Arab Republic of Egypt

National Action Plan For Combating Desertification

Provisional

Cairo

April, 2002

Coordinating Authors

Dr. Abdel Moneim Hegazi
President of the Desert Research Center (DRC), Focal Point of UNCCD.
Head of the Scientific Committee.

Dr. Ismail H. El Bagouri
Research Professor. Dept. of Soil and Water Conservation (DRC) .
Member of the Scientific Committee.

Reviewed By

Prof. Dr. Mohamed A. Kassas
Prof. Emeritus of Science. Cairo University.

Table of Contents

Chapter I

Overview

1.1 Introduction

The formulation of the United Nation Convention to Combat Desertification (UNCCD) , adopted in Paris , 1994 and ratified in 1996, with the active participation of Egypt, gave emphasis to combating the major threats to sustainability of dry lands. The Convention defined desertification as "land degradation in arid and semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities". It also defined combating desertification as " Activities which are part of the integrated development of land in arid and semi-arid and dry sub-humid areas for sustainable development" which are aimed at :

(1) Prevention and / or reduction of land degradation .
(2) Rehabilitation of partly degraded lands.
(3) Reclamation of desertified land.

Land in this context is meant to be the terrestrial bio-productive system with all its components. The first commitment of the countries that ratified the UNCCD is the preparation of National Action Plans (NAP)to combat desertification. According to the convention, NAP should identify the factors contributing to desertification and prescribes practical measures to combat it. This implies the adoption of an integrated approach to the proper identification, assessment and monitoring of factors and processes of desertification and their adverse impacts on resource base and socio- economic aspects, as well as , feasible and environmentally sound measures to combat factors and processes of desertification.

1.2. Basic concepts

Egypt with its lands extending over one million square kilometers , under arid and hyperarid climatic conditions is endowed with varied agro-ecological zones with specific attributes of resource base, climatic features , terrain and geomorphic characteristics , land use patterns and socio-economic implications. To formulate a meaningful NAP for Egypt it would be appropriate to formulate a plan comprised of sub-components, each of which is geared to address the specific attributes of each agro-ecological zone distinguished in Egypt. Such zones could be identified as follows :

1- North Coastal Belts : including North West Coastal Areas and North Coastal Areas of Sinai.
2- The Nile Valley : Encompassing the fertile alluvial lands of Upper Egypt and the Delta and the reclaimed desert areas in the fringes of the Nile Valley.
3- The Inland Sinai and the Eastern Desert with its elevated southern areas.
4- The Western Desert, Oases and Southern Remote Areas : including East Owenat Tushka and Darb El Arbian Areas and Oases of the Western Desert.

Variations of the attributes of these agro-ecological zone are identified (As will be stated in the appropriate sections of this plan). Active factors of desertification and their impacts are necessarily varied. It would be appropriate to formulate a NAP with sub-components to address and focus on the varied natural attributes, priorities of actions, and specific desertification processes.

Such approach would facilitate the investigation and identification of appropriate techniques, capacity building needs, participating stakeholders , required legislation , economic tools, incentives, finance , as well as social implications. This approach would also help to define institutional setups and responsible parties. It would also facilitate the identification of suitable indicators for desertification processes, as well as, appropriate techniques for monitoring ongoing and future desertification processes in each of these agro-ecological zones.
This approach will also ensure that the identification of projects, research needs and public awareness campaigns is geared and tailored for the needs of each agro-ecological zone.

1.3. Institutional Aspects

To ensure the success and achievement of NAP's objectives a national coordination authority in Egypt was established to replace the previously established Steering Committee for Combating Desertification. The newly established Authority according to the Ministerial Decree No. 2356 for the year 2001 is headed by the Deputy Prime Minister , Minister of Agriculture and land Reclamation , as high level decision making authority, with high level representatives of seven ministries including; Agriculture and Land Reclamation, Water Resources and Irrigation, Foreign Affairs , Local Development, Higher Education and Scientific Research, Environmental Affairs, Planning and International cooperation, in addition to a group of high level experts. The newly formulated Committee is intrusted with ; (a) The formulation of general policies in accordance with the commitments of Egypt towards the implementation of the UNCCD, (b) Endorsement of local , regional and international agreements and projects, (c) Coordination among ministries, authorities, NGOs and varied stakeholders concerned with combating desertification.

A Scientific Committee was established to be affiliated to the National Coordinating Committee for Combating Desertification (NCCCD). The Scientific Committee is headed by the president of the Desert Research Center (Dr. Abdel Moniem Hegazi) who is the National Focal Point for UNCCD. The other members of the Scientific Committee are high level experts from varied institutions of previous and recognized expertise in the fields of combating desertification. The Scientific Committee is entrusted with the following :

(a) Survey, compile and analyse previous and ongoing activities to combat desertification .
(b) Assessment and monitoring of processes of desertification .
(c) Coordination of activities with the various stakeholders.
(d) Follow up on the implementation of commitments of Egypt towards the implementation of UNCCD .

(e) Follow up on implementation of the NAP and assessment of the impacts of its activities.

Since the inception of NCCCD and its affiliated Scientific Committee in July 2001 concerted activities were conducted to expedite the formulation and endorsement of NAP of Egypt.

Egypt is endowed with a multitude of academic and research institutions, as well as, centralized and local governmental institutions and authorities. It would be very wasteful not to benefit from the previous studies, plans, data, research outcomes and reports. Each of the agro-ecological zones referred to above has had its fair share of previous studies and investigations . Such studies might not be of harmonized nor set according to standard specifications; But to process and compile these previous activities would be very useful as a database relevant to each zone, such that previous efforts are not wasted, real gaps are identified and appropriate follow-ups are planned.
The required basic and thematic maps, aerial photographs, satellite imageries, GIS facilities and interpretation expertise are available in various institutions, ministries and research centers.

Basic tools for planning could be acquired or jointly used from the various sources and institutions provided proper collaboration plans and suitable incentives are assigned . Ample consideration will be given to the documentation and compilation of indigenous knowledge and experience which are a wealth in itself in addition to its great value for appropriate planning of NAP's activities.

1.4. Basic Features of Agro-ecological Zones

1.4.1. North Coastal Areas

The North Coastal areas of Egypt are composed of two major sub-zones ; Northwest Coast and the North Coastal Areas of Sinai .

1.4.1.1. Northwest Coast

The Northwest Coast of Egypt forms a belt about 20 Km deep, which extends for about 500 Km between Amria (20 Km west of Alexandria) and El Salloum near the borders with Libya .

Physiography

The region can be subdivided into five physiographic areas , each with its own particular topographical features (FAO/UNDP 1970; Ayyad *et al.* 1990):

- **Alexandria to Alamein :** The coastal plain is wide and includes three main ridges running parallel to the coast – a recent coastal ridge covered by sand dunes, and two old consolidated ridges – with flat depressions in between . The coastal plain rise to the Maruot Plateau at an elevation of 5-40 m asl.
- **El Alamein to Ras El Hekma :** This is an irregular succession of alternating low hills and closed depressions, sloping from south (60 m asl) to north (the coastline). There is an almost continuous range of dunes along the coast.
- **Ras El Hekma to Ras Abu-Laho :** The cliffs of the Libyan Plateau run parallel to the coast. A discontinuous series of dunes develops at a distance varying from 200 m to 3 Km from the coast. There are some saline

depressions in the lower part of the plain, some with outlets to the sea. The escarpment of the plateau is deeply cut by wadis .

- **Ras Abu-Laho to Sidi Barrani :** This region is characterized by a uniform topography. The coastal belt of alluvial soils is narrow and intermittent. South of the coastal belt, a large area of gentle uniform slopes extends up to the Libyan Plateau.
- **Sidi Barrani to Salloum :** A flat coastal band 2-4 Km wide, is found South of the dunes, starting some 10 Km east of El Salloum. A few large depressions occur along the edge of the Libyan Plateau at 200 m asl. Some important wadis dissect the escarpment, especially southwest of Sidi Barrani.

Main Climatic Features

The North West coast (NWC) is characterized by dry Mediterranean climate, with average high and low temp of 18.1 °C and 8.1 °C in the winter and 29.2 °C and 20 °C in the summer, respectively.

Rainfall in the Northwest Coast ranges between 105.0 mm / yr at El Salloum and 199.6 mm / yr at Alexandria . Data from eight stations situated near the coastline show that most of the rainfall (70% or more) occurs within the winter months (November to February), mostly during December and January .

There are significant variation in rainfall from one location to another , which is attributed mainly to the orientation of the coast at these locations. The prevailing rainfall gradient from north shows that the average mean decreases sharply from 150 mm near the coast to 50 mm at 20-70 Km inland.

The NWC area has the highest average wind speed in Egypt in the winter where wind speed could reach 18.5 Km/hr. Wind speed drops gradually inland.

Soil and Water Resources

Soil types and properties are highly influenced by geomorphic and pedogenic factors. The main soil units could be summarized as follows:

- Coastal oolitic sand dunes.
- Soils of the lagoonal depressions.
- Consolidated dunes.
- Deep sand and clay loam soils.
- Moderate to limited depths of sandy to clay loam .
- Wind blown formations.
- Soils of the alluvial fans and outwash plains over the plateau.

Water resources are mainly that of rainfall, groundwater resources are limited and usually of low quality especially with respect to varied salinity content.

Human Resources

Human Resources are diversified in distribution, background, level of education and occupations. Agropastoralists with tribal traditions are the main dwellers of rangelands. Lately wide-spread construction of touristic villages and summer resorts spread all along the Mediterranean Sea Coast bringing human resources affiliated to these villages and summer resorts. Urban dwellers occupy several cities and small towns along the main International Road to the libyan borders.

