

3 STATE OF ENVIRONMENT IN MOROCCO

The present report was based on the Report on State of Environment in Morocco⁴ (REEM), which was prepared by the Environment Department and completed by environmental monograph results, also prepared by the Department⁵. This report has been organized according to the themes accepted within the planned vision adopted at NAPE level. The corresponding themes are as follows :

- Water resources
- Soil resources
- Air and energies
- Natural surroundings
- Natural disasters and major technological risks
- Urban spaces and environment

For each theme, the following paragraphs present the main elements coming out of the above-mentioned environmental assessments, based on indicators resulting from REEM and environment regional and local monographs.

3.1. Water resources

Morocco is characterized by a semi-arid climate marked by an important yearly and inter-yearly irregularity as well as by an important space variability. Renewable water resources in Morocco are evaluated at an average of about 21 billion m³/year. They provide water for rivers and underground water, that is 1000 m³/year/inhabitant. Sebou, Bouregreg and Oum Errabia basins represent by themselves 2/3 of the country's potential. The hydrous potential which can be (technically and economically) mobilized is estimated⁶ at 21 billion m³, out of which 16 billion coming from surface waters. Quantities really mobilized do not exceed 56% of the potential.

Agriculture remains the activity consuming more water, with 80% of the general consumption. What is left is dispatched among industrial activities and domestic use.

⁴ Report on State of Environment in Morocco (REEM), Direction of Observation, Studies, and Coordination, 1999

⁵ Regional environmental monograph prepared by Environment Department between 1995 and 1999.

⁶ Hydraulic in figures, Ministry of Public Works, Professional Training and Training for Managerial Staff, Hydraulics General Administration, 1993

As far as supplying drinking water is concerned, junction rate in urban areas is of 83% (1998). In rural areas, the rate of getting drinking water was 14% in 1994 and reached 40% in 2001, result of PAGER program implementation. Moreover, it is planned that at the end of this program, that is in (2010) 11 million inhabitants in rural areas, dispatched over 31000 villages⁷ will get drinking water.

Water resources are undergoing a serious scarcity due to lack of rationality in using and managing the hydrous potential. For instance, the deteriorating conditions of AEP networks in cities lead to a loss of 35% of delivered waters. The silting up of dams impounded waters is an element that jeopardizes the output of hydraulic work, which results by a loss of more than 60 million m³ of storage⁸ capacity each year. Beside these quantitative problems, water resources are undergoing a quality deterioration due to different forms of pollution. Discharging domestic and industrial waste without processing them is harmful to rivers and marine areas. The intensive use of herbicides and fertilizers is also among forms of pollution that damage underground waters. The latter were also facing the problem of mineralization due to sea water intrusion, result of surexploitation (case of Gharb, Triffa ... water tables). On its side, the important concentration of activities in limited spaces generate a pollution which goes beyond any auto-purification of aquatic surroundings and rivers already weakened by successive droughts and hydraulic accommodations. Added to all these elements, casual pollution as well as the one generated by rubbish dump usually located on strands of rivers.

3.2 Soil resources

For a country like Morocco for which agriculture constitutes the mainstay sector of economy, soil constitutes a strategic resource. Morocco has 8,7 million hectares of useful agricultural land (SAU), that is 12% of the total surface of the country. The irrigated land represents 13% of the useful agricultural land⁹.

At the exception of alluvial plains, Moroccan soils are in general fragile because of their weak content in organic material, of the substrate nature, strong slopes and climate aggressiveness.

Soils are subject to several types of pressure:

- Hydrous and wind erosion: soils erosion and loss in earth constitute a natural deterioration process which affects at different degrees, an important part of the national territory. Thus, in a total watersheds surface of about 20 million hectares, surfaces exposed to risks represent 75%. The annual accumulated loss in earth is estimated at about 100 million tons and the storage capacity lost due to the silting up, was estimated at about 50 million m³/year.

⁷ Document presenting PAGER, prepared for PAGER half-way assessment seminar, Hydraulic General Administration, February 7th, 2002.

