

S6 411

Distr.: LIMITED

ECA/NRD/CART.9/ORG.16  
October 1996

Original: ENGLISH

Ninth United Nations Regional  
Cartographic Conference for Africa

Addis Ababa, Ethiopia  
11-15 November 1996

**Desertification Dynamic Monitoring in Arid and Semiarid Zones  
of North Africa, by Remote Sensing**

***Régional Project : Desertification Dynamic Monitoring in Arid and Semi  
Arid-zones of North Africa, By Remote Sensing  
SUDDAN Project***

***SUMMARY***

Developed on the basis of the different national programs of North African sub region countries : Algeria - Egypt - Libya - Morocco - Mauritania - Tunisia, the SUDDAN project has been initiated and implemented by C.R.T.E.A.N. with the collaboration of O.S.S. It aims the characterization and the monitoring of desertification socio-economic and physics indicators in arid and semi arid zones of North Africa, by remote sensing technics.

In fact, if the desertification process and its causes has been defined owing the C.I.D « Convention Internationale sur la Désertification », the extent of the lands degradation and sanding up, and also the deep causes of their evolution are ill known.

This project, essentially with a methodological nature, covers 19 pilot sites distributed on all the concerned sub-region in 5 principal categories (oasian sites, agro-pastoral sites, pastoral sites, agro-sylvo-pastoral sites, agro-urban sites) and chosen according to complementary criteria for lands degradation processes in relation with the desertification.

## **THE SUDDAN PROJECT**

**« Desertification Dynamic Monitoring in Arid and Semi Arid zones of North Africa, by Remote Sensing »**

## SUMMARY

Conceived by the « Centre Régional de Télédétection des Etats d'Afrique du Nord) (C.R.T.E.A.N) with the collaboration of O.S.S (Observatoire du Sahara et du Sahel), the SUDDAN project : North Africa Desertification Dynamic Monitoring, aims the characterization and the monitoring of desertification socio-economic and physic indicators in arid and semi arid zones of North Africa, by Remote Sensing technics.

With a methodological nature, SUDDAN project covers nineteen pilot-sites distributed in all the studied sub region which includes Algeria, Egypt, Libya, Morocco, Mauritania and Tunisia. These pilot-sites are representatives of the different degradation phenomena of lands.

## RESUME

Conçu par le C.R.T.E.A.N.( Centre Régional de Télédétection des Etats d'Afrique du Nord) avec la collaboration de l'Observatoire du Sahara et du Sahel (O.S.S), le projet SUDDAN : Suivi de la Dynamique de la Désertification en Afrique du Nord vise la caractérisation et le suivi des indicateurs physiques et socio-économiques de la désertification dans les aones arides et semi arides d'Afrique du Nord, Grâce aux techniques de télédétection.

Essentiellement à caractère méthodologique, SUDDAN couvre 19 sites pilotes répartis sur toute la région étudiée - comprenant l'Algérie, l'Egypte, la Libye, le Maroc, la Mauritanie et la Tunisie - et qui sont représentatifs des différents phénomènes de dégradation des milieux,

## TABLE OF CONTENTS

**1 - Introduction**

**2 - General purpose**

**3 - Pilot-sites selection**

**4 - Methodological approach**

**5 - Project organization**

**6 - Conclusion**

## **1 - INTRODUCTION :**

Developed on the basis of the different national programs of North African sub region countries : Algeria - Egypt - Libya - Morocco - Mauritania - Tunisia, the SUDDAN project has been initiated and implemented by C.R.T.E.A.N. with the collaboration of O.S.S (*Fig 1*). It aims the characterization and the monitoring of desertification socio-economic and physics indicators in arid and semi arid zones of North Africa, by remote sensing technics.

In fact, if the desertification process and its causes has been defined owing the C.I.D « Convention Internationale sur la Désertification », the extent of the lands degradation and sanding up, and also the deep causes of their evolution are ill known.

This project, essentially with a methodological nature, covers many pilot sites distributed on all the concerned sub-region and chosen according to complementary criteria for lands degradation processes in relation with the desertification.

## **2 - GENERAL PURPOSE :**

**To define and to validate a method for desertification dynamic characterization and monitoring in arid and semi arid zones of North Africa, by Remote Sensing.**

From this general purpose, it follows three specific purposes :

- to test, by land physic indicators and remote sensing, the most appropriate methodology for desertification dynamic monitoring in the concerned national institutions.
- to execute an experimental monitoring on the chosen pilot-sites, representative of all the desertification processes.
- to translate the monitoring by a standardized and harmonized dynamic mapping at the sub-region level.