1.4.1.2. North Coastal Areas of Sinai

Physiography

The northern strip to depth of about 5 Km from the shore line has a very gentle slope in south / north direction reaching about 20 m asl in the southern parts. Then a medium slope develops towards inlands reaching elevations of 90 m asl. The physiography of North Sinai sub-zone is characterized by the Tina Plain in the east which are formed of Nile alluvial deposits in the most low lying areas of Sinai. In the middle is the Bardaeweel lagoon (Shallow Lake). South of Bardaweel extend desert plains with large areas of sand dune belts and sand sheets. The eastern parts of the coastal areas have the highest average rainfall in Egypt. It is dissected by the largest wadi in Sinai, Wadi Al Arish, which emerges from elevated gravelly plains and terraces in the south to a distance of about 20 Km till the Mediterranean sea coast.

Climatic Features

North Sinai areas are characterized by the dry Mediterranean climate type with relatively rainy , cool winters and dry hot summers. Air temperatures are similar to those of the NWC but with large variations diurnally, seasonally and geographically. The annual wind speed is around 14.0 Km/hr and the prevailing wind direction is north-west and north.

The amount of rainfall in Sinai decreases from the north-east towards the south-west . the greatest amount of rainfall is found in Rafah (304 millimeters / yr.) in the north-east . The annual average along the Mediterranean coast amounts to 120 mm / yr. Rainfall decreases in the uplands to the south to about 32 mm / yr. On the whole, the average annual rainfall in the entire Sinai Peninsula is 40 millimeters , of which 27 millimeters are estimated to come from individual storms that may provide 10 millimeters at a time.

Rainfall occurs in Sinai mainly during the winter season (November to March) and during spring or fall . Rainfall is practically absent from May to October. Along the Mediterranean Coast , 60% of the rain occurs in the winter , while 40% falls during the transitional seasons. Due to differences in water availability, growing seasons differ in the different parts of the Governorate of North Sinai.

Soil and Water Resources

The desert soils of northern Sinai , are of three different origins: aeolian, alluvial and soil formed in situ. The latter is related to land form and are found in the plateau region of Wadi Al Arish on either calcareous or volcanic parent material.

The majority of alluvial soils were formed under recent climatic conditions. They constitute the present wadi beds and they are characterized by a granulometric differentiation according to flood intensities and sedimentation times. As a consequence, soil in the upstream of the wadis are coarser in texture than the soils further downstream.

In the dune area the soils are generally different than in the gravel plain. The dune area is dominated by soils with almost no signs of soil forming processes. Saline soils are found exclusively in the coastal zone . Haplic calciosols dominant the desert region in the gravel plains .

The Tina plain in the west was formed of alluvial Nile deposits as a natural extension of the old Nile Valley . The soils are heavy textured with high salinity contents due to water logging condition attributed to the near-sea and low lying location.

Water resources are varied ; Rainfall water with possible runoffs if the rainfall exceeds 10 mm per rainy storm. When runoff occurs wadi beds will begin to carry water depending on the amount and duration of rainfall. It is estimated that 60 percent of the mean rainfall in Sinai is lost to evpotranspiration .

Groundwater in Sinai may be classified into two types. Shallow groundwater, occurs mainly within weathered layer of igneous and metamorphic rocks, quaternary rock, recent deposits such as wadi fill or sediments and sand dunes . Deep groundwater mainly occurs as semi – confined aquifers of per-Quaternary formation. Groundwater resources in the North Coastal area are limited in nature and in general of low quality.

A third water resource is being introduced to the area, namely " Al Salam Canal" which will convey mixed Nile and agricultural drainage water across the Suez Canal to reclaim 400,000 feddans in Northern Sinai

Human Resources

Population are mainly of tribal. Socio-economic characteristics are based on tribal systems of normads and depend on rainfed agricultural products, livestock and local crafts.

1.4.2. The Nile Valley and the Reclaimed Desert Fringes

This agro- ecological zone represents the greater majority of cultivated lands of the Nile Valley , as well as, most of the reclaimed desert lands , mainly, on the western and eastern fringes of the Delta in addition to relatively limited areas at on fringes of the Valley in Upper Egypt. (total areas over 7.5 million feddans).

Geomorphology

The Nile Valley system extends from the Mediterranean shores of the Nile Delta to the North till Aswan in the south over an area extending from 22° - 32° latitude North under arid and hyperarid conditions. The following geomorphic units could be distinguished .

a-Rubble Terraces **:** these are the remnants of the piedmont alluvial plains, built up by gravelly or coarser soil material brought down from the slopes of the high lands. Subsequent uplifts of the land in relation to the level of the sea have resulted in a number of terrace levels which are distinguished according to their relative age.

b- River Terrances: These are the reminants of the old Nile deposits in the desert fringe areas. There exist three or sometimes four different levels.

c- Alluvial fans : These are the accumulations of debris at the feet of the escarpments, brought down from the desert plateau by steep tributary streams descending through ravines thus the transported materials spread out in the shape of a fan. The fans usually consist of coarse gravelly and sandy fragments which are neither well – sorted nor rounded. Sands are washed down and deposited at the base of the fan . These deposits cover narrower areas between higher ground and they are described as out wash plain.

d-Wadis **:**are depressions , large or small , which may or may not have been formed by stream erosion , and many carry a flow of water on occasions . The term is commonly used for natural lines of drainage , but also for any gully or elongated depression however deeply incised.

e-Wind-blown sand : given rise to such distinct geomorphic units as large sand dune areas, ripple dunes, and sand sheets of varying thickness located in the fringes of the Nile Valley.

Soil and Water Resources

The most pronounced feature of this agro-ecological zone is the Nile River which provides Egypt with 55.5 billion m^3/year with its magnifesent High Dam providing perennial storage of excess Nile water and Lake Nasser Nabia representing the largest man-made fresh water lake extending about 500 Km south of Aswan beyond the sudanese. The old Nile water conveyance system is still functioning with additional major canals conveying fresh Nile water to the newly reclaimed desert soils in the fringes of the Valley which are of relatively higher elevations. Sizable amounts of the agricultural drainage water of the old Valley are recycled in the conveyance system and mixed with the fresh Nile water to be used for horizontal expansion of cultivated areas .
Groundwater (mostly recharged by the Nile water) are of relatively limited use in the Valley but are specially used in the desert fringes.

Soils varied including the fertile deep alluvial soils of the old Nile Valley, soils of the river terraces at different reliefs which are deep soils with gravelly and reddish sub-soils, in addition to the soils of the fringes including desert calcareous soils of varied textures and non- calcareous soils

characterized with low soil fertility and inferior soil physical , chemical and biological properties.

Human resources

The Valley and The Delta include the greater part (95%)of the Egyptian population. Aside from urban dwellers of mega and major cities, the rural population comprise traditional farmers, graduates from varied institutions and investors of varied economic status.

1.4.2. The Inland Sinai and the Eastern Desert

Geomorphology

The inlands of Sinai Peninsula are distinguished into varied geomorphic units including the following :

a- High Lands

The southern mountainous region.

It consists of igneous and metamorphic rocks, forming high paches. This region has a triangular shape with its base facing north . It is deeply dissected with numerous narrow and long wadis bounded by steep cliffs. The wadis act as water collectors , some of which have reasonable groundwater potentials.

b- The Central dissected table lands :

El Tieh table lands :

It extends to north of the southern region, from which it is separated by a huge excavation stretches in a N- SE trend as far as about 60 Km. This excavation which averages 10 Km width is opened from northwest . It is influenced by several drainage systems. These systems include Gulf of Suez system at the western and south western sides. Gulf of Aqaba system at the eastern and south eastern fringes . Perennial channel over flow takes place at several wadis dissecting the western and south western fringes of El Tieh table land.

El Egma table land:

It occupies the central portion of El Tieh table land. To the west, it is limited by the upstream portion of W- Al Arish and its tributaries. This excavation stretches in a NW-SE direction for about 40 Km attaining about 15 Km width at bir El Malha area . Due to this excavation both Egma and El Tieh table lands are completely separated. The surface of this table lands is intensively dissected with drainage lines , flow towards north , and joining together into W. Al Arish.

c- Morphotectonic depressions

These depressions stretch in a NW – SE trend (Gulf of Suez trend) ; among them are El Qaa, W. Arab and El Malha . The floors of these depressions are mostly capped with gravels and mesas of gravels which rise up above these floors.

d- Out wash plain

It is found in different locations of Sinai Peninsula . It constitutes gently sloping expanses covered with alluvial deposits. These expanses are developed at the wash slopes of central and southern table land. The majority of these resulted from the coalescence of several alluvial fans.

e- Sand dunes

In south Sinai , sand dunes have been recently accumulated at several isolated patches .

The Eastern Desert extends from the Nile Valley to the Red Sea, It is composed of a back – bone of coastal mountain ranges flanked by plateau, intensely dissected by steep wet and dry valleys which drain either to the Nile or to the Red Sea.

The eastern desert is comprised of the following landforms.

- The high rocky mountains : Generally, the surface of the Eastern desert is very rugged and rises in some places to more than 2000 m asl especially in the southern areas .
- The desert floor : it is covered with countless sounded highly-polished pebbles of brown flint or white quartz , materials brought down by ancient streams and spread out near the former shore-line.
- The drainage channels: They are intensely dissected by valleys and ravines and all their drainge are external . Most of the drainge lines run along major fault lines, and it is noticeable that while the eastward drainage lines runs to the Red Sea by numerous independent wadis, the westward drainage lines run to the Nile Valley . Coastal mountains from the water divide.

