ligneux : <i>Rhanterium</i> , <i>Arthropodium</i>
Faune	Très rare
Population	11 700 habitants
Activités économiques	Agropastoralisme Forte anthropisation et désertification

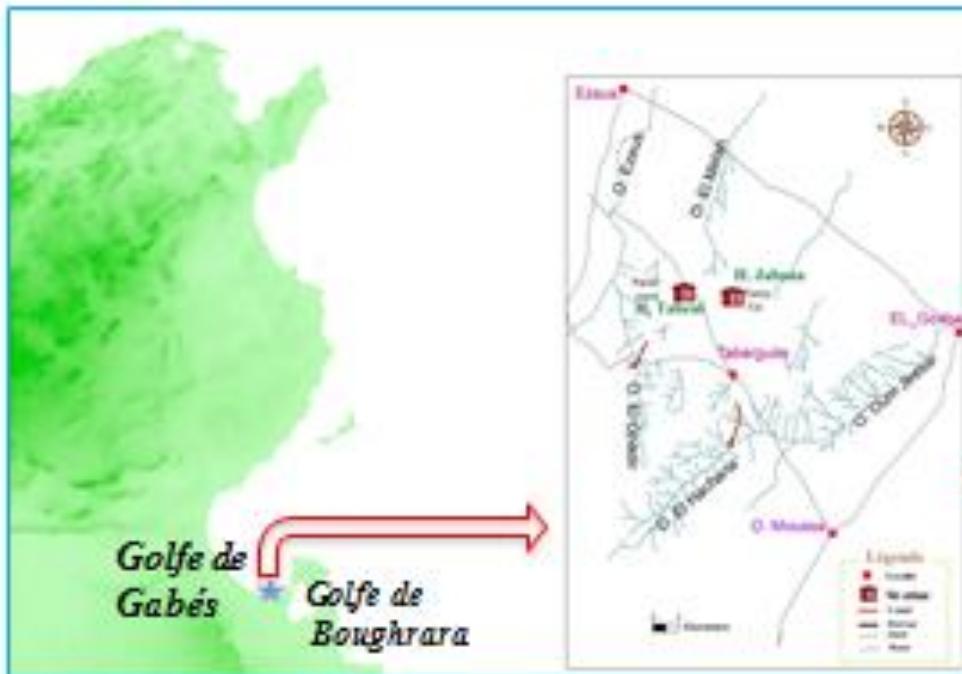
Desertification Index

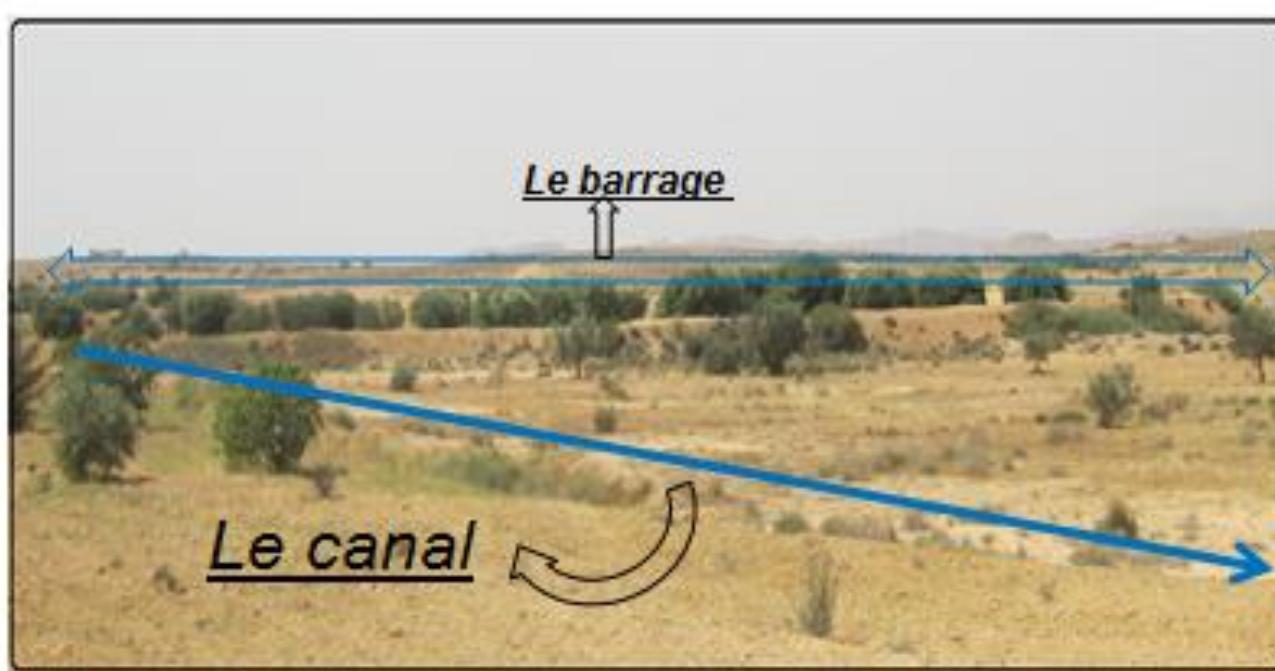


Environ 48 % (environ 46 700 ha) du territoire de l'observatoire de Menzel Habib présente un **risque très fort à maximum de risque à la désertification** ;

