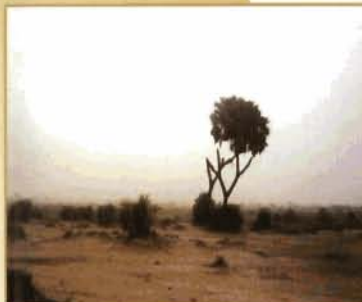


**SD n° 2**

OBSERVATORY  
NETWORK  
FOR LONG TERM  
ECOLOGICAL  
MONITORING

# ROSELT / OSS



ROSELT / Oss organization,  
operation and methods

RÉSEAU  
D'OBSERVATOIRES  
DE SURVEILLANCE  
ÉCOLOGIQUE À  
LONG TERME

OBSERVATOIRE  
DU SAHARA  
ET DU SAHEL



ROSELT / Oss collection – Scientific Document n°2



Sahara and Sahel Observatory (Oss) has set up a Long Term Ecological Monitoring Observatories Network (ROSELT/Oss) in the circum-Saharan zone. In the framework of its programme of Environmental Monitoring, helping the policies of implementation of the National and Sub-Regional Action Programme (NAP and SRAP) to combat desertification. This device has been elaborated within and to serve the African countries, to ensure the long term monitoring of desertification and to develop associated research activities. An expertise mechanism has been undertaken, conducting to the selection, and then to labellisation by Oss, of twenty-five observatories in eleven countries. fourteen pilot-observatories have been activated in the first place of the programme, within the financial support of France and Switzerland.

This document is part of the « *ROSELT/Oss scientific and technical collection* », which includes the Scientific Documents (SD) and the Technical Contributions (TC).

SD are synthesis documents about the scientific bases of the programme or the scientific items related to desertification. TC are technical documents such as individual works (dissertations, PhD thesis, master dissertations...) or collectives works (thematic or geographic approaches) undertaken in the frame of the programme. Each draft leaflet of the ROSELT/Oss methodological guidebook is edited such as a TC. Once tested and validated by the whole body of the network, they will be grouped and edited such as Scientific Documents.

The aim of the « *ROSELT/Oss scientific and technical collection* » is to share, step by step, within the international political and scientific community, the scientific and technical advancements of the network in order to :

- a better knowledge on the causes, consequences, mechanisms and extend of desertification ;
- the elaboration of a monitoring system adapted to the conditions of arid zones for a better help to decision.

It highlights the permanent effort realised by the ROSELT/Oss network and completes the others products of the network : local databases, management tools of metadata, Local Environment Information Systems for the integrated processing of the information and the prospective simulation, web site ([www.roselt-oss.org](http://www.roselt-oss.org)).

The regional coordination  
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**ROSELT / Oss orgazisation,  
operation and methods**

**ROSELT / OSS**

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## Preamble

The Observatory Network for Long-Term Ecological Monitoring (ROSELT/OSS) is a programme set up by the Sahara and Sahel Observatory (OSS). It is made up of a number of observatories which operate in a network at regional level in Africa, in the geographical zone of the OSS. This zone comprises three sub regions : North Africa, West Africa and East Africa.

ROSELT is a specific and original tool created by the OSS. It is the first network in Africa to:

- 1) organize scientific monitoring of the environment. This allows, on the one hand, the characterisation of the causes and effects of land degradation, and on the other, a better understanding of the mechanisms which lead to desertification ;
- 2) provide reliable data on land degradation in arid areas and pertinent biophysical and socio-economic indicators of desertification, as well as to assess the state of the environment within the OSS zone.

The ROSELT/OSS programme is strongly based on the recommendations from the meeting organised jointly by PIGB, MAB/UNESCO and OSS in July 1992 at Fontainebleau (France), which, moreover, lead to the GTOS programme. The first stage of ROSELT was instigated by the OSS at the time of its launch in 1990. This was marked by a workshop held in Rabat in Morocco in April 1994 and then by the drafting of a founding document, entitled: « Conceptual, organizational and operational framework of ROSELT/OSS » (1995 , ROSELT/OSS, SD1, 2004).

During the launch phase, twenty-five observatories or clusters of observatories received ROSELT/OSS certification and fourteen pilot observatories were selected for training in funding applications.

In 1998, the pilot operational phase commenced in order to test the data collection, processing and normalised data circulation protocols. To start with,

certain North-African and Egyptian observatories were able to start their environmental monitoring work with financial aid from the Swiss Department of Development and Co-operation (DDC). From the year 2000, the implementation of the whole network was trusted to the regional operator with financial aid from the French global environment fund (FFEM) and french ministries.

The development of ROSELT/OSS was a progressive shift, taking it from the initial phase which was primarily dedicated to conceptual and organizational development, to a more operational stage which is oriented towards better structuring and consolidation of the acquired knowledge of the network.

The second phase was initiated by a regional workshop in June 2000 in Bamako, Mali. It brought together national ROSELT/OSS representatives, sub-regional operator teams, the regional operator and all ROSELT/OSS partners. This event was an opportunity to reiterate the major orientations of the network, to examine what had been achieved, and to consolidate and update the existing structure, its operational practices and the methods it uses.

Upgrading is a continuous progress and, of course, a must. One of the conditions of long term maintenance of ROSELT/OSS is to do with its capacity to develop as a function of national and international situations and needs, and the scientific and technical advances it is able to make.

The present document presents the organisation, operational practices and methods the network uses, through the co-ordination of the regional operator. It is based on the founding document published in August 1995, and on the documents presented, discussed and amended during the Bamako workshop.



# ROSELT/OSS and desertification

ROSELT/OSS and international agreements,  
in particular the implementation  
of the Convention to Combat Desertification (CCD) in Africa :  
local to regional.

The ROSELT/OSS programme fully subscribes to the Rio declaration and to Agenda 21 (conventions on bio-diversity, climate change and combating desertification), and is a key mechanism of the three proposed and approved conventions the United Nation Conference on Environment and Development (UNCED).

Its strategy is part of a hierarchical and participative approach, focusing on local and sub-national levels to provide for needs at national, sub-regional and regional levels in a coherent manner. It takes into account the characteristics and particularities of the zone in which the Oss is involved, (eco-climatic, socio-economic and cultural).

ROSELT/OSS makes a fundamental contribution to the implementation of the Convention to Combat Desertification (CCD), in particular through the National and Sub-Regional Action Programmes (NAP and SRAP), in collaboration with international organizations and programmes.

## ***ROSELT in the Oss***

ROSELT/OSS is a key programme running by the Sahara and Sahel Observatory (Oss). Within the framework of the Oss's "Strategy 2000", it constituted the core of the leading programme for the implementation of a Device for Observation and Monitoring Desertification in Africa (DOSE, *dispositif d'observation et de suivi de la désertification en Afrique*). This programme relies on three principles : to capitalise on the information available in Africa, to process it and organize its circulation. Within DOSE, the ROSELT/OSS programme was run in parallel with the circulation of "Desertification Information System" programmes (SID-SISEI) (*programmes systèmes de circulation de l'information sur la désertification*) and IMAGES (the use of satellite imaging in desertification monitoring).

ROSELT/OSS is from this point on, integrated into "Monitoring-Evaluation of the Implementation of the CCD in Africa" programme, the Oss organisational framework. This programme exists thanks to close collaboration between the Oss and the sub-regional African Organisations (CILSS, IGAD, UMA). In this context, ROSELT/OSS contributes to the implementation of national environmental monitoring and monitoring-evaluation systems for action programmes to combat desertification.

## ***ROSELT/OSS and desertification***

The fundamental purpose of ROSELT/OSS is to **improve knowledge of the mechanisms, causes, consequences and scope of desertification** in arid and semi-arid zones of the circum-Saharan area.

In spite of the quantity and quality of research work on land degradation in arid and semi-arid zones, very little research has been conducted into the dynamic links between the biophysical conditions of land degradation (including desertification) and population lifestyles.

Faced with the problem of desertification, societies have for many years developed mechanisms to protect themselves against its detrimental effects the best as they can. There is a long tradition of migration of populations during the dry season, mobility of herds (the importance of transhumance), extensive and highly dispersed crops to reduce economic and climatic risks, etc.

This adaptive response of societies clearly denotes the existence of strong links between societies and their environment ; links that are important to understand before undertaking development action or renewable resource management initiatives.

Furthermore, the scientific community and research beneficiaries are faced with a serious lack of environmental data over a sufficiently extensive period of time to determine trends through reliable indicators.

## ***ROSELT/OSS and its objectives***

The fundamental objectives of ROSELT/OSS are :

- 1) the long-term surveillance of the evolution of ecological systems,
- 2) the research into better understanding of the interactive functions between populations and their environment at local level, in particular the respective and/or synergetic roles of climatic and anthropological variations in land degradation.

In order to achieve these objectives, ROSELT/OSS was primarily designed as a long-term monitoring network (over several decades) with continual collection of "ecological" data, covering all aspects of the rural environment.

ROSELT/OSS is equally designed to function as a research 'platform' in order to promote harmonised methodologies for information collection and processing, and to better understand the mechanisms which lead to desertification.

## ***ROSELT/OSS, a long-term environmental monitoring device that facilitates decision-making***

In order to be plausible, ROSELT/OSS must not only satisfy short and medium term concerns, but should also guarantee the continuity of the network in the long-term. To meet these needs, the following specific objectives have been defined :

### ***Use and enhance existing knowledge***

Historically, definition and evaluation of environmental change have been applied in numerous countries according to a thematic approach, which is all too often sector-based. Often the data mass produced is disparate, dispersed between various institutions (*i.e.* inaccessible), corresponding to a limited period, etc.

ROSELT/OSS strives hard to bring together, validate, and use these resources, to establish an initial diagnostic of the territory and to serve as a basis for a harmonised monitoring strategy and data collection.

The use of this validated historic data, allows for a faster construction of the relevant indicators of environmental change in the arid and semi-arid circum-Saharan area.

### ***Set up a harmonized environmental monitoring system***

One of the fundamental mandates of ROSELT/OSS is to become a standard reference in Africa for the collection and processing of environmental data used for the evaluation of changes in ecosystems and agro-ecosystems.

It must also provide to those involved in development planning appropriate, effective and harmonized tools in order to assist them in decision-making at the different required levels.

- *Harmonization of the data series to be collected by the observatories*

ROSELT/OSS progressively achieves a common “minimum dataset” in all observatories, whilst preserving the specific characteristics of each. This dataset also takes into account the data collected and indicators developed by other long-term environmental observation networks within the framework of NAP/CCD or other programmes and projects having convergent objectives.

- *Harmonization of sampling and data collection methodologies*

Without breaking the continuity of observations on the ground achieved so far, ROSELT/OSS is progressively harmonizing approaches to be compatible with the anticipated outputs at the level of pilot observatories. This methodology will be applied to all observatories of the network, with respect to the development of national networks.

- *Harmonization of information-processing methodology*

Data processing methods are designed from the outset of data collection to :

- be appropriate to data interpretation for improved understanding of desertification mechanisms ;
- be adaptable to constrained research into the interactions between series of bio-physical and socio-economic variables ;
- be comparable between one observatory and another ;
- produce anticipated ROSELT/OSS outputs.

### ***Assure the long-term continuity of the monitoring system***

The sustainability of ROSELT/OSS is dependent upon a monitoring system which is both technically reliable and low cost. This low cost can be achieved by : defining the minimum amount of data required for the evaluation of the predetermined indicators ; using the most appropriate and lowest cost methodologies (field observations, interpretation of satellite images, combination of both, etc) and by the simplicity of monitoring by properly trained national teams.

### ***Institutional presence of ROSELT/OSS in national policies***

The sustainability of the network relies essentially on the commitment of the individual countries and their adoption of ROSELT/OSS.

OSS and the regional operator promote and oversee ROSELT/OSS as a key element of desertification monitoring within the National Action Programmes to combat desertification (NAP/CCD), which are a requirement of the CCD.