⁸ PDES document 2000-2004, tome 3: Basic infrastructures, Ministry of Economic Forecast and Planning

⁹ Document of National Action Program for Struggle against Desertification, Ministry of Agriculture, Rural Development, Water and Forests, June 2001

- Non convenient agricultural practices: soils productivity can decrease, or even become null (due to salinity for instance) if the agricultural practices do not respect a certain number of rules as regard to rotation, ploughing and irrigation techniques . A study¹¹ was made within the International Program of research on irrigation and draining techniques, estimates the surface of soils in Morocco which are threatened by salinity excess, at 500 000 ha. Other studies report that more than 37000 ha of irrigated soils are already seriously attacked by salinity.
- Urbanization and Agricultural lands: non controlled urbanization and illegal building occur in general on the most productive lands of the urban centers. Moreover, the SDAU instead of introducing regulations which would limit agricultural land disappearance, define extremely extended zones, often disproportionate compared to real needs of these urban centers.
- Operating techniques on mining ressources as well as methods used in the majority of sites are archaic and do not plan for any rehabilitation work or restoration of the exploited sites. They, furthermore, generate polluting material which contributes to air, water and soil contamination. The major generated pollutants are metals dust and chemical products residues used in valorization processes as cyanide and acids .

3.3 Air and energy

In urban areas, air pollution is not sufficiently estimated. Available studies have a prompt character and are often qualified of being little representative. Cities having been the subject of these studies are Casablanca, Rabat, Marrakech¹² and Oujda .

In Morocco, atmospheric pollution is mainly due to emissions of industrial units and transport. Emissions of GHG (Greenhouse Gases) in Morocco are less important than they are in other countries, but Moroccan cities do not escape from atmospheric pollution problems. It is the energy sector that contributes more to these emissions with 56% of the total emissions, followed by agriculture (25%), forests (7%), industrial processes (7%, particularly in the line Mohammadia - Safi) and waste (5%).

The energy sector, apart from the nature of used fuels and production and consumption patterns, represent one of the principle sources of pollution in Morocco. Bad oil product quality used in Morocco is well known. It contributes, to a very important degree, in increasing the harmfulness of polluting emanations from thermal power stations, industrial units and cars exhaust fumes. It is suitable to point out at this level, that renewable energies are not widely used and thus contribute till nowadays by an insignificant percentage to the national energizing statement.

¹¹ United Nations Program for Development and World Bank

¹² Inventory of greenhouse gas, Environment Department, April 1999.

3.4 Natural surroundings

This theme regroups all aspects related to fauna, flora and natural ecosystems. Sectors dealt with are about biodiversity, fragile ecosystems, forests and ranges.

3.4.1. Biodiversity

The geographical position of Morocco, the diversity of its climate, its land forms and its natural surroundings make of it one of the richest countries in biological diversity in the Mediterranean region. This richness can be seen in a flora composed of 7000 species subject to inventory, 1350 out of them are endemic. For its part the Moroccan fauna is well varied, with more than 24000 species. It has 92 land mammalian species, 334 bird species and about 15300 land invertebrates. Sea fauna counts more than 7100 species, and aquatic continental fauna includes 1575 species¹⁴.

Humid zones are particularly rich as far as biodiversity is concerned. They actually count twenty permanent lakes concentrated essentially in the Middle Atlas and about ten inshore swamps. Among these zones, four are classified with sites of international importance according to RAMSAR convention. It concerns Merja Zerga (Kenitra) reserve, Sidi Boughaba (Kenitra) reserve, Affenourir (Ifrane) lake, and Khnifis (Laayoune) bay which constitute nests for migrating birds. Besides, 13 other humid zones are considered of international importance.

Biodiversity in Morocco is the subject of different pressures, most of which are due to socio-economic factors. Resources surexploitation (fishing, gathering algae and corals, grazing...) the loss of housing caused by deforestation, urbanization and loss of humid zones as well as the pollution of life surroundings threaten an important number of species with disappearance.

Humid zones are particularly getting deteriorated because of drought and anthropogenic pressure. The chemical pollution caused by effluent discharging of worn-out waters and artificial draining of soils for agricultural needs or urbanization, leads to ecosystem destruction, disappearance of many fauna and flora species and disruption of intercontinental circuits of migratory birds.

According to the national study on biodiversity, several species of fauna and flora are threatened with disappearance of which 1670 species of flora, and 610 species of fauna including 85 sea fish species and 98 species of birds.

