



Islamic Republic of Mauritania

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National Adaptation Programme of Action to Climate Change

NAPA-RIM

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and of Environment**

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Project Coordination Unit**



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List of acronyms

CC	Climate Change
CE	Community Educator
DENV	Department of the Environment
DM	Dry Matter
DRTE	Department of Research, Training, and Education
DSFSC	Department of the Surveillance of Fisheries and Marine Control
EEZ	Exclusive Economic Zone
GHG	Greenhouse Gases
IEC	Information Education Communication
INCCC	Initial National Communication on Climate Change
IPCC	Intergovernmental Panel on Climate Change
IUCN	World Conservation Union
IWRM	Integrated Water Resource Management
MEA	Multilateral Environmental Agreements
MFME	Ministry of Fisheries and Maritime Economy
MIOFR/NCOFR	Mauritanian Institute for Oceanographic and Fisheries
MRDE	Ministry of Rural Development and Environment
MWE	Ministry of Water and Energy
NADWS	National Agency for Drinking Water and Sanitation
NAP	National Action Plan to Combat Desertification
NAPA	National Adaptation Programme of Action
NCAARD	National Centre for Agronomic and Agricultural Research and Development
NCSAR	National Centre for Livestock farming and Animal Research
NCWR	National Centre for Water Resources
NEAP	National Environment Action Plan
NPBA	National Park of Banc d'Arguin
PRSP	Poverty Reduction Strategy and Action Plan
SPO	Socio-Professional Organization
UNCCD	United Nations Convention to Combat Desertification
UNCBD	United Nations Convention on Biological Diversity
UNFCCC	United Nations Framework Convention on Climate Change
V / A	Vulnerability / Adaptation

Preamble

At present, it is impossible to make accurate forecasts regarding climate change and its adverse effects, particularly at local and regional levels. Though a number of strategies have previously been devised at community level with regard to adaptation to variations of climate and to extreme meteorological phenomena, the process did not involve consultation, and none of the strategies have been indexed. Thus, one of the purposes of the present exercise is to identify the urgent measures which must be taken to broaden the range of current solutions and increase capacity for resistance to climate change and to extreme meteorological phenomena. The Intergovernmental Panel on Climate Change (IPCC) is firmly of the opinion that adaptation to climate variations and to extreme meteorological phenomena is an excellent way to develop long-term adaptation capacities.

The National Adaptation Programme of Action (NAPA) is therefore an exercise defined as a simplified and direct communication tool for spreading information on the urgent and immediate adaptation needs in Least Developed Countries (LDC), including Mauritania. The definition of priority activities summarizing the urgent and immediate needs will be the main focus of NAPA. The annotated guidelines provide the methodological approaches applied to identify priority activities, though they are not intended to be prescriptive.

The NAPA does not impose any obligations, but instead offers opportunities. It is a stage in the process designed to meet a country's urgent and immediate needs regarding adaptation to climate change. The low adaptation capacity common to LDCs is related to the bad socio-economic situation prevailing in these countries. The poor communities in the LDCs are the most vulnerable, and they need more protection. The goal of NAPA is to enable LDCs to take action on some of the causes of their vulnerability and to undertake activities aimed at meeting their needs in this area. For example, activities undertaken could include measures to reduce the adverse effects of climate change and implement forecasting policies enabling reaction to future disasters.

The rationale for establishing NAPA rests on the low adaptive capacity of LDCs to climate change; hence the need for immediate and urgent support to start devising strategies adapted to current and projected needs in the area of climate change. Mauritania does not consider the drafting of the NAPA document to be an end in itself, but rather a stage in enabling a response to needs in adapting to climate change. Activities proposed in this context are those whose further delay in implementation could increase vulnerability or lead to increased cost at a later stage.

The NAPA document, under the aegis of the Department of the Environment in the Ministry of Rural Development and of Environment, is the result of an arduous and repeated study carried out by a group of Mauritanian experts involving all the stakeholders¹ at regional level (Wilaya), and the central level (administrations, civil society, partners, and the private sector). The results of each stage have been submitted on each occasion for validation to the public and to the NAPA Implementation and Steering Committees, bringing together all the main sectors in Mauritania.

The group of experts of Mauritania's National Adaptation Programme of Action have fully assimilated the philosophy underlying the preparation of the NAPA process, and in that regard, acknowledge the tremendous and valuable efforts made by the LEG team to provide

¹ See appendix for the list of persons and experts involved in the NAPA preparation process.

our local experts with precise guidelines detailing the procedures required for its implementation.

To all those who participated in the NAPA preparation process, I am addressing my sincere gratitude and thanks, as well as those of the Government of Mauritania and its people. In particular, I am referring to the UNEP/GEF Staff, Mr EL Hadrami Ould Bahneine, Director of Environment, Mr Baye Fall, the Project Coordinator, the editing task force team, the expert groups (sectoral and ecosystemic) as well as the stakeholders in general. Special thanks are addressed to Mr Ravi Sharma of UNEP before his departure to his new GEF assignment for his diligent assistance from his distant location, and without which this work could not have been achieved.

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Part 1: COUNTRY PRESENTATION AND PROJECT RATIONALE

I. Introduction and parameters

1. The National Adaptation Programme of Action (NAPA) is a mechanism within the United Nations Convention on Climate Change, which is specifically designed to help LDCs to identify their priority adaptation options to climate change and to communicate these in an accessible manner.
2. Mauritania is an LDC, and has also signed and ratified all Rio conventions, namely the United Nations Framework Convention on Climate Change (UNFCCC) and its protocol, called the Kyoto Protocol, the Biodiversity Convention and the Convention to Combat Desertification. For two reasons², Mauritania became the lead country to launch the NAPA preparation process and therefore gained the status of pioneer and a reference to consultations for subsequent exercises at regional and even continental level.
3. In other words, Mauritania has worked through all the NAPA stages as described in the Least Developed Countries Expert Group (LEG) guidelines. The present document summarizes the main outcomes resulting from these applications. That is, in other words, the drafting of the NAPA document is based on the main elements listed in these guidelines; in particular:
 - a) A participatory approach involving the key stakeholders, particularly local communities. The participation of the whole community, both males and females, the private sector, NGOs, and institutions of civil society was vital for two reasons. First, these people and institutions could provide information on the present adaptation strategies that the NAPA is designed to improve. Second, they are the ones most affected by climate change and therefore the main beneficiaries of the NAPA planned priority measures. This representation was extended to include the wilayas pertaining to the ecosystems that are characteristic of the country broad regions.
 - b) A multi-disciplinary approach that does not exclude any field work sensitive to climate variation.
 - c) A complementary approach based on existing plans and programmes, among which the national action plan to Combat Desertification, biodiversity strategies and national actions plans or other national sectoral policies.

² Mauritania has also carried out various activities in the areas of raising public awareness, training of experts, inventory of greenhouse gas, preparation of national communications on climate change, elaborating national action plans, undertaking thematic studies and environmental strategies, and has created departments and bodies advocating environment management: Ministry of Rural Development and the Environment, Directorate of Environment, the National Committee for Development and Environment (NCDE), the Technical Committee for Development and Environment (TCDE), the Regional Committee for Development and Environment (RCDE), etc. In general, this legal and institutional framework aims to protect the environment against any form of pollution and degradation. In this regard, the new guidelines provided by state authorities to the department responsible for NAPA, the Department of the Environment (DENV), are worthy of praise and will certainly bear fruit and, with the addition of extra human resources, will swiftly bring Mauritania to the same level as the other countries in the world involved in the field of environmental protection.

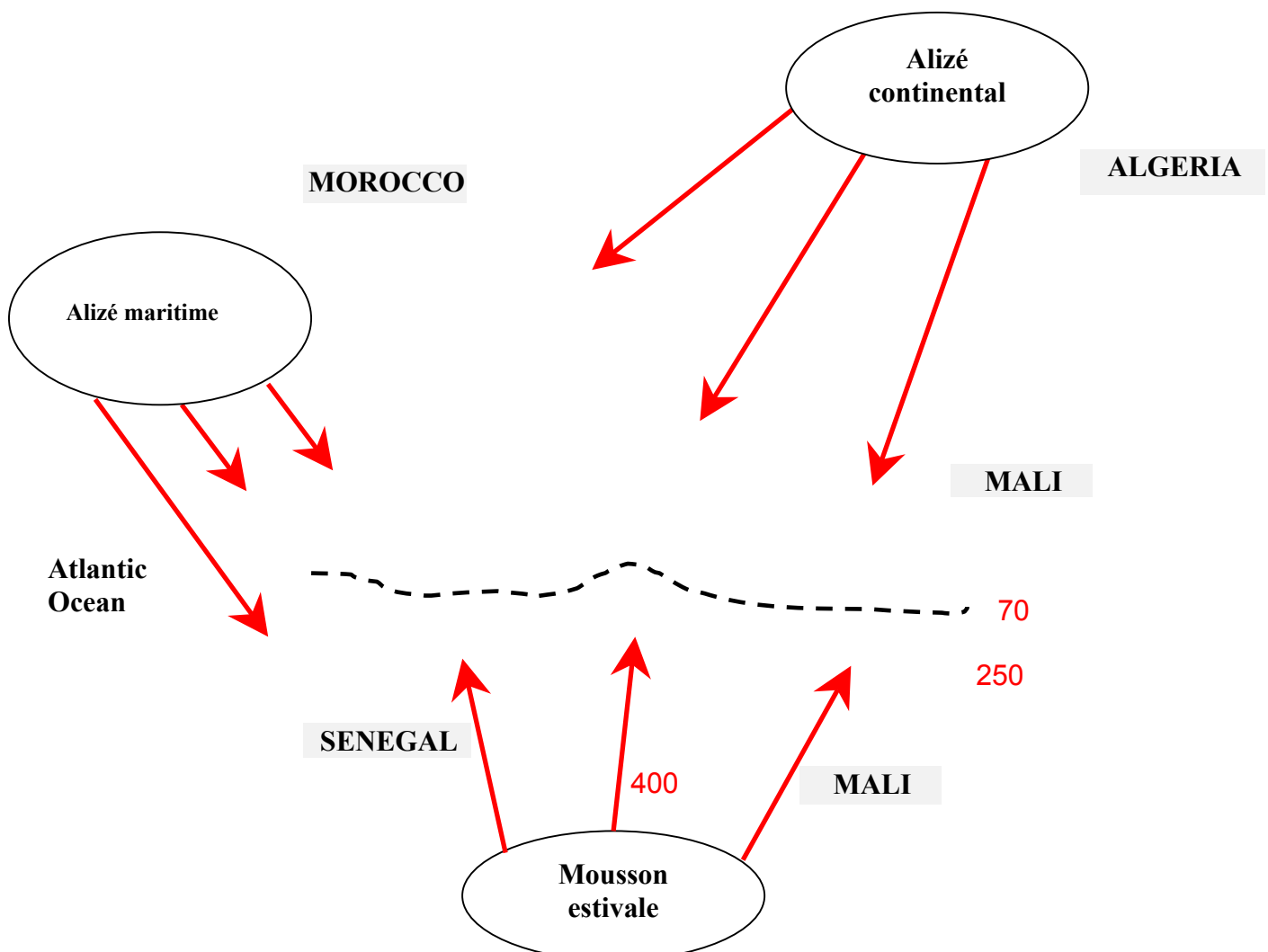
- d) Sustainable development whose principal focus is the struggle against poverty
4. Equality between men and women: Climate change has different impacts on men and women, and in most cases, the adverse effects of change disproportionately affect women. For example, with the increasing frequency of drought experienced in Mauritania, it is women who have to walk longer distances to collect water and firewood or develop new income-generating activities, such as weaving, tie-dying, etc. Women are often the chief guardians of vital local and traditional knowledge. Thus, they need to be recognized as key stakeholders in the consultation and decision-making processes, even though they have not been represented in great numbers.
 5. Countries as the driving force behind the approach adopted: This approach followed a sectoral and ecosystem approach based on the impacts observed, and the level of intensity proportionally felt by these countries during the last few years.
 6. Rational management of the environment: the environment, here more than anywhere else constitutes the pool of resources that fulfils the essential and immediate needs of communities.
 7. Cost-effectiveness: the essential factor without which it would be impossible to select the best adaptation options proposed by the stakeholders or to generate significant beneficial effects for the beneficiary regions and communities
 8. Simplicity: NAPA is different from other standard project funding requests because of the urgency attached to its preparation by its promoters.
 9. Flexible procedures, depending on specific national situations; flexibility of choice, approaches or methods.
 10. The presentation of the Mauritania NAPA document includes a list of priority activities (Part 2 – Chapter VI) and a brief rationale and list of a set of precise criteria which were used to identify priorities (Part 1). The priority activities specified in the NAPA process will be submitted to the entity responsible for the management of the NAPA funds mentioned in paragraph 6, Decision 7/CP.7 (GEF), as well as to the other sources of funding, with a view to obtaining funding for the implementation of the said activities.
 11. In the first section, Chapter 1 presents some general information about the country, relevant to the NAPA process. The general characteristics of the country are presented, together with the main pressures exerted on the environment and the way in which climate change (CC) and climate variability disturbs the biophysical processes and the key sectors. Chapter II gives a description of the background to the adaptation programme to provide a proper appreciation of the priority needs of the country, identified in Chapter III and the selection and classification tools, presented in order of priority in the following chapter. Chapters V and VI present respectively the list of priority activities and the procedure adopted in Mauritania for the preparation of the NAPA.

1.1. Country overall characteristics

Major demographic and geographic characteristics

Demographically speaking, the last population and habitat census carried out in 2000 revealed that Mauritania's population accounts for 2,508,159 inhabitants. With an area of more than one million square kilometres (1,030,700 sq. km), the calculated growth rate is 2.4%, and the density is near 2.5% inhabitants per sq. km. However, the density of inhabitants per sq. km varies from 0.4 in the north with a desert climate, to 20 in the south, in the Senegal River valley. The district of Nouakchott alone, on the Atlantic coastline, accounts for about 22% of the country's entire population living in less than 1% of the country's surface area.

Three-quarters of the Mauritanian territory is covered by Saharan desert, and the remaining one quarter is a Sahelian zone. Mauritania is therefore one of the countries most vulnerable to the effects of desertification. This is the consequence of the winds activity that sweep the country. These air masses are made up of 3 main currents blowing throughout the year: marine trade wind, continental trade wind, and the summer monsoon. The precipitation-bearing air masses are the marine trade wind and the monsoon.



Climate and the environment

This situation divides the country into two main climate zones: the Sahara and the Sahel; each of them having a coastal element and a mainland element. The coastline in each climate area is characterized by relatively high humidity, and small daily and annual variations in temperature, while the mainland area shows much greater variations in temperatures, both daily and annual, and an extreme dryness in the atmosphere, particularly in the Saharan region, which experiences a very low annual rainfall with high evaporation.

Socio-economic data

The economic potential of Mauritania relies mainly on the mining sector, fishing, raising of livestock, and to a lesser degree, agriculture. However, given that the per capita GDP is US\$380, and that 46% of its population live on less than a dollar a day, the country is included among the Least Developed Countries. It is ranked 152nd out of the 173 countries listed in the World Bank report on human development of 2002.

The economic and financial reform policies adopted by Mauritania in the 1990s with the support of the donor community made it possible to restore the major macro-economic balances and to lay foundations for sustainable growth propelled by a dynamic and competitive private sector. This resulted in the evolution of the main economic indicators as presented in the following table.

Table: Evolution of the main economic indicators

Year / Indicator	1987	1991	1997	2000	2001	2002
Actual GDP growth rate	1.9	2.9	3.2	5.1	4.6	4.2
Inflation rate (%)	8.2	5.6	4.6	3.3	4.7	4.0
Fiscal balance (% of GDP)	0.1	-6.7	4.2	-4.5	-5.6	6.3
Balance of current account excluding official transfers (% of GDP)	-27.5	-14.7	-9.0	-6.0	-10.0	0.0

Source: Office of National Statistics

This was accompanied by a sharp improvement in the main indicators of sustainable human development, as shown below:

- Gross rate of those attending school increased to 88% in 2002, and the illiteracy rate decreased to 42%;
- Improved health care (geographic accessibility to basic health training has significantly improved to reach about 80% in 2001 (within a radius of 10 km) against 75% in 1998, and only 30% in 1990);
- Guinea worm and poliomyelitis have been practically eradicated;
- Infant mortality has been appreciably reduced (87% in 2000 compared with 112.2% in 1998, and 140% in 1988);
- Life expectancy at birth has increased from 49.2 years in 1990 to 53.6 years in 1998;
- The proportion of the population with access to drinking water has increased appreciably both in rural and urban areas (the level of connection to the supply increased from 15.4% in 1990 to 35% in 1997).

These results have made it possible to push back the frontiers of poverty by a considerable margin: affecting 56.6 % of the population in 1990, financial poverty has been brought down to 50.5% in 1996 and to 46.3% in 2000.

In addition, in March 1999, the country was declared eligible for the initiative to reduce the debt of the most indebted countries in the world. This initiative was completed in June 2002 with a resulting reduction of the debt by 40%.

In the framework of this initiative, a Poverty Reduction Strategy and Action Plan for a period up to 2015 were drawn up in 2001. Long-term objectives of the strategy are as follows: (i) to reduce the proportion of the population living below the poverty threshold to 27% by 2010 and 17% by 2015; (ii) to achieve social development objectives on the basis of the recommendations of various world summits before 2015; and (iii) to reduce social and regional disparities.

After three (3) years of implementing the PRSP priority action plans, Mauritania has achieved significant progress, even though the results, in the main, have fallen short of the initially planned objectives. Thus, actual economic growth is assessed as an average of 4.1% per annum in 2001-2003, the budget balance (excluding donations) was around 4.1% of the GDP in 2003, the deficit in current accounts (excluding official transfers and oil) was an average of 10.3% of annual GDP and the inflation rate 4.6% in 2001-2003. At the same time, coverage of import costs by national reserves exceeded the planned objectives, reaching an average of 7, 8 months in 2001-2003 and even reaching 8, 1 months in 2003)³.

As far as external debts are concerned, the country completed the reinforced Most Indebted Countries initiative, which took the form of significant reduction of outstanding external debt. Mauritania's debt was reduced by 622 million US\$ in Net Discounted Value (NDV), or US\$1,100 million in nominal value and 50% of the outstanding external debt. The country's obligations in servicing the debt will be reduced by half between 2002 and 2011, dropping from US\$88 million in 1998 to an average of US\$39 million over the period under consideration.