### ***Reinforcing of the countries's technical and scientific capabilities***

ROSELT/OSS has a substantial training component designed to strengthen the technical and scientific capability of the different countries. At present, it proposes three major types of training :

- National or sub-regional training workshops for technicians in harmonised data collection methods and data processing at observatory level within ROSELT/OSS ;
- Targeted visits and work experience for managers which take place within the network, according to need and according to the skills of the specialised institutions within ROSELT/OSS and its associated partners ;
- Professional development for managers according to their specific subject and the characteristics of the observatories.

## ***Make the knowledge usable for development planning***

- *Tools for the processing and circulation of information* (see p. 36, 41, 44)

For the harmonization of release of information produced by the network, equal emphasis is placed on the use of processing, communication and distribution tools :

- An integrated system for information processing : Leis-ROSELT/OSS (Local Environment Information System for ROSELT/OSS) ;
- A tool for communication within the network : the website ;
- A metadata management tool : to reference and share all the information on historical and collected data within the network's observatories.

The networked structure of ROSELT/OSS encourages exchange between the observatories and between countries. The structure is an operational framework which promotes interaction amongst parties interested by a particular topic.

- *ROSELT/OSS decision-making tools* (see p. 33)

ROSELT/OSS products are prepared with view of providing managers and development managers with information on the state of the territory under observation, the risk of desertification of the territory in time and in space, and the key elements for the interpretation of this risk. The presentation of the results and the dissemination of the means to accomplish them must adhere to the various levels of organisation: from the local (the agents responsible for production and the protection of resources as well as for the population), to sub-national (cf. country planning) and national (national programmes). There are two major types of product :

- Initial and periodic diagnostic of the territory at local level: characterisation of the state of the system being studied, its functioning and its responses (prospective scenarios) ;
- Indicators of environmental changes and of the risk of desertification at the different levels concerned and at different levels of decision, with a "minimum indicator set" which is common to all observatories, as well as indicators which are specific to individual observatories.

## ***ROSELT/OSS : a research platform for desertification studies***

Through its long-term network structure, ROSELT/OSS pursues two objectives :

- The comparison at any given time (synchronic) between observatories which can show the existence of common desertification mechanisms despite the functional variations of human and ecologic systems ;

- Long-term comparisons (diachronic) of trends between observatories.

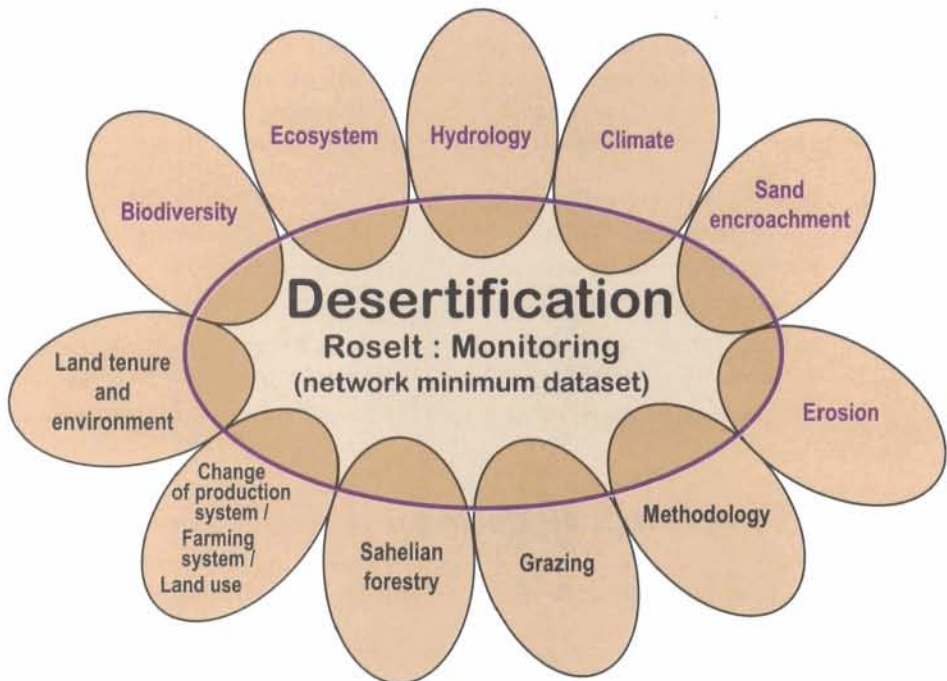
In order to do this, ROSELT/OSS ensures that short and medium term thematic research projects are part of the network :

- To study desertification mechanisms in finer detail along with the associated issues (bio-diversity, climate change, sustainable development, etc.) ;
- To assist with the progressive definition of the parameters, indicators and corresponding methodologies which should be included in the “minimum dataset” ;
- To interpret long-term data series to extract trends.

This partnership must be reciprocally beneficial. Research projects benefit in the short term from the use of an operational network as a research platform to investigate specific themes related to desertification, but also to respond to the needs of other international conventions (of biodiversity and climatic change).

The thematics identified in ROSELT/OSS (**Figure 1**) are driven by the associated research teams, but mobilised independently from the function of the network itself. They are put in place by the national teams and happen through the use of work placements, contributing equally to the strengthening of national capabilities.

ROSELT/OSS ensures that associated research projects are of interest to the whole of the network from the local to the regional level by emphasising the importance of scale.



**Figure 1 :** ROSELT/OSS : a research for desertification studies.

# Organization and functioning principles of ROSELT/OSS

With reference to the founding document of ROSELT/OSS in 1995, the operational structure of the network (**Figure 2**) facilitates both of the objectives defined in the previous chapter, and the international approach to the implementation of the UNCED convention, Rio. The emphasis is placed on approaching issues at local level, and their integration in national, sub-regional and regional policies.

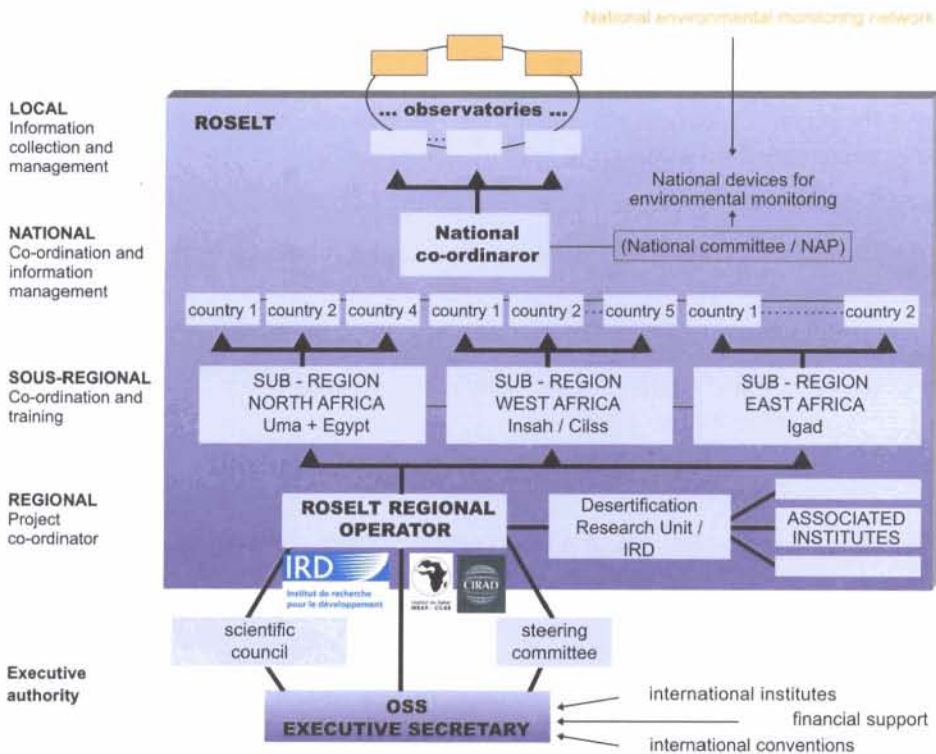


Figure 2 : Structure of the ROSELT/OSS network.

## **Local level : ROSELT/OSS observatories**

### **An observatory is :**

- a territory which is characterised by homogenous bio-physical and socio-economic functioning ;
- a set of scientific, human and material resources ;
- an organised system for the collection and processing of data : from the station to the field, then the ecological region ;
- a response to a demand for decision-making aids at different levels of spatial integration.

**ROSELT certification is given to the observatories by the Oss** once they have met predetermined criteria and met with the approval of a scientific committee. They are an initiative run by and for the African countries according to the following stages (**Figure 3** and founding document of ROSELT/OSS, 1995 ; SD1, 2004) :

- 1) Proposal of candidate territories by the countries which provide the necessary data and define their priorities ;
- 2) Selection and expertise at the sub-regional and regional level ;
- 3) ROSELT certification by Oss according to the following criteria :
  - the availability and quality of existing scientific and technical knowledge ;
  - the bio-climatic zones which characterise arid lands (eco-regional representativeness) ;
  - major distinctive ecosystems (steppes, savannas, associated crop systems, etc.) ;
  - the different uses of natural resources in each of the three sub-regions.

**From its conception the network is designed to evolve** according to the following phases :

- The operational pilot phase of the programme applies and tests data collection and processing protocols in a limited number of “pilot” observatories. The protocols are defined from the integration and harmonization of existing methodologies (this is the current phase with fourteen observatories).
- Network consolidation and extension phase, within the framework of the CCD, of further observatories chosen to increase representativeness. At present, twenty-five observatories or clusters of observatories have received ROSELT/OSS certification ; others will be added according to requests for membership of the network and the consideration of possible new themes.



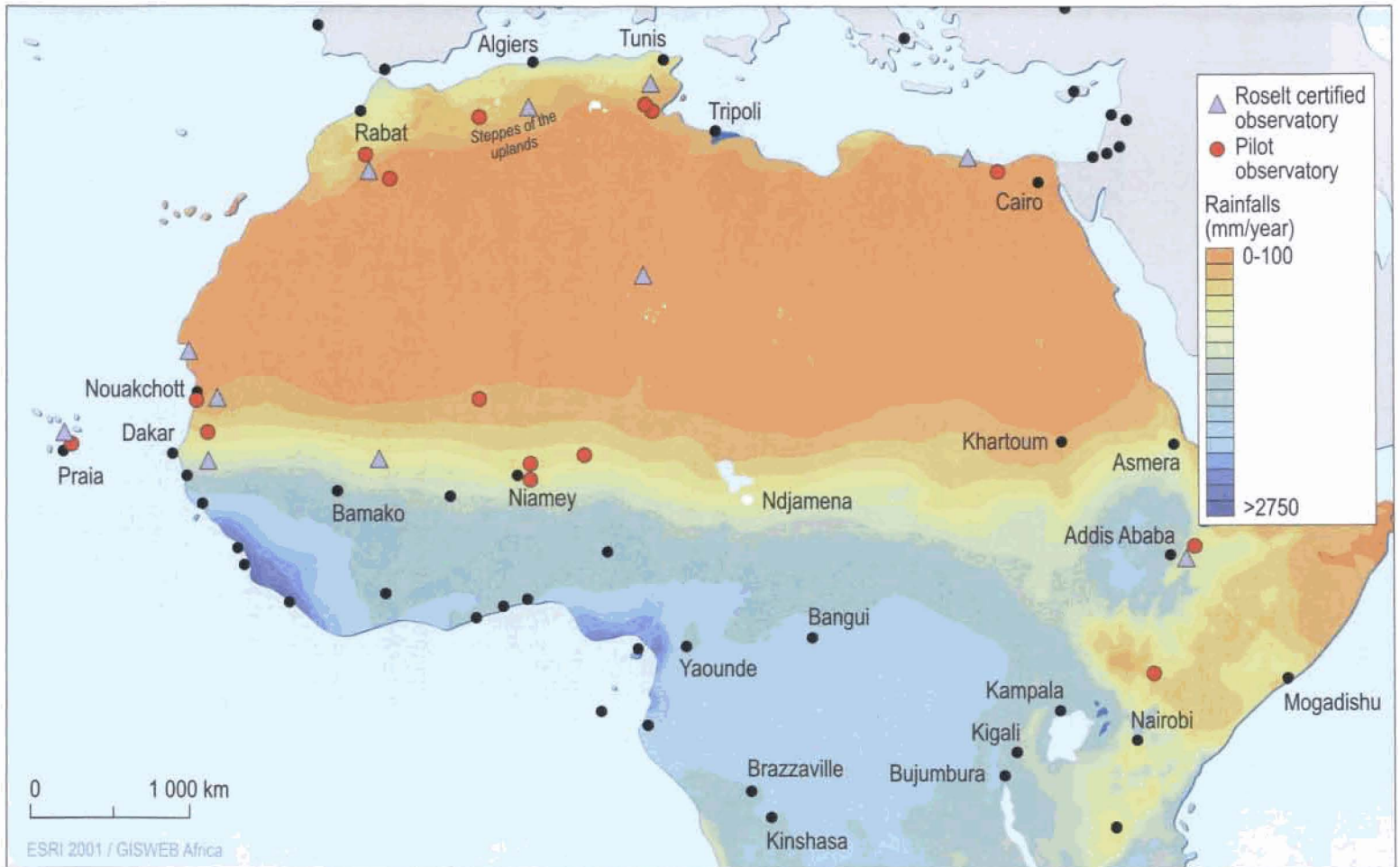


Figure 3 : The ROSELT/OSS circum-Sahara observatories.