Soil Resources

The soils of inland Sinai could be categorized as follows :

- Wadi Soils

They represent the main wadis founded in the central and southern portions of Sinai. El Bruk , El Giddi, Feiran, Sudr, Nakhl and Wadi Al Arish. These soils are different according to local formation ; terraces (fine to coarse materials intermixed by calcareous formation), main channels (coarse to fine sand materials) and deltas (covered essentially with fine materials).

- The plains Soils

They represent the plain distributed along the whole area of Sinai; El Gifgafa, El Qaa and the plain located east of Suez Canal. They have a fine to moderate, texture, moderately saline and have agriculture utilization potential.

The soils of Eastern Desert differ widely according to their contribution in the landforms . The soils are outlined in the following :

1- Soils of the beach deposits

They are dominated by sands and gravel and extend at the present sea level and rise in places few meter above that levels.

2- Soils of the coastal sabkhas

These soils occupy vast areas in the inland portions of the coastal plain e.g. at Mellaha . These result essentially form the accumulation of surface run – off water in the coastal depressions.

3-Soils of the wadi filling.

These soils are comprosed of cobble generally mixed with varying quantities of sand and sandy loam and silt.

Water Resources

Despite the very low rainfall over this zone yet the geomorphic factors combine with the intensity of infrequent rain showers to form flash floods which have definite adverse environmental impacts on infrastructure soil-erosion and touristic installations before being lost to the adjacent marine areas.

Human Resources

Human resources are diversified with bedwin partoralists especially in Sinai and the South Eastern Desert areas. Urban dwellers are related mainly to part cities touristic villages and oil fields in coastal areas. Supporting jobs come from transportation means and few protected areas.

1.4.3. The Western Desert, Oases and Southern Remote Areas

Geomorphology

The Western Desert extends from the southern boarders towards the Northwest Coastal areas in the North, is a massive plateau with a general slope towards the north , starting from an elevation of about 1000 m asl to the extensive Qattarah depression with 134 m below sea level. The western plateau is distinguished with uniform flat surface 40% of which is covered with sand dunes and extensive areas of sand sheets (The sand sea). Several depressions of varied areas are scattered in the western desert including the famous oases of Siwa in the north , Baharia and Frafra in the central section , Dakhla and Kharga in the south. These Oases, that are distinguished with artesian wells of large discharge of fresh water, are mainly closed, and fragile ecosystems where population is concentrated .

Climate

This ecological zone is characterized by hyper-arid climatic conditions with rare rainfall and extreme temperatures. The winds over the western desert in north western or northern direction extend from the Mediterranean over the western desert with fallen speed. These winds are the major factors of erosion and deposition processes in the western desert .

A clear evidence of these processes is the formation of the great sand sea by the eroded sediments of the Qattarah depression located in the north.

Soil Resources

The soils have been classified as weakly developed Red Desert soils which have a higher chrome than typical Red Desert soils and they have a very thin or no A-horizon .

The formations of these soils are derived from a number of parent materials, indicating that the hot dry climate was the main soil forming factor that is responsible for the characteristics these soils as Red Desert soils. The soils are formed of sand and are calcareous in nature. However, the main soil types that distinguish the western desert, except the depressions , are related to the following .

Order Entisols Comprises the following suborders :

- Torri-psamments which could be Typic or Lithic .
- The Typic Torri psamments characterized by very deep loose wind blown sands, low ripple to medium dunes, no diagnostic horizons, gently undulating to rolling .
- The Lithic torri psasmments , have characteristics of the typic one except they are very shallow to shallows soil depths.

Orthents (Typic Torri orthents : that have deep soil of the low lying area between : consolidated dunes and rocky areas , they have gravelly sand, the gravel content is more than 35% which is contaminated with lime and gypsum materials.

Miscellaneous Land types

- High sand dunes in many parts of this desert, they take the shape of parallel lines of high and almost impassable dunes extending in a N-S direction.
- Rock land and very shallow soils occasionally with rock outcrop on the surface.

Water resources

Water resources are mainly that of the huge Nubian sandstone aquifer that extends with varied thickness under the majority of the area of the Western Desert. This major water resource is of excellent qualities in most areas. The renewability of such resource received many investigations with the majority of conclusions confirming a non-renewable or very slowly renewable water resource.

However, in view of huge water resources available in this aquifer a macro developmental plan of East Owenate area is being implemented.

Human resources

Human resources are sparsed but diversified with valuable indigenous experience and knowledge. Population are located mainly in the Oases and the newly developed macro projects in the southern areas, in addition, to few touristic sites. Educational background is low, however , skills and handicrafts are wide–spread. Human activities are based on Oases agricultural activities, few grazing areas and mining of iron in Bahariah Oasis. Economic instruments related to marketing and conducive to social developments need to be enhanced.

Chapter II

Desertification Processes in Egypt

The overview of the agro-ecological zones of Egypt shows considerable variations among these zones with respect to (a) climatic features under prevailing dry Mediterranean, arid and hyper arid conditions (b) geomorphological and terrain attributes (c) availability of natural resource base and quality (d) human resources characteristics and distribution. (e) prevailing land use patterns. Such variations result in varied processes of desertification as defined by the UNCCD. These processes of desertification vary in magnitude, cause and impacts from one ecological zones to another , some of the desertification processes might be unique and linked to a given agro-ecological zone, others could be shared by more than one ecological zone based on the main factors of desertification active in these zones.

This chapter is devoted to the identification of factors and processes of desertification active in each of the four agro-ecological zones referred to in the preceding chapter. The main objectives of such identification is to specify the elements and objectives of combating desertification in Egypt. Proper assessment of factors and processes of desertification and its adverse impacts on the resource base and socioeconomic conditions of the local stakeholders would contribute to the Definition of objectives and priorities of the National Action Plan to Combat desertification in Egypt.

The following sections will review processes and factors of desertification active in each zone.

2.1. North Coastal Areas

2.1.1. Degradation of natural rangelands

The main land use is the marginal rangelands and associated pastoral system and animal production. It is estimated that natural rangelands occupy about 6.5 million feddans out of which 3.75 million feddans are in the NWC sub-zone while the rest is in Sinai Peninsula.

The present status of these rangelands shows serious degradation . Loss of plant cover and valuable genetic resources and biodiversity could be attributed to physical , as well as, human induced factors.

The major physical constraints are attributed to the amount , distribution , inter-seasonal and inter-annual reliability of rainfall. Recurrent drought spells are indicated by the recorded climatic data. Among the major human induced factors is overgrazing beyond the critical levels of these marginal rangelands in view of the enhanced marketing potentials of sheep and goats in neighboring Libya , Saudi Arabia and the local market. The result is the serious degradation of the plant cover , which in turn leads to enhanced wind and water erosional processes.

Degradation of natural rangelands was reported (DRC) to reduce productivity of meat by 50% , milk 40% and wool by 25%

2.1.2. Increased trends of cultivating areas of rangelands

It is well recognized that the production system of the coastal areas is a mixed cereals/animal/fodder production system based on a fragile ecosystem. Traditional cultivation of cereals especially barley and certain drought tolerant fruit trees including figs and olives has been a long standing tradition in areas with potential catchment of rain water.

The increased installation of water harvesting and storage structures has undoubtedly raised total production of cereal and horticultural crops and led to a continuing expansion of the cultivated area. However, in view of the fragile

nature of the environment, it is questionable whether a continued large scale expansion of cultivation , to a level attainable only on the basis of the technical feasibility of water harvesting , would be sustainable over the long term. Further, the expansion of cultivation causing eradication of the plant cover and degradation of the soil resource base would be at the expense of the remaining rangeland and would have implications for the viability of an animal production element in the mixed farming system in its present form an issue likely to be of major social concern to Bedouin pastroralists , in addition to irreversible degradation of resources bases.

2.1.3. Wind and water erosion

The soils in the region face the dynamic problems of water and wind erosion . The main factors conducive to soil degradation are natural relevant to intensity and duration of rainstorms which could be enhanced by terrain attributes as well as human overus. Conservation practices should be elaborated based on an integrated management approach including soil, water , plant , and animal resources. The trade – off relations between agricultural expansion and resource conservation is the subject of maximum consideration .

In conjunction with the expansion of cultivation, the level of mechanized land preparation has also increased to a point where only a few farmers continue to use animal draft power. The higher number of tractors has enabled larger areas of cereal land to be prepared. Access to additional tractors for use by groups of small farmers could improve the timeliness of cultivation , but the methods of plowing and the levels to which tractors become available , need to be carefully monitored in view of the potentially adverse effects of mechanized cultivation on soil structure which in turn could enhance wind and water erosion .

2.1.4. Socio-economic Constrains

There is little organized marketing of agricultural commodities produced in this zone. Private traders are able to exploit the situation to their advantage. The principal agricultural outputs are lambs, cull stock, fig, and olive oil. There is little structure to the market system and producers tend to sell on an individual basis to a trader . Wool producers receive a poor price because wool is presented for sale in a dirty and ungraded condition and frequently contains sand and foreign matter. There is also an urgent need for small – scale industries to process the rapidly expanding production of fruit, vegetable , and olives for oil.

Agriculture development in the governorate Marsa Matrouh has been constrained due to insufficient financial support. The extent of credit for agricultural activities remains minimal .