In December 1999, the Government adopted a Declaration of Good Governance to consolidate the achievement of a democratic government and to improve the operation of the legal system. On the basis of the declaration, the National Programme for Good Governance focuses on seven areas, each of them constituting an action plan: (i) promotion of a legal and judicial framework to anchor a democratic State; (ii) modernization and strengthening of capacities in the public administration; (iii) improvement of the capacity to monitor and manage public resources and economic governance; (iv) support for the process of decentralization; (v) promotion of the private sector and strengthening of the state/private sector partnership; (vi) promotion of human rights and empowerment of civil society, and (vii) improvement of the quality of the work of Parliament.

³ From the PRSP implementation report 2002 and the Programme Review Mission (January 2004)

1.2. Pressures on the environment

Like all the other countries in the Sahel region, Mauritania experienced severe drought during the 1970s and the 1980s. The decrease in rainfall resulted in several adverse ecological, economic, social, and even cultural consequences. In fact, the drastic reduction of the vegetation increased desertification and led to a heavy reduction of the livestock and agricultural production and triggered a process of pauperization in rural communities. These formerly nomadic communities settled either in the areas they considered most favourable (wetlands), or took part in a massive rural exodus to the main urban centres.

The non-mobile and urban environment has also experienced some problems related to various forms of pollution. The quality of drinking water and sanitation has become a matter for concern as regards public health. The quality of the air in the main urban centres (Nouakchott and Nouadhibou) is being degraded by increasing quantities of vehicle exhaust fumes, all the more polluting as most of these vehicles are very old and they run on poor quality fuel.

The environmental situation is characterized by a very fluctuating and generally poor level of rainfall, massive deforestation for natural⁴ and anthropological⁵ reasons, the denudation of bio-physical protection, which accelerates wind and water erosion, and in three-quarters of the country, the real lack of productivity as far as the land is concerned (arid zone).

1.3. Bio-physical processes and climate change

Land ecosystems

The land in Mauritania is entirely located in the arid zone (Sahara and Sahel). The biological processes are affected by the water deficit existing in this zone. The fauna and flora have developed adaptation mechanisms that are now being upset and disturbed by the phenomenon of climate change (weather variability).

Marine ecosystems

The marine and coastline areas of Mauritania are an area of contact between species requiring a temperate environment and those needing a tropical one. This zone is characterized by the upwelling phenomenon, an exchange between deep cold waters and surface warm waters, which promotes great biological richness and diversity. As yet, little is known about the way the marine ecosystems in Mauritania operate, despite the great efforts made by the Ministry of Fisheries and Maritime Economy (MFME), the Mauritanian Institute for Oceanographic and Fisheries Research (MIOFR formerly NCOFR), and the National Park of the Banc d'Arguin (PNBA). In other words, little is known about the *ecobiotics* of the species and their habitats.

Nevertheless, the biological processes of these marine ecosystems are also being upset by climate change. The melting of snow and the surfaces it covers (decrease of the albedo) has two interlinked consequences: the rise in the level of water and the elevation of temperature. The latter effect has consequences on the ecology of marine species and their habitats.

⁴ Rainfall deficit, drought, wind and water erosion

⁵ Land cleared for agriculture, forest fires, use of forest trees for firewood, etc.

1.4. Key sectors and climate change

One of the main features of livestock farming in Mauritania is the optimal use of natural resources thanks to the mobility of its production system, though support for it is limited to a few activities in the field of animal health and the establishment of pastoral community organizations. The few development activities undertaken in the last 40 years to manage grazing routes have attempted to transform the production method involving the movement of livestock without regard to ecoclimatic conditions or the experience and the know-how of the farmers. The legal system has always suppressed pastoralism by means of models of agricultural intensification, and of organization of space, which has resulted in livestock being kept in one place, thus upsetting the practice of moving livestock from one pasture to another, with its consequent flexible management of natural resources. On the basis of this observation, the Government has adopted a set of measures designed to preserve and promote nomadic Livestock farming through a new pastoral code.

Agriculture is a traditional activity in Mauritania, profoundly influenced by the presence of water. Agriculture is thus very localized in the eastern and south-eastern parts of the country, and along the Senegal River. The traditional crops in Mauritania are sorghum, millet, maize, wheat, barley, and “niebe” (beans) and their related wild species. These species may be grown in association with varieties of gourds. Given the role played by the date palm (*phoenix dactilifera*) in the agricultural system as well as in local traditions, fruit growing is also among the traditional agricultural practices in Mauritania. During the last twenty years, crops such as irrigated rice in the Senegal River valley, market-gardening, and cultivation of fruit trees, have appeared in various regions of the country on an increasing scale. The four traditional agricultural methods in Mauritania are: rain-fed crops or “dieri”, subsidence crops, irrigated crops, and oasis crops.

The forestry sector is characterized by the exploitation of igneous and non-igneous resources by local communities to meet their needs. Collection of firewood for cooking used to be limited to dead wood. Now, however, urban centres are using charcoal, which is particularly devastating to rare forest formations, in order to meet the needs of fuel in households lacking any other form of energy (a programme to make available butane gas has not been able to satisfy these needs). Igneous and non-igneous resources are also being used by local communities in the construction of homes (beams), weaving mats (*Sporobolus robustus*), in herbal remedies, in tanning of hides (pods of *Acacia nilotica*), food (wild fruits), and beauty products (henna).

The fishing sector in Mauritania consists of two sectors: traditional fisheries and industrial fisheries (local, foreign, and jointly-owned companies). These two sectors are complementary but there is also some conflict related to sharing of space (access to fishing zones, the type of engines used, also competition for several species (mainly cephalopods). The traditional fisheries sector has been growing very fast. In 2001, it comprised a fleet of 4,000, including 2,790 national *pirogues* (canoes), 1,114 chartered boats, and 249 with free licences.

It is difficult to be sure of the quantities of catches made by traditional fisheries because of the dispersion of the landing sites, uncontrolled marketing networks, and the lack of cooperation on the part of some fishermen and a number of companies to put a value on traditional fishing products.

- Traditional fishing of octopus started in 1985 and it experienced a rapid growth to reach peak production of 8 000 tons in 1992.
- Green lobster fishing has experienced uneven development. However, this type of fishery has been decreasing overall since the 1980s.
- Mullet fishing (yellow mullets and black mullets) has experienced great changes related to the high financial stakes involved in marketing the dried eggs of this species on the European markets. Between 1985 and 1994, its production ranged between 100 and 1,400 tons.
- The fishing of kob (or southern meagre) was stable from 1985–1987 (about 2,000 tons) and it experienced a sharp increase between 1988 and 1989 (5,000 tons and 4,000 tons). Since then it has been steadily decreasing.
- The catches of sardines are not accurately known. However, the Mauritanian Institute for Research on Ocean and Fishery uses the figures from the health certificates and quantities sold on the market in Nouakchott to give an estimated production figure of around 4,000 tons a year.
- Rays and sharks are fished in the PNBA. Reports also state that at Nouadhibou, sharks are fished when kob are not available. A rough estimate regarding the PNBA puts these catches at around 2,600 and 2,800 tons of selachians (1,300-1,600 tons of guitar rays, 500-700 tons of tollo (shark) and 500-800 tons for the other species).

II. Framework of the Adaptation Programme

This chapter describes observed and projected weather variability and climate changes, as well as the actual and potential adverse effects expected from these changes. These results are based on studies and research already carried out or in progress and/or on empirical and historical information and traditional knowledge.

2.1. Adverse effects of climate change

The most obvious effects of climate change on the land ecosystem in Mauritania is desertification and its consequences. In fact, the disappearance of the vegetation gives rise to the movement of the sand and to badlands, depending on the type of substrata. In either case, climate change entails damaging consequences for both rural and urban environments and communities, which are ecological, social, and economic in nature.

Climate change (weather variability) affecting water courses and resources means a reduction in production potential, increased livestock costs, restriction of the vital concept of space, generates more urban agglomerations and therefore reduces grazing lands, causes the level of the water-table to fall, and springs and other natural sources of water to disappear.

As far as production systems are concerned, the most vulnerable, and the most affected, activities are those dependent upon rainwater, especially rain-fed agriculture. The production systems with low or even no vulnerability are pastoral systems where owners are dwelling in urban areas, and, semi- and/or intensive systems. With regard to the health of the animals and the survival of the livestock, the method of managing the herds, long-distance moves and heavy concentration of animals around wells, tend to promote contagious diseases. Furthermore, periods of shortage of fodder lead to problems associated with malnutrition and make animals less resistant to attack and other environmental factors.

Since 1950, Livestock farming in Mauritania has been extremely vulnerable to the effects of drought, particularly with regard to bovines whose numbers were reduced by about a third between 1969 and 1975. Furthermore, the lack of fodder as a result of drought has reduced livestock production performance. Over periods of serious lack of fodder, animals stop growing and lose weight. In fact, if the situation does not improve, it will not be possible to meet the demand for meat in the country by 2015. There would be a meat deficit of around 54,000 tons. In addition, the overall production of milk in 2015 would be about 519,000 tons, which could not meet the ever-increasing demand for milk in the country. As regards leather and hides, there is a need to establish a modern industry, to develop an efficient collection network, training and awareness among the stakeholders in this area.

At present, an estimated 55% of the total population is living in urban areas in comparison with less than 5% in the 1960s. The drastic reduction in numbers of livestock, the deterioration of financial capacity, and the massive rural exodus experienced by the livestock herders and their families have led to the emergence of vulnerable socio-professional groups. What is now being seen is a concentration of animals in the hands of farmers, civil servants and traders, because the traditional breeders have become poor and have ceased their nomadic lifestyle, and sold their livestock. For these rich people who have become owners of large herds, Livestock farming is a status symbol and represents a good opportunity for investment, which is why livestock changes hands. Furthermore, the significant changes in the production system, i.e. the decline of nomadic ways (reduction of purchases of animals that most need to be moved (camels and sheep) in favour of less mobile animals (bovines and goats) has led to the reduction of nomadic movement in both space and time, the reduction of the traditional barrier between Livestock farming and agriculture, and the establishment of both people and animals around urban areas, which has led to the emergence of peri-urban livestock herding.

With regard to marine and coastal ecosystems, the adverse effects of climate change can be observed through the rising of the sea level and of the temperatures, the increased frequency of major storms and the consequences they generate.

The rise in sea level brings with it increased flooding in the rainy season, coastal erosion, the infiltration of sea water in the water-tables, the disappearance of low-lying wet lands and all the related biodiversity, major effects on the human habitat and on all the coastal socio-economic infrastructures.

Topographical maps of the different parts of the coastline reveal the existence of a number of low areas or areas made vulnerable by human activities, which are threatened by the rise in sea level. Simulations carried out by experts during the Initial National Communication on Climate Change in 2001 estimated that the potential damage of marine transgression or flooding, as a result of climate change, could generate losses amounting to US\$ 3,956 million by 2020 and US\$ 6,330 million by 2050.

For instance, the NPBA ecosystem, noted for its high biological productivity, would be among the first to be affected by a rise in sea level. The rise in the level could mean that these marshes would be submerged, or that they would have to be maintained after being moved inland, or that they might even be extended if they experience a high level of vertical and lateral sedimentation.

The warming up of the sea as a result of climate change will have enormous consequences on the constituents of the marine and coastal ecosystems. For example, some definitively marine species might take the place of certain coastal species.

Generally speaking, this increase in heat will endanger the life cycle of some species and cause the disappearance of their habitat.

At present, fisheries and marine resources, which account for more than 12.5% of Mauritania's GDP, will also be affected by the adverse effects of climate change, through the disturbance of the biotopes of some species and the dwindling stocks of some populations. This could result in a fall in economic growth, a considerable loss of foreign exchange (decrease in exports), and an increase in the unemployment rate (in 1996, traditional fisheries generated 21,000 jobs in the country).

2.2. Background to the NAPA

2.2.1. Relationship between NAPA and socio-economic development in the country

Rationale

The summary of vulnerability studies revealed that all the vital sectors of the economy are affected by the weather variability phenomena and climate change. The socio-economic consequences are all the more dramatic given that they affect communities that live mainly on natural resources.

It is all the more important to focus on these consequences, as the measures planned in the framework of the PRSP and the current sectoral strategies do not take the aspect of climate change sufficiently into consideration.

NAPA intervention strategy

NAPA is based on a participatory approach, involving all the development stakeholders, working for the implementation of more appropriate projects for adaptation to the degradation of the environment. The identification of potential compatibilities between several environmental conventions, for example, can be probably more efficiently achieved through the active and consistent involvement of the stakeholders, since local communities and other stakeholders often work on environmental problems that go beyond specific sectors of interest.

The intervention strategy must aim to render the NAPA more consistent with development plans as well as with other national policy declarations and international obligations. For this purpose, it is important to identify the groups that have already taken part in activities related to the implementation of multilateral environmental agreements (MEA), such as national strategies for biodiversity.

Finally, the NAPA process will benefit considerably from the anticipated general involvement of the stakeholders concerned, in particular, the local communities who are the most directly affected by climate change, and who are vital to the expression of needs and the formulation of ideas for adaptation projects.

The object of this section is to show the existing relationship between socio-economic development in Mauritania and climate change, as well as the areas through which this needs to be taken into consideration in the NAPA.

Vulnerability to climate change in Mauritania

The results of the studies from the initial presentation, together with the complementary studies carried out in the context of NAPA, have enabled the consulted parties involved to opt for a sectoral and ecosystem approach based on the accurate identification of the sectors and ecosystems most vulnerable to climate change and their relationship with the living conditions of the poor in general and the rural community in particular. The main results reveal a significant level of vulnerability, related, amongst other things, to:

- Significant degradation of arable land;
- Degradation of pasture and loss of livestock;
- Degradation, even disappearance, of forests;
- High risk of collapse of coastal dune bar;
- Decrease of water resources.

The effects of climate change on the development of the country's economy can be measured through the evolution of the most vulnerable sectors and sub-sectors, i.e: agriculture, Livestock farming, forestry, but also the pressure on the water resources both for human needs as well as for others (cattle, irrigation, etc.).

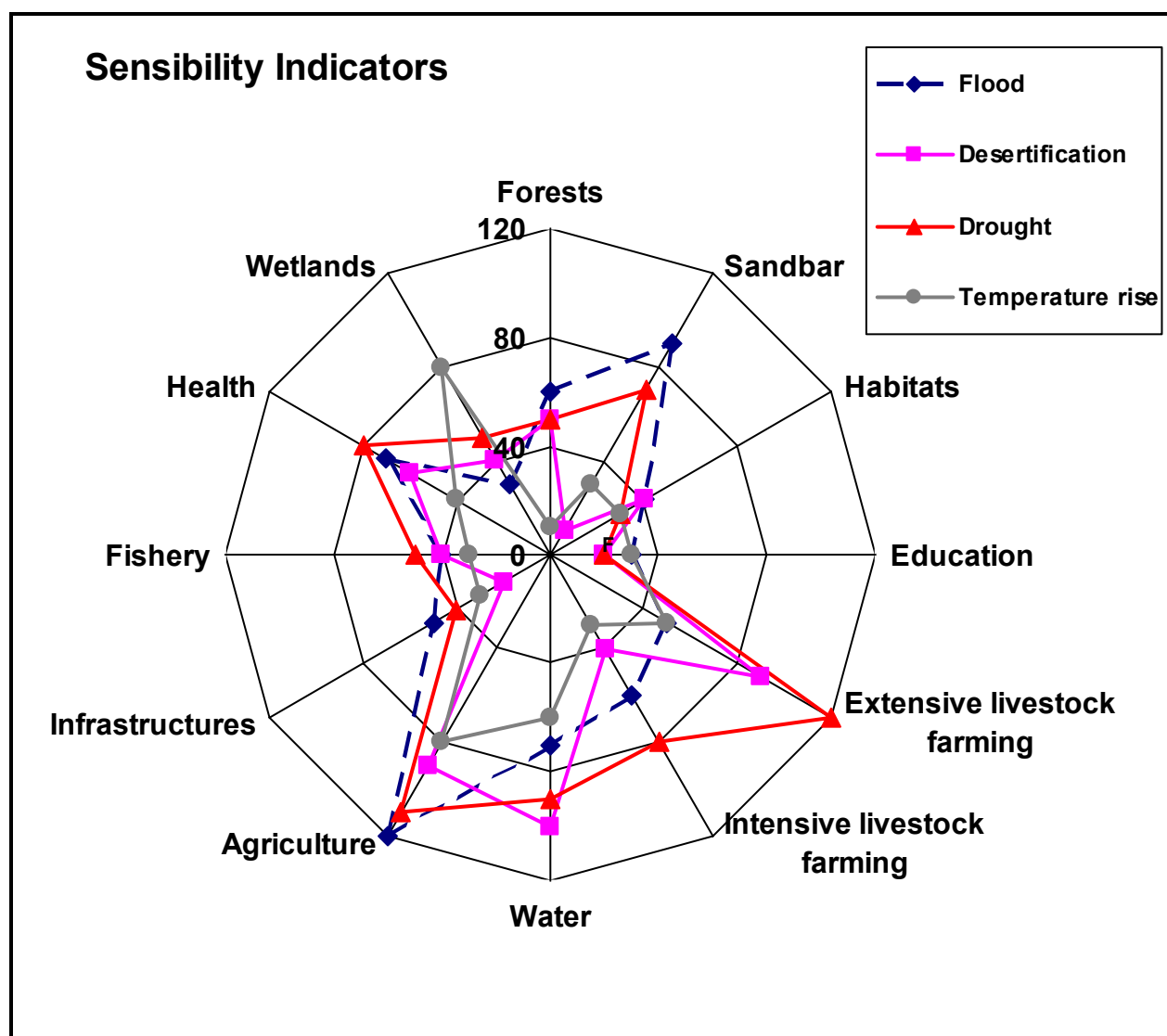
These sectors and sub-sectors correspond mainly to the rural areas. Though the rural areas are home to 45% of the country's total population and 56% of the active population, they are home to more than 75% of the poor and they generate only 26% of GDP.