- the fully operational phase for the observatories and continuous enhancement of the network over the long-term, with a harmonization of different levels of organisation. This phase will work in progressive interaction with the national environmental monitoring systems, in particular those which are currently being set up through the NAP/CCD.

Within the context of the implementation of the NAP/CCD, these three phases can happen simultaneously.

Each observatory is placed under the responsibility of an observatory scientific coordinator in conjunction with the ROSELT/OSS national scientific coordinator and the National co-ordination body (ONC) of the NAP/CCDs. The duties of the observatory scientific coordinator are as follows :

- to contribute to the development of the work programme by following an inter-disciplinary and multi-institutional approach which is compatible with the environment problems encountered by each observatory ;
- to ensure the collection of data in the field according to the progressively harmonized methods of the network ;
- to integrate the data into a local database and meta-database ;
- to analyse data through a local environment information system (ROSELT/OSS-LEIS) and to participate in the preparation of products (assessments, thematic maps, indicators, etc) ;
- to ensure, with the regional operator, the development of skills of the people involved in the activities of the observatories ;
- to ensure that the observatory remain sustainable, by maintaining awareness of the synergy of the different programmes and projects in the observatories, and by promoting a participative approach with local populations.

At the regional operator level, the emphasis is placed on the need to improve the coherence of the network of observatories, in terms of :

- the physical size and delineation of the observatories ;
- the valorisation of existing resources ;
- the harmonized methodology for the collection and processing of information.

**Table 1 : List of the certified pilot (P) and no-pilot ROSELT/OSS observatories.**

Country	Name of ROSELT/OSS observatories	Bioclimate
<b>NORTH AFRICA</b>		
<b>ALGERIA</b>	High Steppic Plains of South-Oranais (P) Tassili N'Ajjers	Mediterranean : from semi-arid to per-arid Desertic, hyper-arid semi-continental
<b>EGYPT</b>	El Omayed (P) Matruh	Mediterranean aride Mediterranean arid, HAEP, with thermal variant
<b>MOROCCO</b>	Oued-Mird (P) and Issougui (P) Fezzouata	Mediterranean inferior arid Mediterranean hyper-arid (saharan)
<b>TUNISIA</b>	Haddej-Bou Hedma (P) Menzel Habib (P) Oued Gragger	Mediterranean arid
<b>WEST AFRICA</b>		
<b>CAPE VERDE</b>	Ribeira Seca (P)  Ribeira Principal	Tropical, semi-arid to arid, mono-modal, with oceanic coastal variant  Tropical, sub-humid, mono-modal, with coastal variant
<b>MALI</b>	Cercle de Bourem (P) Niono, Delta occidental Boucle du Baoulé	Tropical, arid, mono-modal Tropical, semi-arid, mono-modal Tropical, semi-arid to sub-humid
<b>MAURITANIA</b>	Nouakchott (P)  Boutilimit  Banc d'Arguin	Tropical, arid, mono-modal, with oceanic coastal variant Aride à hyper-arid, mono-modal, with coastal variant Arid to hyper-arid, mono-modal, with coastal variant
<b>NIGER</b>	Torodi (P) - Tondikandia (P) Dandiantou (P) - Keita (P)	Tropical, semi-arid, mono-modal
<b>SENEGAL</b>	Grappe du Ferlo (P) Tissé Kaymor	Tropical, semi-arid, mono-modal
<b>EAST AFRICA</b>		
<b>ETHIOPIA</b>	Melka Werer (P) Awash Park	Tropical, semi-arid, bi-modal Tropical, dry sub-humid, bi-modal
<b>KENYA</b>	Kibwesi - Kiboko (P)	Tropical, semi-arid, bi-modal

## **National level : country**

Eleven countries are represented in ROSELT/OSS : Morocco, Algeria, Tunisia, Egypt, Mauritania, Mali, Niger, Senegal, Cape Verde, Ethiopia and Kenya.

Membership of other countries of the OSS area is planned (Burkina Faso, Chad, Uganda, Libya, etc).

**The national level is under the responsibility of a technical and scientific institution.**

An institution which possesses scientific and technical competences appropriate to ROSELT/OSS, is designated by the country to hold responsibility at national level. Its director is the ROSELT/OSS programme national representative. National structures and co-operation partners provide the equipment and operational resources it needs along the lines of those used by the ROSELT/OSS network.

The national institute designates a national scientific co-ordinator whose tasks are as follows :

- to co-ordinate the activities of the ROSELT/OSS certified observatories according to technical and financial methods as detailed in the contract with the regional operator and the OSS ;
- to mobilise the skills required, either internally or from the national partner institutions ;
- to centralise and process observatory data and to develop ROSELT/OSS products at national level ;
- to disseminate information on ROSELT/OSS as broadly as possible within the country and encourage national authorities to take it into account in their national programmes (NAP) on environment, development and particularly desertification ;
- to ensure the technical capabilities of its team are strengthened in terms of environmental monitoring within the framework of the network ;
- to identify technical assistance and expertise needs with the regional operator ;
- to provide information to the regional operator and the OSS and contribute to the enhancement of results from the ROSELT/OSS observatories, and in particular for the preparation of decision making products ;
- to participate, on behalf of their country, in the preparation of documents required to meet the operational needs of the network, and in particular those aimed at preparing applications to bilateral or multilateral funding organizations ;
- to develop partnerships with national and international research and development bodies involved with ROSELT/OSS, as well as with the local populations ;

- to propose new territories that are compatible with ROSELT/OSS objectives, taking national concerns into account.

**In order to guarantee both the sustainability and the scientific quality of the national observatories, ROSELT/OSS relies on two partnerships :**

- a scientific partnership so as to ensure the quality of data collection and processing : with scientific institutions (national research institutes, universities, specialised higher education establishments [high schools] etc), scientific projects, etc. ;
- an institutional partnership and national policy (NAP/CCD committee, environment commission and sustainable development, etc.) so as to ensure the sustainability of the monitoring at the lowest possible cost.

ROSELT/OSS contributes to the implementation of National Action Programmes ; in this respect, the national representative must operate in close collaboration with those responsible for the NAP (the national co-ordination body, etc.), under the supervision of the minister in charge of the combat against desertification. He can, when necessary, turn to the support of a ROSELT/OSS national guidance committee which is made up of :

- the environmental planning departments : National Environmental Action Programme (NEAP), National Action Programmes, etc ;
- the major national research institutions having an interest in environmental monitoring ;
- the technical services of the ministerial department responsible for the environment and the combat against desertification : water and forestry, meteorology, environment, rural development, etc ;
- the managers of the ROSELT/OSS observatories in that particular country.

The national scientific co-ordinator set up a national interdisciplinary and multi-institutional working group for the implementation of ROSELT/OSS activities.

## ***Sub-regional level : East, West and North Africa***

**The ROSELT/OSS sub-regional level is represented in West Africa by the CILSS/Sahel Institute (INSAH).** The OSS progressively involves the sub-regional institutions in its different programmes, in North-Africa, the UMA (the Union of Arabic Mahgreb), in East Africa, and the IGAD (Intergovernmental Authority on Development).

**The tasks at sub-regional level are as follows :**

- to promote the participation of ROSELT/OSS in the preparation and implementation of sub-regional action plans (SRAP) ;

- to promote synergies between similar programmes at the sub-regional level ;
- to participate in the design and preparation of ROSELT/OSS products as a federator of groups of countries ;
- to participate, with the Oss, in negotiations with funding agencies, and to represent the network for specific sub-regional actions ;
- to contribute to the enhancement of ROSELT/OSS products at international level.

**A scientific, technical and political partnership is encouraged :**

- Scientific partnership : with scientific and/or training institutions which operate in the circum-Saharan area and, which target one or more areas of environmental management (specialised institutions from inter-governmental bodies, international research centres, devolved regional satellite bodies, United Nations agencies, initiatives/network/focal centres).
- Technical and political partnership :
  - with, if possible, the supervision of the inter-governmental body in charge of the implementation of the Convention to combat desertification ;
  - influence within the sub-regional action programme ;
  - technical influence with specialised institutions and/or an inter-state organization covering the sub-region and most appropriate to ROSELT/OSS objectives (e.g.: the CILSS for West Africa).

## ***Regional level***

**The organisation of ROSELT/OSS at regional level includes the following :**

- The Sahara and Sahel Observatory (Oss), the executive authority ;
- The regional operator is the project coordinator and can be delegated as the executive authority by the Oss. It is made up of a consortium of bodies which are appointed for a four years period and, should ideally include an operator from the Northern countries and an operator from the Southern countries.

**In its capacity as executive authority of the ROSELT/OSS programme, the Oss has the following duties :**

- to ensure the development strategy of the ROSELT/OSS programme ;

- to ensure the monitoring and evaluation of the scientific and technical results of the programme, as well as the financial evaluation of allocated funds ;
- to promote contacts, particularly institutional contacts, throughout the project, amongst the Northern and the Southern countries, their scientific and technical organisations and the international organizations ;
- to negotiate with funding agencies, with the support of the regional operator, to secure funding complementary to that which is already mobilised ;
- to promote ROSELT/OSS outputs in the action programmes planned by the CCD at different levels, through the development of effective desertification monitoring mechanisms ;
- to valorise the ROSELT/OSS outputs, with the support of the regional operator, the sub-regional countries and the organization concerned, towards the CCD authorities, as well as policy makers of the member countries of the Oss and the donors.

**The tasks of the regional operator are to :**

- organise and ensure the proper functioning of the network ;
- define the actions to be carried within the network ;
- ensure, in collaboration with the Oss, the continuity of scientific and technical contacts between the network and the countries of the North and the South and their scientific and technical bodies as well as their international organizations ;
- propose and harmonize scientific and technical concepts and working methods ;
- design, guarantee, and prepare development aids produced by ROSELT/OSS ;
- put together results and contribute to the valorisation of products through workshops and synthetic reports ;
- contribute to the preparation of funding applications and, in collaboration with the Oss, participate in negotiations with funding organisations ;
- carry out continuous internal scientific and technical evaluation of ROSELT/OSS and take appropriate initiatives to correct weak points ;
- provide methodological support for the design of national networks ;
- ensure, on behalf of the Oss, the co-ordination and internal control of the financial management of funds made available to the network.

The regional operator of the 2000-2004 operational phase consists of a **consortium of three institutions** : the **IRD**, which heads up the consortium (Institute of Research for Development, Montpellier, France), the **INSAH** (Institute of Sahel,

Bamako, Mali) and the CIRAD (Centre for International Co-operation in Agronomic Research for Development, Montpellier, France). **Around the ROselT/Oss programme, the IRD has created a specialised services unit (su) entitled "Evaluation and monitoring of the cause, consequences and mechanisms of desertification in the arid and semi-arid zones".**

The regional operator should ensure that the network **becomes part of a regional and international scientific environment** : specialised agencies of the United Nations (FAO, UNEP, UNESCO, etc), CGIAR, relevant international networks and initiatives, international organizations/associations, etc. With this in mind, an official agreement has been signed between UNESCO and OSS, with the intention of improving the co-ordination of their long term ecological monitoring (UNESCO/MAB and ROselT/OSS programmes). In the context of the ROselT/OSS network, the Cesia (Italy) operates on the pilot site at Keita (Niger).