2.1.5. Surge of Construction of Summer Resorts and Villages

Within the last two decades a surge of construction of summer resorts and touristic villages took place in the areas adjacent and all along the coast line. Such rapid expansion of urbanization could very well had its adverse impacts on biodiversity of natural flora and socio-economic aspects of production systems in the region.

2.2. The Nile Valley and the Reclaimed Desert Fringes

The Nile Valley system is one of the most ancient agricultural systems in the world . It represents the most fertile lands (around 6.25 million feddans) in Egypt and probably in the whole region . It is also the most densely populated area in the Middle East region. Agricultural products are highly diversified and intensive cropping system is practiced all year around.

Despite the high significance of this sub-zone to food security , trade balance and economics, yet it has been the subject of several desertification factors and processes through the last few decades . Some of these factors and processes have been dealt with through technical and legislative measures which resulted in significant decline of adverse impacts. Others are still the cause of continued processes of desertification to varied extents. The following is a brief account of these processes.

2.2.1. Salinity of Soil Resources

In view of the prevailing surface irrigation technique in addition to overuse of irrigation water which in turn exert large pressures on the surface drainage system which used to be the main system for drainage. The constraints in drainage coupled with the dominant heavy textured alluvial soils and seepage from the conveyance canals lead to water – logging in many areas of the old Nile Valley which in turn lead to increased soil salinity and in certain areas soil sodicity develops .

> Reports estimate that salt – affected soils represent between 35.0-43.0 present of the total areas in the old valley (El Gabaly – DRC).

Soil salinity , sodicity and water logging conditions would have definite adverse impacts on soil productivity which was estimated to be in the range of 30-35% of the potential productivity .

2.2.2. Urban encroachment and Soil Scrapping

Serious adverse and irreversible desertification process used to continually sizable areas of highly fertile areas into urban residential areas or scrapping the top 1.0-2.0 meters of the soil for the manufacturing of red bricks . Legislations that were passed in the year 1983 and again 1985 imposed serious penalties on fertile soil scrapping and calling for the conservation of the fertile areas.

Fortunately, soil scrapping was virtually halted , however, urban encroachment continues up till present time with a lower rate. The continued urban encroachment is attributed to expansion of the existing villages and towns . Recent surveys from 1992-1995 showed urban encroachment to have covered around 20,000 feddans of fertile areas. It is estimated that urban encroachment and soil scrapping may have caused the desertification of 20,000 feddans yearly.

2.2.3. Pollution of soil and water resources

Few decades ago agricultural products of the old Nile Valley were renowned for their excellent quality and high productivity . Farmers traditions of applying high doses of naturally produced organic fertilizers (animal barn yardmanure) with few complementing chemical fertilizers were perfected and practiced as long standing traditions. After the construction of the High Dam , in the seventies, the sharp reduction in the sediments load carried by the Nile water, accompanied by publicity campaign based on mis informed sources gave the impression that the use of chemical fertilizers especially nitrogenous ones should be enhanced considerably to compensate for the lack of Nile sedimenties.

Henceforth the consumption of chemical fertilizers increased sharply. An investigation by the Academy of Scientific Research and Technology (1971-1975) showed that the amount of chemical nutrients in the drainage water increased sharply causing water eutrophication which meant not only overuse of fertilizers but also huge economic losses. The overuse of fertilizers continued through the nineties coupled with more intensive use of pesticides and other chemical fertilizers seeking ever increased productivity especially after the liberization of prices of agricultural products. The use of pesticides increased in Egypt from 2143 tons in the fifties up to 11700 tons in 1990. The overuse of chemical fertilizers and the residues of applied pesticides were sources of pollution of soil and water resources.

Other sources of pollution are the dumping of industrial waste water in the irrigation canals. Such source of pollution was enhanced considerably after the rapid expansion of textile , chemical , automotives , leather …etc industries in the sixties , seventies and eighties.

The seepage of some sewage water with low treatment levels was another source of pollution especially in the seventies . These sources of pollution caused adverse impacts especially towards the end of irrigation canals draining in the lakes in the far north regions of the Nile Delta where pollutants were accumulated with high concentrations causing adverse chemical and biological impacts.

2.2.4. *Mismanagement of soil and water resources*

This is a major factor of desertification especially in the reclaimed desert areas in the western and eastern fringes of the old cultivated areas in the Nile Valley. Three reclaimed desert areas – in the last few decades – comprized mainly two types of desert soils; calcareous soils of varied texture and non-calcareous coarse textured soils. These soils are characterized by different sphysical constraints, low fertility and resilience. There appropriate cropping pattern and management practices are quite different in many ways than those of the old Nile Valley. It is unfortunate that all the traditional farmers and the greater majority of the agricultural graduates at varied levels have their experience background and education based on cultivation practices of the old alluvial fertile lands. Lately, efforts are being made to correct such situation. However, mismanagement practices still prevail in the reclaimed desert areas. As an example, the insistance on growing corn and bananas and other crops and fruits of high nutrients and water requirements in soils of poor fertility and inferior soil-water properties.

Other practices including using organic fertilizers originating from the old alluvial areas which are not well fermented leading to the infestation of the new lands with weeds , parasites and diseases that are not indigenous in the new lands . All in all mismanagement practices in the newly reclaimed desert areas lead to reduction of productivity and loss of potential economic gains.

2.2.5. Sand encroachment on the fringe areas

Processes of sand encroachment and mobile dunes are widespread in the desert areas due to several factors including the arid and hyper arid climatic conditions , geomorphology and the geologic formation prevailing in these areas. It is estimated that sand formations cover more than 16% of the total area of Egypt. These conditions lead to active sand encroach on the fringes of the cultivated areas practically in most areas of Egypt. Several investigations were carried out to assess the impact of sand encroachment on the cultivated areas . In 1986 an estimate of 1.8 million feddans were affected by sand encroachment and active dunes. Again a rough estimate report that the reduction in productivity could reach 25% of the potential productivity of the affected areas.

Sand encroachment and active dunes do not affect the cultivated areas only, but also it threatens the infrastructure , strategic installation and means of communication in most areas. These processes have adverse impacts on transportation of inputs and produced agricultural commodities, as well as, the marketing processes and the living habitats.

2.2.6. Shoreline eorsion

The erosion rates of shorelines of the Nile Delta has been enhanced in the last two decades . Sattlit imagery estimated the areas lost to the sea to be several thousand feddans. This was attributed to the lack and change of sediment load of the Nile water discharged to the Mediterranean Sea at the end of Demiatta and Rashid Nile main branches . Other investigations warn of the impacts of climate change on the coastal areas of fertile valley . These could present more serious and adverse impacts than the present erosion rate of shorelines.

2.3. The Inland Sinai and the Eastern Desert

2.3.1. Practices inappropriate to the Quality of land and water resources

The soil resources of this zone are of fragile properties, mainly calcareous in nature with high salinity contents. In addition, the water resources for agriculture are mainly dependant on shallow ground aquifers of low qualities (inferior ionic composition with dominance of the Na^+ and Cl^-) with varied salinities.

Agricultural practices including irrigation methods, irrigation scheduling , leaching fraction, as well as, choice of cropping pattern should be planned to suit the qualities and the constraints of the soil and water, as well as, the prevailing climatic conditions. Farmers and investors have been going into success and failure stories of trials and errors. Such approach is not appropriate for sustainable productivity in addition to economic losses pertinent to invested capitals lost.

2.3.2. Wind and water erosion processes

The nature of surface sediments, active winds and barren lands in the region are conducive to very active wind erosion . The topographic nature (elevated areas, plateaus , dissecting wadis with deep slopes and low laying coastal areas) coupled with the rain showers with intensities (surpassing 10 mm/one shawer) would lead to water erosional processes.

Wind and water erosional processes cause active erosion and deposition which threaten the sustainability of available fragile soil and water resources. In many cases the eroded materials and carrying water are lost to the Gulf of Suez , Gulf of Aqaba and the Red Sea. The limited and patchy soil suffer considerably from losses of soil material, loss of productive layers and / or deposition of transported materials of varied origin and qualities on top of productive layers.

2.3.3. Flash Floods

As specified in the previous section (2.3.2) when terrain attributes combine with in frequent but prolonged thunder showers of intense rainfall (as one of rainfall characteristics in this zone despite the low average annual rainfall, the resultant is the formation of gushing floods origination from higher elevation, through dry vallies and into flood plains in the narrow coastal areas and finally in most cases to the adjacent marine areas. Such serious flash floods cause serious damage to infrastructure , touristic installation and large losses of fresh water and soil materials.

2.3.4. Loss of plant cover and genetic resources

The elevated and southern areas of the Eastern desert are the only areas in Egypt to receive summer rainfall due to Eastern winds. The elevated areas as mount Elba and the surrounding valleys receiving considerable runoff are rich with diversified natural plant communities. Some of these plant species are true pedemic and one considered to be highly valuable genetic resources adapted to the desert conditions.

The lack of proper conservation practices , overgrazing of herds of camels ruminants , and deforestation for fuel cause the serious losses of plant cover and valuable genetic resources.

Proper and sustainable utilization practices of plant species producing valuable commodities and products could be a viable solution to poverty stricken bedwins and local population. The potential economic returns that could be generated from appropriate agro-industrial activities are presently lost in addition to the jobs that could be initiated with such activities .