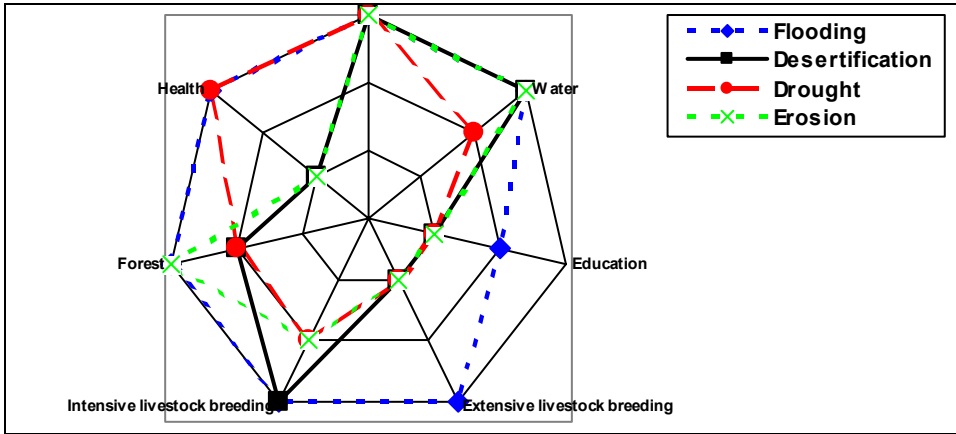
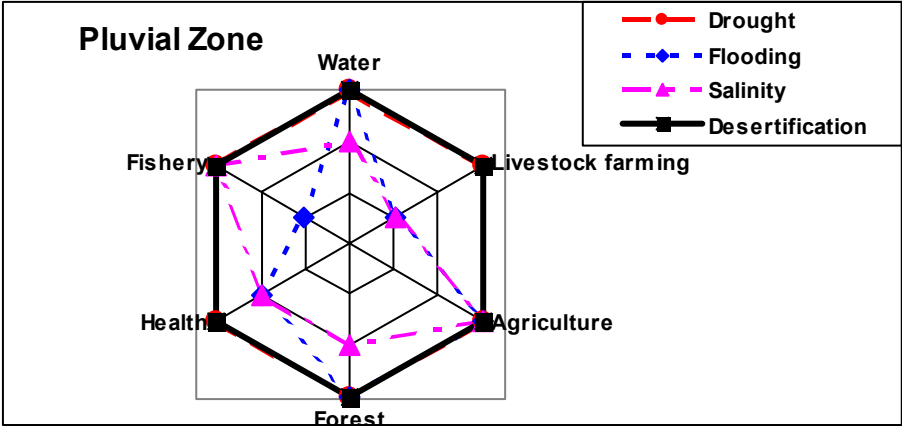
In fact, these production systems, both in agriculture and Livestock farming, have experienced a strong decline because of their almost complete dependence on climatic conditions, which have greatly deteriorated in recent decades.

Each element of climatic stress has had a considerable impact on communities' sources of subsistence and their environment (see diagrams below). For instance, the considerable fall in the level of the rainfall has resulted in the loss of livestock, a loss that is greater among animals that are moved around (extensive breeding), the massive rural exodus among livestock herders and their cessation of a nomadic lifestyle, and the drop in agricultural production (particularly rain-fed agriculture) and the massive immigration to urban areas of farmers. Thus, if the situation does not improve (a positive change in rainfall and/or implementation of mitigation or adaptation measures), the sub-sector of Livestock farming, representing about 67% of the rural sector GDP and 12% of the country's GDP, will continue to deteriorate and will result in:

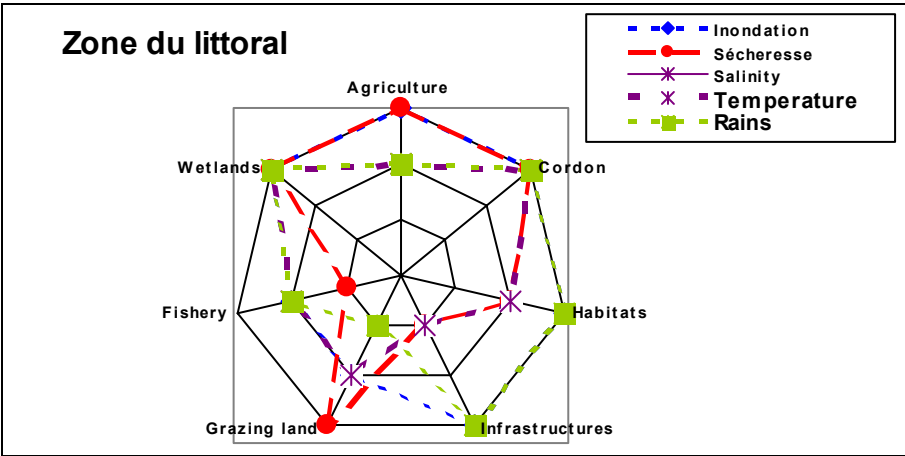
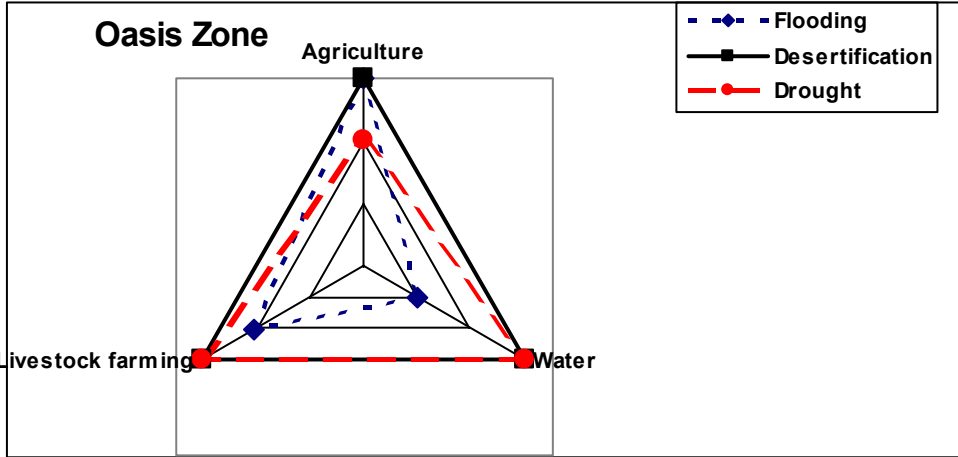
- Poor growth rate of this sub-sector, 2.6%;
- Fodder deficit by 2015, of 669,734.8 tons of dry food, whereas it is presently in excess.

Illustration of the results of consultation of the stakeholders on the status of sectoral vulnerability in the country





Thus, the vulnerability level of each sector in relation to type of climatic stress is represented on a sliding scale of 30 (< 30 means low, 30-60 medium, and > 60 high). Whereas on the previous page, a summary is made comparing on a single diagram the different climatic stress factors to the subsistence conditions of the people, on the current page is a breakdown of the zones most affected by each of the most common climatic stress factors in the ecosystem.



Climate change and the main socio-economic indicators

Mauritania is very vulnerable to climate change, owing to its climate and the advance of the desert. This exogenous factor has a significant effect on the various scenarios of the country economic growth. Thus, in the absence of an adaptation policy, the potential consequences of climate change on socio-economic development path are immediate and significant at every level.

The main socio-economic development indicators stated in the preparation phase of PRSP are the following:

- Real economic growth estimate is at 4.1% per annum in 2001-2003;
- Budget balance (excluding donations) is - 4.1% of GDP in 2003;
- Deficit in the current accounts (excluding official transfers and fuel) averages an annual 10.3% of GDP;
- Inflation rate averaged 4.6% per annum in 2001-2003.

However, imports sustainability by bank reserves exceeded the targeted goal, reaching an average of 7.8 months in the period 2001-2003 (it even reached 8.1 months in 2003)⁶.

The medium-term objectives remain those specified in the PRSP, namely sustained growth: (i) to decrease the incidence of poverty to 24.8% by 2010 and to 16.3% around 2015; (ii) to achieve by 2015 the social development objectives determined on the basis of the recommendations of the various world summits; and (iii) to reduce social and spatial discrepancies.

However, one of the fundamental conditions for the achievement of these objectives is to enable the country to be more prepared to resist climate change through a strategy of adaptation and appropriate voluntary mitigation measures. This is the ultimate goal of the NAPA process, which should be an essential core catalytic mechanism in shaping country's development strategies and policies.

2.2.2. NAPA and implementation of other multilateral agreements strategies (UNCCD and CBD) relationship

A. National strategic goals

The national strategic goals are specified in the Poverty Reduction Strategy and Action Plan to 2015. The context is to fight poverty in relying on four major focus areas which converge towards achieving the targeted objectives. These aim to:

- i. speed up economic growth, the basis for any reduction in poverty, to improve the competitiveness of the economy to reduce its dependency on exogenous factors;
- ii. appraise growth and productivity potential of the poor;
- iii. develop human resources and access to vital infrastructures;
- iv. promote finally a real institutional development based on good governance and full participation of all the stakeholders involved in fighting poverty.

⁶ From the PRSP Implementation Report 2002 and the Programme Review Mission (January 2004)

The NAPA falls within the scope of the goals that put forward a range of priority measures focussing mainly on the traditional sectors. To avoid duplication in achieving the Multilateral Environment Agreements (MEA), objectives through eco-landscapes and underlying objectives having in common the three United Nations Conventions (UNFCCC, UNCCD, and CBD), a detailed comparative study has been carried out on the content of the action plans resulting from the conventions during the preparation of the NAPA to identify synergies at two different levels:

- The relationship and the ecological links between the different ecosystems and their functions;
- The socio-economic systems established by countries to control the use, monitoring and protection of their natural resources.

The NAPA elaboration process took into account the synergy between the different conventions by inviting the various coordinators and resource persons of the programmes of the other conventions to become full members of the NAPA teams. The search for synergy is not limited to this participation. In fact, the criteria used for ranking the options include synergy between the MEA.

B. Synergy with the other United Nations Conventions

• Synergy basis between MEAs: common objectives

MEAs, especially UNFCCC, UNCCD (Convention to Combat Desertification), and CBD, have common objectives of promoting sustainability, whether it be through the achievement of sustainable development in the sectors affected by drought (Article 2 of UNCCD), sustainable use of biological diversity (Article 1 of CBD), or ensuring sustainable economic development through the mitigation of effects of climate change (Article 2 of UNFCCC). Each convention thus aims to increase the strength and resilience of ecosystems, which in turn helps to reduce the economic and social vulnerability of a country and its inhabitants.

This objective is explicitly stated in UNFCCC, which focuses on climate change with a view to promoting sustainable economic growth and continuity of food production. By reducing their vulnerability, countries are in a better position to resist external disruptions (ecological and economic) and to adapt to climate change. Similarly, UNCCD aims to ensure the rehabilitation, conservation, and sustainable management of land and water resources to improve living conditions at community level. This link is particularly vital in countries whose economic health relies mainly on activities based on the status of local ecosystems, such as agriculture.

The study of these three conventions shows that they have several points in common.

• The search for synergy is a key requirement in drawing up the NAPA.

As required by the NAPA guidelines (Decision 28/CP.7), this programme should be structured in conjunction with all the other priority programmes of the country, and especially those governed by the two other United Nations Conventions on the environment, namely UNCCD and CBD, to achieve the best results from the activities scheduled in each agreement and to avoid duplication of effort.

In fact, national strategies for implementing these conventions are carried out in closely-linked fields of activity. For this reason, the links between these strategies and the NAPA will

be studied individually, pointing out the potential for meeting the requirements of each convention through the main areas of focus of the strategy and their relationship to the priority adaptation measures proposed in the context of the NAPA.

- **NAPA and the national biodiversity strategy**

The national strategy on biological diversity (NSBD) aims to achieve all the objectives of the international convention on biological diversity, as follows:

- Emphasis upon biodiversity conservation
- Sustainable use of biodiversity components
- Equitable division of benefits resulting from the exploitation of genetic resources

At the same time as attempting to contribute to solving the priority environmental problems in Mauritania, this strategy establishes the links between environmental problems and socio-economic development of the various sectors of society in order to achieve sustainable development. This strategy advocates the conservation of biological diversity, the regulation of sustainable management of natural resources, the management of environmental risks, and integrated development of the land.

The links between the national strategy and the NAPA focus on their common objective, summed up as sustainable development through the improvement of the management of the environment. Both programmes have also adopted the same participatory methodology to develop their options and strategy measures.

Consideration of the options in both strategies shows that the existing links include all the options mentioned for the 17 themes described in the national strategy on biological diversity. Themes of the strategy cover the various sectors chosen for the NAPA.

The table below shows an example of these links

NSBD	Sector	Corresponding options
Conservation	Forestry	- Reinforcing institutional structures for nature conservation - Improving knowledge about resources and their management - Reforestation and agro-forestry
	Livestock farming	- Camel traction to install firebreaks
	Arid ecosystems	- Studying impacts on the environment - Re-organizing communities which are victims of climate change
Marine resources	Coastal ecosystems	- Preserving diversity of fish population and preventing over-fishing to promote sustainable development

Ligneous resources	Forestry	- Finding substitutes for ligneous fuels - Reinforcing institutional structures for nature conservation - Improving knowledge about the resource and its management
	Arid ecosystem	- Sand dunes fixation projects - reforestation for energy and agro-forestry
Agricultural resources	Agriculture	- Improving pumping systems (small-scale drip irrigation projects) - Improving dykes - Improving farming methods
	Livestock farming	- Developing crops for fodder
	Arid ecosystem	- Studying impacts on the environment

• NAPA and NAP

The National Action Plan to Combat Desertification (NAP) aims to alleviate the adverse effects of drought, and is based on the experiences of other countries and the recommendations formulated in the CCD to implement its agreed strategy with the objective of enabling local communities, NGOs, grass-root community organizations, and local civil structures to improve their methods of management of natural resources.

This strategy is based on the following guidelines:

- Improving the living conditions of communities by combining the issues of management of natural resources and the struggle against poverty;
- Integrating objectives and strategies from the other major conventions (such as the convention on biological diversity and the convention on climate change) into the NAP objectives and strategies;
- Capitalizing on previous experiences in the fight against desertification and mitigating the effects of drought;
- Drafting the NAP in terms as clear, concise, and efficient as possible to enable it to adapt to change.

The NAP focuses on seven priority areas: institutional, legal, protection of natural resources, production in rural areas, research and funding.

Besides their participatory methodology based on the capitalization of previous experiences, the NAP and NAPA action plans also have in common their quest for sustainable development through a balance between resources from ecosystems and the needs of local communities. In this context, both plans work towards improving methods of managing natural resources.

The priority options and adaptation measures put forward by NAPA integrate the strategy guidelines of the NAP, particularly those related to the protection of natural resources and production in rural areas.

- **NAPA and NEAP**

The National Environment Action Plan (NEAP) constitutes the general framework for the political environment of Mauritania. Its objectives, based on Agenda 21 recommendations, are to establish an overall framework for the management and protection of the global environment through: desertification control, the sustainable and equitable management of mainland and fishing resources and the monitoring of environmental problems such as pollution.

The analysis of NAPA document shows that all of its options conform to the objectives of NEAP, especially that of sustainable and equitable management of natural resources.

It must be noted that one of the major obstacles to the success of previous strategies has been the lack of knowledge of the resources. From this has devolved the great need for research, training and information. Improved cooperation between the various coordination units is indispensable in getting over this obstacle and to reduce the possibility of failure of the action plans.

2.3 Obstacles to NAPA implementation

The chief obstacles to the implementation of NAPA might be of a financial and administrative nature.

As regards funding:

- The difficulty of obtaining the necessary funds for the implementation of the proposed priority activities;
- The experimental nature of the priority activities proposed to GEF involves the limitation of the scope of the desired impact on a national scale;

As regards to administration

- The absence of an institutional framework specific to the implementation of NAPA benefiting from operational support; the bodies National Centre for Development and Environment (NCDE), Technical Centre for Development and Environment (TCDE), Regional Centre for Development and Environment (RCDE) and others bear witness to a lack of driving force;
- The obsolete nature of the laws which exist on the environment in relation to the conventions (MEA);
- The as yet informal nature of the project as perceived by the decision-makers in general;
- The diversity of the mechanisms engaged at national level in the area of the environment without any obvious connecting relationship, which necessarily weakens the DENV.

All these obstacles will have to be surmounted before a positive impact can be hoped for on the priority adaptation needs, but they have still to be defined.

III. Identification of essential adaptation needs

Climate change has created a need for adaptation in the various vulnerable sectors. For this reason, response strategies have been drawn up by the communities concerned.

3.1. Previous and current adaptation practices concerning climate change

In the face of renewed drought in the 1970s and 1980s, the people of Mauritania have improved their community management devices, and have even devised new strategies regarding the use of natural resources.

For instance, in the Livestock farming sector, mobility has been adopted as a strategic response to variability of rainfall and scarcity of grazing pasture. It has made possible the development of grazing land, and of areas without water, and the seeding of pastures over a very wide radius.

Mobility has enabled nomadic people to adapt their production to harsh eco-climatic conditions and to develop a whole system for managing natural resources based on consensus and pastoral solidarity. In fact, the mechanisms for access to resources adopted by livestock herders are based on the principle of the Islamic 'Fiqh' through community of pastoral resources, consensus, and shared responsibility.

Among poor households, Livestock farming is a source of income, a means of capitalization and a form of insurance. These different aspects are all the more important if they are situated in a context of poor and uncertain agricultural production. Traditional solidarity enables poverty to be dealt with through mechanisms driven by a religious and traditional ethic.

Among the new adaptation strategies for pastoralists, one of the most important is the development of Livestock farming close to a permanent tent or a house; this is frequently used with goats raised for their adaptive capacity with limited food requirement, a few camels and cows. But lately, a significant new trend has been observed, which is to partition the grazing area in an effort to achieve food self-sufficiency and also inspired by the need to settle in one spot. In addition, the phenomenon of settlement, a consequence of drought, has accelerated the development of lands for agricultural use and an urgent search for a new economic space.

With regard to agriculture, farmers have adopted adaptation measures focusing on crops better adapted to drought, a shortening of the vegetative lifecycle in the rain-fed system, the use of fast maturing crops and of watershed crops in catchments areas of dams and wetlands. The development of irrigated agriculture through the management of water, the diversification of crops focusing on market gardening, and crops grown under glass, the intensification of agriculture, the development of drip and spray irrigation are other strategies recently developed in the country in response to climate change.

In the forestry sector, traditional methods of meeting the basic wood requirements among communities living in the vicinity of the forests and the new country policy promoting improved furnaces and renewable sources of energy, the use of gas and participatory management of natural resources are some of the main features of the new national strategy for adaptation to climate change.

Concerning water, local communities have developed rudimentary devices in an effort to adapt to the new context of lack of water. With regard to surface water, these devices help to manage and store rainwater. They consist of large domestic canaries, rudimentary water storage pools, dykes, and sea flooding for slowing down streaming surface waters.

As regards underground water, wells (ogglats) have been dug in areas where water is not very deep. These devices are destroyed every winter and are usually no more than 5 meters deep. In some places, deeper traditional wells with walls supported by branches have been dug.

With decreasing rainfall in conjunction with significant desertification resulting in the almost total disappearance of surface waters (lakes, streams, seasonal ponds) and the decrease in the level of water-tables, other effective but more expensive methods have been developed.