### **Mechanisms for the evaluation of the programme**

The OSS is dependent upon the work of a ROselT/OSS **Scientific and Technical Committee (STC)** which evaluates the results of the network and proposes guidance. The council was established in September 2001.

External auditing is carried out by the ROselT/OSS **Steering Committee (ST)** set up by the OSS which includes the president of the STC, the executive secretariat of the OSS, and the representatives of the funding organizations and of the regional operator.

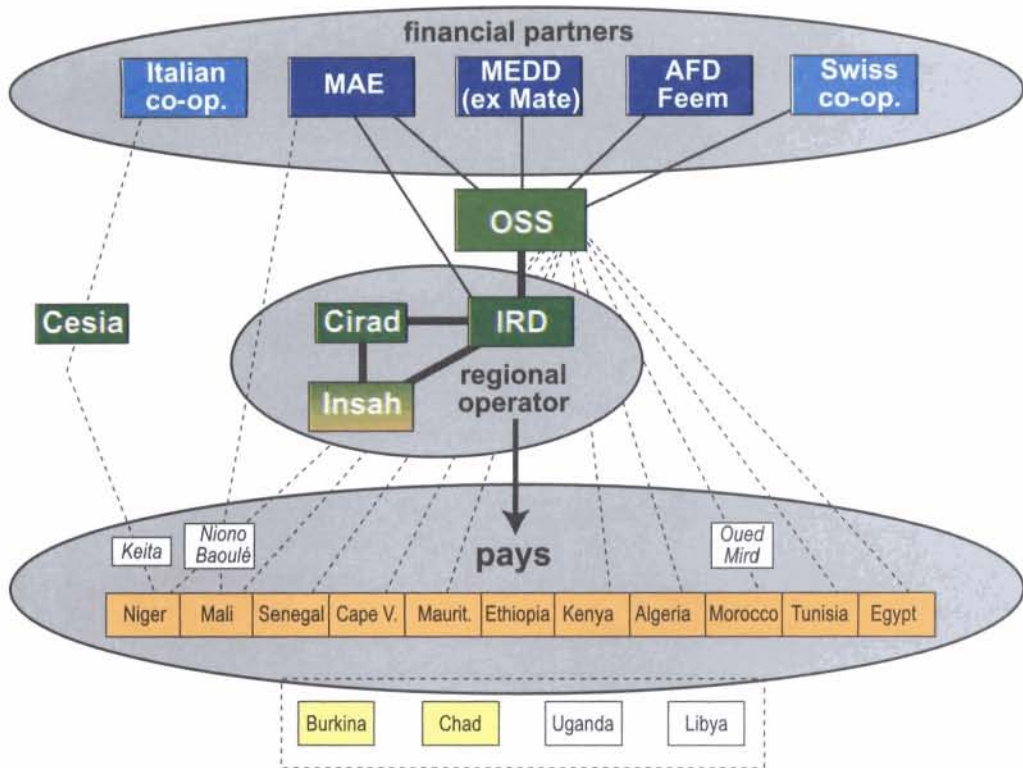
Equally, the regional operator gathers expert thematic specialists likely to help in the ROselT/OSS technical and scientific implementation in observatories and, if needed, conduct scientific and financial audits in countries on behalf of the OSS.

### ***The financial and contractual mechanisms of the network implemented for the 2000-2004 phase***

The implementation of a programme such as ROselT/OSS is confronted with a number of complexities as associated with working with a large number of national and international technical partners and a large number of financial partners (Figure 4).

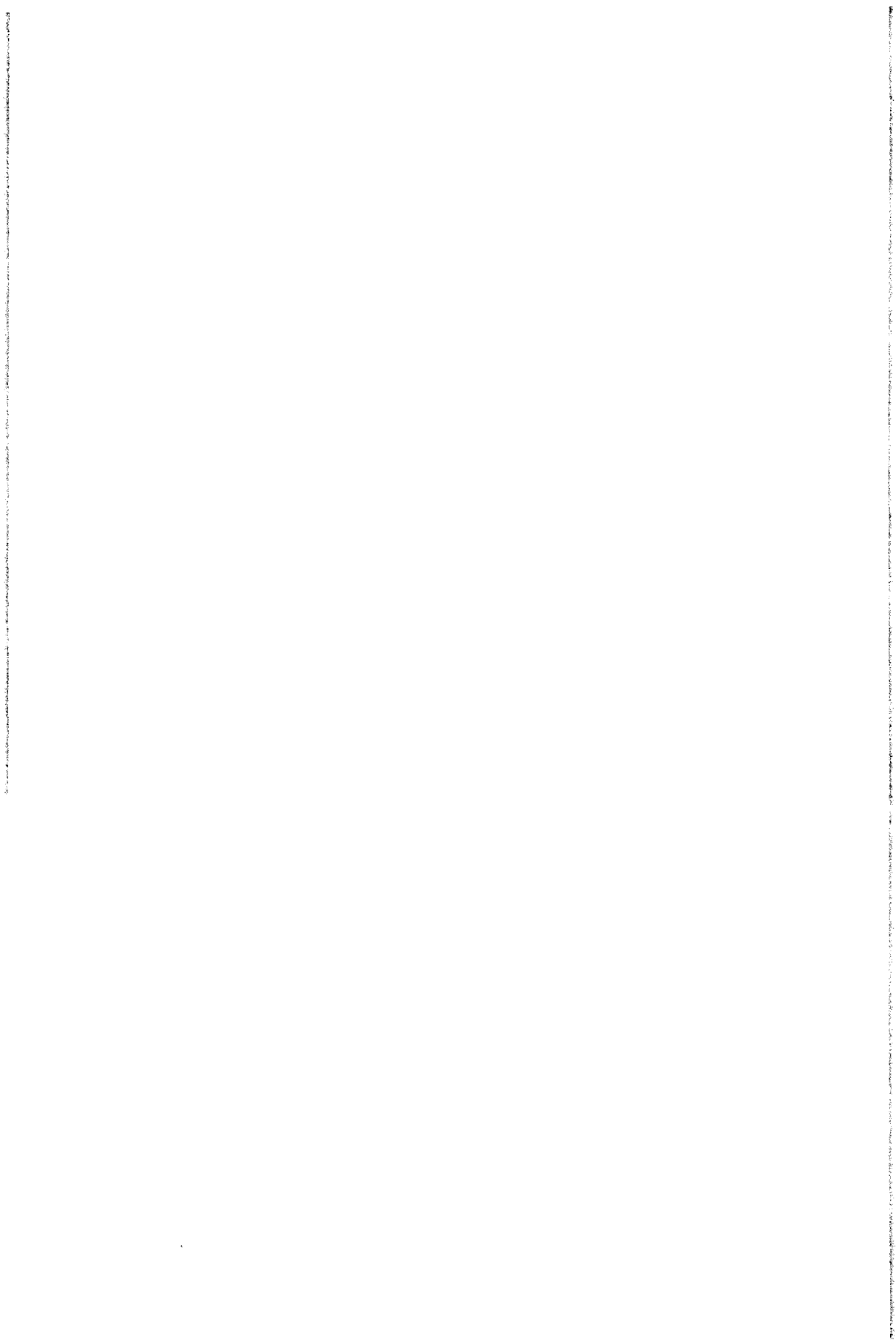
With this in mind, the OSS and the regional operator are committed to the simplification of the mechanism. In general terms, contractual policy within the network includes a four-yearly framework agreement between the partners at the different levels of the organisation. These are subject to annual amendment which incorporate the provisional action plan for the year ahead and the anticipated funding.





**Figure 4 :** ROSELT/OSS 2000-2004. contractual relationships schema. (The lines represent the contractual relationships).

\*  
\*   \*



# ROSELT/OSS products, concepts and methodologies

## *The network activities*

One of the fundamental duties of the regional operator is to propose and harmonise scientific and technical concepts and working methods within the network. It is also responsible for the design, assurance and preparation of decision-making tools for development planners.

During the start-up phase of the network, work was focused on the definition of activity schedules for observatories, which were divided up into the three categories as described in the table shown next page. They were for the most part implemented in chronological order (monitoring, processing, products) in several observatories, using methodologies that were common practice within the partner institutions.

The following operational phase was focused on the definition and development of products common to the network, and is based on methodological proposals coordinated by the regional operator. These propositions allow for the analysis of the suitability and quality of parameters measured, notably for the development of indicators of change.

This chapter presents these methodologies, which will be used to structure the information collected by the programme. The structure will depend on the requirements of the end product. The methodologies will be used in the progressive definition of the minimum dataset, which is to be common to all observatories within the network :

- the concepts and methodological proposals for the study of environmental change, in particular desertification ;
- ROSELT/OSS decision-making aids ;
- the tool for the processing of environment information : LEIS (Local Environment Information System).

It also presents the device of the regional operator for the inventory and circulation of information including :

- a metadata management tool ;
- a website.

*A typical activity schedule for an observatory (network implementation phase).*

- O - Preliminary activities.**  
The first programme phase for a four-years period including the valorisation of existing data on ROSELT/OSS observatories in the form of a summary report and the completion of a land occupation map (point zero).
- A. Long-term environmental monitoring activities.**
  - A1 :** Monitoring of land-use and surface features.
  - A2 :** Monitoring of meteorological and climatological parameters.
  - A3 :** Monitoring of edaphic and soil parameters.
  - A4 :** Monitoring of vegetation and plant resources.
  - A5 :** Monitoring of fauna.
  - A6 :** Monitoring of water resources.
  - A7 :** Socio-economic monitoring and monitoring of uses.
  - A8 :** Monitoring of land tenure management and land tenure conflicts.
- B. Analysis, interpretation and synthesis of information – Study of mechanisms.**
  - B1 :** Impact of climate change on the environment.
  - B2 :** Impact of human activities.
  - B3 :** Study of interactions between ecological systems (resources) and social system (uses).
  - B4 :** Development and/or experiments on systems of information on the environment at local level and methodologies for investigating desertification mechanisms.
  - B5 :** Study of the dynamics of ecosystems, agro-systems and reference populations.
- C. Development of decision-making and development tools.**
  - Co :** Environmental databases.
  - C1 :** Aid in the development of natural resources management plans.
  - C2 :** Aid in the restoration and management of plants and animal species and ecosystems.
  - C3 :** Environmental guidance studies for development projects.
  - C4 :** Production of desertification indicators.

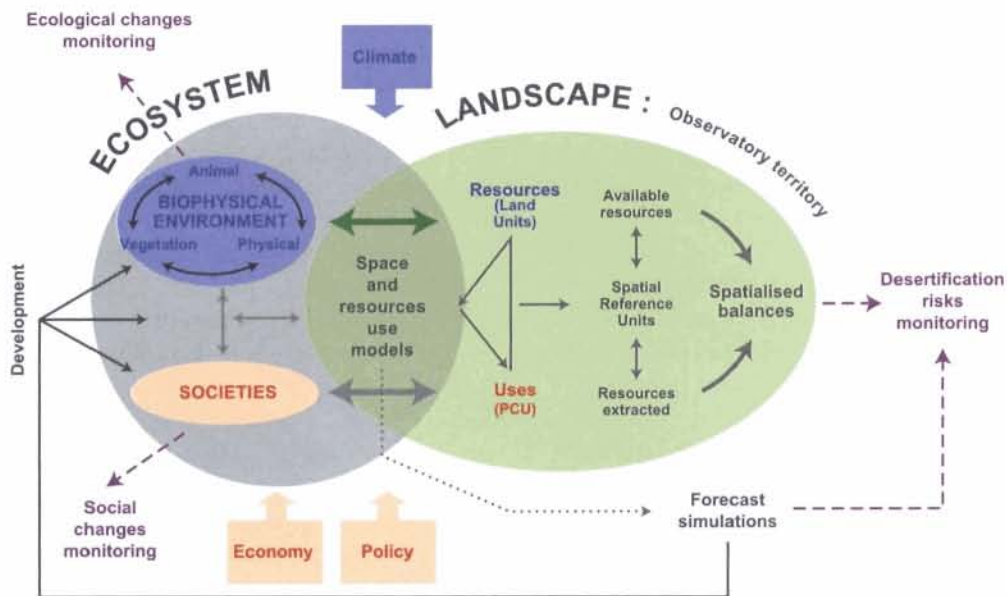
## ***Concepts et methodologies for desertification studies : “ the network’s methodological charter ”.***

From the start, the purpose of ROSELT/OSS is to monitor the evolution of ecological systems. These are defined as the systems of interaction between populations of different species living within a shared area, and their interaction with the physical environment. Well-identified forces, in particular in arid and semi-arid zones, direct this evolution : endogenous mechanisms specific to the ecosystem (vegetation succession for example), climate changes and anthropogenic activities.