3.4.2. Fragile ecosystems

Coastline: coastal zones in Morocco are of an important ecological interest. They are composed of several types of habitats (lagoons, estuaries, beaches and cliffs) and shelter an extremely varied flora and fauna. They also have very entertaining landscapes. Furthermore, Moroccan coastline is the support for an important economic activity. On the Atlantic coastline

¹⁴ National study on Biodiversity, State Secretariat in charge of Environment, 1997
National Report on Biodiversity, presented to the 4th Conference of signatory parties to the Convention on Biodiversity (Bratislava, 1998)

live 61% of the big cities urban population, 80% of industries permanent employees and 53% of tourist capacity and 92% of maritime traffic.

This concentration of urban and tourist activities (sometimes even in public maritime field), as well as that of industrial and harbor facilities in a reduced space lead to a multitude ways of coastline environment deterioration. Dumping of waste water, hydrocarbons, and dangerous substances is the reason behind the deterioration of sea environment, which has bad consequences on piscatorial resources, and therefore, on fishing activities and populations survival which depends on it. The demographic excess, accentuated by rural depopulation encourages the development of slums and diseases. Harbors activities also generate other forms of pollution which results from discharging oil products and as well as emission of dust coming from manipulating bulk products. Beaches are also exposed to problems in their natural equilibrium due to abusive extraction of inshore sand which may provoke irreversible withdrawal of the coastline and destruction of natural habitat.

Oasis: Moroccan oasis spread over the big saharian valleys of the south, particularly in the Province of Ouarzazate and Errachidia and occupy a surface of 44.000 ha (Tafilalet oasis is the biggest in the world) .

Oasis are fragile ecosystems. They are threatened mainly by two problems: Salinity¹⁵ and sand dune. Those forms of deterioration are aggravated by obstinate droughts and cultural practices, grazing of spontaneous vegetation and excessive harvest of woody plants for firewood in palm groves pastoral areas. Losses due to sand dune in Errachidia and Ouarzazate oasis have reached 115 ha between 1960 and 1986. For their part, 5.500 ha , that is 10% of total surface of Tafilalet palm groves have been invaded by sand.

Mountains: Mountains constitute an important component of Morocco relief. They cover 15% of the national territory. 35% of the country rural population live there. Moroccan mountains are distinguished by the variety of their ecological features. Thus, among the different sets of Moroccan mountains, an important diversity is clearly shown at flora and fauna levels as well as at rain, nature and soils fertility levels.

The regions of mountains undergo a set of pressures shown through over-exploitation of natural resources due to the increasing demographic growth and to overcrowding in certain regions, as well as to effects of obstinate drought. The deterioration of the resulting environment is aggravated by numerous zones vulnerability to erosion (the rate of deterioration in Rif mountain zones is about 2000 t/km²/year)¹⁶ and by landslides as well.

This situation is more acute especially that mountainous zones have been marginalized in the absence of socio-economic development projects and life conditions precariousness.

¹⁵ A study was made in 1981 by Tafilalet ORMVA, concerning 21000 ha, has revealed that 5% of palm groves soils are salty (4 to 6g/l) and 18% are very salty (>16g/l). An inquiry was realized in 1998 by the same Office indicates that 7.6% of this land is deserted because of high level salinity

¹⁶ Study for elaborating the National Plan for Developing Pouring Basins, Administration of Water and Forests and Soil Preservation, 1975.

3.4.3 Forests

Forests represent 12% of the national territory, that is a surface of nine million hectares, of which there is more than 5.8 million of natural forests : 13.2000 ha of cedars, 1.36 Million ha of evergreen oak, 830.000 ha of argane, 350.000 ha of cork oak, 600.000 ha of thuja, 110.000 ha of pine, 330.000 ha of juniper, 970.000 ha of secondary essences and 1.1 Mha of saharian acacia). Reforestation concerns about 530.000 ha¹⁷.

Moroccan forests constitute the support for several economic activities (10 million working days per year and 220 million dirhams representing transfer incoming handed over to townships. Forest biomass has an incontestable energizing and pastoral function for rural populations and plays an ecological role for flora and fauna biodiversity. It also plays a role in soils protection, in cycle regulation and in hydrous results watersheds.