As regards marine and coastal ecosystems, the significant density of arrowheads from the Palaeolithic era in the Baie du Levrier attests to earlier intensive hunting activity. Fishing and “sea crops” (collecting shell fish) also appear on a large scale. Livestock farming was also practiced generally along the whole of the coast of Mauritania with very limited water and vegetation, where most of the population led a nomadic existence. But the continued increase in aridity probably made most of the coastal inhabitants move southwards. Gradually, there would remain only a few small groups of “collector fishermen”, probably ancestors of the *Imraguen*.

The practice of preserving fish, and processing of catches (mainly carried out by the women) are some adaptation devices developed by the communities living along the coastline. Thus, yellow mullet is used in its entirety and processed into “tichtar” (dried flesh), oil (“dhin” prepared from the head and guts), and salted and pressed roe (dried eggs stages IV and V); waste and bones are pounded and used as fuel. Because of the scarcity of fresh water, seawater is used for cooking.

3.2. Appropriate solutions to adapt to climate change

Appropriate solutions to adaptation to climate change for the Livestock farming sector focus on the reduction of risks related to the restriction of grazing land, and the development of animal health and production. To ensure that pastoral land is not partitioned, the establishment and the implementation of a pastoral code promoting free access to resources and mobility are essential.

Epidemiological studies should be carried out and broadened to enable the development of an epidemiological map, and a schedule of the various prophylactics for the most prevalent diseases of the different species, depending on systems of husbandry, eco-climatic conditions and categories of animal.

To improve animal products, an open core selection programme ought to be thoroughly researched in an attempt to ensure effective participation of livestock herders. The main effort should focus on improving the conditions of local poultry farming (prevention of disease, housing, watering and feeding conditions). Once the basic foundations have been laid, pedigree cockerels of mixed rustic lineage could be introduced to improve local species. Popularization of village poultry farming should be organized using women nominated by their respective communities.

Breeders should be given strong support to advise them to feed their chickens a more balanced and economical diet. This will also involve agreed activities to disseminate adequate techniques to improve the nutritional and quantitative value of fodder, and to implement provisions designed to provide animals with supplementary minerals (small workshops for making salt-licks and multi-nutritional blocks).

Livestock herders' organizations should make it their business to facilitate the spread of information, and to supply and stock supplementary feed for strategic periods. The strengthening of marketing potential should focus on improving networks for marketing milk, red and white meat, leather and hides by taking action on conservation equipment, types of conservation, and collection systems.

As far as agriculture is concerned, adaptation devices relate mainly to rain-fed crops, aiming at: (i) improving agricultural methods in pluvial zones and introducing new drought-resistant, high-yield cereal species; (ii) promoting economical irrigation techniques in oasis areas (drip irrigation pilot schemes); and (iii) training and informing producers, their Socio-Professional Organizations (SPO), and Community Educators (CE). For irrigated crops, the appropriate solutions involve the intensification and the diversification of agriculture to promote crops with high yields and small-scale irrigation.

In forestry, the strategy advocated to control the prevention of the adverse effects of drought is to promote collaboration between the different structures involved in collecting, analyzing, and monitoring pastoral and agricultural information, and the structure following up plant diseases.

To save forest resources, an alternative source of energy should be used to meet the needs of communities. The use of butane gas is the most promising form in the light of the experience of SOMAGAZ (Mauritanian Gas Company). However, other new or renewable forms of energy could be envisaged: kerosene, wind and solar energy, peat, etc.

Development of forests is another adaptation device. Forestry development helps organize what is currently a chaotic area of exploitation. It integrates the concepts of management and control. The very existence of forests in Mauritania is under threat because they are being used without any form of renewal. Sustainable development of these forests therefore requires that production activity there should be limited to their capacity for regeneration.

As regards to water resources, appropriate solutions to adaptation to climate change should be sought in the effective implementation of the Integrated Water Resource Management approach, which is based on the following criteria:

- *Regular assessment of availability of water resources and requirements. In fact, good management of water resources requires a good knowledge of the resources, both as regards their development in quantity and quality as well as from the perspective of demand. It is therefore important to establish a functional evaluation network (quantity and quality) properly distributed throughout the country*
- *Establishment of a system of monitoring and mitigation of impacts related to the dynamics of sustainable socio-economic development which respecting the conservation of the environment.*
- *Establishment of a communications strategy to promote rapid dissemination and circulation of information among partners in an effort to organize periodic submission of results and to draft priority action plans.*

- *Establishment of a schedule for division of water and management regulations to prevent conflict of use. Knowledge of the resource must be taken into account at various levels so as to enable short, medium and long term projections and to share the resources equitably.*
- *Establishment of instruments of legal and economic regulation to promote improved use of water resources.*
- *Prior reinforcement of capacities to ensure the perfect implementation of Integrated Water Resource Management through the creation of viable institutions responsible for monitoring and evaluation of the status of water resources and the provision of reliable information to the various partners.*

The measures for adapting to climate change in the arid and semi-arid ecosystems of Mauritania consist, first, of developing measures designed to put an end to the causes of the degradation of these areas and, second, measures for their restoration. They are mainly measures relating to three principal exploitation sectors of land ecosystems (wood and charcoal, pasture-land and agricultural production) and adequate developments ensuring sustainable management of the various land ecosystem types (wetlands, agricultural ecosystems, forests, pasture-land ecosystems).

To respond to climate change, the land ecosystems of the country can also be strengthened by additional measures which might focus on reforestation for energy purposes (agro-forestry projects) and production (building planks for quickset hedges or wind-breaks, notably) and assisted plantation of trees (manual or aerial sowing of seed, hoeing).

Regarding coastal and marine ecosystems, appropriate adaptation solutions could take the form of development of fisheries, the general control and monitoring of the fish resources and creating awareness among of the various stakeholders. Other response strategies concern chiefly the protection and strengthening of the coastal belt and the integrated management of wetlands.

IV. Selection criteria to prioritise options

4.1 Need for criteria

The NAPA is a programme based on a diagnosis of all the sectors that are vulnerable to climate change. This diagnosis, established through a participatory process, has led to the identification of a number of options and measures aimed at adapting to climate change and/or mitigating their effects.

However, though each of the identified options is important in its own right as contributing in one way or another to the process of mitigation and adaptation, they cannot all be implemented. In fact, financial resources are limited and adaptation options and measures to climate change are not the only ones eligible for funding. Moreover, Mauritania is not the only country presenting a NAPA requiring funding.

Thus, it is extremely important to identify priority measures and options to maximize their chances of obtaining funding from the Global Environment Facility (GEF) and the donors most interested in the fight against the effects of climate change, hence the necessity to rank the options and measures on the basis of objective criteria.

The criterion is defined as a standard, a principle, an indicator for carrying out an evaluation. In NAPA, it aims to demonstrate:

- compatibility with the national priority choices
- compatibility with the vulnerability of the target communities
- objectivity (an equipment cost)
- subjectivity (a preference, binary)
- individualization or grouping of criteria

4.2 Basis for identifying criteria

The LEG guidelines, while leaving countries some freedom to define the criteria they deem appropriate, give indications that are both suggestive and relevant for the exercise, as follows:

- Cost-effectiveness ratio;
- Extent or gravity of the adverse effects of climate change;
- Poverty reduction to increase the capacity for adaptation;
- Synergy with other multilateral agreements in the field of environment;

The evaluation of these criteria in relation to the various options and measures identified will be based on, among other things:

- Loss of human life and loss of livelihood;
- Health;
- Food security and agriculture;
- Existing water resources, their quality and accessibility;
- Basic infrastructures;
- Cultural heritage;
- Biological diversity;
- Management of land and forestry use;
- Other environmental assets.

The consultation carried out throughout the country among all the parties primarily involved enabled the identification, and then in a second exercise, the selection, of a number of criteria based on the LEG guidelines and the particularities of the country.

4.3 Identification and validation of criteria

To determine the classification criteria, many methods were considered: cost-benefit analysis (CBA), cost-effectiveness analysis (CEA) and multi-criteria analysis (MCA). The choice of MCA was made because it includes CBA and CEA, but also because it permits the use of non-monetary and qualitative variables and indicators resulting from an almost complete lack of data. The choice of this methodology also stems from the need to take into account the scarcity of financial resources in the country, resources which have to be utilized with maximum effectiveness, as well as constituting a factor in the mobilization of external funds.

The MCA phases are implicitly taken into account throughout the NAPA preparation process; thus:

The background to the decision is found in stages 1 and 2, the identification of the options in stages 3 and 4, the identification of the criteria in stages 4 and 5, the grading of the options/criteria and method of standardization in stage 6 and the

weighted values of the criteria, the analysis of the results and the susceptibility analysis in stage 7.

In the MCA approach, the criteria are themselves divided into two groups (cost on the one hand and effectiveness on the other) which, when applying a rate indicative of the weight each has in the overall range of selected indicators, total together 100%.

- Cost: this relates mainly to the financial cost. This criterion represents the need to take into account the scarcity of the country's resources. In actual fact, this is an unavoidable constraint in a country such as Mauritania with limited financial resources. It is therefore applied to all the options and adaptation measures.
- Effectiveness: it is examined in terms of advantageousness in its aspect of climatic risk avoided, its contribution to sustainable development, and of support and feasibility.

These criteria, which rely heavily on those suggested by the NAPA guidelines, have been re-examined in the Mauritanian context. Whereas the cost factor includes the negative balance resulting from the absence of financial resources in the country, the four sub-groups of criteria relating to effectiveness are revealed as advantageous or as serving to avoid negative impacts, with positive connotation.

- Climatic risks avoided: lives saved, livelihoods guaranteed, infrastructures saved;
 - The criterion of lives saved is important in a country like Mauritania where water resources are scarce, drought is frequent and where the marine coastline is continuously weakened and poorly protected.
 - The criterion of livelihoods protected stems from the same logic perceived from the standpoint of the pressure exerted on the scarce resources such as water, people, etc., to ensure minimum subsistence levels for human and animal communities.
 - The criterion of saved infrastructures relates to the aspect of the of the existing infrastructures, particularly in relation to climatic disasters and the frequency of aggressive sandstorms. In a country such as Mauritania with a low coastline and a heavy concentration of human habitation, particularly in the southern region, and such a vast desert in the northern part, it is indispensable to take this criterion into account.
- Contribution to sustainable development: fight against poverty, synergy with the other conventions;
 - the criterion of the struggle against poverty is fundamental at a time when Mauritania has one of the lowest poverty indices and is addressing this major problem through the implementation of a strategy to combat poverty (PRSP)
 - Mauritania is party to the international conventions resulting from the Rio de Janeiro meeting of 1992 (CBD, CCD, UNFCCC). The synergy between the other two conventions and that on climate change is a relevant criterion, given that it promotes an integrated implementation of the national action plans of the conventions and development policies, all optimizing the use of scarce resources, and avoiding, among other things, duplication of effort.
- Support measures: participation (creation of awareness, agreement to participate) this criterion enables consideration of the contribution of the adaptation option to

raising awareness among the people and in their participation in the achievement of the option's objectives.

- Feasibility: possibility of obtaining funding, technical feasibility
 - The criterion of the possibility of obtaining funding allows an evaluation of the extent to which the PAMs could arouse interest in funding, taking into consideration the guidelines followed by Mauritania's traditional partners and the capacity of the beneficiaries to mobilize their participation.
 - The criterion of technical feasibility assesses the potential feasibility or the technical simplicity of the option, i.e. whether the technological choices of the option are easy to implement, whether the people will be able to understand the choices, stick to them and adopt them. Though this criterion is implicitly taken into account in the drawing up option budgets, for the beneficiaries there is the aspect of a recurrent burden, which it is important to anticipate.

These are the criteria with their relative weighting that have been validated by the implementation and steering committees before being applied to all the projects proposed in order to arrive at a final list of the priority adaptation activities. The classification procedure proper is described in chapter VI.

V. List of priority adaptation activities and measures

To be evaluated, each adaptation option is compared, weighing up the advantages and disadvantages. Examples of advantages are: decrease in risk, contribution to sustainable development and poverty reduction, qualitative gains (social, in particular); disadvantages pertain mainly to financial costs and non-monetary constraints (difficulties, obstacles, etc.). The prioritization of the options devolves from the participatory exercises later carried out by the same stakeholders from professional circles and civil society.

This chapter lists, in order of priority, the activities and measures of adaptation to climate change that have been selected on the basis of the criteria mentioned in the preceding chapter.

1. Better knowledge of the regimes of surface waters for 20 ponds;
2. Construction of decelerating runoff waters obstacles (small dikes) in pluvial and oasis areas ;
3. Promotion of water-saving techniques in oasis zones;
4. Introduction of electrical 50 MPs in the irrigated valley ;
5. Dissemination of the water dropping technology in the valley and oasis zones;
6. Promotion of cattle mobility;
7. Reorganization of the communities adversely affected by climate change;
8. Promotion and development of domestic poultry farming;
9. Improvement of the farming techniques in pluvial zones;
10. Substitution of ligneous fuel;
11. Participatory reforestation for energy and agro-forestry in agricultural zones;
12. Genetic improvement of the local bovine breeds;
13. Improvement of underground waters management in the Aftout zone;
14. Preservation of the diversity of fish communities;
15. Introduction of new fodder species in the natural routes;
16. Protection and reinforcement of the dune belt of the coastline;

17. Training and information of SPOs (Socio-Professional Organisations) and CEs (Community Educators);
18. Processing of unrefined fodder and multi-nutritional blocks;
19. Restoration and integrated management of the low lands and wetlands;
20. Development of fodder crops;
21. Monitoring of the quality of water for three priority cities;
22. Establishment of a livestock fodder factory;
23. Experimental use of the drip technique in oasis zones;
24. Drawing up of a plan to safeguard Nouakchott;
25. Improvement of knowledge on forest resources and their sustainable management;
26. Fixation of drifting dunes threatening the country's socio-economic infrastructures;
27. Support for improved monitoring of the piezometric networks of the Aïoun sandstones in the Hodh;
28. Institutional reinforcement of the body responsible for nature conservation;.

The above is the product of the consultation process on NAPA, i.e. a list of the priority activities and measures of adaptation that conform to the development objectives and the country's poverty reduction strategies, while increasing the vulnerable communities' capacity of adaptation.

A number of project request profiles have been considered to take account of the differences and similarities among the selected priority activities and to be incorporated into the adaptation programme. In this regard, the plan suggested by LEG has been found generally satisfactory and applicable, though minor amendments have proved necessary.

VI. NAPA preparation process

6.1 Establishment of NAPA implementing bodies

The Director of the Environment (DENV), in charge of the NAPA project, appointed the Coordinator of the climate change project as head of this project with the task of administering the NAPA process; the DENV also agreed with UNEP on the appointment of a Technical Adviser to the project. This first step also enabled the selection of the project team of experts composed of 5 experts specializing in the following areas: Livestock farming, forestry, agriculture, surface water and underground water) and 2 experts in ecosystems, arid/semi arid and marine coastline, of 3 economists and a 3-member editorial group. This team is supported by 2 experts in communication (a journalist and a sociologist) and an expert responsible for the synergy among the international conventions referred to as the Rio generation (conventions on bio-diversity, the struggle against desertification and the Framework Convention on Climate Change). The eighteen various profiles that make up this project management team were chosen on the basis of an equal division among the following employment sectors: (i) 6 professionals from the public service sector, (ii) 6 academics and (iii) 6 experts from civil society.

The other NAPA body is headed by the Director of Environment, known as the NAPA network or implementation committee composed, in addition to the preceding team, of the focal points of the various ministerial departments involved and those of the country's administrative wilayas and of civil society. The appointment of these focal points was made

by the Project following a transparent consultation process attended by the institutions and stakeholders concerned.

Finally, the supervisory body of the NAPA process is the steering committee chaired by the Director of Research and Planning of the Ministry of Economic Affairs and Development) and it comprises 10 members representing the various employment sectors.

The whole mechanism was created by a decree issued by the ministry responsible for the project, the Ministry of Rural Development and the Environment (MRDE), which defined and created the respective roles and also appointed the project coordinator as secretary to the various committees.

6.2 Review of studies and research arising from climate change

Each theme expert worked closely with one of the economists to review the existing documentation on the sector for which he was responsible, and highlighted the nature of the vulnerability of the sector in question and the economic dimension of this V/A (Vulnerability/Adaptation). To this end, he carried out a review and analysis of the existing documentation, and then an identification of the relevant factors contained in the documentation capable of serving as the basis for planning the options designed to combat negative effects of climate change on his sector.

The investigation results expected from each theme expert in collaboration with his economist partner were:

- ⇒ Collection and analysis of the relevant documentation on the sector;
- ⇒ Synthesis in the form of a report on the vulnerability/adaptation of the sector to climate variability;
- ⇒ Establishment of an inventory of the existing adaptation options.

These results were recorded in the sectoral reports and then grouped first according to theme (Group 1), and then ecosystems (Group 2) to form the outcome of a stage in the process.

6.3 National consultation

The drafting of NAPA started with a review of the existing documentation on themes (surface and underground water, Livestock farming, forests, agriculture) chosen arbitrarily by the group of experts. This review made it possible to demonstrate the vulnerability of the sectors concerned to climate change and to record the existing adaptation options. The results of this investigation carried out by the project experts were presented at a national consultation workshop to launch the NAPA process during which all the stakeholders (public sector, civil society, representatives of the regions of the interior) made amendments and improvements before ratifying the overall results.

6.4 Consultation at regional level

The preceding outcome was summarised in presentations made at regional workshops attended by experts from the project, and the sectoral and regional focal points of the public sector and civil society. For this, the country was divided into four blocks: the pluvial block composed of: Assaba, the 2 Hodhs and Tagant; the irrigation block made up of Guidimakha, Trarza, Gorgol and Brakna; the oasis block including Adrar, Tiris-Zemmour and Inchiri and finally, the coastal block made up of the district of Nouakchott, Dakhlet-Nouadhibou and the Senegal River delta.

The decentralised workshops dealt with these four blocks which were deemed to be strategically homogenous with regard to climate change, but also, and particularly, from the point of view of the logistics of workshop organisation; some of the wilayas actually belong to several agro-ecological zones and cannot be considered as belonging strictly to the zoning defined above.

The regional workshops were organised on the model of the national launch workshop. The climate stresses were identified by ecosystem and comparisons were made in relation to their effects on the sectors and the communities. Thus, on the basis of the results of the comparison, the degrees of vulnerability of the sectors were established during these decentralised workshops. A diagram illustrates the results obtained from this participatory evaluation (see above). During the same decentralised workshops, the following were also carried out: identification of the adaptation options and prioritisation criteria, and simulated exercises in prioritising options.