The landscape is the observable spatial result of these interactions between ecological and social systems. For the understanding of environmental changes, ROSELT/OSS should therefore concentrate not only on the structure and functioning of the ecosystems, but also on the landscape, which is the preferential study place in which these interactions take place.

To do this, ROSELT/OSS devotes particular attention to the modes of use of space and resources by societies. More than a series of recurring diagnoses that would be limited to a diagnostic report, ROSELT/OSS offers a spatial modelling of these interactions, allowing simulations for change forecasts.

The collection and management of the set of information is thus structured around the concepts and methodologies which are outlined in the data structure schema (Figure 5).



**Figure 5 :** Conceptual model for the study of environmental changes within ROSELT/OSS.

With reference to the “ecosystem approach” section of the schematic, one of the main tasks of ROSELT/OSS is to develop and use indicators of ecosystem change, in particular through the valuation and use of ecological historical datasets available for the observatories (this availability is also a key criteria to ROSELT/OSS certification). The corresponding methods were mostly detailed in the 1995 ROSELT/OSS document.

In the following paragraphs, the emphasis is therefore placed on the “landscape approach” of the schematic. Accordingly, the methodological propositions are progressively implemented in the pilot observatories to allow the spatial integration of socio-economic and bio-physic datasets (Local Environment Information System : LEIS, cf. p. 35) in particular through their spatial representation in terms of uses and resources.

### **Resources-uses system**

The functioning of socio-economic systems, through the production systems, defines the usages and practices. It is controlled by different variables (demographic, micro and macro-economic, ethnological, historical, religious, etc) at several scales (local, national, international, etc).

The functioning of ecological systems determines a level of production of resources. It is controlled by different variables (climatic, morpho-pedological, and biologic) at several scales (local, regional, continental, global).

The availability of a resource (natural and sustainable) in such systems is only defined in reference to its identified usage(s). It is defined therefore by the functioning of the ecological system and its utilisation by the population.

The “resources/availability/usages/extraction” ensemble undergoes continuous evolution with time. The consequence at any given moment will determine the balance under evaluation.

The system for the analysis of resources-uses interactions presented in this document, functions internally within a level of spatial organisation (the territory of the observatory) and, is exposed to relationships with an external system with which interference occurs.

Amongst the external determinants which are likely to affect the interactive functioning, the most significant are : national policy (for example through taxation or rural/forestry acts, credit assistance, inducements and grant, etc.), international policy (for example the implementation of the Convention to combat desertification, etc), the evolution of regional markets (the need for seasonal or perennial labour, changes in production orientations, etc), the intervention of development projects, and finally the climatic change at continental and global scale.

### ***A landscape approach***

The landscape is considered to be (at any given moment) the observable result of two series of interacting factors and interactions : those related to bio-geophysical characteristics, and those related to the use of space and resources.

In order to analyse the dynamics of environmental change, the methodological proposition consists of formally distinguishing the spatial information plans which express these two sets of factors. It is only through the subsequent confrontation of these two plans that the impact of one on the other, and the retro-actions which may result, can be evaluated.

It is necessary therefore to delimit on one hand, areas which are homogenous from a biophysical point of view (Landscape Units = LU), and on the other hand, areas which are homogenous from the point view of resource exploitation practices (Combined Practices Units = CPU). The intersection of these two spatial information plans determine the Spatial Reference Units (SRU). The entirety of the SRU reconstructs a landscape for which it is possible to know the respective parts of these two sets of interactive factors.

The definition of the SRU is an integral part of the analytical phases of the ROSELT/OSS observatories (cf. p. 31). Reiterations should be generated at regular intervals compatible with the dynamics of the changes in question (five to ten years).

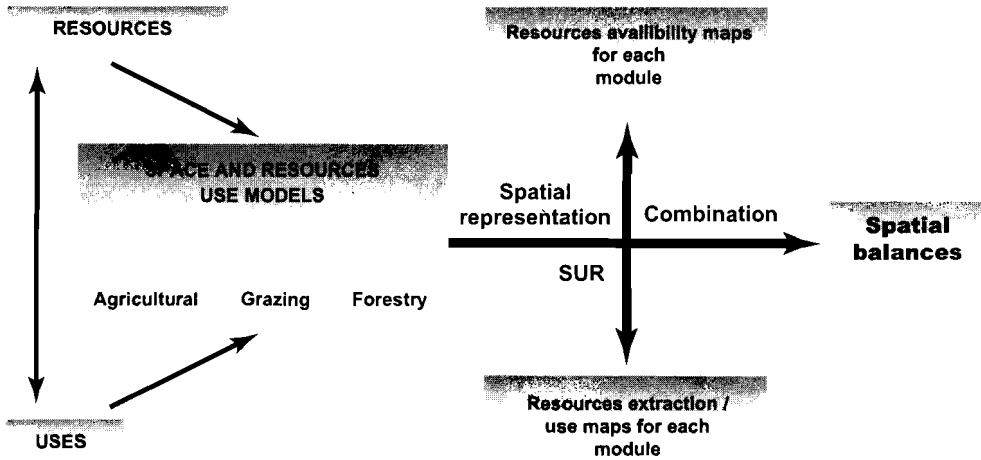
**An approach by module of land and resources use and spatial resource/usage balances**

The multi-use of space and resources is the common to the majority of arid and semi-arid zones. The characteristics of the spatial reference units are therefore a product of various usage modes, as well as determining the nature and quantity of resources for the usages under consideration.

Since the objective is to analyse the state and evolution of the spatial reference units as a function of these different modes of usage, with as many different types of management as there are modes, a module-based analytical approach has been chosen, to intervene before completing a balance which constitutes a summary of operations and extractions. Each usage is associated to one or more resources and their relationships in time and space are specific.

In the circum-Saharan zones, the modes which dominate resource use, and which generally determine a significant impact on the environment, are well identified : agricultural usage for pluvial cereal crops, pastoral usage (livestock farming) and fuel wood usage (domestic energy needs).

For each type of identified use, a model of using space and resources use model is developed (Figure 6).



*Figure 6 : From functioning by activity to a spatialised multi-usage balance.*

A single model is used for the spatial representation of practices in rural areas (determination of CPUS). The model chosen incorporates human activity which fundamentally structures the landscape : agricultural activity in the Sahelian agro-pastoral zone, pastoral activities in the zones where pluvial agriculture cannot be

practiced. **The other models** of functioning identified within the area of the observatory **are applied in the SRUS** which are delimited and structured from the “principal” module.

The functioning of SRUS is inferred from all the space and resources use models established for each usage identified, to which an availability and an extraction are associated.

The spatialization applied for the models of using space and resources, on the basis of SRU zones, allows for the mapping of resource availability and extractions associated with each type of usage.

The combination of these two later aspects on the SRUS establishes a detailed balance in space and in time for each type of usage. These initial balances, called “modular balances” enable to identify zones of imbalance between resources and extraction for a particular usage and, by following the construction chain, to identify the causes.

The combination of modular balances using the spatial content of SRUS, allows the creation of a global, multi-usage audit for the entire area of the observatory. This audit shows the condition of the landscape at any given moment, and by following the construction chain, improves understanding of the respective roles of bio-physical and socio-economic factors, and thus enables the interpretation of the condition. These balances thus contribute to the evaluation of desertification risks.

## ***ROSELT/OSS decision-making aids***

The term “ROSELT/OSS decision-making aids” refers to spatial and/or generated data from environmental modelling, designed to provide decision-making tools to development planners at local level (the scale of the areas of the observatories), sub-regional and regional level (the scale of the circum-Saharan area). The national level scale can only be taken into consideration with the development of national environmental monitoring networks with the framework of the NAP/CCD.

Due to the nature of the phenomenon of desertification, the preferred approach is spatial, and therefore cartographic. The graphs, tables and texts, as well as aiding the interpretation of maps, further increase the clarification of the dynamics of certain indicators.

The long term environmental monitoring in ROSELT/OSS includes successive diagnostics, with a periodicity compatible with the dynamics of environmental changes (five to ten years), and the continuous observations of pertinent factors to highlight these changes (seasonal or annual scale). These two approaches combined lead to the following products :

- an initial characterisation of the territory ;
- the use of diagnostic indicators generated from the interactive system of



resources/usages (cf. p 27, Fig. 5 : “landscape” part) and of continuous indicators of the ecosystem functioning (cf. p 27, Fig. 5 : “ecosystem” part) ;

- prospective scenarios.

### ***Thematic mapping for the initial characterisation of the territory***

Generally such maps already exist at various scales within the certified observatories. Where this is not the case, then they should be developed by the countries and the observatories. Such maps are valid for at least ten years. As part of a long-term monitoring exercise, a periodical updating may be justified. Types of map include the following :

- cartography of the physical environment : geology, pedology, geomorphology, topography, groundwater and surface water features ;
- socio-economic cartography: historic mapping of population settlements, ethnic group dispersion, administrative boundaries, spatial expression of customs and traditions, etc. ;
- cartography of the interface between the physical and the socio-economic environment : land tenure, infrastructure.

Digital format mapping is preferred to facilitate integration with GIS (Geographic Information System), which is an EIS module (Environment Information System).

### ***Desertification indicators***

The indicators must meet the following conditions (cf. ROSELT/OSS DS4, 2004) :

- be “processed” data: meaning that the raw data has been processed according to a protocol, whatever it might be : such as simple statistical processing and/or mathematical models of different levels of complexity ;
- follow the same processing protocol (for individual indicators) for every observatory of the network ;
- indicate a state, pressure or response of the system under investigation ;
- be pertinent (a good representation of the situation), sensitive (reaction to change), reliable (available, based on reliable knowledge, preferably correlated to an information system), reproducible and useful (simple, suitable for the user).

They must be associated with “benchmarks” and “thresholds” (values beyond which the process changes its nature, and thus affects the structure or the functioning of the system).

Desertification is a dynamic process. The characterisation of its state can only be defined with respect to a spatial and temporal reference. The corresponding indicators can be generated from a synchronic and/or diachronic approach.

**In synchronic mode**, the chosen areas are compared as a function of the variation of well-established factors of desertification (*e.g.* rainfall gradient, usage gradient, etc), whilst ensuring that the majority of the remaining factors remain comparable.

This approach can be applied at observatory scale and allows the development of valuable local indicators. It can be reinforced by the comparison of different observatories at sub-regional and indeed regional scale ; this is one of the advantages of networking ROSELT/OSS observatories. If correctly implemented, the application of this approach can produce results within a relatively short timescale. It requires meticulous and properly adapted sampling, which is progressively proposed to the observatories (cf. ROSELT/OSS DS4 and CT1, 2004).

**In diachronic mode**, the factor time is varied for a given area. This mode corresponds to the notion of monitoring.

This approach should be applied to historical datasets, once they have been identified and validated. For this reason, the availability of this information constitutes one of main criteria of ROSELT/OSS certification for the observatories. The scientific task of validation is, however, delicate : lack of georeferences for data, changes in the protocol of data collection, etc. It is one of the major challenges for ROSELT/OSS to, in the short term, improve the development and test of environmental changes indicators based on historical datasets.