7. Archeological prospections of ancient hydraulic structures in the South of Tunisia

Touil et al. (2016)





8. Mapping of *Gsours* (ancient granaries) of the south east Tunisia

Laroussi et al. (2003, 2008, 2010)



Panorama des Gsour dans le Sud-Est

Tunisien

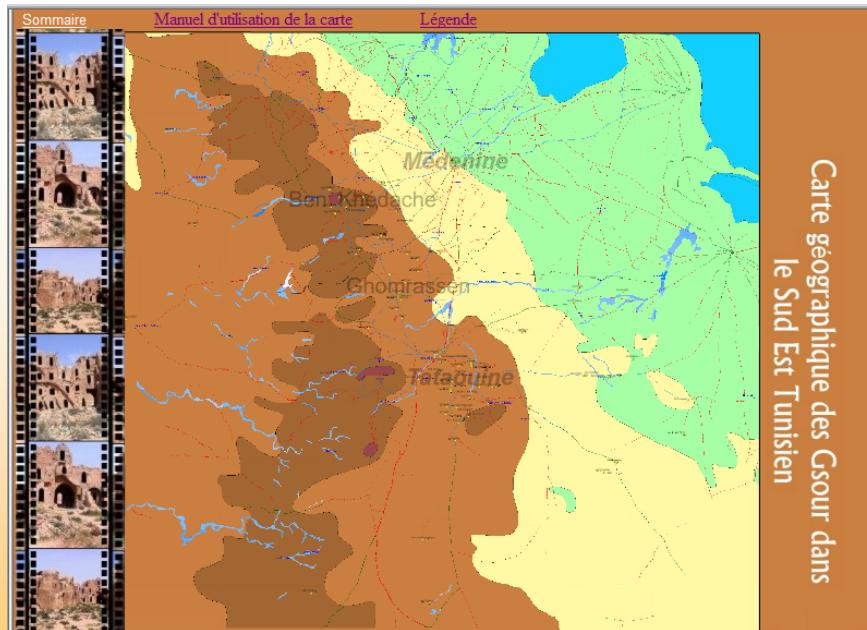
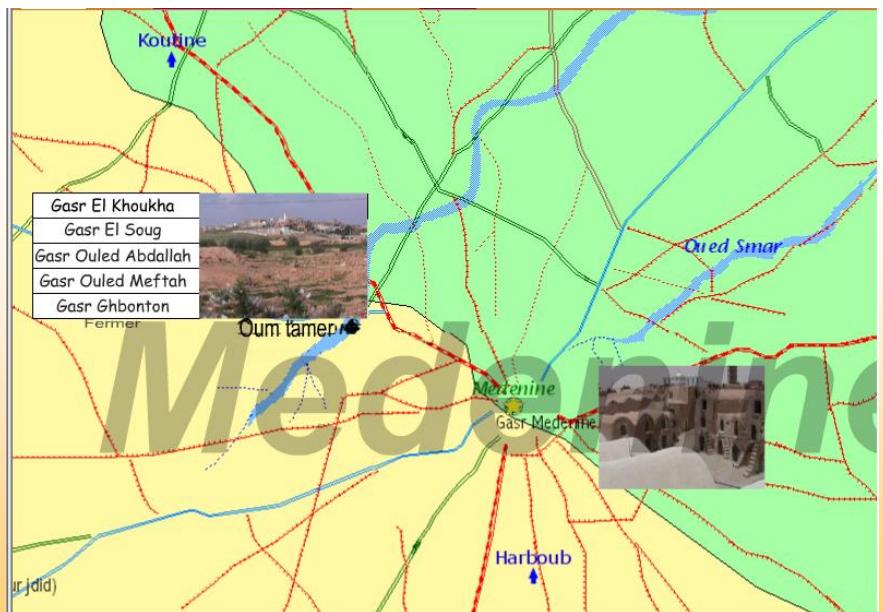
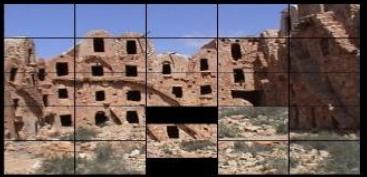
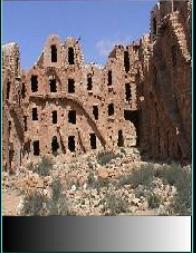