The various consultations (national and regional) were greatly enriched by the educational tools and exercises provided by training workshops held in Ouagadougou, Niamey and Dar es Salaam, organised by UNITAR, CILSS and UNEP, attended by some members of the management committee of the project.

6.5 Classification criteria

The multi-criteria methodology was used (see chapter IV, section 3 above). On this basis, four sub-groups of criteria were identified. The first sub-group is cost; the other four sub-groups are climate risks avoided, contribution to sustainable development, support measures and feasibility and represent the efficiency component.

These criteria, drawing heavily on those proposed by the NAPA guidelines, had initially been proposed by an ad hoc committee appointed within the committee of experts, and had been widely debated by that committee of experts and the project co-ordination team. It is important to note that the above discussions took place before, during and after several (national and regional) workshops that discussed the issue of the criteria in the context of the implementation of the participatory method adopted at the start of the process.

The outcome was the break-down into the following four sub-groups on effectiveness as follows:

- Climatic risks avoided: lives saved, livelihoods guaranteed, infrastructures saved;
- Contribution to sustainable development: fight against poverty, synergy with other conventions;

- Support measures: participation (creation of awareness /agreement);
- Feasibility: possibility of obtaining funding, technical feasibility.

The GDP criterion had been proposed by the ad hoc committee but was later withdrawn during the discussions between the group of experts and the project co-ordination. This criterion was proposed as the key to determining the pro-rata contribution of each sector to the selected projects. This resulted from the public's request that no vulnerable sector should be omitted from the portfolio of the projects proposed for funding.

It was therefore decided that:

- 30% of the options selected should be reserved for ecosystems and divided equally between the arid and coastal ecosystems;
- 70% of the options should be reserved for the productive sectors and divided among these sectors in proportion to their contribution to the GDP.

The criterion of technical feasibility was the subject of much debate before being adopted. Its purpose is to assess the degree of ease with which the project can be implemented at the technological level, (familiar technology, human and material resources available on the spot, ease of assimilation of the procedures by the people, etc.). The criterion of financial feasibility refers to eligibility as far as potential donors are concerned. These criteria were themselves ranked by assigning a weighting to each criterion, both referential and comparative in relation to all the other criteria (see attached table).

It is these criteria along with their respective weightings that have been validated by the implementation and steering committees before being applied to all the projects proposed, leading to the definitive list of priority adaptation activities.

6.6 Categorization of priority adaptation options

On the basis of an exhaustive inventory of the adaptation options identified during the initial launch workshop, selective adjustment and grouping were gradually carried out by the successive workshops, resulting in the final selection of those considered to have the highest priority.

Livestock farming sector

The adaptation measures for this sector revolve around three main axes:

- Improvement of quality and quantity of livestock fodder. This axis includes the development of fodder crops, the establishment of a production unit for livestock feed, the processing of rough fodder and manufacture and use of the multi-nutritional blocks;
- Genetic improvement and diversification of animal production. This axis includes the genetic improvement of the local bovine breeds, the promotion and development of domestic poultry-farming, the introduction of new fodder species in the natural pastures;
- The promotion of livestock mobility (popularisation of the pastoral code and support measures) constitutes the third axis. This strategy is the best adapted to the local realities and the local community that boasts an ancestral know-how combined with total familiarity with the environment.

Forestry sector

The adaptation measures of the forestry sector also revolve around three main areas:

- improvement of knowledge of the ligneous resource, a necessary condition for its sustainable management. The present situation is characterized by a poor knowledge of forest resources. The last review dates back over twenty years and the situation has changed considerably since then;
- substitution of ligneous fuel as domestic energy to alleviate the pressure on the forests of the southern part of the country which are more and more threatened. Butane gas remains the most promising form of energy, the other forms of energy (wind and solar energies in particular) being little developed.
- the last area of interest concerns institutional strengthening of the body responsible for nature conservation. Without this reinforcement, the legislation put in place will have no chance of being enforced and the meagre forest formations will continue to be destroyed without any protection.

Agricultural sector

The adaptation measures of the agriculture sector concern capacity building by means of offering training and information to the producers, their SPOs and CEs. However, agriculture in Mauritania remains dependent on water; thus, adaptation is focused on forms of optimising water, notably:

- The improvements of farming techniques in pluvial zones and introduction of new varieties of high-yield drought-resistant cereal, and
- The promotion of economical irrigation techniques in oasis zones (pilot scheme using the drip technique).

Water sector

The adaptation measures in the transverse area in all the preceding sectors aim to improve knowledge of the resource, economical use of the resource and monitoring of both quality and quantity.

Surface water:

- Use of hydro-electric energy of Manantali Dam;
- Contribution to a better knowledge of the surface water regime;
- Support for the dissemination of new irrigation technologies.

Underground water:

- Improvement of monitoring of the piezometric networks of water tables;
- Improvement of management of the resource;
- Monitoring of quality of the water;
- Experimental use and extension of the new adapted technologies.

Arid and semi-arid ecosystems

One of the major consequences of climate change in Mauritania remains the movement of shifting dunes. The surface areas are unfortunately so large that it is impossible to wage a battle against them all; consequently, the one measure proposed is the fixation of shifting dunes threatening the country's social and economic infrastructures.

The other measures focus on the people adversely affected by climate change and concern participatory reforestation for energy and agro-forestry in the agricultural zones and the reorganization of the communities adversely affected by climate change, taking account of the options they have already adopted.

Marine and coastal ecosystems

- **Beaches and dune bars: resistance or recession**

Resistance is necessary where an urban area needs protection from invasion by the sea. It is possible to resort to artificial building up of the sea shores with sediment or to erect constructions, either parallel or perpendicular to the beach. These can be jetties similar to walls or even enrichment borders better able to absorb the energy of the waves.

Recession occurs where the shores are not inhabited. Here there is constant recession of the coast in the form of gradual movement of its various components.

- **Fishing**

The adaptation measures may concern modifying and reinforcing the fishing operations and fish monitoring programmes to prevent over-fishing and ensure a sustainable exploitation, improvement in fish farming, in such a way as to preserve the genetic diversity of the fish populations, re-population of certain sectors using hardy species and consideration of the requirements of the fish habitat in planning coastal development.

- **Habitat and socio-economic infrastructures**

Adaptation comes through the institution of town planning standards which take account of climate change, respect the planned removal of all infrastructures established in sectors susceptible to the effects of climate change and fulfil the plan to develop the coastline taking climate change into consideration.

- **Low lands and wetlands**

The adaptations may concern the establishment of the resources of the wetlands as protected areas, the restoration and integrated management of the creatures living there and the development of fish farming in the Aftout.

6.7 Classification of priority options

After reviewing the climate change adaptation options of the theme sub-sectors and the ecosystems, the experts agreed on twenty-eight “options”. These options were the subject of repetitive and repeated ranking exercises using criteria that have themselves been filtered through a series of discussions and selection.

In this regard, the experts had to consider various questions before seeking answers from the stakeholders, on the following issues:

- Do the options selected actually correspond to the needs resulting from the vulnerability of resources and livelihoods?
- Are the criteria or indicators selected quantifiable in absolute value or relative value?
- Can the qualitative indicators be quantified and how?
- Who will participate in the grading of the criteria, and in what form?

The calculation method

The following procedure was applied in these prioritisation exercises:

1. taking each criterion, allocation of a comparative grade to each option on a scale to be determined; in the following example, the lowest grade is 1 and the highest is 5 for the criterion of lives saved, whereas there is a variation of between 2 and 55% in the criterion of poverty reduction; the choice of what the scale means has to take into account increasing values for the profits (advantages) and decreasing ones for the costs (disadvantages). Here, the options are compared against each other considering each criterion separately. For example, the following table illustrates the application of this step in some workshops held in the interior of the country (Kiffa and Atar) where 11 options were ranked using 5 criteria;

Summary reminder of the results of the vulnerability study – Mauritania (example presented in the workshops of Kiffa and Atar)					
Priority adaptation measures	Cost (million US\$)	Efficiency/advantages			
		Lives saved 0 -5	Infrastructures saved 1 -20	Poverty reduction 1 –100%	MEA synergy 0-4(+)
Option 1: reorganisation of communities adversely affected by climate change	0.6	5	10	2	+
Option 2: Improvement of agricultural techniques in pluvial zones	1.2	5	2	20	++
Option 3: Promotion of water-saving techniques in oasis zones	0.2	4	3	40	+++
Option 4: Substitution of ligneous fuel	0.7	3	1	25	+++
Option 5: Better knowledge of the surface water regime	0.4	4	2	10	+
Option 6: Promotion of livestock mobility	0.2	3	1	55	++++
Option 7: Construction of					

Flooding breakdown dikes in pluvial and oasis zones	0.6	4	15	5	+++
Option 8: Promotion and development of domestic poultry farming	0.2	3	1	60	
Option 9: Introduction of 50 electric GMPs in the valley	1.0	1	15	60	++++
Option 10: Participatory reforestation for energy and agro-forestry in agricultural zones	1.0	3	3	40	+++
Option 11: Dissemination of the drip technique in the valley and oasis zones	0.3	2	1	50	+++

2. To carry out a simultaneous comparison of the options on the basis of all the criteria, it was necessary to standardize the scales, that is, to express the values of the criteria in the same unit of measurement on a common scale. This was obtained by applying the following formula:

$$\frac{l-M-x}{M-m}$$

Where M represents the maximum value, m the minimum value and x the value of the option when reading in each column; then in the next step, use in the formula a weight instead of l (where the criteria hypothetically have the same weight) when a differentiation between the criteria has to be made (here the comparison meets the values in the columns).

3. As the preceding step was carried out on a full-scale level that is with all the options and all criteria it was possible to reduce everything to the same scale and to allocate a weight to each criterion (coefficient). In fact, the criteria do not have the same importance for all participants in the various workshops;
4. For each option, the score was multiplied in relation to each criterion by the relative weight of the criterion. This led to a relative score (referred to as a weighted score) for the option for each criterion;
5. Calculation of the average score for each option is done by adding up the scores and dividing them by the number of criteria; this is the weighting process.
6. The rank of each option is thus determined by comparing the averages obtained.
7. The sensitivity of the results obtained was then evaluated. This sensitivity analysis consists principally of changing the relative weight of the criteria or the option scores.

Priority Adaptation Measures (PAM)

The final result of this ranking is shown in the following table where each colour relates to a sector for ease of reading.

Projects	Scores	Rank	Sectors
Better knowledge of the cycle of the surface waters for 20 ponds	4.23	1	Water
Construction of flooding breakdown dikes in pluvial and oasis zones	4.10	2	Water
Promotion of water-saving techniques in oasis zones	4.05	3	Agriculture

Introduction of 50 electric Moto-Pumps in the valley	3.96	4	Water
Dissemination of the drip technique in the valley and oasis zones	3.82	5	Water
Promotion of livestock mobility	3.80	6	Livestock farming
Reorganisation of the communities adversely affected by climate change	3.73	7	Arid ecosystem
Promotion and development of domestic poultry-farming	3.70	8	Livestock farming
Improvement of agricultural techniques in pluvial zones	3.65	9	Agriculture
Substitution of ligneous fuel	3.65	10	Forest
Participatory reforestation for energy and agro-forestry in agricultural zones	3.53	11	Arid ecosystem
Genetic improvement of locale bovine breeds	3.50	12	Livestock farming
Improvement of the management of underground water in Aftout	3.47	13	Water
Preservation of the diversity of fish populations	3.42	14	Marine eco.
Introduction of new fodder species in the natural routes	3.40	15	Livestock farming
Protection and reinforcement of the dune bar	3.35	16	Marine eco.
Training and information of SPOs and CEs	3.32	17	Agriculture
Processing of unrefined fodder and nutritional blocks	3.31	18	Livestock farming
Restoration and integrated management of the lowlands and wetlands	3.24	19	Marine eco.
Development of fodder crops	3.13	20	Livestock farming
Monitoring of water quality for 3 towns	3.11	21	Water
Establishment of production unit for livestock fodder	3.05	22	Livestock farming
Experimental use of drip technique in oasis zone	2.93	23	Water
Establishment of a plan to safeguard Nouakchott	2.87	24	Marine eco.
Improvement of knowledge about, and sustainable management of, the forest resources	2.85	25	Forest
Fixation of shifting dunes threatening the country's socio-economic infrastructures	2.81	26	Arid ecosystem
Support for better monitoring of the piezometric networks of the Aïoun sandstones	2.64	27	Water
Institutional reinforcement of the structure responsible for nature conservation	2.55	28	Forest

Process of selection

Some working hypotheses were formulated and discussed by the participants at the various workshops. One example often mentioned is the one where the number of projects would be limited by the insufficiency of financial resources; in addition, the concern of the decision makers is to involve all the vulnerable sectors. In this particular case, it was agreed to apply a weighted quota. It was suggested that 70% of the projects should be allocated to the thematic sectors and 30% to ecosystems (15% for coastal ecosystems and 15% for the arid ecosystems). The 70% of the thematic sectors will in their turn be broken down on the basis of the various sectors' contribution to the GDP (figures in brackets) which is as follows, according to the latest up-to-date sources:

- Livestock farming 41% (12%)
- Agriculture 21% (6%)
- Water 35% (10%)
- Forests 3% (0.8%)

In the event, for example, where it would be possible to fund only 20 projects⁷, applying this proposal would give the following break down:

Sectors	Weights	# forms to select	Total # of forms
Weight of thematic sectors	70%		21
Livestock farming	41%	5.74	7
Agriculture	21%	2.94	3
Water	35%	4.90	8
Forests	3%	0.42	3
Sub total	100%		
Weight of ecosystems	30%		7
Arid ecosystems	50%	3.00	3
Marine ecosystems	50%	3.00	4
Sub total	100%	20	28

According to this hypothesis, only the forest sector would be excluded, because it ended up with 0.4 shares of an option which cannot be rounded up to a higher unit before the others.

But it must be noted that the scores were awarded by the local focal points of the programme during a workshop, which they attended with the experts. The result of the ranking process was submitted during a workshop including a broader public where it was discussed. Thus, it appeared that the quality of the work depends largely on the humility of the participants and on their ability to appropriately score the options and criteria; there have been lobbies in such circumstances as these which were prejudicial to the quality of the results expected.

Sensitivity analysis

It is understood that the sensitivity analysis is justified because of:

- the large number of factors affecting the choice of criteria and options;
- the large number of factors involved in the scoring and weighting process;
- the large number of points of view of the partners and members of the NAPA team.

The sensitivity analysis, using software employed by “Enda Tiers Monde” during the Dar es Salaam workshop, made it possible to consider this diversity and show the impact of the differences on the results:

1. the range of stakeholders, each with their own, sometimes totally different, objectives, introduced elements into the group dynamic that influenced the results of some of the workshops;
2. the difficulty in reaching solutions satisfactory to all meant that everybody had to accept that there are winners and losers.

⁷ This is a well-known hypothesis: it is rare that arbitration is carried out on the basis of the number of projects but rather according to the limits of the funding obtained

However, some PAMs proved to be not very susceptible to flexibility in the variation of scores and did not change their order of priority; this is the case of: construction of flooding dikes in pluvial and oasis zones (2), introduction of 50 electric water pumps (GMPs) in the valley (4), dissemination of the drip technique in the valley and oasis zones (5), promotion of livestock mobility (6), promotion and development of domestic poultry farming (8), improvement of agricultural techniques in pluvial zones (9), and substitution of ligneous fuel (10).

6.8 NAPA Project Profiles

The priority adaptation options thus defined were stated on project forms in accordance with the outline laid down in the guidelines (see chapter V above) and accompanied by a rationale, the whole composing the NAPA document. To this end, each option was initially formulated within a logical framework defining its major and specific objectives, the components and anticipated activities, the human and financial contributions and the objectively verifiable indicators of success, as well as the sources and means of verification.

The plan for the resulting logical framework for each option is as follows:

- Title
- Considered analysis/rationale in relation to climate change, including the affected sectors
- Description
 - Objectives and activities
 - Inputs
 - Short-term outputs
 - Potential long-term results
- Implementation
 - Institutional arrangements
 - Risks and obstacles
 - Evaluation and monitoring
 - Financial resources

6.9 Validation process

This document, prepared by a team of two experts, an environmentalist and an economist (see appendix), and having benefited from the contributions of the project and co-ordination unit experts, was submitted for ratification by the public and the government. Additional contributions were then made by all the parties concerned.

First, a workshop on the ratification of the draft was organised for a much diversified public composed mainly of the participants to the preceding workshops. Their work led to an improvement in the content of the draft, which was then submitted to the implementation committee representing the first stage of checking by the representatives of the government.

The comments of the implementation committee concerned the form of the document. It was recommended that the forms on the promotion of the drip technique for more effective use of water and the forms on the production and improvement of livestock should be combined. A request was also made that the costs of the projects should be adjusted without changing the order of priority, together with a recommendation to review some paragraphs in light of the problem of climate change in the country.

Finally, the amended result was submitted for approval to the steering committee, the last stage of ratification by the Government. At this stage the co-ordination unit noted the importance of noting the references or location in the Public Investment Programme (PIP) of each PAM. The steering committee ratified the document in its entirety, subject to the withdrawal of a PAM entitled “Establishment of a production unit for livestock feed”, owing to its commercial bias, and the correction of the map on p.8 above. The document was then produced in its final form before being submitted to the Minister of Rural Development and the Environment for his stamp of approval.

The subsequent activities, planned in the project document and which will be carried out after NAPA emerges from the approval stage, include in order:

1. Translation of NAPA into English, Arabic and the national languages;
2. Dissemination of NAPA to the public through the media and circulation;
3. Endorsement of NAPA by the GEF focal point;
4. Transmission to UNEP for submission to the organizations concerned and/or funding organisms.