2.4 .The Western Desert , Oasis and Southern Areas

2.4.1. Over-exploitation of soils and groundwater resources

The Oases are the significant sites of agriculture developments in the Western Desert. Agricultural activities in the Oases are completely dependent on groundwater resources, mainly, from the Nubian Sandstone Aquifer of good quality water . Groundwater used to come

up to the surface in the form of artesian wells. In view of the intensive cultivation that was practiced in the Oasis with high water requiring crops including rice and alfalfa in addition to overuse of irrigation water the static level of water in the wells dropped considerably. Such over exploitation of the soil and groundwater resources in a closed system , like that of Oasis in depressions, caused deleterious impacts on the resources base , as well as, on the environment.

Over exploitation of the groundwater caused deterioration of quantity and quality of well water . The static water levels in the relatively shallow wells (50-100 m depth) dropped considerably leading to expansion of the number of deep wells (1000m). This shift required greater digging and operating costs, reduction of available water and increase of cost of production per unit of commodities produced.

Over irrigation caused the formation of shallow water table leading to increased salinization and degradation of the relatively limited soil resource base.

2.4.2 Sand Encroachment and Mobile Dunes

Mobile dunes and sand sheets occupy vast areas of the Western Desert estimated at 149,500 Km^2. Practically all the oases suffer one way or another from sand encroachment and mobile dunes hazards.

The adverse impacts of sand encroachment and mobile dunes are limited to the oases where most of the agricultural activities are located, it also extend to affect the roads and railways connecting these oasis to the marketing and processing centers in the old Nile Valley causing significant economic losses and large expenses to protect and maintain these means of transportation and communication.

Sand encroachment hazards also threaten the course of the Nile at Menia and Assuot in Upper Egypt , as well as , lake Nasser of the High Dam. As pointed out before these hazards also cause reduction of productivity in the cultivated and reclaimed areas in the western fringes of the Nile Valley in Upper Egypt.

Additional adverse impacts are predicted for the macro soil reclamation projects in the southern areas of the Western Desert including Tushka , East Owenate and Darb Al-Arbien where hundreds of thousands of feddans are marked for reclamation and establishment of macro developmental plans.

2.4.3. Management practices and sustainability

The available land resources in this zone are of weak characteristics and low resilience with wide spread physical , biological and chemical limitations.

Most of these resources are located in a closed fragile ecosystem which are isolated from the Nile Valley System. Management practices and utilization of those resources for agriculture and desert development should maintain these ecosystems free from invading pests and non desirable weeds and plant species , through the application of proper and integrated conservation practices.

Conservation of the indigenous flora and fauna with the preservation of the valuable genetic resources and species adapted to the harsh

environment and hyper-aridity of this zone represent an important mean of combating desertification.

Rational use and reuse of water resources is imperative due to the enclosure of the ecosystem and the need to deal with excess drainage water in non-conventional ways, other than the traditional systems of the old Nile Valley, would be of paramount significance to prevent the presently prevailing conditions of water logging and salinization of soil and water resources.

2.4.4. Socio-Economic Constraints

The present population and communities are scattered with low educational background. Although skills and handcrafts are available , however, technological skills to address the needs of developmental activities are rare. There are definite needs to create incentives to reverse the present migration trends toward urban centers of the Nile Valley in addition to the attraction of human resources to migrate to the newly developed areas in the Western Desert.

Chapter III

Previous and Ongoing Activities

Combating Desertification Processes

This chapter presents a review of previous and ongoing activities to combat the factors and processes of desertification prevailing in each of the agro-ecological zones of Egypt. Such review is of great importance to assess and analyze the impacts of such activities in achieving its technical and scio-economic objectives and be identifying the lessons to be learned. The review is also important for the activities of the NAP to build on previous achievements and preventing duplication of efforts and loss of time and human endeavors. Finally the review of previous and ongoing activities will help in identifying gaps, hotspots and priorities to be addressed and dealt with by the proposed NAP activities.
The present review is presented based on major activities carried out each of the agro-ecological zones to facilitate setting of priorities and is enhance the efficiency of the future NAP activities.

3.1 North Coastal Areas

Both the Northwest Coastal areas and that of North Sinai have been the subject of various investigations and activities that could contribute to combating desertification starting in the 1960s. The number of investigations has particularly grown during the last 20 years. These activities were varied in objectives, scale, and applied methodolgies. Studies and research projects have been sponsored and carried out by various national institutes and authorities and sometimes in co-operation with regional and international organizations. Foremost among the national institutes are the Desert Research Center (formerly Desert Research Institute), the Agricultural Research Center ,the National Research Center, the Academy of Scientific Research and Technology, the General Authority for Reclamation, Projects of Agricultural Development (GARPAD), and the Universities of Alexandria and Suez Canal. The participation of the regional and international organizations are noted in the following activities.

3.1.*1.Activites in the Northwest Coast*

3.1.1.1. The World Food Programme (WFP)

This program was carried out in the entire Northwest Coastal areas during (1963-1973). It was revived in 1979 and continues till present. The project focusses on the improvement of soil and water resources, hence contributing to Bedouins welfare sedentarization. The project activities include :

- Cleaning of old cisterns and establishment of new ones.
- Construction of dikes.
- Building of houses and animal sheds.
- Planting fruit trees.

3.1.1.2. The Food and Agricultural Organization (FAO)

FAO was active in the Northwest Coast in 1965-1970, and again from 1988 till present, the current project aims to develop agricultural production by using modern agricultural methods, irrigation systems, and plastic greenhouses. The project is more active in specific sites such as El Qasr, Om El Rakham, Sidi Barrani, and Abu-Laho. It includes trials on soil and water conservation works in Wadi Shaiab and Wadi Taweila.

3.1.1.3. The Australian Dryland Farming System

In 1980-1983, McGowan International Ltd investigated the feasibility of introducing the Australian dryland farming systems in the Northwest Coast. In the course of their work, they planted crops and established pasture on some 3.800 fed (1.357 ha) at seven trial sites.

3.1.1.4. The German Agency for Technical Cooperation (GTZ)

In 1988, GTZ began operations in El Qasr on an area of 40 x 70 km. It established agro-climatic stations and land use planning and environmental monitoring stations. The project focused on rural development.

3.1.1.5. The World Bank and the Government of Egypt (Ministry of Agriculture and Land Reclamation)

A feasibility study entitled "Management Project" was conducted in 1992 in the Western Province from Matrouh westward almost to the Libyan border. The aim of the study was to make the best use of the limited resources available to the local populations through the analysis of natural resource base and the assessment of the sustainable development possibilities. This was folloed by a development programme that extended till 2001.

3.1.1.6. Programme for Rehabilitation of Rangelands

Since the fifties several projects for rehabilitation and development of rangelands were coverd. These projects included:

a) The project for improvement of rangelands of Ras El Hekma in Matrouh Governorate. This project was carried out by the Desert Research Center (DRC) with the support of US-PL 480 programme in an area of 5000 feddans. The main objectives were to protect has El-Helema rangelands against overgrazing, introduction of new species and varieties appropriate for rangelands , organizing grazing practices, enhancing the benefits from surface water resources (Rainfall and Runoff) and available ground water resources. The project activities almost doubled the carrying capacity of this area for four years.

b) The project for improvement of arid lands carried out by the Authority for the Northwest Coast in collaboration with National Research Center (1980-87).

c) The project for range areas improvement in 10,000 feddans west of Mersa Matrough carried out by the Authority for the Northwest Coast and the DRC (1987-1992).

3.1.1.7 ICARDA in collaboration with the DRC and ARC

ICARDA, DRC and ARC conducted a project in the Northern coastal areas of Egypt in 1995 entitled Resource Management in the Rainfed Areas of Egypt. This project included studies on agronomic practices, soil fertility, management of water resources and socio-economic aspects with synthesis of all the latter.

The project also assessed the constraints and potentials of the studied areas.

3.1.1.8. A project supported by UNDP and IDRC had started in (1992-1998) in the area of (Fuka-Matrouh) under the title "Coastal area management programme" with the objectives of planning the integrated management of coastal areas, sustainable development , modeling of decision making and building expertise in the field. The project activities included establishing of a database for the information pertinent to the project area, soils suitability analysis and environmental impacts assessment of the developmental activities.

3.1.2 Activities in North Sinai Coastal Areas

3.1.2.1. During the 1950s and 1960s concernted efforts were conducted to develop and enhance the productivity of Wadi AlArish cultivated areas especially in its parts located within the coastal areas north of Sinai.

An earth dam was constructed (Al Arish Dam) to conserve 5.0 million m^3 of wadi Al Arish water to be used for boasting productivity and increasing the cultivated area. Unfortunately the Dam's reservoir was silted quickly by the sediments transported by water since no proper measures were applied to minimize water erosion in the catchment. A new dam is being planned to conserve about 20 million m^3 in an appropriate location further south with suitable measures for conservation and sustainability of the function of the new dam.

3.1.2.2. JAICA in 1989 carried a rular development pfoject in North Sinai with emphasis on the supplemental use of groundwater

3.1.2.3. GTZ started a technical cooperation project "Rural Development of North Sinai", in 1991. The aim of the project is to provide a general overview of the soils and land suitability in the North Sinai Governorate.

3.1.2.4.The project for improvement of range areas in East Sinai in an area of 1000 feddans carried out by the Academy for Scientific Research and Technology in collaboration with the DRC.

3.1.2.5. Experiences in fixation of sand dunes:

The varied technologies of mechanical, chemical and biological fixation of mobile dunes were tested and applied in several activities in the North Coastal areas including the following:

a) The project in North Sinai (1960-1967) carried out by the Authority for Desert Development.
b) Fixation of sand dunes in North Sinai carried out by Academy for scientific Research and Technology in cooperation with University of Alexandria (1984-1994).
c) Utilization and fixation of sand dunes in local stakeholders Shiekh Zowied and Rafah areas in Northeastern Sinai (1980- till present).
d) Programme for tree plantation along the major roads of North Sinai and the Authority for Development of Sinai (Ongoing).