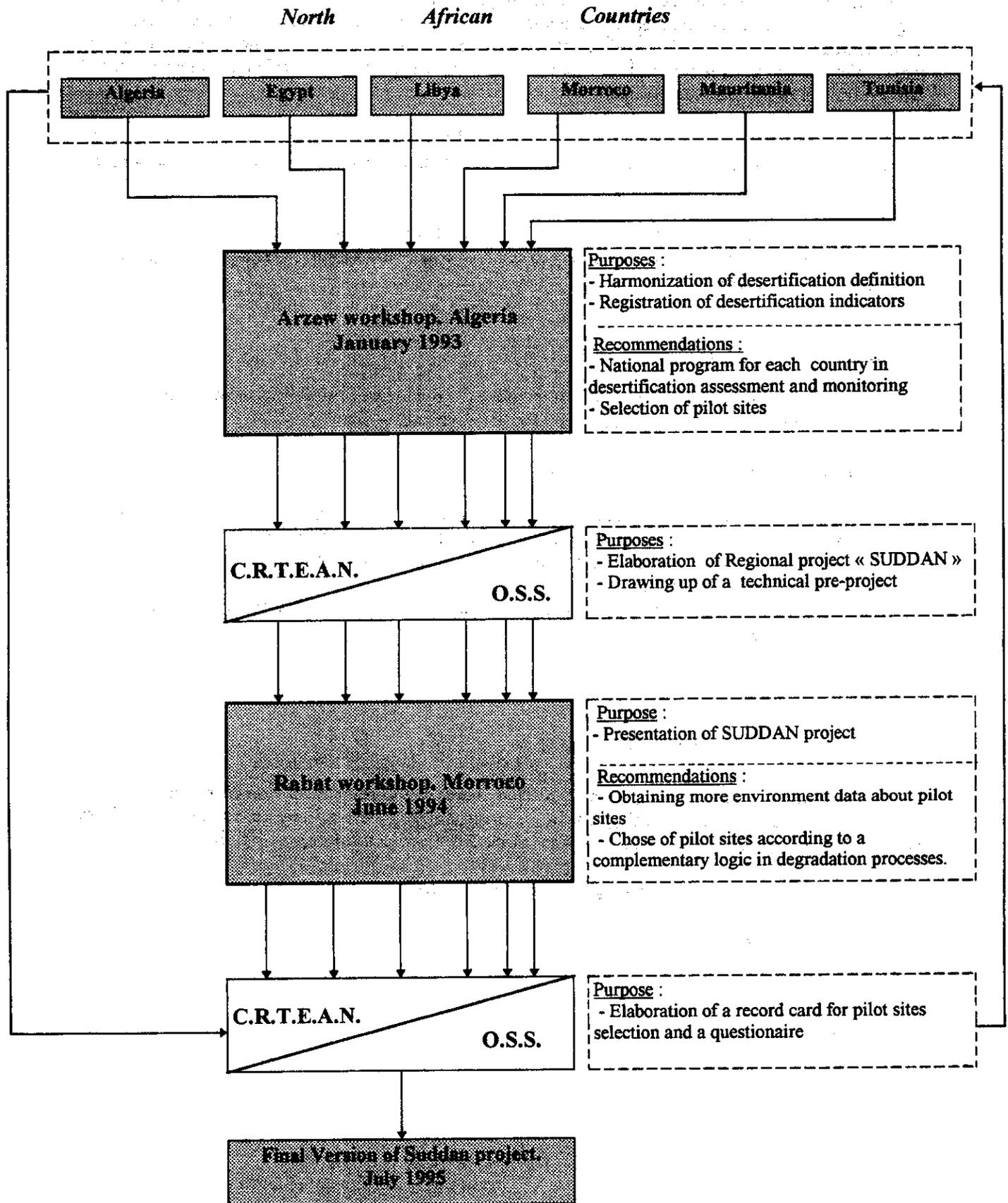
## **3 - PILOT SITES SELECTION :**

The pilot sites of SUDDAN project has been retained according to a complementary logic in degradation processes, and according to their socio-economic or socio-cultural vocation (table 1). They are distributed in the different bioclimatic zones of the North African sub region (*fig. 2*).