Part 2: PRIORITY ADAPTATION ACTIVITIES

VII. Profiles of priority adaptation projects classified by sector

7.1 Livestock farming sector

<u>Heading/Title of project</u>	<i>Development of fodder crops</i>
<i>Locality</i>	<i>Senegal River Valley</i>
<i>Sector</i>	<i>Livestock farming</i>
<i>Field</i>	<i>Food</i>
<i>Type</i>	<i>Pilot project</i>
<i>PIP Reference</i>	<i>Support for the fight against dangers to the crops</i>
<i>Rationale</i>	<i>By using appropriate fodder species (dolichos (bean), Angola peas and forage niébè) and by adopting appropriate cropping and exploitation practices, the farmer or agro-breeder can improve the quality of his livestock. There are many plant species available for fodders which exist in almost all the eco-climatic regions. It is important to have a wide range of species allowing a good level of adaptation to the context or local usage, thus enabling reduction of costs at all levels (inputs, labour, etc.). However, fodder crops are still in the embryonic stage in Mauritania. The few trials carried out by the research unit and some producers have not really resulted in widespread dissemination.</i>
<u>Components and activities</u>	
<i>Objectives</i>	- Establishment of reserves for periods of hardship (fodder deficit) leading to improvement in the seasonal availability of fodder; - Increase in fodder production; - Improvement of fodder quality; - Reduction of pressure on other fodder resources; - Feed for intensive Livestock farming; - Establishment of fodder reserves for period bridging the seasons.
<i>Activities</i>	- Provision and production of fodder seeds; - Education in farming techniques and fodder conservation methods.
<i>Expected outcomes</i>	- Development of fodder crops; - Giving value to agricultural by-products; - Increase of the production per beast and per hectare (milk, meat); - Carbon fixation in permanent pasture lands.
<u>Implementation</u>	
<i>The project will concern the Senegal River valley (irrigated zone),</i>	
<i>Administrative arrangements.</i>	<i>Under the responsibility of the Department of Livestock farming, and will involve the co-operatives (farmers and agro-farmers) and cooperate with technical services such as the National Centre for Farming and Veterinary Research (NCFVR), the National Centre for Agronomic and Agricultural Research and Development (NCAARD) and the National Society for Rural Development (NASORD), M'Pourié farm and interested private promoters.</i>

<i>Risks and obstacles</i>	- Decrease in soil fertility (without provision of fertilisers and manure) in cases where the fodder is exported after reaping; - Compacting of soils trampled by animals; - Risk of introduction of disease or destructive birds or insects that could affect the local vegetation; - Risk of introduction of species becoming weeds in the areas; - Introduction of weeds along with poor quality seeds; - Aridity and other major climatic constraints; - Need for manpower for other agricultural tasks; - Cost of establishment of fodder crops; - Land not adequately secured. - Quantity of fodder produced per area developed; - Nutritional value of fodder plants;
<i>Monitoring and assessment indicators</i>	- Livestock performance;
<i>Duration</i>	5 years
<i>Funding</i>	US\$ 600,000

<u>Heading/title of project</u>	Promotion and development of domestic Poultry farming
Locality	National
Sector	Livestock farming
Field	Improvement of food
Type	Food security and fight against poverty
PIP Reference	Special Support Programme for Food Security

Rationale	- The development of domestic poultry farming constitutes an important channel for the improvement of the living conditions of low-income households adversely affected by climate change. - Moreover, it allows rural women in particular to be reached through agreed actions for improvement, and can thus give access to the integration of women in the development of small-scale farming in general.
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Components and activities

Objectives	- Introduction of an additional activity for rural women; - Development of rural poultry farming, improvement of white meat production; - Increase of food for consumption (especially meat); - Increase of income of rural women (fight against poverty).
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Activities	The project will provide women's co-operatives with a sufficient number of hens and possibly pedigree cockerels. The main basic actions should revolve around preventive treatment, especially vaccination against Newcastle disease, and secondly, anti-parasite treatment. Drinking water must be permanently available and of good quality. Efforts should be made concerning the accommodation conditions (ventilation, no over-crowding, bedding, etc.) and hygiene.
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Finally, food should be improved through maximum use of local by-products (sorghum, millet, calcinated bone powder, rice bran, kitchen scraps).

Finally, genetic improvement may be envisaged by the introduction of pedigree cockerels. The choice of breeding stock will be based on a thorough evaluation of their real suitability (consumption rating, growth rate, resistance to disease and to local climatic conditions).

Expected outcomes	- Country self-sufficiency in meat; - Fight against poverty; - Food security (animal proteins); - Creation of permanent jobs; - Improved local breeds, leading to increased production; - Increased production (eggs and meat); - Increase of rural women's income.
Implementation	
Admin. arrangements	NCFVR, through its veterinary service will pilot this operation with assistance from the Department of Livestock farming and the cooperation of the National Group of Mauritanian Poultry-Breeders and women's co-operatives
Risks and obstacles	- Humidity increases parasite infection risks; - Predators; - Genetic constraints; - Food value of chicken feed;
Monitoring and assessment	
Indicators	- Share of traditional poultry farming in national production; - Productivity of improved breeds; - Importation of white meat.
Duration	2 years
<u>Funding</u>	US\$300,000
<u>Heading/title of project</u>	Promotion of livestock mobility
	Dissemination of the pastoral code and support measures
Locality	National
Sector	Farming
Field	Pastoralism
Type	Education and creation of awareness
PIP Reference	Development of Livestock farming
Rationale	Settlement as a consequence of climate change has considerably disturbed the organisation of livestock movement and caused the degradation of pasture lands in the populated areas, particularly around the large and relatively durable watering points (ponds and rivers) and around inhabited areas where bought-in fodder increasingly has to compensate for the decrease of pasture available. Thus, for breeders, livestock mobility is their only recourse against lack of fodder and/or water.
<u>Components and activities</u>	
Rationale	

	- Sustainable exploitation of natural resources; - Improvement of livestock herders' revenue bases through organizational and investment measures.
Objectives	- Safeguarding of pasture space; - Establishment of protected pasture space, creating an inalienable and indefeasible public space; - Preservation of livestock mobility; - Guaranteed free access for the breeders to pastoral resources (grassy, open pastures, surface or underground water, Amersal pits and licking grounds); - Consideration of pastoral interests in all development activity involving the pastoral space.
Activities	- Organisation of an awareness and education campaign on the pastoral code. This will have two objectives: - o Circulation of information on the pastoral code: this campaign will require the organisation of many workshops and meetings; - o Identification of implementation tools. - The campaign to create awareness of, and to educate people concerning popularize the pastoral code will take place at the local level, an area whose boundaries are acknowledged by a given local community and which is worked in the traditional way by the members of the community. - Strengthening of the organisational capacities of the breeders through training, advice and assistance from the technical services; - The development of support measures (investment, etc).
Expected outcomes	- Rational management of natural resources; - Improvement of access to pastoral resources; - Preservation of pastoral function of the wetlands; - Protection of system of sustainable management of natural resources.

Implementation

Admin. Arrangements	The project will be placed under the supervision of the Department of Livestock farming. DRTE, in collaboration with the Department of Livestock farming and the regional Delegations, could undertake a campaign creating awareness and education concerning the pastoral code. However, the Department of Livestock farming, together with its decentralized technical services, will be responsible for the implementation of the infrastructures.
Risks and obstacles	- Partitioning of the space; - Frustration of farmers; - Significant fluctuation of fodder resources both in space and in Time; - Under-exploitation of the grazing routes through lack of watering points; - Failure of system of information to farmers; - Survival of traditional movement of livestock as regards routes followed; - In the absence of adaptation and modification of the old systems of resource management, demographic growth, settlement of the population and the search for remunerative

activity constitute threats to the environment, especially around inhabited areas;

- Quantitative and qualitative deficit of infrastructures to accommodate and care for animals in the markets, methods of transport used and by the absence of marked out routes for sending livestock to the markets and of routes for movement of herds.

**Monitoring and assessment
Indicators**

- Degree of awareness of pastoral code (survey) and its application;
- Number of conflicts resulting from land use;
- Composition of vegetation around water points and in the marked out spaces;
- Organisational capacity of the Socio-Professional Organisations.

Duration 18 months
Funding US\$300,000

Heading/title of project Introduction of new fodder species on the natural grazing routes

Locality	Tiris-Zemmour, Inchiri, Tagant
Sector	Livestock farming
Field	Food
Type	Development for structuring the routes
PIP Reference	Management of routes and development of Livestock farming

Rationale

In arid zones, the continuous degradation of the routes creates vast barren areas subject to wind and rain erosion and which are in the end lost as pasture. These barren areas end up with cover poor in vegetation and a low reserve of seed in the soil. Hence the necessity to introduce new fodder species into the natural pastures routes.

Components and activities

Objectives

- Initiate rehabilitation of the routes;
- Increase plant cover by introducing appropriate species;
 - Achieve a vegetation composition of the pastures offering maximum animal production in the short term and the most sustainable possible in the long term;
- Use pastures and grazing routes which have no or few surface water resources;
- Improve productivity of the herd.

Activities

- Planting pasture through seeding after clearing, ploughing, and preparation of the seed beds;
- Seeding by simple manual, mechanic or aerial sowing of the natural grazing routes;
- Planting of cuttings and young plants.

Expected outcomes

- Better provision of fodder and pasture after the establishment plants and ligneous fodder;
- Improved living standards thanks to the more stable lifestyle of the stockbreeders which gives them access to social services;
- Increase of all farming and herd parameters (milk, reproduction, meat, health);
- Improvement of bio-diversity (increase of number of species in local vegetation);
- Improvement of soil fertility;
- Increased fixation of CO₂ in the grazing routes.

Implementation

Admin. Arrangements

The project will be under the supervision of the Department of Livestock farming in collaboration with NCFV and NCAARD. Thus, the breeder organisations, co-operatives and NGOs active in the environment will be involved.

Risks and obstacles

- Reduction of bio-diversity (implanting of standardized pastures, introduction of weeds and invasive species in competition with the local species);
- damage caused to the livestock during the implantation process;
- introduction of weeds, harmful insects, disease and predators;
- decrease and poor distribution of rainfall causing lowering of water table;
- difficulties in buying seeds and plants;
- land tenure system (communal lands);
- encroachment of sand into the pasture zones;
- decrease of the natural fodder resources;
- disorderly settlement and concentration of rural communities.

Monitoring and Assessment indicators

- bio-diversity of the fauna and flora;
- rate of soil vegetation cover;
- measure of vegetation cover and measure of plant biomass (contribution to the biomass of the species sown or planted or the total vegetation cover);
- number of heads of livestock in the rehabilitated zones;
- evaluation of livestock mobility;
- number of animals visiting the drinking points;
- surface area of tree cover and barren zone (at various distances from the water sources).

Duration Funding

2 years
US\$600,000

Heading/title of project

Genetic improvement of the local bovine breeds

Locality

South and south-east Mauritania

Sector

Farming

Field

Genetic improvement

Type

Increase of production

PIP Reference

Development of farming

Rationale

Livestock farming in Mauritania is almost exclusively transhumant. In addition, the poor potential of the local breeds does not allow a high level of profitability from the activity. The production level is caused by the low genetic level of the animals. Hence the necessity to genetically improve the local bovine breeds.

Components and activities

Objectives

- improvement of milk and meat production through improvement of the genetic potential of the bovines;
- have more productive animals, more efficient in terms of use of the resources (lower input/production ratio) ;

Activities

Improve knowledge of the performance of the various breeds depending on the main systems in which they develop. This genetic improvement is achieved through two techniques: selection and cross-breeding.

Expected outcomes	● reduction of animal pressure (fewer animals to care for, for the same level of production); ● food security; ● health: more productive but often more vulnerable animals.
<u>Implementation</u>	
Admin. Arrangements farming	This operation will initially concern the river region. The project will be under the supervision of the Department of Livestock in cooperation with NCFVR, breeder organisations and private promoters. It will last four years.
Risks and obstacles	● difficulties in controlling genetic progress in intensive farming systems; ● reduction of animal bio-diversity; ● introduction of new diseases; ● problems, for some improved breeds, concerning living in certain environments; ● change in the perception of the value of species and breeds; ● more choice of production characteristics; ● need for more efficient farm management.
Management and assessment indicators	- level of production; - animal productivity; - level of pressure on resources.
Duration	3 years
Funding	US\$500,000
<u>Heading/title of project</u>	Treatment of unrefined fodder and manufacture and use of multi-nutritional blocks
Locality Sector Field Type PIP Reference	Senegal River Valley Livestock farming Food Pilot project Development of farming
Rationale	The recent droughts have caused a decrease of the biomass and a reduction of the pastoral spaces, which in turn has led to the non-availability of fodder. Thus, to remedy this situation, it is important and sensible to make use of unrefined fodder, notably rice straw, through treatment by urea and the improvement of food quality by way of the provision of multi-nutritional blocks.
<u>Component and activities</u>	● enable better use by the livestock of unrefined fodder resources, with a technical advantage, i.e., improvement of the food;.
Objectives	● compensate for the deficit of the feed ingested by ruminants by adding a food supplement rich in energy, nitrogen or minerals; ● enable the animals in the extensive systems to cope better with the lack of fodder during the periods bridging the seasons; ● increase productivity of ruminants in the dry season; ● improvement of quality of poor fodder; ● satisfaction of maintenance and production needs of livestock to make Livestock farming more economical; ● increase of income of small-scale owners and agro-

	breeders; ● creation of employment in the area of manufacture of multi-nutritional blocks and their marketing.
Activities	The main activities will be limited in the first year to the organisation of training on the processing of straw by urea and the manufacture of multi-nutritional blocks and practical education for the benefit of Livestock farming technicians, community educators, breeders' associations and agro-breeders. Unrefined fodder enrichment by urea processing is envisaged on a large scale in the wilayas of Brakna, Trarza, Gorgol and Guidimakha. There are large crop residues, 40,000 tonnes for rice straw alone in the Rosso zone (Trarza).
Expected outcomes	● improvement of the quality of unrefined fodder; ● use of unrefined fodder to reduce the use of pastures and over-grazing in periods of lack of fodder; ● creation of jobs.
Implementation	
Administrative arrangements	The implementation of the project will be carried out by the Department of Research, Training and Education (DRTE) with the cooperation of the Department of Livestock farming.
Risks and obstacles	● discontinuance of straw and harvest by-products of the production zones; ● increase in the removal of nutrients from cultivated land; ● reduction of the fertility of the soil if there is no other form of organic restitution; ● risk of artificial increase in animal presence within one particular region, beyond the natural capacity imposed by the level of fodder resources; ● concentration of nutrients in animal production areas, with the risk of water and soil pollution; ● high level of inputs; ● low price of animal products; ● availability of inputs (ammonium, caustic soda, urea, etc.); ● difficulty in the supply of inputs; ● difficulty of the technique and supply of inputs for the small-scale breeders; ● unsatisfactory targeting of beneficiaries.
Monitoring and assessment indicators	● turn-over of farming; ● animal concentration in the zones of extensive pastures; ● concentration of nitrates and phosphorous in the soils and water; ● proportion of breeders having adopted the technique; ● number of animals receiving treated fodder and blocks; ● productivity of the animals having received treated fodder and blocks..
Duration	18 months
Funding	US\$300,000

7.2 Forest Sector

<u>Heading/title of project</u>	<u>Substitution of ligneous fuel</u>
Locality	National. The country's forest zones (the river zone and the south-eastern part of the country) urban populations (those of Nouakchott, mainly and those living near forest zones).
Sector	Forest
Field	Domestic energy
Type	Investment
PIP Reference	Rural community development project
Rationale	The forests are over-exploited (wood cutting) to satisfy the energy needs of (mainly) urban and rural households. Studies have shown that the energy demand of Mauritanian households cannot be met solely by the country's ligneous cover in the short or long-term. Thus, in order not to exhaust all the country's forests, this demand needs to be satisfied through another form of energy. Butane gas is the most suitable form to address this ever-increasing demand, particularly in urban centres.
<u>Components and activities</u>	
Objectives	The general objective is to put an end to the pressure exerted on the forest cover. The specific objective is to substitute wood and charcoal used as domestic fuel by butane gas.
Activities	● raise public awareness of the necessity of using butane gas instead of wood and charcoal; ● provide affordable butane gas and help the people (particularly those in rural areas and the outlying suburbs of the big urban centres); ● develop income-generating activities to redeploy people who had been engaged in the business of selling wood and charcoal.
Expected outcomes	Use of butane gas instead of wood and charcoal in urban and rural households.
<u>Implementation</u>	
Admin. arrangements	The project will be jointly carried out by the institution responsible for the environment in cooperation with the department responsible for energy
Risks and obstacles	The risks and obstacles relate to poverty (ability to purchase the equipment) of the target populations (rural populations and of outlying suburban areas) and to their eating habits. They also relate to the availability of gas in the rural areas at prices that are competitive with those of wood and charcoal.
Monitoring and assessment indicators	The impacts of the project will be assessed through the decrease of pressure on the country's ligneous cover. For the purposes of monitoring, the project will be reviewed midway and at the end, and will be subject to audits and field visits, quarterly and half-yearly reports.
Duration	2 years
Funding	US\$700,000

<u>Heading/title of project</u>		Institutional reinforcement of the structure responsible for nature conservation
Locality		National: Institution responsible for the protection of forest environment
Sector		Forestry
Field		Institutional reinforcement
Type		Community development project
<u>Rationale</u>		Administratively, the protection and sustainable management of the forest ecosystems are the responsibility of the Department of the Environment and Rural Development. The absence of reliable data from this institution and the absence of a direct person of reference at the Department at the level of the Ministry of Rural Development and the Environment (MRDE) regional delegations hinders regular monitoring. The absence of human and financial resources is also responsible for the non-application of the various policies recommended for the sector. The current absence of supervision and control of forest activities shows the necessity to strengthen the institutional capacities of the organs responsible for the protection of the forest ecosystems. It is a question of strengthening the human, material and financial capacities.
<u>Components and activities</u>		
	Objectives	The general objective is to develop the capacities of the institution responsible for the protection of the environment so as to help it to fulfil its mission. The specific objective is that the institution responsible for the protection of the environment is able to fulfil its mission
	Activities	Considering the legal weapons (forestry code, hunting code) existing in the selected activities: • To strengthen the human resources (recruiting skilled staff); • To strengthen material and financial resources (logistical resources and computer and cartography equipment).
	Expected outcomes	The main expected result is that the institution responsible for environmental protection becomes operational with skilled and motivated staff, equipped with effective material and financial resources.
<u>Implementation</u>		
	Administrative arrangements	The project will be carried out with the help of one of the international organizations working in the field of environmental protection.
	Risks and obstacles	The risks and obstacles which might be encountered in the project concern the identification of the real needs in capacity building.
	Monitoring and Assessment indicators	Project impacts will be evaluated through the decrease in pressure ligneous cover throughout the country. For monitoring purposes, the project will be reviewed midway and at the end, and will be subject to audits and field visits and quarterly and half-yearly reports
	Duration	2 years
	Funding	US \$ 400,000