In general despite the implementation of several projects for sand dunes fixation especially in North Sinai, the treated areas are far from adequate due to several reasons including the following:

- Lack of adequate numbers of transplants and materials used.
- Lack of personnel and appropriate experiences.
- Lack of participation of local stakeholders and their conviction and awareness of the significance of the problem.
- Lack of adequate financial resources.

3.1.2.6. The National Research Center carried out scince 1990 a project for the introduction of salt tolerant and drought resistant verities of cereal and forage crops to enhance the productivity of the cultivated areas in North Sinai.

3.1.2.6 Use of desert genetic resources to combat desertification:

The flora of Egypt contains a considerable number of palatable species belonging to families: gramineae, leguminoase, cruciferae, compositae. chenopodicaea, labitateae and nitrarianceae. They are mostly considered as halophyte plants which could be efficiently utilized in several aspects as fodder, fuel, landscaping, sea-side dune stabilization , biological recovery of waste lands degraded by salinity or alkalinity, land reclamation, range rehabilitation and utilization of brackish waters. Since the conservation and utilization of plant genetic resources have become a priority in Egypt, scientists of the Desert Research Center (DRC) have successfully established a new gene bank at Sheik Zuwayid, North Sinai.

The facility has been conceived to address especially the optimum utilization of the plant genetic resources from dry and desert areas.

3.2 The Nile Valley and Reclaimed Desert Fringes

3.2.1 legislations

- Legislations were passed in the years 1983 and again in 1985 imposing serious penalties for scrapping of the top soil material for manufacturing ored brick. This caused virtual halting of such practices.
- Urban encroachment on fertile lands prohibited and city limits were marked. However, urban encroachment still continues (at a much lower rate). Recent surveys from (1992-1995) showed urban encroachment to have impacted around 20,000 feddans of fertile areas. This is attributed to expansion of the existing rural villages and towns in contradiction to the formulated law.
- In the early stages of desert soils reclamation in the fringes of the Nile Valley , surface irrigation was practiced widely in the newly reclaimed water logging areas which caused water logging and salinization even in coarse textured soils over a period of 15-20 years. Such conditions led to uprooting of fruit tree of their prime productivity with serious economic losses. Hence forth, a legislation was formulated prohibiting the adoption of surface irrigation practices in newly reclaimed desert areas. Such action was very benefitial in restoring the productivity of these areas, saving sizable water resources through the application of modern irrigation techniques , as well as , enhanced the income levels of the local farmers.

3.2.2. Soil improvement activities

Soil surveys carried by the Ministry of Agriculture showed and load reclamation showed that there is a great need for land improvement and soil conservation to combat a reported decrease in the productivity of the land in the Nile Delta and Valley (old &old new lands). In 1971, the Ministry of Agriculture established the Executive Authority of Land Improvement Projects (EALIP) as a semi-autonomous organization belonging to the Ministry of Agriculture (MOA).

EALIP was vested with overall responsibility of carrying deteriorated land improvement techniques in Egypt as follows:

The Nile water has an alkalizing effect on the alluvial soil, especially on those that contain a large fraction of highly expanding clays. The area suffering from sodicity is estimated about 10% of the salt affected area. The application

of gypsum is becoming a general rule and it is a common practice to add an average of five tons perfeddan to the soils.

- Physical limitations of the soil profile are improved by sub soiling which improved the soil structure by creating a zone of fissuring and cracks, breaking up compacted layers and so improving the drainability of the soil. The activity has now become a routine proceduer in soil improvement work in Egypt carried by EALIP.
- Lack of land leviling for the soil surface, this can be improvement by carrying partial leviling and zero leveling carried by the use of laser beam. The adoption of such activity leads to saving about 25% of the irrigation water, and prevents secondary salinization.
- EALIP is responsible for clearance and maintenance of the open secondary and collector drains whereas the farmers should maintain their field ditches in proper working order, in actual practice; this does not occur and often after some years the system is in disorder.

  The land improvement program is now covering the entire irrigated land of Egypt. Since the establishment of EALIP and until the end of March 1994, the following soil improvement activities were accomplished;

– Sub-soiling in an area of 3.638×10^6 feddans;
– Additional of 5.504×10^6 tons of gypsum to the soil.
– Land leveling using updated technology was introduced and carried by the laser beam in over 2.9×10^6 .
– An increase in the agricultural production exceeding 30% was reported.

3.2.3. Conservation of land Resources from pollution

The long standing traditions of rotational use of fertilizers in the old fertile valley soils was altered after the construction of the High Dam under the wrong impression that the lack of sediments load in the Nile water due to the construction of the High Dam will lower the fertility of the Nile Valley soils. This wrong impression led to the extensive use of chemical fertilizers, pesticides and agrochemicals amendments.

The extensive use of nitrogenous fertilizers led to excessive leaching of nitrates to the water table and further to the groundwater resources. The produced food products could be contaninated with pesticide residues and rejected as export commodities. Health and environmental hazards are serious threats to the humans, animals, flora and fauna with adverse effects extending to the main areas where drainage water are discharges.

The Ministry of Agriculture and Land Reclamation carried out concerted efforts through research extension and public awareness efforts to curtail the use of pesticide and agricultural chemicals with possible polluting impacts. Introduction of Integrated Pest Management practices gained widespread endorsement and sharply reduced the total tonnage of applied pesticides.

The introduction of economic reforms and proper pricing of agricultural of inputs and products by the Ministry of Agriculture and Land Reclamation led to the improved and rational use of chemical fertilizers, thus minimizing the pollution hazards.

Such important conservation measures didn’t curtail sources of soil pollution only but also it had its beneficial impacts on the pollution of water resources and the recycled agriculture drainage water.

3.2.4 Drainage improvement and conservation of water resources

The Ministry of Water Resources and Irrigation has been involved in continued activities to achieve improvement of drainage conditions, conservation of irrigation water in quantity and conservation of the shorelines. The following is a summarized review of the major activities:

Implementation of projects of open and tile drainage to prevent the degradation and desertification of the productive soils. These projects are of particular significance after the construction of the High Dam with perennial irrigation and cropping patterns of more than one crop per year.

The main benefits of these projects could be summarized in the following .

a) Combating soil salinization and soil alkalinity.
b) Minimize soil logging , improve aeration and ameliorate the oxidation / reduction potential.
c) Enhance soil productivity by 17-25%.
d) Lowering of water table.
e) Improving physical and chemical soil properties.
f) Adding, additional areas to be cultivated upon conversion from open drainage to tile drainage.

3.2.4.1. Tile drainage projects

Tile drainage was introduced in to a total area of 5.101 million feddans with 3.661 million feddans (areas) in the Delta and 1.440 million feddans in the Upper Egypt up till 30/6/2001 , with total expenditures of 2325 million L.E. This was carried out at a rate of 160,000 feddans/year (Over thirty years). The cost of implementing tile drainage is recovered over 20 year with two years grace starting from full implementation.

The present plan calls for the introduction of tile drainage in additional 1.3 million feddans till 2008.

3.2.4.2. Open Drainage was introduced in 7.23 million feddans (4.962 in the Delta and 2.268 in the Upper Egypt).

3.2.4.3. Conservation of water resources

- Establishing numerical and geographical databases for ground water and water resources of relevance.
- Development of innovative techniques for water harvesting and conservation of flood waters in varied locations in Egypt.
- Formulating regulations for the reuse of wastewater and means to protect ground water and other water resources from pollution.

3.2.4.4. Combating of seawater intrusion

The following activities are being carried out to protect the shore-line areas of the Delta and certain important locations along the North-Western Coastal areas from sea water intrusion for the prevention of salinization of the productive agricultural soils and the conservation of the sea shore-line.

- Protection of Rashid shore-line.
  Establishing a marine wall 5.0 kilometers long.
  Establishing 5 beach heads to the east for protection.
  Use of modern techniques in a trail area of 1.0 Kilometer length.
- Protection of Balteem shore-line
  Protection for a distance of 8.0 kilometers through four stages.
  Protection of Ras- ElBar shore-line
  3.5 kilometers were finished while the protection of additional 1.0 kilometer is ongoing.

Other areas include Gamasa, Buroulos, Ezbat El Barg, Port Said, AL-Arish, Alexanderia, and Mersa Matrough.

3.2.4.5. Protection of the River Nile and its branches from pollution

The Ministry for Water Resources and Irrigation prepared a survey for sources of pollution from industrial, agricultural and sewage sources. A national plan was formulated for the protection of water resources from pollution . Three stages of priorities were planned in sequence from the year 200-2017. Measures were planned for periodicals monitoring and application of pertinent legislations and environmental laws.

It was highly recommended to coordinate the proposed activities among the ministries concerned including Ministry of Environmental Affairs, Ministry of Planning and others.

3.2.5. Afforestation in the desert fringes

Significant efforts were carried out to create man-made afforestation in areas, as well as, along the canals and on the peripheries of farm lands in the newly reclaimed desert areas. Such activities provide protection of the farm lands and wood materials for industrial purposes.