Présentation Générale

Présentation du CD-Rom

Parcours des Gsour

Troglodytes Barbares



Laroussi et al., 2014

Training & capacity building

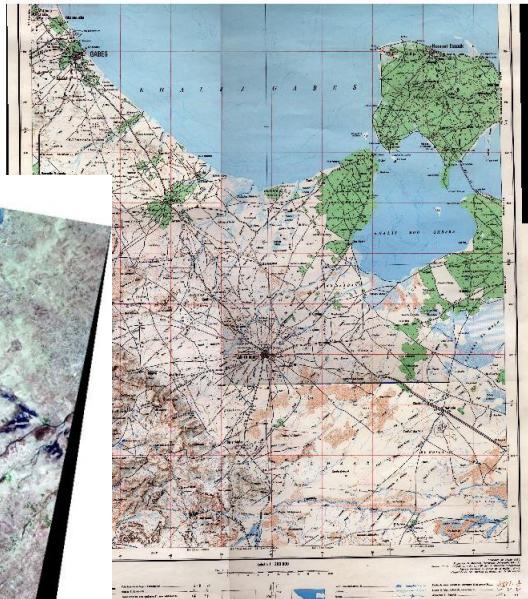
- Training of trainers,
- Supervision of students and trainees,
- Organization of specialized training sessions



Data bases

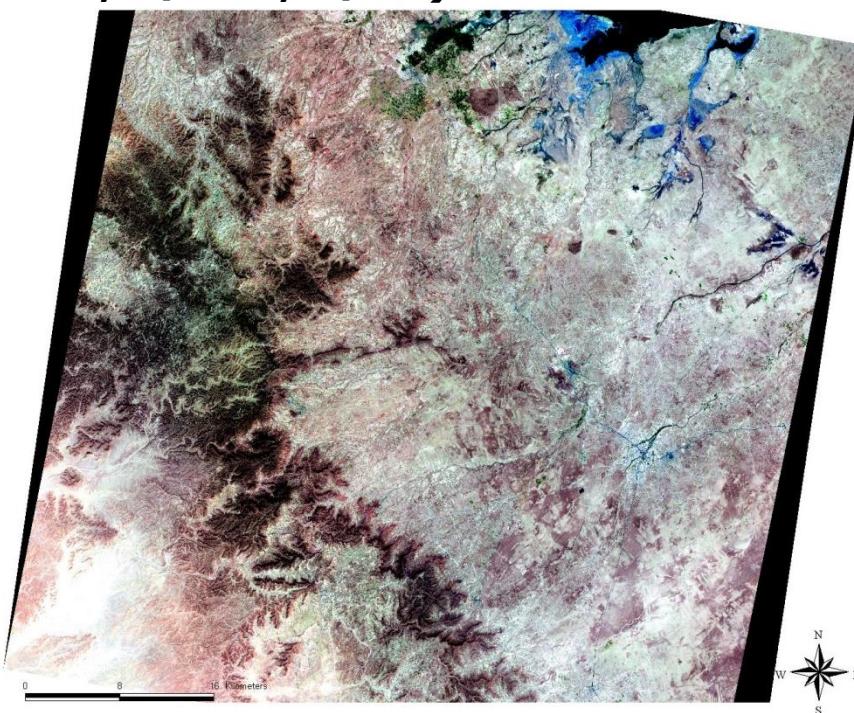
➤Maps:

- Topography (1/200, 1/100, 1/50)
- Geology
- etc.



➤Satellite Images

➤Aerial Photos



Microsoft Access

File Edit View Insert Tools Window Help Type a question for help

CARACTERES : Table

Field Name	Data Type	Description
CODE	Text	
NOM	Text	
ECHELLE	Text	
► LANGUE	Text	
NUMERO	Text	
DP	Text	

Field Properties

General | Lookup |

Field Size: 50
Format:
Input Mask:
Caption:
Default Value:
Validation Rule:
Validation Text:
Required: No
Allow Zero Length: Yes
Indexed: Yes (Duplicates OK)
Unicode Compression: Yes
IME Mode: No Control
IME Sentence Mode: None

The field description is optional. It helps you describe the field and is also displayed in the status bar when you select this field on a form. Press F1 for help on descriptions.

Design view, F6 = Switch panes, F1 = Help.

Démarrer | Navig... | jessou... | Docu... | dbcart... | CAR... | 13:42



Exple:

Le formulaire de
démarrage

Menu Général principal

Déplacer

INSTITUT DES REGIONS ARIDES MEDENINE



G

BASE DE DONNEES NUMERIQUES POUR LES REGIONS
ARIDES

Graphiques

Imprimer Etat

Quitter

Bassin versant

Mesure

Afficher la fenêtre base de données



BEN ZAIED Mongi:
ENIT

Partners

• National

- CNCT
- CRDA (Agriculture)
- Environment
- Universities

• International

- ❖ GIS Unit of ICARDA, Jordan
- ❖ Sahara and Sahel Observatory (OSS), Tunis, Tunisia
- ❖ Maison de la Télédétection (Unité Espace), Montpellier, France.
- ❖ Centre for Advanced GIS Applications, Purdue Univ. (USA)
- ❖ Centre Royal de Télédétection, Morocco
- ❖ Centre Régional de Télédétection, Tunis
- ❖ Center for Remote Sensing and Digital Earth, CAS, Beijing, China
- ❖ Etc.



Thank you

We love deserts but we combat desertification