<u>Heading/Title of Project</u>	Improvement of knowledge of the resource and its sustainable management.
Locality:	forest zones
Sector:	forest
Field:	forestry
Type:	applied research (studies)
PIP Reference:	fodder crops in wet zones
Rationale	The result of the lack of knowledge of the forest potential is the source of the absence of development, and with the lack of such development, there can be no sustainable management of the resource. It is therefore necessary to begin the studies required to establish development whose implementation will ensure the sustainable management of forest resources.
<u>Components and activities</u>	
Objectives	The general objective of the project is the knowledge of the national forest resources. More specifically, the project aims to gather information necessary to the management of forests in Mauritania.
Activities	To carry out a review (plant formation, large wetlands, use of these formations, evolutive trends of these formations) and socio-economic studies; To initiate developments for Mauritanian forests to promote sustainable use and improvement of the current state of plant formation.
Expected outcomes	The expected outcome of the project is the development of the forests in Mauritania.
<u>Implementation</u>	
Administrative arrangements	Administratively, the project will depend on the institution responsible for nature conservation. In its implementation, it has to rely on the country's research institutions.
Risks and obstacles	The risks and obstacles which might be encountered in the project arise from the effectiveness of national expertise in the field.
Monitoring and assessment indicators	The project impacts will be evaluated through the gaps filled in data which can be used for the development and management of forests in Mauritania. For monitoring purposes, the project will be reviewed midway and at the end, and will be subject to audits and field visits, quarterly and half-yearly reports.
Duration	5 years
Funding	US \$ 300,000

7.3 Agricultural Sector

<u>Heading/Title of Project</u>	Improvement of cultivation methods in pluvial zones and introduction of new varieties of drought-resistant high-yield cereal
Locality	Adrar, Tagant, Assaba, Hodh Gharbi, Hodh Chargui, Inchiri, Guidimaka, Gorgol, Trarza and Brakna.
Sector	Rural Development
Field	Agriculture
Type	Support project for the upgrading of the pluvial sub-sector
PIP Reference	Support to the special programme for food security
<u>Rationale</u>	Rain-fed agriculture is greatly dependent on rainfall which inevitably subjects it to the adverse effects of climate change (decrease in rains and their random nature). From this arises the necessity to improve the cultivation methods and the introduction of varieties of drought-resistant cereal.
Components and activities	
Objectives	Improvement of yields taking into account cultivation methods types and the protection of crops against stray animals and their enemies; Effective use of the producers' working time; Introduction of new varieties; Improvement of producers' expertise to improve their performance; Implementation of activities to create awareness and to enable identification of the sites to be covered by the project through missions, diagnostic research, etc.
Activities	Acquisition of agricultural equipment for ploughing, mowing and weeding; Training of producers in efficient and effective use of the equipment through training programmes, seminars, sessions, etc ; Identification, then the experimental use, of high-yield, fast-growing varieties, suitable for various zones.
Expected outcomes	Improvement of productivity of rain-fed crops; Increase in farmers' incomes; Improvement of farmers' knowledge; Reduction of rural exodus and ensuring food and nutritional security of the People; Contribution to national food security.
<u>Implementation</u>	
Administrative arrangements	The project will be carried out by the NCAARD, which will establish a small steering structure, following a participatory process. It is also important that a broad, efficient and effective partnership be developed with: farmers, cooperatives, national and international NGOs involved in the pluvial sub-sector, central and regional technical departments of MRDE, the private sponsors and other stakeholders in development.
Risks and obstacles	reluctance of producers; delay in acquisition of equipment or in obtaining funds, etc.
Monitoring and	

assessment indicators	crop yields; farmers' incomes; oasis populations' nutritional and food level; permanent establishment of communities on their land (level of rural exodus).
Duration	3 years
Funding	US \$ 1,270,000

Heading/ Title of Project	Promotion of water-saving irrigation methods in oasis zones (drip method pilot schemes)
Locality	Adrar, Tagant, Assaba, Hodh Gharbi and Hodh Charghi
Sector	Rural Development
Field	Agriculture
Type	Pilot investment project
PIP Reference	Rural development in the Adrar Oases

Rationale

Components and activities

Objectives	• promotion of water-saving irrigation methods: the drip technique through pilot schemes provided for by the scope of this project; • reduction of pumping costs; • improvement of producers' expertise.
Activities	• implementation of activities to create awareness and to identify the sites which will be covered by the project through missions, diagnostic research, etc.; • training of fruit growers in network maintenance through training courses, seminars, meetings, etc.; • acquisition and the installation of pumping equipment and of the irrigation network; • monitoring and the maintenance of networks; • support to producers and their SPOs for establishment of workshops (units) for construction and maintenance of this type of network to ensure the widest dissemination among the producers and to ensure its permanence.
Expected outcomes	• improvement in productivity of the palm tree and of related crops; • increase fruit growers' incomes through the decrease of costs of pumping; • rational management of the water from the water table by the restriction of losses due to the traditional irrigation method through open culverts; • protection of palm trees against contamination by germs capable of causing dangerous plant disease such as Bayoud disease; • reduction of the rural exodus and ensuring the populations' nutritional and food security; • Contribution to national food security.

Implementation

Administrative arrangements	The project will be carried out by the Department of Agriculture which will set up a small steering structure for the project following a participatory process. It is also important that a broad, efficient and effective partnership be developed with fruit growers, the associations, cooperatives and national and international NGOs involved in the oasis sub-sector, the central and regional technical departments of MRDE, private sponsors and other stakeholders in oasis development
Risk and obstacles	• reluctance of producers; • delay in acquisition of equipment or in obtaining funding.
Monitoring and assessment indicators	• productivity of the palm tree and of sub-oasis crops; • Farmers' income; • Oasis populations' nutritional and food level; • Permanent establishment of communities on their land (level of rural exodus); • fertilizer protection.
Duration	3 years
Funding	US \$ 1,200,000

<u>Heading/Title of Project</u>	Training and informing of producers, their SPOs and CPs
Locality	Agricultural Wilayas and Rural Development
Sector	Agriculture
Field	Pilot support project for producers and CEs
Type	Agricultural advice
PIP Reference	
Rationale	Given the size of the agricultural sector in the GDP and the provision of employment in the rural community, the training of, and provision of information to, the producers as well as their SPOs and agricultural CEs have proved crucial to the improved efficiency and cost-effectiveness of agriculture in Mauritania.
<u>Components and activities</u>	
Objectives	• training and capacity building of producers, their SPOs and CEs in the field of organisation (Cooperative Using Agricultural Equipment), establishment of seed-bearing trees etc), of farm management and the role of the agricultural adviser, etc; • Information, by all channels on communication, on technological progress recorded, particularly advances within their reach and immediately applicable to improve productivity, types of successful farming methods; • improvement of the producers' and CEs' expertise, particularly concerning the use of agricultural methods respectful of the environment; • improvement of the agro-systems productivity and consequently of the standard of living environment of this fringe community.
Activities	• organization of seminars, workshops, on-the-job training sessions, study trips, covering all the themes mentioned above to the benefit of producers and their SPOs; • training of CEs;

	• acquisition and the installation of computer and communication equipment to facilitate the access to worldwide information and to improve expertise; • execution of research studies to modernize irrigated agricultural studies in order to bring achieve the required diagnostics and to propose efficient and effective solutions within the reach of producers depending on category (small-scale producers, large-scale producers, individuals, private sector, etc); • improvement of the productivity of the irrigated systems; • increase in producers' incomes through the decrease of costs related to pumping.
Expected outcomes	• Rational management of farming in general but particularly of agricultural equipment and other production factors; • Updating of knowledge of CEs and producers; • Reduction of rural exodus and ensuring of the populations' nutritional and food security; • Contribution to national food security.
Implementation	
Administrative arrangements	The project will be carried out by the Department of Research, Training and Education (DRTE), which will set up a small steering structure following a participatory process. It is also important that a broad, efficient and effective partnership be developed with producers, associations, cooperatives, national and international NGOs involved in the irrigated sub-sector, the central and regional technical departments of MRDE, private sponsors and other stakeholders in development in irrigated zones.
Risks and obstacles	• reluctance of producers; • Delay in acquisition of equipment or in obtaining funding.
Monitoring and assessment indicators	• Yield of the various irrigated crops; • Farmers' income; • Number of trained farmers and SPOs; • Zone communities' nutritional and food level; • Permanent establishment of communities on their land (level of rural exodus).
Duration	3 years
Funding	US \$ 1,180,000

7.4 Water Sector

6.4.1 Surface Water

<u>Heading/Title of Project</u>	Contribution to a better knowledge of the surface water regimes in twenty (20) catchment areas
Locality	Ecological zones: fluvial, pluvial and oasis
Sector	Water
Field	Mainland surface water
Type	Institutional
PIP Reference	Water and Pastoral Village Project in the Sahel region

<u>Rationale</u>	The catchment areas with unknown regimes in the three ecological zones of the country, in case of heavy precipitation, or extreme drought, generate significant socio-economic damage. Consequently a contribution to the knowledge of their hydrological regime constitutes a priority. Hence the necessity to carry out evaluation studies of the resource by setting up functional networks for hydrological monitoring, enabling early alarms to be sounded to protect people and their property against disaster: Floodings and/or drought.
Components	
General objective	The improvement of the state of knowledge on the resources in mainland surface water with regard to the three ecological zones of the country, with a view to rational management.
Specific objectives	• establishment of networks of operational measures; • publication of monthly news bulletins during the rainy season; • capacity building.
Expected outcomes	• establishment of a functional network; • reports on resource development published periodically; • quantity of training carried out.
Activities	• acquire the material before the rainy season; • install the monitoring tools; • recruit management staff, agents, observers in the field; • organise measurement and data collection campaigns; • data processing; • disseminate news flashes, periodic reports and almanacs on the development of resources; • take part in workshops and in advanced training courses; • create awareness of methods of saving water; • provide advice to the various contributors.
Implementation	
Administrative arrangements	The Department of Rural Development will carry out the project in cooperation with the state structures concerned, the private sector, donors, civil society and local communities. The project is initiated by NAPA and will be supervised by its steering committee. The management of human and material resources (management staff, agents, observers, field and office equipment) of the project is defined as well as users' participation in the protection of the tools and data collection.
Risks and obstacles	• Floodings/droughts; • Pollution; • Increased rural exodus; • Bottlenecks.
Monitoring and assessment	• Reports, minutes, field visits, inspections midway through the process, audits, etc, providing performance and impact indicators including: • number of monitored and equipped catchment areas; • number of trained and recruited observers;

- number of recruited management staff and agents;
- estimate of losses avoided or reduced through early warning messages.

Duration	3 years
Funding	US \$ 423,990
<u>Heading/Title of Project</u>	<u>Support to the dissemination of the drip technique in the river valley and the oasis zones for the development of 300 hectares</u>
Locality	ecological zones: fluvial and oasis
Sector	water
Field	mainland surface water
Type	investment
PIP Reference	Water and pastoral village project
<u>Rationale</u>	The enormous use of water in the various sectors is resulting, given the worsening of the climate, in an ever-increasing pressure on the very limited resources of fresh water, which are vulnerable and very unevenly distributed in space and time in an arid country. It is in an effort to preserve such resources, that the drip method will be disseminated in the river valley and the oasis zones.
<u>Components</u>	
General objective	Dissemination of the drip method in order to reduce the pressure on water resources.
Specific objectives	• Improvement of the living conditions of rural populations; • Rational management of the water resource; • Reduction of GHG emissions in the atmosphere.
Expected outcomes	• Optimal management of the resource adopted by the users; • New water-saving cultivation methods adopted and spread throughout the country; • GHG emissions reduced through the propagation of new methods more attentive to environmental degradation.
Activities	• Acquire field equipment; • Collect data on consumption; • Recruit five (5) engineers and agents; • Arrange training and awareness raising workshops on the use of the drip method; • Ensure the promotion of the equipment by reduction of prices; • Dissemination of reports and almanacs on the development of the method and its appropriation by the targeted populations; • Publicize the rate of avoided emissions.
<u>Implementation</u>	
Administrative arrangements	• The Department of Rural Development will carry out the project in cooperation with the state structures concerned, the private sector, the donors, civil society and the local communities; • The project is initiated by NAPA and will be supervised by its steering committee;

	• The management of human and material resources (management staff, agents, field and office equipment) of the project is defined as well as the users' participation in the implementation of the project.
Risks and obstacles	• Lack of input stocks; • Lack of maintenance; • Increased rural exodus; • Conflicts of areas of competence; • Bottlenecks.
Monitoring and assessment	• Reports, minutes, field visits, reviews midway through the process, audits, etc. containing certain competence and impact indicators including: - developed surface area; - number of trained rural inhabitants; - decrease in water expenditure; - rate of GHG emissions avoided.
Duration	3 years
Funding	US \$ 433,990
Heading/ Title of Project	Contribution to increased value of surface water by construction of twelve (12) Flooding deceleration gates:
	pluvial zones (Guidimakha) and especially oasis zones (Adrar)
Location	Wilayas of Adrar and Guidimakha
Sector	Water
Field	Mainland surface water
Type	Investment
PIP Reference	Dam construction in the Affole
Rationale	The removal of water for agricultural, pastoral, mineral and industrial needs continues to increase in support of development. This situation has led to an ever-increasing pressure on the very limited resources of fresh water, which are vulnerable and very unevenly distributed in space and time in an arid country. These devices are necessary in the oasis and/or pluvial zones where intensive irrigation and Walo crops are impossible.
Components	
General objective	Construction of Flooding deceleration gates to increase the availability of water in the water table.
Specific objectives	• availability of water from the water table to ensure use in various seasons; • improvement of the living conditions of communities in the project zone; • decrease in GHG emissions.
Expected outcomes	• Work effectively carried out; • Drop in rural poverty observed; • Decrease in GHG emissions.

Activities	• Increase staff; • Carry out studies; • Organize workshops for preventive maintenance and repair of works; • Increase productivity; • Reduce the time devoted to fetching water; • Decrease the rate of GHG emissions.
Implementation	
Administrative arrangements	The Department of Rural Development will carry out the project in cooperation with the state structures concerned, the private sector, donors, civil society and local populations. The project is initiated by NAPA and will be supervised by its steering committee. The management of human and material resources (management staff, agents, field and office equipment) of the project is defined as well as the users' participation in the implementation of the project.
Monitoring and assessment	Reports, minutes, field visits, reviews midway through the process, audits, etc. containing certain competence and impact indicators including: number of devices installed; - increase in agricultural productivity; - decrease in fetching of water; - number of communities trained; - diversification of activities.
Risks and obstacles	Degradation of the environment; Silt up and filling with sand of basins; Abandonment of land; Increased rural exodus; Conflicts of competence; Bottlenecks.
Duration	4 years
Funding	US\$ 604,170

<u>Heading/ Title of Project</u>	Education in the use of fifty (50) electric motor pumps in the valley
Locality	Fluvial zone
Sector	Water
Field	Mainland surface water
Type	Investment
PIP Reference	Not included in PIP

<u>Rationale</u>	• Increase in value of the (OMVS) high tensions electrical lines serving the right bank of the Senegal river; • Substantial saving on the national energy bill; • Contribution to decrease of GHG emissions.
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Components	
General objective	Improvement of agricultural productivity in the valley through irrigation by electric motor pumps.

Specific objectives	• Irrigation of 1,000 hectares by electric motor pumps; • Saving on foreign exchange; • Decrease in GHG emissions.
Expected outcomes	• Surface area irrigated by hydro-electric motor pumps increased; • Rate of GHG emissions decreased; • Saving on foreign exchange achieved.
Activities	• Install electric motor pumps in the framework of a pilot project of 1,000 hectares which have already been rehabilitated; • Organize awareness, training and education campaigns; • Recruit and train five (5) engineers for management, agents and support staff; • Decrease significantly the use of GMP (gas-oil); • Ensure the timely maintenance and repair of electric MP; • Extend the experiment beyond the project.
Implementation	
Administrative arrangements	The Department of Rural Development will carry out the project in cooperation with the state structures concerned, the private sector, donors, civil society and local populations. The project is initiated by NAPA and will be supervised by its steering committee. The management of human and material resources (management staff, agents, field and office equipment) of the project is defined as well as the users' participation in the implementation of the project
Monitoring and assessment	Reports, minutes, field visits, reviews midway through the process, audits, etc., containing certain competence and impact indicators including: - number of tasks achieved; - increase in agricultural productivity; - decrease in fetching of water; - number of communities trained; - diversification of activities.
Risks	• Pollution and unmitigated harmful effects; • Technologies which have not been fully mastered; • Increased rural exodus; • Conflict of areas of competence; • Bottlenecks.
Duration	3 Years
Funding	US \$ 1,050,630

6.4.2 Underground Water

Heading/Title of Project	Improvement of management of underground water resources in the Aftout zone
Locality	South and Central Mauritania (Brakna, Gorgol, and Assaba)
Sector	Dhar water-bearing bed
Field	Water
Type	Underground Water
PIP Reference	Institutional and Investment
	Not included in PIP

Rationale	The phenomena linked to climate changes have caused the scarcity of surface water, the drying up of wells and springs, the fall in the level of the water tables and the increase in salinity. This situation is compounded by the marked increase in water use to meet agricultural, human, pastoral, mineral, and industrial requirements. Fresh water resources are scarce, vulnerable and very unevenly distributed in space and time. It is essential therefore to implement a policy of: • Rationalization of the use of the resource by the decrease in waste of the resource and by the population's participation in the burden of water costs (minor maintenance work on hydraulic equipment); • Safeguarding of water quality through campaigns to create awareness of problems related to hygiene on water and by the establishment of protection zones around the water supply points.
Components and activities	
Objectives	To improve the quality of operation and use of the underground water resource in the Aftout (the Wilayas of Gorgol, Assaba and Brakna) in order to protect its quality to optimise water supply points .
Activities	• Carry out community awareness and activity campaigns on the use of water; • Establish protection zones around water supply points; • Make people participate in paying for the cost of water cost through the local communities; • Organise the beneficiary communities into water point committees with manual pumps; • Sign maintenance contracts with the National Agency for Drinking Water and Sanitation (NADWS) responsible for the thermal and solar DEP and SPM networks.
Expected outcomes	• Protection of the resource against pollution phenomena; • Rationalization of use of the resource; • State disengagement from minor maintenance work on pumping systems; • Signature of management and maintenance contracts for places equipped with network of water supply with NADWS.
Implementation	
Administrative arrangements	This project falls within the brief of the NADWS mission, and MRDE is to hand over the technical management of this project to MWE through a protocol of agreement. A coordination unit responsible for the financial management will be set up.
Risks and obstacles	The risks and obstacles of this project are: • Conflicts of areas of competence between the NAPA authorities and NADWS; • Refusal by the people to agree to the project targets.
Monitoring and assessment indicators	• Number of water supply committees established; • Number of protection areas created; • Number of maintenance contracts signed;