This “past” diachronic approach may considerably accelerate the identification of pertinent indicators and the definition of data series to measure for long term ROSELT/OSS monitoring. Considering the variability of precipitation in arid and semi-arid zones, the diachronic approach requires **long-term** dataset (several decades).

ROSELT/OSS will therefore use the combination of several approaches to develop desertification indicators. After considering the proposed methodologies for the integration of bio-physic and socio-economic data, the associated indicators are presented in the following paragraph.

**The indicators derived from the resources/usages system are calculated at the time of each diagnostic in the observatories.** The three main categories of indicators are as follows :

- **Categories of indicators of state** (or response of ecosystems)

In an interactive system which evolves in a cyclic manner over time, an indicator of response at a given moment becomes an indicator of state for the cycle (see ROSELT/OSS DS4, 2004). Most are spatial indicators expressed in cartographic form, constituting an information layer in GIS. They are as follows :

- Land cover : this is made up of the following components : plant formations (types of dominant plants, strata of vegetation :

classification of height and percentage of coverage, dominant or co-dominant plant species) ;

- Soil condition, according to use and farmers' perceptions ;
- Intensity of land use (space and resources by usage). This contributes towards the definition of a complex index of artificialisation, making reference to the level of investment in work and in human/technical resources on the space ;
- Availability of natural resources : spatial distribution of resources in relation to an identified usage : land for agricultural activity, aerial phytomass available and accessible for pastoral use and forestry activity, etc.

- **Categories of indicators of pressure**

**Indicators of pressure (which can be driving forces as well) are continuously evolving. In order to establish a diagnostic at a given point in time, their values are constrained to averages. The indicators of pressure and/or the driving forces are as follows :**

- Population distribution maps ;
- Rainfall distribution maps, etc.
- Extraction of resources : maps developed from spatial modelling of rural practices.

- **The major spatial indicators :**

- Resources/usages balance by type of usage : resulting from cross-referencing resources availability and resources extraction maps ;
- Resources/multi-usage balance: drawn up on the basis of type of usage balances and of predefined Spatial Reference Units, to which all activities can be referred. It is notably from this type of balance, that the risk of desertification in a given area can be characterised.

### ***Prospective scenarios***

Based on the understanding of the interactions between the elements of the system and their operating rules, simulations are achieved by the modification of the model entry parameters.

Scenarios for the landscape or territory dynamics will then be proposed, for example according to three types of probable evolution :

- the acceleration of a trend, *e.g.* the increase or decrease in rural population ;
- the introduction of a discontinuous phenomenon with time; *e.g.* occurrence of a year or series of years of drought ;
- the introduction of new practices ; *e.g.* agricultural intensification.

These different simulations constitute decision-making tools because they allow users to pose questions such as “What will happen if...?” and to get detailed answers, notably in cartographic form.

The data collection between two diagnostic phases allows for the permanent feeding of the Local Environment Information System (LEIS ; cf. *infra*), and for the comparison of the result of the simulations with real observed tendencies.

## ***A tool for the processing of environmental information at the local level: LEIS-ROSELT/OSS***

Faced with the complexity of desertification, and with the objective of determining the extent of land degradation from the ROSELT/OSS observatories, it is essential to anticipate as soon as possible the information processing methods which will allow for the integration of series of diverse factors and will favour three lines of questioning :

- spatial distribution of data at the level of observatory territories ;
- extrapolation to the regions represented by each observatory ;
- modelling of prospective and dynamic simulation.

In order to make best use of the data collected in the observatories, these factors should be considered in the activity schedules of the observatories. To do this, in each observatory, the network is committed to the creation of a Local Environment Information System (LEIS) through the structuring of acquired Environment Information and integrating it with the knowledge of the two systems under investigation through the specific functioning models of each of the observatories (cf. Figure 5).

The development of LEIS-ROSELT/OSS was based on the systematic approach used by the observatory of Banizoumbou (Niger). This approach is based on a sampling device and data collection which was designed to study environment/society interactions. This approach is an aid to the conception and implementation of processing methods for the understanding of the causes, consequences and mechanisms of desertification. This work had resulted in the creation of a LEIS general conceptual approach (ROSELT/OSS DS3, 2004), and a preliminary application with the data from Banizoumbou (ROSELT/OSS CT8, 2004).

The comparison of this work with that carried out on the other territories of the network allows the identification of the common denominators needed to design a generic processing tool which could be applicable to all observatories. It operates around two main modules :

- a data model implemented by a data-base management system (DBMS) and a geographic information system (GIS) ;

- spatial representation rules and models that can be generic but specific parameters.

In this context, the LEIS-ROSELTO/OSS is intended to be a tool to assist in the management, exchange and exploitation of data gathered and knowledge accumulated, with a view of facilitating the characterisation of the state and the study of the dynamics of the territory. By integrating the principles of the ROSELTO/OSS approach into its structure and by establishing its work on data that already existed, the LEIS is clearly one of the concrete and visible achievements of the methodological reflection undertaken by ROSELTO/OSS.

The system-based approach and the thematic objectives of LEIS-ROSELTO/OSS require biophysical spatial data (generally quantitative) and socio-economic spatial data (both quantitative and qualitative) of chronological series, complex mathematical models and satellite images. It requires the simultaneous development of existing tools (modelling and environment information systems) and concepts so as to better integrate and manage the information.

The EIS is above all a tool to organise and process the Environment Information within the consolidation of activities phase of the network. It leads to the definition of the “minimum network dataset”, the harmonization of the data and its collection, harmonization of information processing, and a definition of common products. Finally, it forces all the scientific partners to design their work towards a common goal and therefore a real interdisciplinary practice.

### ***The data series that ROSELTO/OSS collects and/or observes for long-term ecological monitoring***

The ROSELTO/OSS are for the most part gathered on the ground (measured and/or observed, in raw state), and are generally supplemented by remote sensing data as part of a long-term monitoring process.

They lend themselves either to the processing and interpretation by theme, or to integration in the ROSELTO/OSS-LEIS.

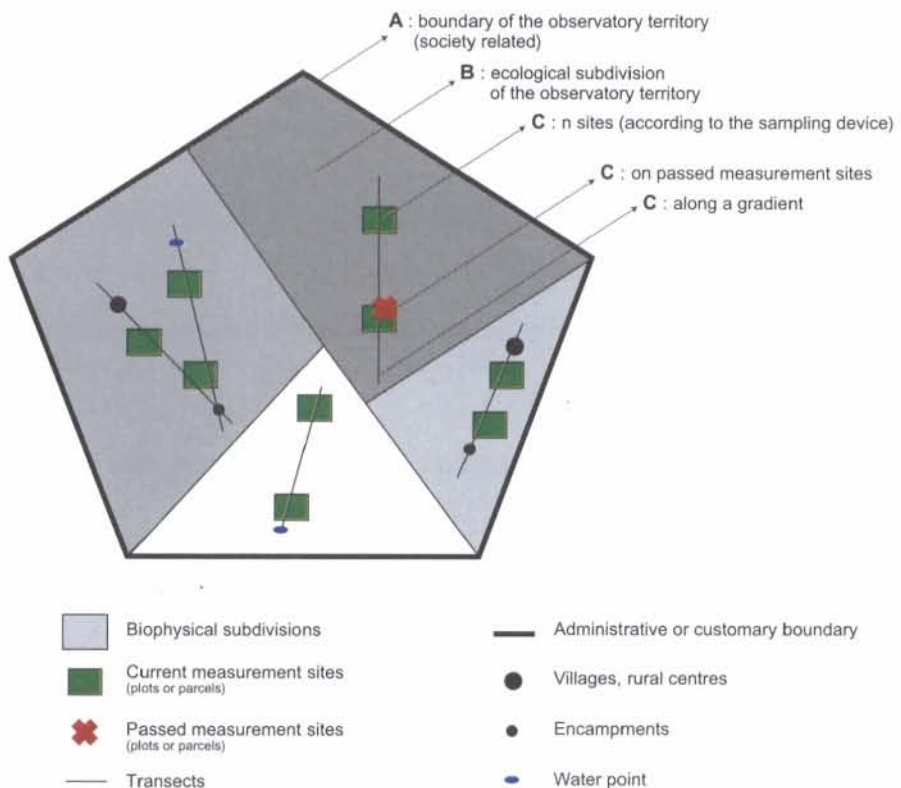
#### ***Sampling and data collection principles in ROSELTO/OSS***

- ◆ **the harmonized sampling and data collection mechanisms** is based on the following principles :
  - It must be set up at the earliest possible moment in preparation for :
    - the integration of majority of data collected into the information processing and management system (LEIS) ;

- the spatial representation of the processes studied ;
  - the extension to the whole observed area ;
  - extrapolation to the region represented.
- It must accommodate compatibility of perception levels between socio-economic and bio-physical systems, and take into account the processes at work at different levels of organization.
  - It must be economic in terms of both time and cost, with simple and reproducible measurement and observations in order to ensure the reliability and longevity of the network of observatories.

In order to achieve these principles, the sampling mechanism fulfils the following criteria (cf. **Figure 7** ; ROSELT/OSS 1995 and SD1, 2004) :

- The boundaries of the observatory should favour a distinction of administrative or sociological boundaries. This does not exclude the possibility of monitoring territory outside the observatory boundaries, which may be important to the interpretation of the results ;



**Figure 7** : Typical sampling map of ROSELT/OSS observatory territory.

- The sampling for long term monitoring plots implementation should be stratified with both land use and ecological mapping in mind ;
  - The number of plots should take into account the possibilities of the monitoring team and should be compatible with the seasonality of the phenomena under investigation ;
  - The positioning of monitoring plots should favour possibly existing measuring sites and must correspond to ecological or land use gradients.
- ◆ **The relationships between the parameters observed and/or measured and the aerial and satellite images must be identified as early as possible so as to facilitate :**
- the spatial distribution and extension of data for the territories covered by the observatories ;
  - the extrapolation to the regions represented by each observatory ;
  - the automatic updating of identified dynamics ;
  - the identification of simple and reproducible measures at minimum cost.

It is however necessary to ensure that the rules and limits of the use of remote sensing in arid and semi-arid zones are respected, in particular for the monitoring and modelling of ecological processes concerned with plant cover evolution. Considering the continual developments in this area, ROSELT/OSS should carefully monitor the state of the art, in particular to optimise the balance between cost and output.

### ***“ The minimum network dataset ” and “ the observatory dataset ”***

The “minimum network dataset” is the dataset necessary and sufficient to interpret ecological and social changes, common to all the observatories and which allows comparisons between different sites.

The “observatory dataset” consists of biophysical and/or socio-economic data linked to local characteristics implicit in the understanding of desertification. They are therefore added to the minimum network dataset.

The data from the “minimum dataset” are part of continuous monitoring (minimum annual time step) or discontinuous monitoring (diagnostic every four or five years according to the nature of the changes) in the observatories.

Within the framework of ROSELT/OSS, the datasets as described above are structured as follows :

- **Bio-physical dataset :**
  - climate : rainfall (spatial, temporal distribution and quantity), meteorological data ;
  - soil and water : quality and spatial distribution (soil surface features, pedology, surface hydrology, hydrogeology) ;

- vegetation : production, structure, quality, spatial distribution and floral diversity ;
- fauna : structure and spatial distribution of fauna.
- **Socio-economic dataset :**
  - population census, characterisation and spatial repartitioning ;
  - national legislative framework for resource access.
- **Dataset in the interface :**
  - land tenure systems on access to resources ;
  - structure and spatial distribution of livestock ;
  - characterisation of production and farming systems ;
  - characterisation of practices and extraction of resources (agricultural, pastoral, forestry).
- **Aerial and satellite imaging :** a basis for extrapolation and spatial expression of field data, to refine existing maps and monitor the dynamics of the environment.