Five principal categories of vocation regroup the hole of these pilot sites :

- Oasian sites
- Agro-pastoral sites
- Pastoral sites
- Agro - sylvo - pastoral sites
- Agro - urban sites.

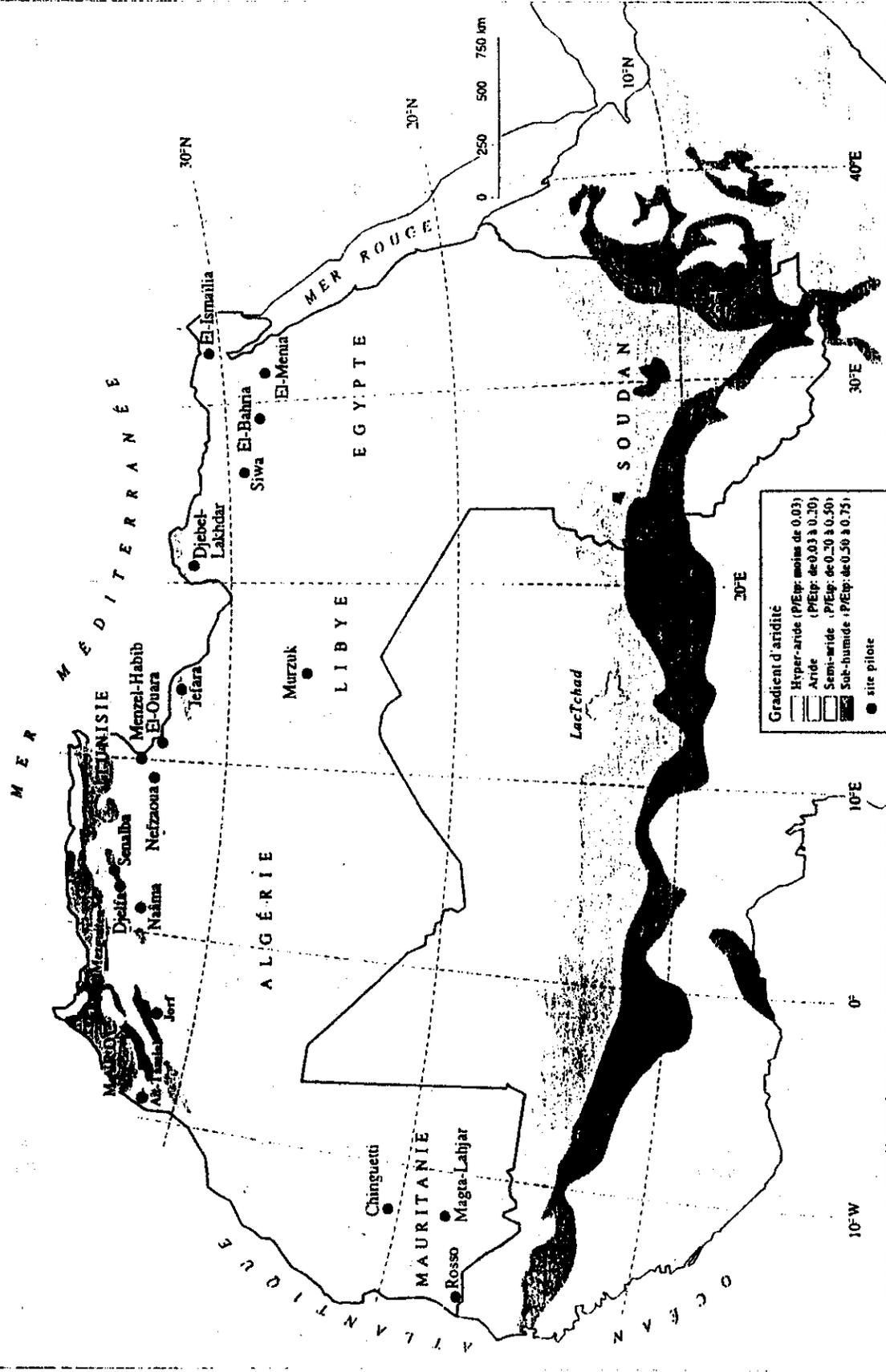
# DIFFERENT STEPS FOR DRAWING UP OF SUDDAN PROJECT REPORT



O.S.S.

Fig. 2 : GEOGRAPHIC DISTRIBUTION OF SUDDAN PROJECT PILOT SITES IN THEIR BIOCLIMATIC CONTEXT

C.R.T.E.A.N.