3.3. Inland Sinai and the Eastern Desert

This agro-ecological zone received fewer activities to combat desertification which were mainly in the form of research investigations conducted mainly by the Desert Research Center (DRC) , Academy of Scientific Research and Technology , Agriculture Research Center (ARC), National Authority for Remote Sensing & Space Sciences (NARSS) , and the local Governorates. These activities include the following:

3.3.1. Introduction of salt tolerant and drought resistant varieties of cultivated crops in addition to formulation of integrated management practices appropriate for limited availability of groundwater resources with low quality due to ionic balance and medium to high level of salinity.

The integrated management practices include the use of varied natural and synthetic amendments to calcureoues and saline soils dominating in this zone.

3.3.2. Investigation of wind and water erosional processes as influnced by climatic, geomorphic features and human induced causes with particular emphasis on the varied location of the Sinai Peninsula. Fixation of dunes and combating of sand encroachment were carried out in limited pilot areas.

3.3.3. Investigation were conducted on the use of natural halophyte products pressed with relatively agricultural waste products to make nonconventional fodder materials with high nutritive used values to supplement the animals on the relatively poor natural rangelands. Such practices led to significant enhancement of animal production and associated products.

3.3.4. The DRC carried active investigations to search for additional soil and water resources, especially, underground water resources in dry wadies wide-spread in this agro-ecological zones. Theses investigations were conducted in wadies of large areas like Wadi Dara and others where significant groundwater resources with qualities that could be used for expansion of cultivated areas.

3.3.5. The DRC and ARC carried out field investigations of the macro vallies of Shalatine, Abo Ramad and Halaieb to investigate the appropriate and innovative techniques of harvesting and water spreading of flood and runoff

waters which are lost in most cases to the Red Sea with its content of eroded soil materials.

3.4. The Western Desert, Oasis and Southern Remote Areas

Activities for combating desertification were concerned mainly on the management of soil and water resources in the Oases, as well as, fixation of mobile dunes and combating sand encroachment and its adverse impacts on farm lands and infrastructure.

3.4.1 Assessment of the soil and water resources (ground water resources) in quantity and quality were conducted for all of the major Oases. Measures to combat the over exploitation of ground water resources and to halt or minimize the rapid drop in state water level which caused reduction in extracted amounts of water and the sharp increases in costs and invested capital for the digging of new wells.

Overuse of groundwater combined with the inferior qualities of the prevailing soil source, physiography, and human induced mis-management practices caused serious salinity problems.

The DRC in collaboration with several doner agents and the local authorities carried out several investigations to curtail the salinity problems with innovative measures and projects. Lately, the Ministry of Water Resources and Irrigation have joined the efforts to alleviate the water logging conditions and salinity hazards.

3.4.2. The DRC had pilot areas for the demonstrations of sand dune fixation using varied techniques and saline water irrigation with considerable successes for chemical , mechanical and biological fixation.

Chapter IV

The Basic Features of the National Action Plan

5.1. Lessons learned

The previous chapters depicted the basic physiographic features, climate characteristics, distribution and attributes of the natural and human resource base and its distribution in the four agro-ecological zones of Egypt. The main factors and processes of desertification active in each of these zones were reviewed . The previous and ongoing significant activities to combat desertification were outlined in each of four zones.

The overall analysis of the presented information and data leads to the following conclusions which justify the necessity and significance of formulating a National Action Plan for Combating Desertification in Egypt. These conclusions are :

5.1.1. There are a multitude of factors and processes of desertification which are active in the various agroecological zones. Desertification processes are induced both by physical and human causes, some of the factors of desertification are specific for each ecological zone while others are common and wide – spread.

5.1.2. Adverse impacts of desertification are highly varied in extension, severity and socio-economic implications.

5.1.3. Despite the magnitude , duration , diversification and the large number of involved in endeavors to combating desertification, yet, most factors and processes of desertification are still active to certain extent in the four agro-ecological zones.

5.1.4. The elaborate activities for combating desertification, with the exception of drainage schemes in irrigate lands, are fragmented , mostly research in nature , conducted in relatively pilot areas and not integrated in a national plan addressing an overall strategy to combat desertification.

5.1.5. The greater majority of activities to combat desertification ended up producing certain reports with some recommendations (mostly site specified) which did not receive a meaningful follow up nor did it address appropriate measures for wider implementation.

5.1.6. Efforts to combat desertification were carried out by many research, governmental and non governmental (few) institutions, in collaboration with several regional and international organizations. However, there were very few instances of integration and complementarity.

5.1.7. One of the main constraints that faced elaboration and enhancement of activities to combat desertification is the lack of national or local financial resources to pay the highly needed financial support to these activities. Even the provision of seed money in many cases would secure the initiation of local action by the local stakeholders.

5.1.8. The role of non governmental organization (NGO's) and that of local communities, which became of significance lately, had a very limited impact as far as the implementation of activities to combat desertification is concerned. Lately more financial resources are allocated for these organizations, however, coordination with the governmental institutions is not advanced.

5.1.9. Very minimal considerations were given to the proper use of media, programs to enhance the public and official awareness with the various aspects of desertification processes, its adverse impacts technically, socially and economically, as well as , the dire need for the conservation measures and its benefitial returns for the present and future generations.

5.1.10. Despite the conducting of several local surveys and the availability of several well equipped and reasonably staffed institution, for monitoring and assessment of desertificaion processes, credible data and measures of areas affected by the various factors of desertification are obviously lacking. The same applies to monitoming and assessment of impact of the various activities of combating desertification .

5.1.11. Uptill present the various aspects of desertification do not receive the appropriate consideration and coverage in the various currcula of the progressive levels of education.

5.1.12. Despite the formulation of several legislations pertinent to combating desertification, mechanisms for emforment need to be established.

5.2. Strategic Objectives

1- National actions to combat desertification form a component of national actions to ensure sustainable development of land resources in the four principal agro-ecological zones. Actions will aim at :
   - (i) Preventive measures that sustain land productivity,
   - (ii) Remediation of degraded lands, and rehabilitation of desertified (lost) lands,
   - (iii) Development of new lands through programmes of reclaiming desert terrtories and provision of new water resources , and programmes of non-agricultural use of land.

2- Action will encompass four principal groups : (i) field actions of corrective rehabilitation and development measures , (ii) programmes of land resources inventory and assessment ,monitoring (land –use processes) and evaluating impacts of actions, (iii) supporting measures that provide means for sustained action (trained manpower, financial resources, technical means, positive participation of stakeholders, etc.), (iv) development of policies and instruments (including legislative instruments and institutional mechanixms).

3- Field actions will be categorized according to requirements of four principal land-use systems : (i) irrigated farmlands , (ii) rain-fed farmlands , (iii) rangelands and livestock management, (iv) non- agricultural land – use (urban development, transport networks, industrial centres, etc.). These

categories and the menance of mobile sand bodies will be addressed in each of the four agro-ecological zones of Egypt.

4- Programmes of inventory , monitoring and assessment need to provide the bases for action (data and information required for planning and designing of action), and to provide means for evaluating programmes of action that are implemented. Scientific institutions involved may be numerous, hence the need of a national body that receives data from various sources and be capable of data analyses and integration (data bank, GIS, etc.).

5- Supporting measures require the contributions of various institutions of education, training, research and development, media and communication , NGOs and civil society bodies, etc. Theses mesures need also the support of finanicial institutions including bi-lateral and multi-lateral aid bodies. To coordinate the inputs of these various actors a national focal body is need to orchestrate these supporting measures.

6- A national policy institution needs to be established and be placed at a high level of policy-making , and to combine political authority and technical competence . The national plan of action to combat desertification will be an integral part of the national plan for sustainable development.

5.3. Guiding Pronciples

The strategy for combating desertification in Egypt is based on the following premises :

5.3.1. Formulation of activities of the NAP will be based on adoption of the integrated approach to address the main factors involved. In addition to securing and adoption of the participatory approach of the pertinent stakeholders in the varied stages of execution including planning , initiation and implementation with possible financial contributions of the beneficiaries.

5.3.2. To successfully achieve the objectives of the previous item, activities for combating desertification will be based on the objectives to be achieved within each of the agro–ecological zones . This is based on the interrelationship of the factors and processes of desertification within a given agro-ecological zone. However, the measures to address nation-wide factors should be adressed separately.

5.3.3. To set priorities for the future action plans to combat desertification for the short medium and long term based on the definition of hotspots, significance of adverse impacts on productivity resource base, economic losses caused and social implication especially with respect to alleviation of poverty .

5.3.4. Integration of the endorsed activities of the various priority categories of the NAP in the appropriate developmental plans through the efforts of the National Coordination Committee for Combating Desertification and its contacts with the decision makers at the highest level.

5.3.5. Integration and meaningful coordination of efforts to combat desertification among the governmental institutions, non-governmental organizations, local stakeholders and local authorities .

5.3.6. Enhancement of the role of women and youth and their participation in the coordinated efforts to combat desertification .

5.3.7. Coordinate and complement the activities of the several national institutions processing the capabilities, equipments and expertise to carry out the badly needed efforts for proper assessment and monitoring of desertification processes in the four agro-ecological zones in Egypt.

5.3.8. Sponsoring well organized public campaigns targetting the decision makers, public officials NGOs , women, youth and local stakeholders.

5.3.9. Integrate the basic concept of desertification and its adverse impacts in the various levels of public education, as well as, higher educational institutions and universities .

5.3.10. The NAP activities will be transformed into appropriate projects to be implemented in the various agro-ecological zones.

5.3.11. Securing the proper integration with the ongoing and projected sub-regional, regional and international activities and projects.