### ***“ Series of thematic data ”***

“ The networks’ thematic data series ” are data which are adapted more specifically to the issues which are particular to one or more observatories (biodiversity, sand encroachment, etc).

Part of the data contributes to the “ network dataset and/or observatory dataset ”, the rest is specific to the study of the mechanisms linked to this thematic.

## ***ROSELT/OSS metadata management tool***

### ***Objectives and interests***

One of the objectives of ROSELT/OSS is the pooling and sharing of the data and experience accumulated by all the observatories in order to promote work to study and combat desertification.

In order to achieve this objective, the metadata management tool has been established as means of storing, accessing and sharing knowledge and data produced by the network.

**It must allow the referencing of all information on network data. It must also facilitate the dissemination and sharing of data amongst the members of the network and, in broader terms, the scientific community.**

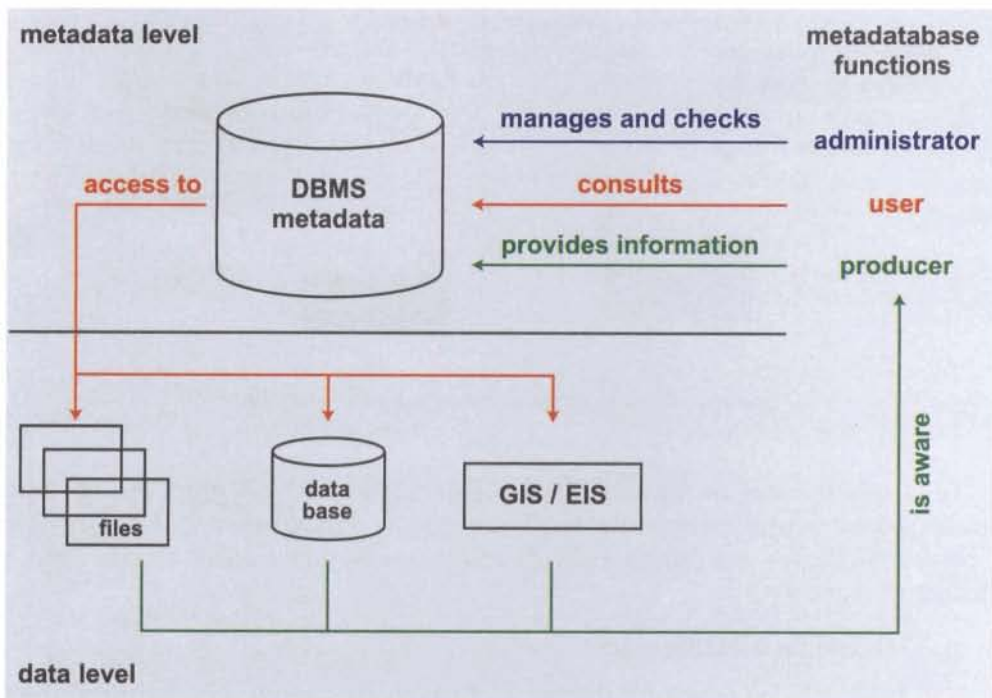


The objective of this tool is :

- to propose appropriate access to information via the Internet, in order to demonstrate the existence of data (field measurements, maps or text documents) which have been gathered or produced by the observatories ;
- to give access to this information according to rules defined by the owners.

### *Those involved and their roles*

The metadata service (**Figure 8**) creates the link between the data producers (ROSELT/OSS observatories) and users (ROSELT/OSS observatories and the scientific community). The service sits within a database structure managed by the regional operator (the administrator). This ensures that the metadata is completed through data-entry and updating modules.



*Figure 8 : Those involved in the metadata service and their roles.*

It also allows consultation of metadata, which directs users towards the data collected and produced by observatories by providing information on the content and characteristics of data.

## Architecture of the metadata management tool

This tool is developed on the basis of a general structure of metadata which is the framework of the database within which this information can be stored (Figure 9).

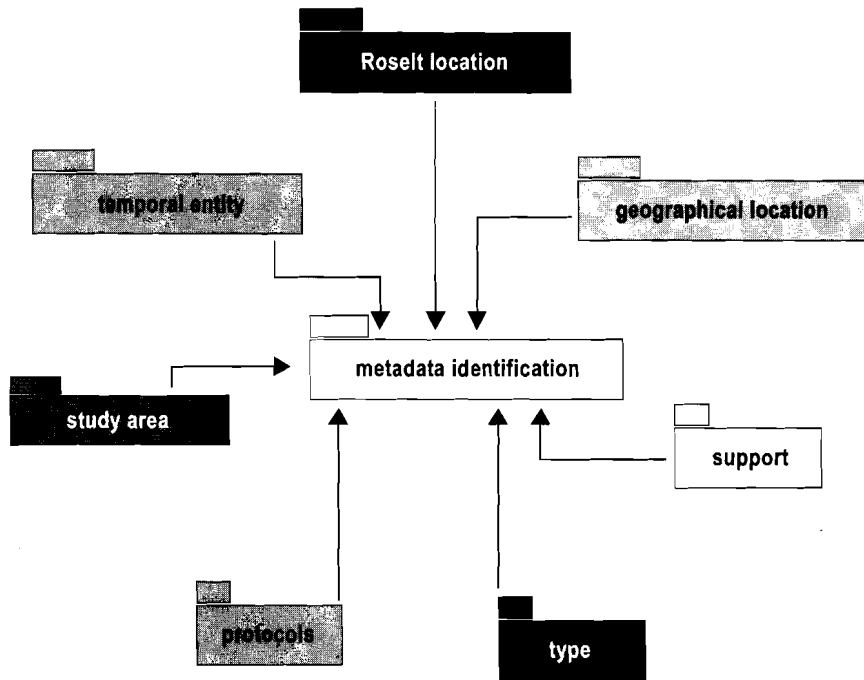


Figure 9 : General information structure of metadata.

The entry content of the metadata is organized within six entry forms which should be filled in by the observatories. The metadata management tool is composed of three modules : an online entry module, an administration module and a consultation module.

### 1) Module for metadata entry

This includes forms on the basis of which data producers (observatories) can fill in metadata that they wish to reference and publish through this service. This module, through forms which are specific to each type of data (picture, map, soil measurement, etc.), secures the entering of auxiliary data and insertion into the metadata database.

### 2) Module for administration of the metadata database

Since the base is available to the regional operator, it can manage the metadata database to guarantee content and coherence. It must also ensure the validation of metadata entered by the observatories.

### 3) **Module for data-search assistance**

This allows us to obtain a list of data using a multi-criteria search function (geographical location: region, country, observatory ; area of interest, type of data ; ground survey, measurements, thematic maps, indicators, etc.), which corresponds to the query formulated. This consultation interface, through the choice of an element from a proposed list, gives us access to an information file giving a detailed description of the data presented (processing protocol, data completion, observatory owning the information, temporal validity, etc.) and access to the data itself, if access is authorised by the owner.

The whole of the metadata service is developed on the basis of client/server technology using internet communication protocols (*http*). It will be accessible to the users using a low-speed internet connection and any operating system.

#### *The completion of the metadata management tool*

The metadata management tool is based on the design of a database which structures information (metadata) about data that exists within the network, by associating that data with categorisation criteria or key words which are used to formulate questions and facilitate access to the metadata, and then to the data.

### ***A communication tool within the network : www.roselt-oss.org***

The purpose of presenting the project and its activities through an internet site, is to ensure its visibility within the international community and for the members of the network in particular. This presentation ensures the valorisation and dissemination of the results obtained, and an exchange of information between the members of the network. The objective is also to allow the metadata management tool to be made broadly available.

Open in June 2001, it is structured according to the following headings (**Figure 10**) :

- objectives and organisation of the network ;
- characteristics of the observatories ;
- data and outputs : updated activity forms, metadata service ;
- concepts and methods ;
- actualities ;
- downloads of ROSELT/OSS documentation.



# ROSELT

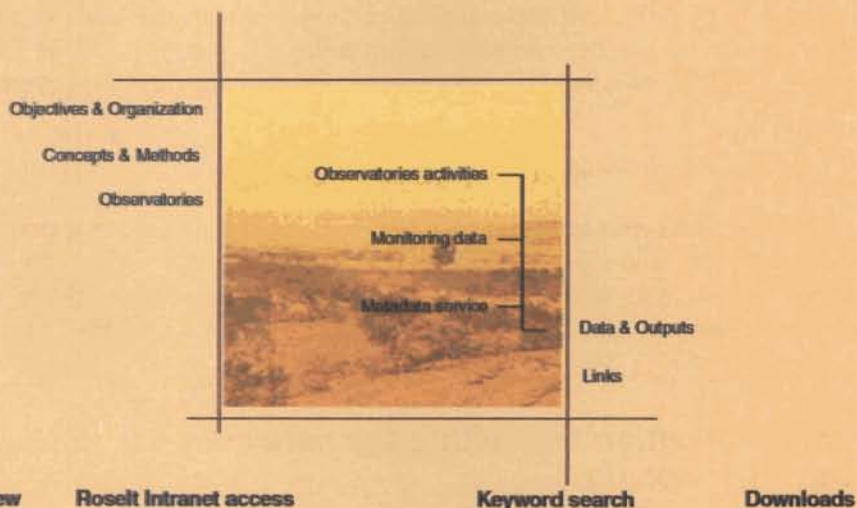


Long Term Ecological Monitoring Observatories Network

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Figure 10 : Front page of the ROSELT/OSS Internet site.

\*

\*    \*

# The contribution of the ROSELT/Oss programme to the implementation of the Ccd

ROSELT/OSS makes a fundamental contribution to the implementation of the international convention to combat desertification (CCD), in particular through National and Sub-Regional Action Programmes (NAP and SRAP).

ROSELT/OSS is the first regional network in Africa which :

- organizes environmental monitoring (scientific and statistic) allowing, on one hand to characterise the causes and effect of land degradation, and on the other hand, to understand better the mechanisms leading to desertification ;
- aims to produce reliable data on land degradation in arid zones, bio-physical and socio-economic indicators relevant to desertification, and an assessment of environmental condition of the Oss zone.

It contributes at the level of each country to the definition of a national environmental monitoring action plan, including a national network of observatories. Thus, ROSELT/OSS contributes to the implantation of the UNCCD in Africa at several levels.

## ***From local to regional***

### *Methodological approach*

ROSELT/OSS is defining a minimum dataset of indicators at lower cost, required for long term monitoring of the environment. This is achieved through the harmonization of local observations made throughout the circum Saharan observatories. The initial phase emphasized the selection of observatories with historical scientific knowledge. The checking and interpretation of this information allows for the identification and testing of indicators within a relatively short period of time. In order to achieve this, it is necessary that the data be made fully available by the countries and that it be validated for this use.

### *Towards a better understanding of desertification*

The comparison of ecological and socio-economic situations between the observatories of North, West and East Africa, allows a better understanding of how different causes and processes lead to identical consequences : land degradation, and the definitive loss of biological production capacity. This synchronic approach

goes beyond the implicit diachronic approach of ROSELT/OSS (observations with time), and constitutes one of the major advantages of the network. Such an approach can only be fully operational if the observation and interpretation are truly harmonized within the network.

### ***Local to national ...***

The ROSELT/OSS observations sites can be considered as “laboratories” which allow the explanation of the continuous interaction between populations and the environment. They provide the minimum indicator set required for environmental monitoring. Observatories of this type, take part in the national network of environmental monitoring. They should consist of the key anchor stations from which a low density network can be set up, to apply the minimum local observations set to develop indicators at national level.

These “light observatories” must be selected in order to succeed in national representativeness. They are preferably located according to sub-national and national ecological and socio-economic gradients, in order to take into account the spatial variation of environmental changes.

The indicators envisaged for this method remain local indicators, which are then extrapolated to a national scale. It is evident that the change of scale does not permit the use of some local indicators, and it is necessary to define and take into account other relevant indicators at each level of organisation (provincial, sub-national and national).

### ***... and toward regional***

Once this type of mechanism has been set up in the circum Saharan countries, the aggregation of national indicators should allow the development of an exhaustive representation of desertification dynamics at regional level.