Source : d'après la carte "World distribution of arid regions" UNESCO, CVRS, 1977.

©IMAGEO-CNRS, 1995.

**Table 1 : SUDDAN project pilote sites**

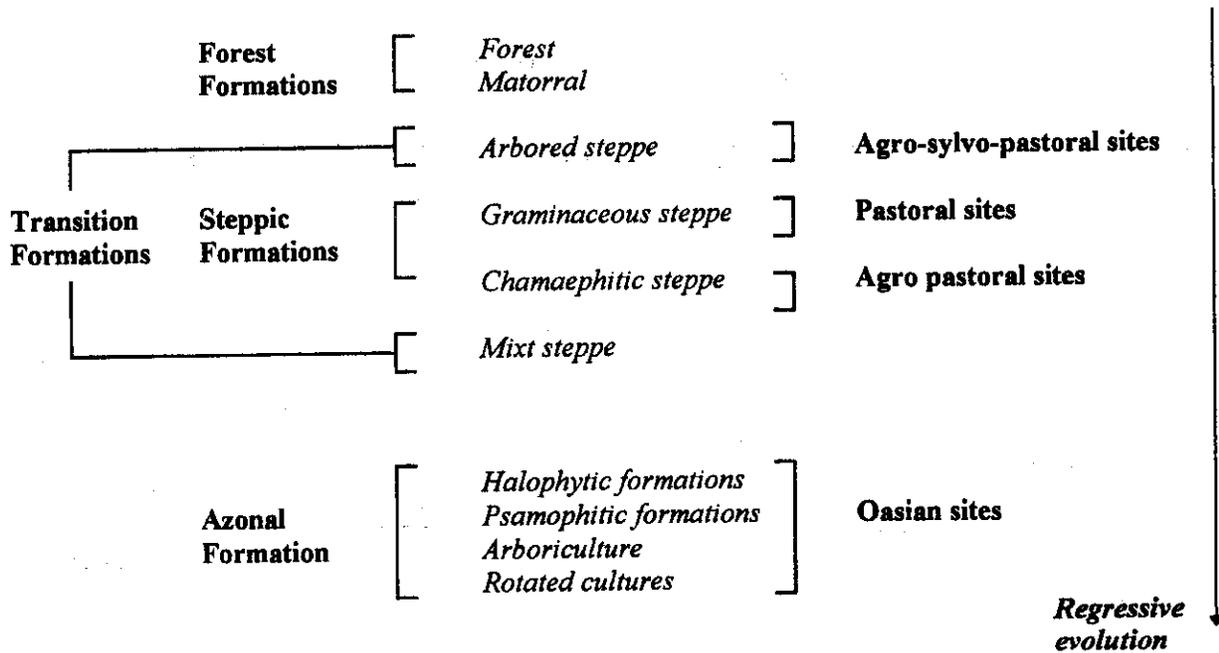
Code	SITE DENOMINATION	SITE NATURE
A1	Chinguetti (Mauritania)	OASIAN SITES
A2	El Bahria (Egypt)	
A3	Jorf (Maroc)	
A4	Mourzouk (Libya)	
A5	Nefzaoua (Tunisia)	
A6	Siwa (Egypt)	
B1	Djebel Lakhdar (Libya)	AGRO-PASTORAL SITES
B2	El Ouara / Jefara (Tunisia)	
B3	Jefara (Libya)	
B4	Menzel - Habib (Tunisia)	
C1	Djelfa (Algeria)	PASTORAL SITES
C2	Mezguiten (Maroc)	
C3	Naâma (Algeria)	
D1	Aït-Tamlal (Maroc)	AGRO - SYLVO - PASTORAL SITES
D2	Rosso (Mauritania)	
D3	Senabla (Algeria)	
E1	El Ismailia (Egypt)	AGRO-URBAN SITES
E2	El Minya (Egypt)	
E3	Magta - Lahjar (Mauritania)	

The desertification processes known in these sites are mainly :

- The eolian erosion : deflation
- The hydric erosion at its different steps : reversible (claws formation) or irreversible (gullies formations).
- The sanding up with its different forms : (dunes, microdunes, nebkha, barkhane, bar, erg...)
- The salinity due to irrigation water quality and also to the nature of the rock.
- The decrease of the vegetal cover and its diversity .
- the soil degradation

Every site can, according to its physical nature, characterize one or more processes.