Yet forests are submitted to different forms of deterioration which can be seen through the declining rate of forests of about 31000 ha per year. Forests ecosystems are submitted to multi-pressures. The main important ones are : increasing demand on woody products due to population growth, woodfire exploitation is evaluated at about 3 times its renewal capacity (that is a decline in forests surface of about 20 to 25 000 ha / an) , direct land breaking for agriculture (about 4500 ha/year), forest pasture particularly in drought years, fires devastating about 4500 ha / year and cities extension to forests detriment

3.5. Natural disasters and major technological risks

3.5.1 Natural disasters

It is mainly about disasters related to four types of risks i) earth tremors risks because of Morocco being at the extension of active zones (South Atlas Accident), ii) flood along valleys of rivers often densely populated and with an agriculture mostly irrigated (flood in Ourika Valley, occurred in 1995 and 1999) or in flooding plains as the Gharb one, iii) slips of lands on mountains sides to crumbly and little steady soils (hafet Ben Zakour in Fez, in 1988) and iv) fires in forests, devastating hundreds of hectares each year.

Handling this natural disaster issue should bring solutions to the following constraints and insufficiencies:

- Absence of a global and coordinated strategy for prevention and struggle against natural disasters;
- Insufficiency in integrating natural risks factors in the process of urban planning, thus leading to dragging precarious buildings on high risks sites (unsteady slopes, river banks, clay land etc.)
- Insufficiency in preliminary cartography researches about natural risks.

¹⁷ Forests National Plan , Ministry in Charge of Water and Forests

► National legislation incompleteness as regard to this matter (excepting for the law on water which provides clauses dealing with innondations) and a multitude of intervening parties which reduces natural ressources prevention capacity.

3.5.2. Technological risks

Several sources of nuisances and technological risks are pointed out in Morocco. Some of them can occur as a result of accidents while transporting chemical products either by maritime or land transport. Others are bound to applied practices in the industrial sector.

Risks of accidents and disasters bound to industry are particularly increased due to activities concentration along the Atlantic coastline (80%), thus, generating impacts located in certain sensitive zones, with high population concentration, such as Casablanca-Mohammadia line and Safi and El Jadida regions.

This situation is aggravated by a legal status known for its decay and lack of adjustment. Lack of coordination between different intervening parties is also a defect which is mainly due to the absence of clearly defined texts governing this sector.

The nuclear sector is still at its very early stages in Morocco and only limited to fields of medicine and scientific research as well as agriculture. This does not mean that our country is protected from impacts of nuclear wastes coming especially from outside. In fact, taking into account its geographical position, next to Europe, and considering the density of international maritime traffic dealing with radioactive products, Morocco is exposed to serious risks of being contaminated. The last incident that occurred lately in the South of Spain has revealed the risks to which Morocco is exposed.

Radioactive emanation risks are especially preoccupying because Morocco is not prepared to have under control nuclear accidents. Indeed, many deficiencies are pointed out. They are about gap loopholes in the law governing this sector, absence of a network for observation, control and supervision and an integrated and coordinated strategy concerning radioactivity at the national level. In theses conditions, one can imagine the enormous difficulties authorities are facing to implement an emergency intervention plan, in case of radioactive accident or pollution.

3.6. Urban areas and urban-related areas

Urbanization counts among the most important phenomena that have marked the Moroccan society in the second half of the last century. Cities, instead of continuing to enjoy being sustained by the economy of their influencing zones, have become the real driving forces of economic growth. This change creates many problems. Controlling urban centers extension, equipment in infrastructures and lodgings and setting up of facilities and services are all difficulties facing the national urban environment.

3.6.1. Urbanism and environment

Morocco is undergoing a strong urbanization: 51.4% of the population were living in urban areas in 1994 (against 30% in 1960). This urbanization is characterized by a lack of balance between regions and provinces (50% of the population are concentrated in coastline regions).

This accelerated urbanization rhythm, increased by a mass rural depopulation is responsible for developing a certain number of negative aspects which are harmful to environment. Shanty towns proliferation, suburbs and illegal slums (9.2% of urban households in 1994), encouraging spreading of diseases, are all consequences of a demographic overcharge. Moreover, the non-controlled cities extension is happening to the detriment of natural spaces and agricultural lands (3000 to 5000 ha per year of agricultural land are used for urbanization ends).