\*

\*      \*

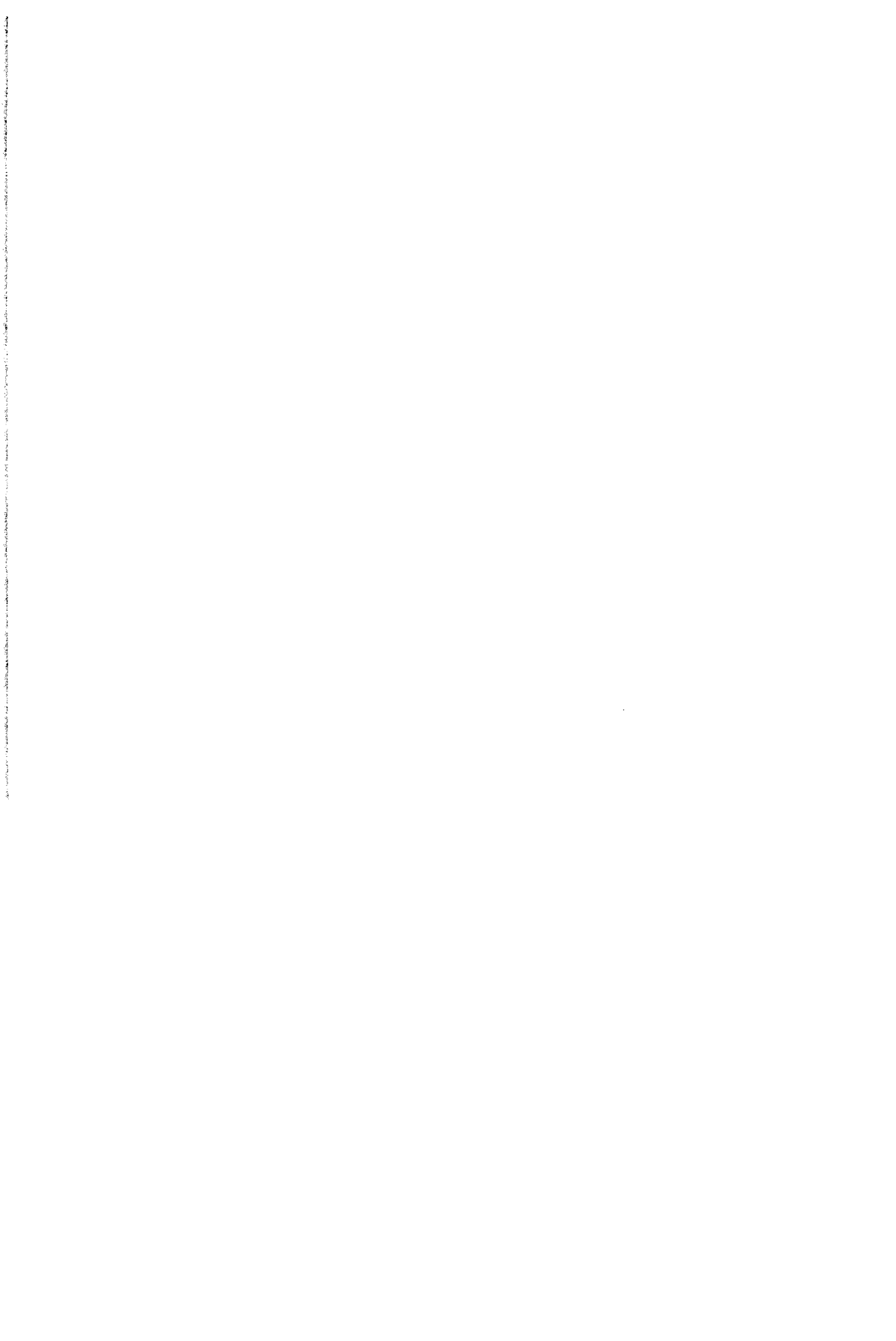
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# List of abbreviations and acronyms

<b>CCD</b>	Convention to Combat Desertification.
<b>CESIA</b>	<i>Centro Studi per l'applicazione de l'Informatica in Agricoltura</i> – Centre of studies for informatics application to agriculture (Italy).
<b>CILSS</b>	<i>Comité Inter-États de Lutte contre la Sécheresse au Sahel</i> – Permanent interstate committee for drought control in the Sahel (Ouagadougou, Burkina Faso).
<b>CIRAD</b>	<i>Centre de Coopération Internationale en Recherche Agronomique pour le Développement</i> – Centre for international cooperation on agronomic research and development (Paris and Montpellier, France).
<b>CNUED</b>	<i>Conférence des Nations Unies sur l'Environnement et le Développement</i> (1992, Rio-de-Janeiro, Brazil).
<b>CPU</b>	Combined Practices Unit.
<b>DBMS</b>	Data-Base Management System.
<b>CST/ROSELT</b>	<i>Comité Scientifique et Technique ROSELT.</i>
<b>DDC</b>	<i>Direction du Développement et de la Coopération du département fédéral suisse des affaires étrangères</i> – Swiss Department of Development and co-operation (Berne, Swiss).
<b>DOSE</b>	<i>Dispositif d'observation et de suivi de la désertification en Afrique.</i>
<b>EIS</b>	Environment Information System.
<b>FAO</b>	U.N. Food and Agriculture Organization (Rome, Italy).
<b>FFEM</b>	<i>Fond Français pour l'Environnement Mondial</i> – French global environment fund (Paris, France).
<b>GTOS</b>	Global Terrestrial Observing System (IGBP).
<b>GIS</b>	Geographic Information System.
<b>IGAD</b>	Inter-Governmental Authority for Development, <i>ex</i> IGADD : Inter-Governmental Authority on Drought and Development (Jibuti).
<b>IGBP</b>	International Geosphere Biosphere Programme (Icsu).
<b>INCO/DEV</b>	INternational COopération for DEvelopment (EEC programme).
<b>INSAH</b>	<i>INstitut du SAHel</i> (Bamako, Mali).

<b>IRD</b>	<i>Institut français de recherche scientifique pour le développement en coopération</i> – French scientific research institute for development through cooperation (Paris and Montpellier, France).
<b>LEIS</b>	Local Environment Information System.
<b>LU</b>	Landscape Unit.
<b>NAP</b>	National Action Programme.
<b>ONC</b>	<i>Organe National de Coordination.</i>
<b>MATE</b>	<i>Ministère de l'Aménagement du Territoire et de l'Environnement</i> (now, MEDD).
<b>MEDD</b>	<i>Ministère de l'Écologie et du Développement Durable</i> (ex MATE).
<b>ONC</b>	<i>Organe National de Coordination.</i>
<b>OSS</b>	<i>Observatoire du Sahara et du Sahel</i> – Sahara and Sahel observatory (headquarters : Tunis, Tunisia).
<b>ROSELT</b>	<i>Réseau d'Observatoires de Surveillance Écologique à Long Terme</i> – Long-term ecological monitoring observatories network.
<b>SISEI</b>	<i>Système d'Information et de Suivi de l'Environnement sur Internet.</i>
<b>SRAP</b>	Sub-Regional Action Programme.
<b>SRU</b>	Spatial Reference Unit.
<b>ST</b>	Steering Committee.
<b>START</b>	Global change System for Analysis, Research and Training (IGBP).
<b>STC</b>	Scientific and Technical Committee.
<b>UMA</b>	<i>Union du Maghreb Arabe</i> (Rabat, Morocco).
<b>UNCED</b>	United Nations Conference on Environment and Development (1992, Rio-de-Janeiro, Brazil).
<b>UNESCO/MAB</b>	United Nations Educational, Scientific and Cultural Organization/ Man and Biosphere Programme (Paris, France).
<b>UNSO</b>	United Nations Sudano-Sahelian Office (New York, USA).

## Countries involved with ROSELT/OSS en 2004

### **Algeria**

*Centre de Recherche Scientifique et Technique sur les Régions Arides (CRSTRA, Biskra)  
et Université des Sciences et Techniques Houari Boumedienne (USTHB, Algiers).*

### **Cape Verde**

*INIDA (Instituto Nacional de Investigacao e Desenvolvimento Agrario, Praia).*

### **Egypt**

*Department of botany, Faculty of science, University of Alexandria.*

### **Ethiopia**

*Pastoral unit/Ministry of agricultura.*

### **Kenya**

*Ministry of land reclamation, regional and water development.*

### **Mali**

*Institut d'Économie Rurale (IER).*

### **Morocco**

*Division de Recherche d'Expérimentations Forestières (DREF, Rabat).*

### **Mauritania**

*Direction de l'Environnement et de l'Aménagement Rural (DEAR),  
Ministère du développement rural et de l'environnement.*

### **Niger**

*Ministère de l'Hydraulique, de l'Environnement et de Lutte Contre la Désertification  
(MHELCD, Niamey).*

### **Senegal**

*Centre de Suivi Écologique (CSE, Dakar).*

### **Tunisia**

*Institut des Régions Arides (IRA, Médenine).*

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PAO – DAO : SIM – 04 67 84 34 58  
Impression : ATELIER SIX – 04 67 63 52 00  
2<sup>ème</sup> trimestre 2005.

## Technical Contributions



- CT1 : Guide ROSELT/OSS pour l'évaluation et la surveillance de la végétation.
- CT2 : Guide ROSELT/OSS pour l'évaluation et le suivi des pratiques d'exploitation des ressources naturelles.
- CT3 : Manuel d'utilisation de l'outil SIEL - ROSELT/OSS (version 1.3).
- CT4 : Application des indicateurs écologiques de la dégradation des terres à l'observatoire de Menzel Habib (Tunisie).
- CT5 : Surveillance of ecological changes in the ROSELT/OSS observatory of El Omayed (Egypt) : first results.
- CT6 : Recherche des indicateurs de changement écologique et de la biodiversité dans l'observatoire de Oued Mird (Maroc) : premiers résultats.
- CT7 : Surveillance des changements écologiques dans l'observatoire ROSELT/OSS de Haddej-Bou Hedma (Tunisie) : premiers résultats.
- CT8 : Espaces-ressources-usages : première application du Système d'Information sur l'Environnement à l'échelle Locale sur l'observatoire ROSELT/OSS de Banizoumbou (Niger).
- CT9 : Recherche d'indicateurs de désertification par analyse comparative de quelques observatoires ROSELT/OSS.
- CT10 : Une approche spatiale pour la surveillance de la faune – Étude de cas au sud du Maroc : la vallée de l'oued Mird.
- CT11 : Guide pour l'évaluation et la surveillance des états de surface et des sols.
- CT12 : Système de circulation de l'information ROSELT/OSS : définition des métadonnées et élaboration des catalogues de référence.
- CT13 : Guide ROSELT/OSS pour la cartographie dynamique de la végétation et des paysages.
- CT14 : Fiches Techniques pour la construction des indicateurs écologiques ROSELT/OSS.
- CT15 : Synthèse comparative de quatre années de surveillance environnementale sur trois observatoires ROSELT/OSS du Nord de l'Afrique : El Omayed, Haddej-Bou Hedma et Oued Mird.
- CT16 : L'approche foncière environnementale : droit et anthropologie à la rencontre des sciences écologiques.

## Scientific Documents



- DS1 : Conception, organisation et mise en œuvre de ROSELT/OSS.
- DS2 : Organisation, fonctionnement et méthodes de ROSELT/OSS.
- DS3 : Concepts et méthodes du SIEL - ROSELT/OSS (Système d'Information sur l'Environnement à l'échelle Locale).
- DS4 : Indicateurs écologiques ROSELT/OSS. Une première approche méthodologique pour la surveillance de la biodiversité et des changements environnementaux.
- SD1 : Conceptual, organizational and operational framework of ROSELT/OSS.
- SD2 : ROSELT/OSS organization, operation and methods, edition 2001, revised in 2004.
- SD3 : Concepts and methods of ROSELT/OSS-LEIS (Local Environment Information System).
- SD4 : ROSELT/OSS ecological indicators first methodological approach for the surveillance of biodiversity and environmental changes.



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