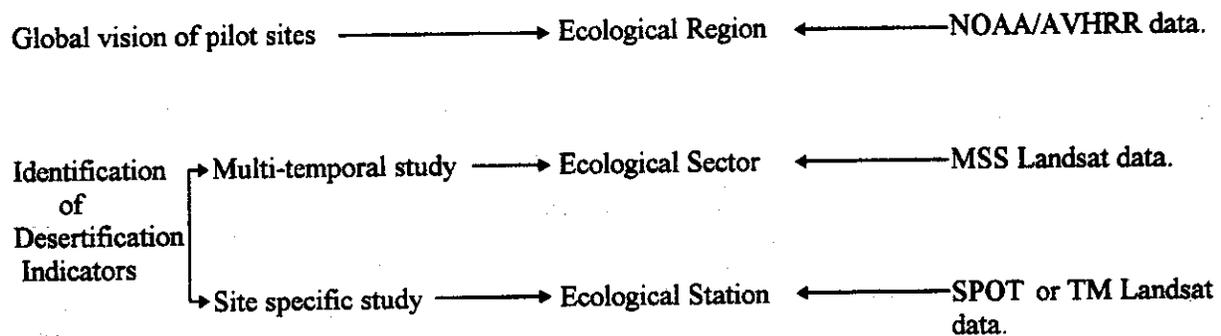
Every category of pilot-site is associated to a sequence inside a degradation dynamic (at sense of OZENDA & KERAUDREN, 1972 ; POUGET, 1979). This sequence is it self associated to a specific vegetal formation.



#### 4 - METHODOLOGICAL APPROACH

This approach is in keeping with a double steps which takes in account the environment global vision of studied pilot sites and the research of the desertification indicators spatially and spectrally identified.

Different ecological perception levels (in G. LONG sense, 1974) will be retained, which requires different supports.



The table 2 summarizes the desertification characterization criteria from the satellites imagery and the multi temporal data used.

**Table (2) : Thematic Methodology**

Process to study	Indicators mesured by remote sensing	Specific References Data
<b>Eolian erosion : deflation , transport and deposit (sanding up)</b>	<ul style="list-style-type: none"> <li>- Albedo</li> <li>- Spectral Signature</li> <li>- Color</li> <li>- Forms : Organized systems</li> <li>- Environment criteria</li> </ul>	<ul style="list-style-type: none"> <li>- Geomorphology</li> <li>- Winds (actives winds)</li> <li>- Sedimentological data</li> </ul>
<b>Hydric erosion (sheet, claw, gully)</b>	<ul style="list-style-type: none"> <li>- Spectral signature</li> <li>- Forms</li> <li>- Environment criteria</li> </ul>	<ul style="list-style-type: none"> <li>- Soil erodability</li> <li>- Rain erosivity</li> <li>- Digital Terrain Model</li> <li>- Substratum, slope, state of vegetal cover</li> </ul>
<b>Salinization</b>	<ul style="list-style-type: none"> <li>- Albedo</li> <li>- Spectral signature</li> <li>- Color</li> <li>- Environment criteria</li> </ul>	<ul style="list-style-type: none"> <li>- Geology - Geomorphology - Pedology</li> <li>- Hydrology</li> <li>- Water quality</li> <li>- Water chemical composition</li> <li>- Evaporation</li> </ul>
<b>Soil degradation : decrease of fertility (transformation of landscape)</b>	<ul style="list-style-type: none"> <li>- Albedo</li> <li>- Spectral signature of :</li> <li>- Clearings                             <ul style="list-style-type: none"> <li>* old</li> <li>* actual</li> </ul> </li> <li>- Cultivation                             <ul style="list-style-type: none"> <li>* cerealculture</li> <li>* arboriculture</li> <li>*Irrigated farming</li> </ul> </li> <li>- Afforestation</li> <li>- Urbanization fronts</li> </ul>	<ul style="list-style-type: none"> <li>- Land use                             <ul style="list-style-type: none"> <li>* climatic data</li> <li>* pedological data</li> <li>* soil agronomical vocation data</li> </ul> </li> <li>- Socio economic data                             <ul style="list-style-type: none"> <li>* population census</li> <li>* incitative actions</li> <li>* development programs                                     <ul style="list-style-type: none"> <li>* infrastructure (school, dispensery, communication ways)</li> <li>* landowner system</li> <li>* Production system</li> <li>* Attractivity of lands</li> <li>* Surface, and underground water potentiality</li> </ul> </li> </ul> </li> </ul>
<b>Decrease of vegetal cover (pasture lands)</b>	<ul style="list-style-type: none"> <li>- Establishment of a reference image in one favorable year for:                             <ul style="list-style-type: none"> <li>* Pasture evolution monitoring from variation of Vegetation Indice and the Brilliance Indice.</li> </ul> </li> <li>* Clearings monitoring :                             <ul style="list-style-type: none"> <li>- old</li> <li>- actual</li> </ul> </li> <li>Forms</li> </ul>	<ul style="list-style-type: none"> <li>- Herds :                             <ul style="list-style-type: none"> <li>* type</li> <li>* composition and size</li> </ul> </li> <li>- climatical data : region, sector, station</li> <li>- estimation of fadder production</li> <li>- necessity to field verification of the fadder quality of pasture land independently from coverage</li> <li>- socio-economic mutations :                             <ul style="list-style-type: none"> <li>* semi - nomads</li> <li>* settlers</li> </ul> </li> </ul>
<b>Impact of struggle works against desertification</b>	<ul style="list-style-type: none"> <li>- Albedo</li> <li>- Spectral signatures</li> <li>- geometry of managed sectors</li> <li>- Contrast effects for the identification of :                             <ul style="list-style-type: none"> <li>* windbreak systems</li> <li>* reafforestation</li> <li>* mecanical and biological fixation system</li> <li>* protected areas.</li> <li>* soils and water conservation works</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- development plans - precise location (G.P.S)</li> <li>- ponctual physical data (rainfalls, wind, evaporation)</li> <li>- biological data : local used species</li> <li>- used technics and materials</li> </ul>