To these household nuisances are added problems related to air quality deterioration, mainly due to cars exhaust fumes and to industrial units waste.

Urban environment deterioration is accentuated by insufficiencies and sometimes even complete absence of legal documents concerning environment. This situation results in ambiguousness and legal situation particularly prejudicial to cities and urban centers development. On the other hand, even when these documents exist, setting-up of equipments and infrastructures rates remains comparatively weak.

Plot ratio does not take into account the impact at the level of drainage, traffic and parking spaces, which results in problems of air pollution, noise pollution and drainage network blocking.

3.6.2. Industrial pollution

The industrial pollution problem which is becoming important in Morocco, as years are going by, is distinguished by the major following phenomena:

- ✧ Strong industrial activity concentration along the Atlantic coastline (80%) especially in Casablanca - Mohammadia line and in Safi and El jadida regions.
- ✧ Predominance of old, non-adapted and polluting technologies so much at the level of production processes as well as to that of sewages handling .
- ✧ Bad planning of industrial stations, localized, in most of cases , in urban zones, not well equipped in suitable mechanisms for drainage of industrial liquid and solid waste .
- ✧ Absence of adapted laws and waste standards.
- ✧ Insufficiency in inciting measures and financing mechanisms to deal with pollution and acquire new clean technologies.

- ❖ Lack of public awareness, information and adoption of systems for managing environmental risks within companies.

In terms of impact on environment, industrial pollution, in its different forms, results in a strong deterioration of water resources and a so worrying atmospheric pollution. The latter is shown through air quality deterioration caused by carbonated emissions which usually have not been subject to appropriated processing and scrubbing. These emanations which concern particularly SO₂ and evacuated particle material have negative repercussions on the population health mainly through respiratory illnesses.

3.6.3. *solid waste*

Increasing urbanization as well as change occurring on modes of production and consumption lead to an increase in the quantity of generated waste. In Morocco, the production of Solid waste :household, industrial and medical has reached 17 500 tons/day in 1999¹⁸. Household waste is about 0.75 kg/day/inhabitant. This increase in solid waste quantity creates different problems at the level of collection (only 85% of household waste are collected), as well as at the level of dumping (only 2% of household waste are recycled or put under controled dumping). We should also mention the problems related to generally using non specialized and non adapted material while collecting and transporting solid waste (loss of lixivats in transport, etc)

The industrial waste¹⁹ (930 000 tons per year) and medical one (100 tons per day) also present various problems as well as a certain number of risks for environment as well as human health.

The absence of a global vision and guidelines for solid waste management at the national level, able to unify sporadic actions initiated by elected bodies and to orient them, remains one of the main problems in this field. This problem is accentuated by insufficiency of financing means and qualified human resources.

3.6.4. *Liquid drainage and sanitation*

Liquid drainage is considered a tricky environmental problem in urban centers and cities in Morocco. Out of 500 million m³ of waste water thrown in urban areas²⁰, only 74% are collected by sewer networks. In terms of surface, the deficit is of about 20.000 ha of urban surface not yet purified.

Liquid drainage problem is first of all a financial one. Establishing costs of processing networks and stations is generally prohibitive (200 000 to 300 000 dh/ha for investment and 6 to 10 dh/m³ for drainage)²¹ which is too much for townships financial means. The question is about financial and institutional arrangements that would allow to take in charge these costs.

¹⁸ Collecting and processing household waste in Morocco, Ministry of the Interior, 1995
Managing industrial and dangerous waste in Morocco

¹⁹ Situation of industrial waste in Morocco, Ministry of Commerce, Industry and Craft Industry, 1994

²⁰ Report on the State of Environment in Morocco , Environment Department, 2001.

²¹ Figures delivered by DEA while preparing for NAPE elaboration, 2000.

On the technical level, there are many proposals and the question is only about the choice to be made according to data specific to each city and center.

Finally, on the institutional level, it deals mainly with stopping more appropriated arrangements in favor of an efficient waste management and assuring costs recovery.

3.7 Summary for the state of environment

The following table sums up the state of environment as described in previous paragraphs. It is based on information taken from REEM and regional and local environmental monographs, realized by the Environment Department.