5.4. Elements of the NAP

As pointed out earlier, in the basic rationale of this NAP, it would be meaningful to formulate a NAP which comprises sub- components dealing with the specific attributes of each the four agro-ecological zones . Such approach would address and focus on integration of related activities , defining hotspots, setting priorities of actions and specifying the needs and requirements of the proposed activities . Such approach would also facilitate the securing of participatory approach of the concerned stakeholders in the various phases of planning , formulation of actions, implementation and follow up . Thus maintaining and securing the sustainability of actions to combat desertification.

The required contributions and roles of concerned governmental institutions , local authorities , NGOs and stakeholders would be easily identified , coordinated and planned with particular emphasis on enhancing the participatory role of woman and youth.

Such approach also would help the identification of needs for training and capacity building at the various levels based on priorities .

The presence of several institutions working on similar objectives , for example , research institutions , institutions of monitoring capacities (remote sensing , database formulation and management , GIS…etc.) could be assigned specific roles that would secure complementarity and collaboration rather than duplication and wasting of efforts, time, manpower and the allocated funds.

In the following section proposed NAP activities will be specified for eash agro-ecological zone to address issues of priorities . A separate section will be devoted to issues of general nature.

5.4.1. North coastal areas

This agro-ecological zone received by far the greater number of investigations, activities and projects that contributed to combating desetification at varied scales. The north coastal areas are unique in their physiography , climatic features, available natural resources and human activities . The present main land use is the agrppastoral land use in the largest area of natural rangelands in Egypt. In addition to the main factors and processes of desertification which were reviewed in the previous chapters, two major events are being introduced to this agro- cological zone namely ; Al Salam Canal conveying mixed Nile and drainage water to Northern Sinai in the eastern direction from the Suez Canal till Al Arish area with the objective of reclaiming about 400,000 feddans . Al Hamam Canal extending in the southern section of the Northwest Coast subzone carrying Nile water in a westerly direction from the Delta western fringes.

The main objective of NAP in this agro – ecological zone is to formulate an integrated , well defined programme , as a major sub-component of NAP to curtail desertification processes and alleviate its adverse impacts on natural and human resources. Such programme will build on the previous endeavors and take into consideration the ongoing and introduced major activities to this agro-ecological zone. The following measures will be adopted to achieve such objective:

5.4.1.1. Carry out in depth analyses, evaluation and assessment of achievements of previous activities conducted in the various locations of this zone, with the objective to extract lessons of success and failure.

5.4.1.2. To compile and process data and findings generated in the previous activities to formulate a comprehensive database built through the application of GIS technology. To produce digital maps for the areas affected by desertification varied periods or time according to unified and standard indicators. Such activity would address the lack of quantitative and credible data pertinent to quantification of the areas affected by desertification and the level of adverse impacts.

5.4.1.3. Among the major objectives of the proposed integrated program are the following :

- Rehabilitation of depleted rangelands through integrated practices of restoration of plant cover, soil and water conservation practices including water spreading water harvesting successful techniques with the appropriate and sustainable provision of seeds, transplants , equipment, etc.
- Limiting the cultivation of cereals and fruit trees to the areas with proven, and adequate supply of soil moisture and / or supplemental irrigation from well defined sources.

- Securing the participatory role of bedwin,women,youth NGOs in the phases of planning – implementation and follow up .
- Compile and process the available indigeous knowledge, practices and beliefs related stakeholders to benefit from it and develop it into appropriate practices.
- Present alternative and feasible solutions to land ownership issues and its impacts on desertification .
- Provide local credit facilities based on feasible measures.
- Conduct appropriate demonstration, training and capacity building programs at varied levels of stakeholders local authorities , NGO's and local decision makers.

5.4.1.4. To establish an efficient desert extension service with qualified personnel and a meaningful and modern system.

5.4.1.5. To assign the role of assessment and monitoring of desertification processes, as well monitoring the impacts of applied NAP activities on the ground.

5.4.1.6. To provide incentives to problem solving research activities to address actual and urgent problems or constraints facing sustainability and updating knowledge and technologies.

5.4.1.7. To elaborate an effective mechanism to secure and integrate contributions of doners , regional and international organizations in the technical or financial contributions.

5.4.1.8. To introduce on the best means for irrigation to support, enhance and sustain the main agro-pastoral system in this zone , having in mind to avoid the hazards and pitfalls of previous irrigation projects in desert areas. To provide for processing and reuse of wastewater and drainage water through afforestation and establishing appropriate green belts at suitable locations to participate in combating sand encroachment and stabilization of mobile dunes.

5.4.2. The Nile Valley and the reclaimed desert finges

This main agro-ecological zone enjoys numerous activities and measures contributing to combating desertification . The varied successes and needs cited in relevant report suggest the following activities.

5.4.2.1. Compile the successful and significant achievements of the ongoing and previous activities to be applied on larger scale in appropriate locations of the Nile Valley , with provision of the needed requirements, funds and materials .

5.4.2.2. Formulate a unified programme for assessment and monitoring of desertification processes active in this zone through remote sensing , aerial photograph and ground truthing , to compile digital maps to follow up the impacts of measures to combat desertification. Special emphasis should be given to sand encroachment and hazards of mobile dunes at the desert fringes of the fertile valley. Such desertification process received , so far, a minimal attention despite reports pointing out that more than 750,000 feddans show

adverse impacts in many areas including Fayoum, El Menia, Assyout and others. Sand encroachment is reported to threaten the course of the Nile (from the western direction) in several locations, as well as, some of the shorelines of Lake Nasser.

The proposed unified programme for assessment and monitoring would assign complementing duties to the several institutions such as the Desert Research Center , the Land , Water and Environment Institute / ARC, the National Authority for Remote sensing and Space Sciences , University of Alexandria and others.

Proper coordination among the participating institutions should be carried out from the inception of the project activities with delineation of the requirement additional equipments and meeds for training and capacity building.

5.4.2.3. Legislations should be reviewed pertinent to the following :

a- Providing proper mechanisms for more efficient enfrocement of legislations especially that for combating urban encroachment on fertile lands which is still through taking place at a lower rates than before.

b- Formulate new legislations to support the activities of combating desertification .

5.4.2.4. To launch well coordinated public awareness compagins targetting the varied stakeholders.

5.4.2.5. To provide incentives to problem solving research programmes according to requirements and needs.

5.4.3. the Inland Sinai and the Eastern Deserts

As depicted from the previous chapter this ecological zone requires the transformation of research findings into activities to be conducted in an integrated approach in pilot and demonstration areas well chosen and defined. Such pilot areas and demonstrations should be carried out according to the following issues.

5.4.3.1. Control of flash floods, defining its usual pathway with modern remote sensing techniques; devising technologies to curtail and minimize its adverse impacts and finally provide the means to get the benefit of such water resources which, in many cases, collect huge amounts of surface runoff water.
The location of these activities could included prone areas in inland Sinai, locations in the Red Sea areas with threats to tourist sites and facilities.
Institutions with required assessments and monitoring capabilities have been referred to in previous sections.

5.4.3.2 Field application of the management packages which have been achieved through the combined efforts of the Research Stations and field sites of investigations affiliated to the DRC and other scientific institutions that were referred to before.

5.4.3.3. Special considerations and field activities should be geared towards conservation and utilization of the highly valuable genetic resources, plant

communities and species of the diversified elevated areas and its associated wadis , the prevailing soils, under varied conditions of temperature, rainfall and runoff conditions.

Such activities are the subject of considerable financial support from doners concerned with environmental issues.

The integration of such activities with appropriate resource management and utilizations practices could provide considerable boosting of the income of local stakeholders and alleviate poverty, and provide added job opportunities, in addition to provision of export commodities produced by the multipurpose plants of high economic returns.

5.4.4. The Western desert, oases and southern areas

As referred to before the main activities to combat desertification are focused on the management of resource base under the conditions of the Oases in the Western Deserts. Developmental activity and land reclamation processes have been conducted for several decades. Meanwhile, the introduction of macro projects for remote deserts areas in the south including Tushka, East Owienate and Darb-AlArbein projects pose major challenges for sustainable development and highly possible sources of desertification processes. These need to be addressed.

The programmes that need high priority in the short and medium term of priorities are the following:

5.4.4.1. Formulation of databases of the multitude of investigations, surveys and applied practices for each of the main Oases in this zone.

5.4.4.2. Carry out in-depth analysis of the data and research outcomes with particular reference to many contradicting reports from consulting firms and institutions pertinent to the sustainability, quality and attributes of the soil and water resources.

5.4.4.3. Ample consideration should be given to elaborate appropriate measures to protect the cultivated areas and infrastructure against sand encroachment of mobile dunes.

5.4.4.4. Innovative approaches to properly manage the natural resource base of contained hydraulic systems of fragile nature should be investigated based on the available data of previous activities. Integrated management programmes should receive field verification.

5.5. Proposed Programmes of Action

Programme 1

Rehabilitation of drainage in old irrigated farmlands.

Programme 2

Soil rehabilitation in old irrigated farmlands.

Programme 3

Soil conservation in rain-fed farmlands.

Programme 4

Rehabilitation of rangelands and livestock management.

Programme 5
Sustained agriculture in farmlands irrigated with mixed water and in newly reclaimed (remote areas) farmlands.
Programme 6
Stabilization of mobile sand bodies.
Programme 7
Monitoring and assessment of land and water resources, maintoring land degradation and monitoring impacts of rehabilitation programmes.
Programme 8
Education, training and manpower development.
Programme 9
Public participation, including :
- Awareness,
- extension and vocational training ,
- civil socity bodies (NGOs), etc.,
- women participation in rural development.

Programme 10
ProgrammeNational institutional arrangement.