The reference data which includes the multi-temporal data, the old maps, the thematic maps, management plans, aerial photographs, satellite data at different resolution radar dat..., will serve to analyse all the processes with a right choice of dates, according to the phenomena which must be identified and cartographed.

## 5 - PROJECT ORGANIZATION :

The project duration is three years and its organization is based on the division of scientific activities between the north african countries national institutions concerned by SUDDAN, european scientific laboratories, the C.R.T.E.A.N. and the O.S.S. Each entity will have a specific role (*fig. 3*) :

- the North African national structures will assure the scientific and technic works : land work, data processing and will be co-ordinated by a National Coordinateur.
- the european scientific partners ( France, Italie, Germany) will assum an adviser role and will support the advanced works, expertise and training.
- the C.R.T.E.A.N will assure the regional co-ordination between the different national teams et will mobilize the two project committees : Steering Committee ; Scientific & Technic Monitoring Committee and the Regional Project Chief.
- the O.S.S, according to its mission will assure the link between the northern and southern partners in order to increase the North African subregion countries capabilities to monitor and manage the knowldges about the desertification struggle.

## 6 - CONCLUSION :

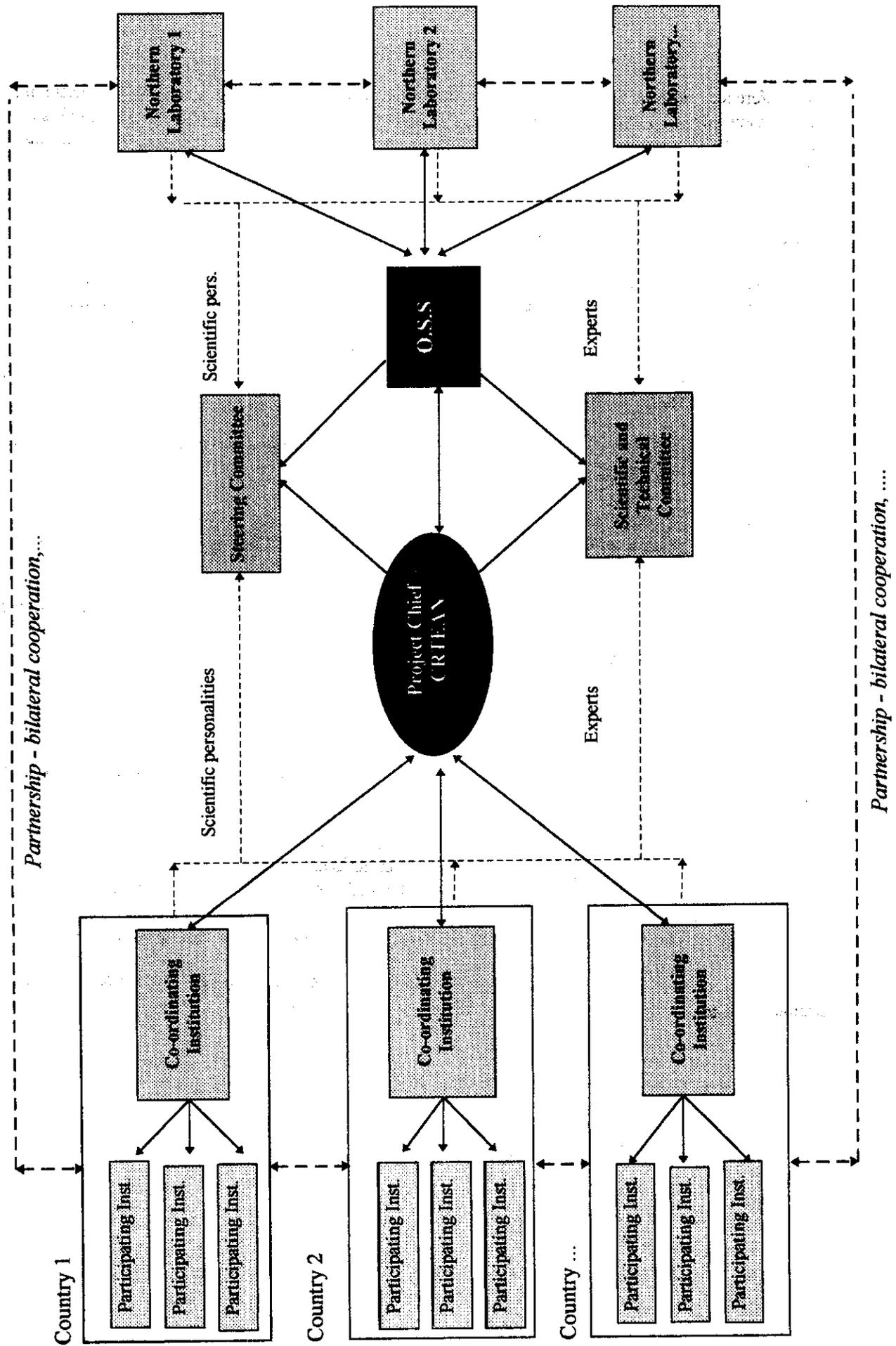
In addition to the know-how and technological transferts for the benefit of north african sub region countries, the others interests are :