THEMES	ENVIRONMENTAL PROBLEMS
<i>Water pollution</i>	<ul style="list-style-type: none"> - Salinity of underground water tables - Deterioration of rivers quality due to discharging industrial and household waste without processing them. - Hydrous ressources contamination by pesticides and fertilizers - Absence of standards and laws regarding water - Underground reserves weariness - Dams silting up
<i>Drinking water and drainage</i>	<ul style="list-style-type: none"> - Losing water due to leaks at the level of drinking water networks (35%) - Rural areas being under-equipped to get access to drinking water - Sanitary risks related to water contamination - Insufficiency concerning purification of waste waters and use of raw water for irrigation. - Proliferation of hydrous origin diseases
<i>Soil resources</i>	<ul style="list-style-type: none"> - Losing fertility and arable layers because of wind and hydrous erosion (22 000 ha / year) - Dams silting up due to erosion - Soils saltiness. About 500 000 are potentially threatened with risks of salinity. - Soils desertification. (90% of Moroccan soils are threatened with desertification problems) - Urban zones development to the detriment of agricultural land - Sand dune in oasis and dry zones - Deterioration due to mining and quarrying activities

THEMES	ENVIRONMENTAL PROBLEMS
<i>Air and Energies</i>	<ul style="list-style-type: none"> - Air pollution, circulation, industry, handicraft... -Nuisances of quarrying dust -Bad quality of used fuels -Decrepit cars -Absence of reliable and exhaustive data on air quality. -Industrial and carbonated emissions not processed - Absence of standards and laws
<i>Biodiversity</i>	<ul style="list-style-type: none"> - Threats to rare fauna species - Over-exploitation of aquatic fauna - Destruction of ecosystems which are the habitat of a diversified fauna - Destruction or excessive exploitation of flora including endemic species
<i>Fragile ecosystems</i>	<ul style="list-style-type: none"> - Deterioration of coastal environment: harbor activities, non-controlled urbanization - Human activity concentration at the coastline level - Piscatorial resources deterioration - Unprocessed industrial and household waste - threats of oasis sand dune - Risks of salinity - Natural or artificial drying of humid zones - Natural resources over-exploitation - Erosion and landslide - Under-equipment of mountain areas - Deterioration of population living conditions
<i>Forests</i>	<ul style="list-style-type: none"> - Breaking - Non controlled extension of cities to the detriment of forests - Exploitation for energizing ends (firewood) - Forests deterioration due to fires - Ranges breaking - Ranges over-exploitation

THEMES	ENVIRONMENTAL PROBLEMS
<i>Natural disasters</i>	<ul style="list-style-type: none"> - Insufficiencies as regard to risks characterization and knowledge - Insufficiencies as regard to management and intervention capacities in case of crisis - Insufficiencies in the follow-up of risks expectations and control
<i>Main technological risks</i>	<ul style="list-style-type: none"> - Insufficiencies as regard to risks knowledge and their assessment - Insufficiencies in law provisions regarding technological and industrial risks management - Insufficiency when it comes to prepare institutional operators in the field of control and follow-up of technological and industrial risks.
<i>Urban development and environment</i>	<ul style="list-style-type: none"> - Anarchistic development of cities and centers - Slums proliferation - Rural depopulation problems - Deficiency basis infrastructures: AEP, drainage... - Green spaces reduced - Pressure exerted on the existing green spaces - Deterioration of the urban fabric and historical heritage in old cities - Risks on health due to different aspects of urban pollution
<i>Industrial pollution</i>	<ul style="list-style-type: none"> - Deficiency in standards and laws related to dumping - Industrial activity concentration in sensitive and risky zones - Deficiency in inciting people to use suitable technologies
<i>Waste</i>	<ul style="list-style-type: none"> - Wild and non controlled discharges (controlled discharge almost absent) - Collecting household waste is not covering all areas - Absence of special waste processing: toxic waste, hospital waste, pesticide waste - Waste undervalorization - Decrepit conditions of urban drainage networks
<i>Drainage</i>	<ul style="list-style-type: none"> - Unprocessed waste - Natural water contamination - Coastline contamination - Proliferation of hydrous origin diseases