- The development of the sub region national potentialites, since the real actors for the realization of this project are the north african national institutions.
- The uniformization and harmonization of the methodological approach at not national level but regional level.
- The standardization of characterization norms of the desertification and processing tool.

It is clear that one of the ambitions of this project will be not only its realization but also its prolongation to the sahelian Africa, for the interest of our continent.

**ORGANIZATIONAL DIAGRAM OF SUDDAN PROJECT**

**Fig. 3 :**



## BIBLIOGRAPHIC REFERENCES

- CRTEAN/OSS, 1993 - Actes du séminaire d'Arzew, Algérie, Janvier.
- CRTEAN/OSS, 1994 - Projet Régional pour le suivi de la Dynamique de la Désertification en zones arides et semi arides d'Afrique du Nord, « SUDDAN » ; Avant-Projet Technique.
- CRTEAN/OSS, 1994 - Actes du séminaire de Rabat, Maroc, Juin.
- CRTEAN/OSS, 1994 - Projet Suddan : Fiche signalétique pour le choix des sites
- CRTEAN/OSS, 1994 - Projet Suddan : Questionnaire sur les apports et les besoins des institutions participantes.
- LONG G, 1994 - Diagnostic phytoécologique : applications à l'aménagement du territoire, 2 tomes, Masson, Paris.
- OZENDA P., KERAUDREN J., 1952 - Carte de la végétation de l'Algérie au 1/200.000 : feuille Guelt Es-Stel, Djelfa. Edit. IGN, France.
- POUGET P. 1979 - Les relations sol - végétation dans les steppes sud-algéroises. Thèse Doct. Etat, Aix Marseille III, Univ, 555 p.
- UNESCO/CNRS, 1977 - World distribution of arid regions.
- UNESCO/MAB, 1979 - Carte de la répartition mondiale des régions arides, notice explicative + carte au 1/25.000.000, notes techniques du MAB, 7, 1 - 55.