	• Number of pumps powered by humans and number of technicians trained; • Number of awareness workshops organised.
Duration	3 Years
Funding	This project fits into the framework of the adaptation measures related to climate change and complements the support project to the reform of the sectors of water, sanitation and energy. This project is initiated by NAPA and its request for funding is submitted to the partners in development. The cost of the project is estimated at US \$ 250,000.
Heading/Title of Project	Support for improved monitoring of the piezometric networks of the water tables of Aïoun sandstones and of the Hodhs pelites.
Locality	South-East Mauritania (the 2 Hodhs and the Assaba)
Sector	Water
Field	Underground water
Type	Research
PIP Reference	Not included in PIP
<u>Rationale</u>	The chronic drought the country has witnessed during the last three decades has caused an ever-increasing pressure on underground water resources whose stocks are unknown and not monitored. This option aims to monitor the quantitative and qualitative development of the stocks of underground water and it will make it possible to : - Improve knowledge of the resources of water; - Manage the resource rationally; - Predict crisis situations;
Components and activities	
Objectives	The general objective of this project is to improve the state of knowledge of underground water resources on a countrywide scale and the specific objective is to ensure improved knowledge and sustainable management of resources of aquifer water from Aïoun sandstones and Hodhs pelites. To achieve these objectives, it is necessary to carry out the following activities:
Activities	• Acquisition of the monitoring equipment; • Installation of the functional observation network with monitoring stations equipped with automatic recorders; • Organization of measurement and data collection campaigns; • Drafting of periodic reports and almanacs; • Functional monitoring network; • Reliable collected, processed and disseminated data; • Periodic publication of reports on the development of the resource.
Expected outcomes	• Sustainable management of the resource; • Making water supply secure for communities, livestock and agriculture.
Implementation	

Administrative arrangements	This project falls within the brief of the National Centre For Water Resources (NCRW), and MRDE is to hand over the technical management of this project to MWE through a protocol of agreement and set up a coordination unit responsible for the financial management
Risks and obstacles	The risks and obstacles of this project are: • Conflicts of areas of competence between the authorities of NAPA and NCRW; • Resource outage.
Monitoring and assessment indicators	• Number of trained observers, agents and management staff; • Number of workshops to create awareness; • Reports on the seasonal and annual fluctuations of water table levels; • Hydro-geological annual statement of water tables; • Early warning system for crisis situations.
Duration	2 Years
Funding	This project fits into the framework of the adaptation measures related to climate change and complements the support project to the reform of the sectors of water, sanitation and energy which is funding the diagnostic studies and for restructuring the network. This project is initiated by NAPA and its request for funding is submitted to the partners in development. The cost of the project is estimated at US\$ 800,000

<u>Heading/Title of Project</u>	Support for the experimental use dissemination of the drip method in the oasis zones
Locality	Oasis zones
Sector	Water
Field	Underground water
Type	Institutional
PIP Reference	Sustainable development of the oases in the Adrar Stage III
<u>Rationale</u>	The need for water in the oasis zones is continually increasing, given the rapid population growth and sustained socio-economic development. This situation is compounded by an ever-increasing pressure on the freshwater water tables, which is scarce, vulnerable and very unevenly distributed in time and space. The supply of water in the oasis zones is carried out through a large number of wells equipped with motor pumps (e.g.: 500 motor pumps in Tawaz in Adrar) which capture alluvial water tables of which the reserves are limited and dependent on rainfall. This abnormal use of water tables leads to the irreversible destruction of their hydrodynamic characteristics. To combat this scourge, it is necessary to introduce new methods of irrigation to decrease the pressure on the water-tables

Components and activities

Objectives	• To improve the socio-economic development of communities of the oasis zones; • To optimise the use of the water resource • To ensure the permanence of the oases through sustainable
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	management of alluvial water-tables; • To decrease the number of motor pumps and the volume of water removed; • To decrease the GHG emissions in the atmosphere.
Activities	To fulfil these objectives, the following activities are required: • Experimental use of the drip method on ten (10) farmers in the oasis zones; • Organization of monitoring campaigns on the development of the resource; • Drafting of reports and almanacs on the development of the method and its appropriation by the targeted populations; • Organization of training and awareness workshops; • Propagation of the method.
Expected outcomes	• Resource sustainably managed on the basis of pertinent technical and scientific information; • Competent and optimal management of the resource adopted; • Introduction of new water-saving cultivation methods adopted; • Decrease in GHG emissions by the popularization of new irrigation methods more attentive to the degradation of the environment.
Implementation	
Administrative arrangements	This project could be managed by the Department of Agriculture or by a coordination unit responsible for the management of NAPA projects.
Risks and obstacles	The risks and obstacles of this project are: • Conflicts in the area of competence between the various departments of MRDE and the projects concerning the oasis zones; • Refusal by farmers to agree to project targets; • Inputs stock outage; • Mastering the method;
Monitoring and Assessment indicators	• Evolution of the developed areas; • Increase in productivity; • Savings at the water point; • Reduction of parasitic plants on the farms.
Duration	2 years
Funding	This project fits into the framework of the adaptation measures related to climate change and complements the rural development oasis project in Adrar by its management of the resource of water. This project is initiated by NAPA and its funding is submitted to the partners in development. The cost of the project is estimated at US\$ 400,000.

<u>Heading/Title of Project</u>	The study and monitoring of water quality in Magta Lahjar, Tintane and Wompou.
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Locality Brakna (Magta Lahjar), Hodh El Gharbi (Tintane) and Guidimakha (Wompou).

Sector	Water
Field	Underground water
Type	Investment and research

Rationale

Supplying drinking water to the localities of Maghta Lahjar, Tintane and Wompou is achieved through boreholes which capture water from the aquifer water table. The continuous drought and the significant exploitation of these water tables has caused a fall in the water level, a drop in the flow from the boreholes and deterioration of water quality, often thought to be caused by the high nitrate level.

This measure aims to identify new resources of water and monitor the development of the quality of water, and this will allow:

- improvement of the knowledge of the water resources;
- identification of new resources;
- rational management of the resource;
- possibility of anticipating crisis situations.

Components and activities**Objectives**

To improve the conditions of provision of drinking water in quantity and quality to the populations of the three localities. To achieve these objectives, the following are required:

Activities

- Establishment of piezometric networks for monitoring;
- Establishment of a methodology for collecting and processing data;
- Achievement of new hydro-geological and geophysical investigations to identify new water resources;
- Creation of new water capture devices;
- Connecting new boreholes to Project to Supply Drinking Water networks.

Expected outcomes

- Functional observation network;
- Reliable collected, processed and disseminated data;
- Periodic reports published on the development of the resources
- Improved conditions of provision of water to the communities in quantity and quality.

Implementation

This project falls within the brief of the National Centre For Water Resources (NCWR), and MRDE is to hand over the technical management of this project to MWE through a protocol of agreement and set up a coordination unit responsible for the financial management.

Risks and obstacles

The risks and obstacles of this project are:

- Conflicts of areas of competence between the NAPA authorities and the NCWR;
- Resource outage

Monitoring and assessment indicators

- Report on seasonal and annual fluctuations of the levels of water tables and annual forecasts;
- Hydro-geological annual statement of aquifers;
- Early warning system for crisis situations
- Savings at water points;
- Number of prospected sites;
- Number of completed productive boreholes;

- Improvement of conditions of provision of drinking water to communities.

Duration	3 Years
Funding	This project falls into the framework of the adaptation measures related to climate change. This project is initiated by NAPA and its financing is submitted to the partners of development. The cost of the project is estimated at: US\$ 1,000,000

7.5 Land Ecosystems

Heading/ Title of Project	Fixation of shifting dunes threatening the national socio-economic infrastructure
Locality	All the ecosystems which contain shifting dunes. The target populations are those close to the dunes.
Sector	Forest
Field	Forestry (soil protection and restoration)
Type	Investment
PIP Reference	National Action Plan to Combat Desertification (NAP)

<u>Rationale</u>	Silting up with sand is threatening several important national infrastructures. Their permanent protection through a biological method consisting of restoring the ecosystem is necessary.
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Component and activities	
Objectives	The general objective of the project is the restoration of the arid and semi-arid ecosystems facing problems of silting by sand. More specifically, the project aims to achieve the fixation of sand dunes where they threaten national socio-economic infrastructures.
Activities	The activity to be carried out is the mechanical and biological fixation of shifting sand dunes.
Expected outcome	The expected outcome is the permanent protection of the infrastructures threatened by sand dunes.

Implementation	
Administrative arrangements	Administratively, the project will depend on the institution responsible for the protection of nature (using national expertise in the field)
Risks and obstacles	The risks and obstacles can only be of a financial order or related to rigorous implementation of the expected activities.
Monitoring and Assessment indicators	The impacts of the project will be estimated through the recovered silted environments and through the protected socio-economic infrastructures. For the purposes of monitoring, the project will be reviewed midway and at the end, as well as being subject to audits and field visits and quarterly and half-yearly reports.
Duration	4 Years

Funding US\$ 1,500,000

Heading/Title of Project

Participatory reforestation for energy and Agro-forestry in the agricultural zones

Locality	The rural environment and the farming areas and their populations.
Sector	Agro-forestry
Field	Agriculture/Forestry
Type	Investment
PIP Reference	Decentralized rural electrification. Phase I

Rationale

Trees also play an important role with regard to the fields: they provide shade and diversify production (firewood, wood for use and fodder). Hence, this type of project covers the development of quickset hedges, the association of trees and crops and small areas of reforestation on the basis of rapid growth. In addition, rural women are having to move further and further afield to find wood. The pressure on the forest formations is being felt more and more by the villagers through the scarcity of local products. It seems prudent to carry out reforestation for energy and to associate trees with crops.

Components and activities

Objectives

The general objective of the project is the sustainable management of agricultural ecosystems through the introduction of the tree into cultivation systems. The specific target is the improvement of ligneous production (firewood, wood for use and fodder) through partnership with trees.

Activities

The activities to be carried out are the planting of quickset hedges, village reforestation and the introduction of trees in partnership with crops

Expected outcomes

The chief expected outcome is the partnership of trees and crops for improved protection of soils and the planting of fast-growing species to satisfy the populations needs in the agricultural environment for ligneous products.

Implementation

Administrative arrangements

The project will be carried out jointly by the institution responsible for the environment in cooperation with that responsible for agriculture.

Risks and obstacles

The risks and obstacles can only be of a financial order or related to rigorousness of implementation of the planned activities

Monitoring and assessment indicators

The impacts of the project will be evaluated through the village reforestation carried out and the level of introduction of trees into farming environments. For the purposes of monitoring, the project will be reviewed midway and at the end of the process, as well as being subject to audits and field visits and quarterly and half-yearly reports.

Duration

5 Years

Funding	US\$ 1,000,000
<u>Heading/Title of Project</u>	The reorganization of populations adversely affected by climate change, taking into consideration the options they have already adopted
Locality	The target areas are the outlying suburban areas of large urban centres, the wetlands and the tarred roads used by the target populations.
Sector	Rural
Field	Fixation of communities on their lands
Type	Social
PIP Reference	Not included in PIP
<u>Rationale</u>	The climate changes resulting from the deterioration of the rainfall level have affected the great majority of the rural and nomadic populations. This situation has driven these populations to adopt various strategies to adapt to the new conditions. These strategies include rural exodus, connection between tarred roads and permanent settlement in the favourable areas (wetlands).
Components and activities	
Objectives	This situation is harmful to the ecosystems which host these populations and even to these populations themselves. Hence, reorganization of these populations seems necessary.
Activities	The activities to be carried out are the redirection of options already adopted by the populations: population settlement along the tarred roads (adaptation to climate change) and disordered settlement.
Expected outcomes	The expected outcome is the establishment of the populations adversely affected by climate change.
<u>Implementation</u>	
Administrative arrangements	Administratively, the project will depend on the institution responsible for Nature conservation. Its activity must be complementary to other activities from other relevant ministerial departments.
Risks and obstacles	The risks and obstacles which might be encountered by this project are related to the conditions necessary to make the adaptation options viable and respectful of the environment. It is a question of satisfying the needs of the newly fixed populations as regards drinking water, power, agricultural land, income generating activities, schools, health centres, etc.
Monitoring and assessment indicators	The impacts of the project will be evaluated through the new situation of the newly settled populations. For the purposes of monitoring, the project will be reviewed midway and at the end of the process, and will be subject to audits and field visits and quarterly and half-yearly reports.
Duration	2 Years

Funding	US\$ 600,000
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7.6 Marine and coastal ecosystems

<u>Heading/Title of Project</u>	The implementation of a safeguard plan for the town of Nouakchott and its infrastructures.
Locality	The project is located in Nouakchott
Sector	Coastal ecosystems
Field	Infrastructure and housing
Type	Investment project
PIP Reference	Urban development programme

<u>Rationale</u>	In recent decades, the Nouakchott coastline has seen accelerated urbanization resulting from the deteriorating climate and the crisis in the rural environment. Nouakchott currently accommodates over 25% of the country's population, a great part of industry (fish processing, tourism, construction, etc.), of commerce and of other socio-economic infrastructures. Most of the town's suburbs as well as numerous socio-economic infrastructure, some of which are vital to the development of the country, are in the low areas susceptible to Flooding (Sebkha and Aftouts). With the effects of climate change, it is the communities, accommodation, socio-economic infrastructures and the economy of the region or even of the country which will be affected in a general way.
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Components and activities

Objectives	• To institute and make compulsory the enforcement of standards for town planning taking into consideration climate change by revising, for example, the SDAU in relation to the various scenarios of a rising sea level; • To carry out by 2006 a development plan for the coastline in Nouakchott; • To ensure security for over 80% of the inhabitants of Nouakchott located in the areas at risk consequent upon climate change by building a breakwater 1.5m to 2m high and 5 to 6m wide along the whole west front of Nouakchott by 2009; • To relocate by 2009 over 60% of the infrastructures established on the dunes and to orchestrate a planned removal of all the infrastructures established in the sectors susceptible to the effects of climate change; • To create awareness by 2009 in over 70% of the contractors and the subcontractors of the appropriate construction methods for areas at risk.
Activities	Section 1: Institutional aspects • To carry out town planning and development studies taking into account climate change; • To draw up regulations to get them adopted them by the relevant authorities. Section 2: Technical aspects • Financial and technical study for the building of a breakwater for the protection of Nouakchott; • Building of the breakwater; • Studies of the various scenarios for strategic withdrawal of

the infrastructures established in the areas at risk.

Stage 3: Creation of awareness

- Drafting an Information, Education, communication (IEC) strategy adapted to the needs of contractors and subcontractors on the appropriate construction methods for areas at risk;
- Implementation of the IEC strategy through the various channels of communication (radio, TV, Press, etc);
- Monitoring and assessment of the communication strategy.

Expected outcomes

Section 1: Institutional

- A plan for urban development and laws are written and adopted.

Section 2: Technical

- A 20km breakwater built on the west Nouakchott front;
- A strategic withdrawal programme of the infrastructures established in the areas at risk is drafted and implemented.

Stage 3: Creation of awareness

- An adapted and operational IEC strategy implemented through various means of communication (radio, TV, press, etc) and followed up.

Implementation

Administrative arrangements

The project will be steered by a small multi-sectoral structure which will be led by a committee bringing together all the sectors involved in the implementation of the project.

Risks and obstacles

- Techniques in terms of the adaptation of building and equipment methods to climate change;
- Raising of funds for the project.

Monitoring and assessment indicators

- Monitoring of the implementation of the project by the coordination and multi-sectoral committee;
- Monitoring of activities;
- Monitoring of the project midway, involving all the stakeholders;
- A plan for urban development taking into account the climate change drafted and adopted;
- Regulations drafted and adopted;
- A bypass built for the protection of the town;
- Strategies for withdrawal set up for the areas at risk;
- Strong involvement on the part of communities;
- IEC programme carried out;
- All the activities of the project carried out within the specified time.;
- Expected results achieved.

Duration

Five (5) Years (2005-2009)

Funding

US\$ 2,091,000

Heading/Title of Project

Protection of the diversity of the fish population and prevention of over-fishing with a view to sustainable development

Locality
Sector
Field

The project is located in Nouadhibou
Coastal ecosystems
Fishing

Rationale

Fish resources are facing increasing difficulties, especially the degradation of part of the marine and coastal ecosystems, the over-fishing of a few of the main species in demand, illegal incursions of the fishing fleet into prohibited zones, the use of prohibited fishing equipment or which are not sufficiently selective, intensification of the competition between traditional, and industrial fishery.

As a result of climate change, the alterations in the characteristics of the marine currents (temperature, salinity, etc.) and of the general movement of the oceans, the rising of the sea level, etc, will certainly have an effect on the productivity of these ecosystems, the marine and coastal habitat and the diversity of the resource.

Components and activities

Objectives

- To ensure the establishment of rules and norms taking into consideration the requirements of the fish habitat in the planning of coastal development;
- To extend monitoring of the resource which is currently limited to the whole EEZ;
- To promote through targeted programmes the genetic diversity of fish populations by fish farming;
- To create awareness among the various stakeholders on innovative fishing techniques.

Activities**Section 1: Technical aspects**

- To integrate by 2009, the aspect of climate change into coastal planning in order to take account of the requirements for the fish habitat;
- Studies for the implementation of development plans for fisheries, particularly with a view to prohibiting the fishing of certain species very susceptible to the effects of climate change;
- Introduction of the CC dimension into all the programmes and projects in the fishing sector;
- Equipping the Department of Surveillance of Fisheries and Marine Control (DSFSC) with effective means to make possible the Exclusive Economic Zone (EEZ) surveillance by the provision of buying patrol boats, radar equipment, human resources, etc.
- The development of simple techniques adapted to climate change contexts in the field of fish farming to preserve genetic diversity.

Section 2: Aspect of creating awareness

- Drafting of an IEC strategy adapted to the needs of the fishing sector regarding climate change and the risk of exhaustion of fishing resources;
- Implementation of the IEC strategy through the various channels of communication (radio, TV, press, etc.);
- Monitoring and assessment of the communication strategy.

Expected outcomes**Section 1: Technical aspects**

- Technical tools are created;
- Regulations prohibiting over-fishing of rare species are drafted, adopted and enforced;

- Aspect of climate change is taken into account in fishing sector programmes;
- DSFSC is equipped with effective means to carry out EEZ surveillance;
- Fish farming methods are implemented in a significant way to preserve the genetic diversity of the fish populations.

Section 2: Creation of awareness

- An adapted and operational IEC strategy is implemented through the various communication channels (radio, TV, press) and is monitored.

Implementation

Administrative arrangements

The project will be steered by a small multi-sectoral structure led by a committee bringing together all the sectors involved in the implementation of the project

Risks and obstacles

The monitoring process will have the following characteristics:

- Monitoring of the implementation of the project by the coordination and the multi-sectoral committee;
- Monitoring of activities;
- Monitoring midway through the project involving all the stakeholders.

Expected Outcomes

- Sustainable exploitation of the fishing resource, particularly that which is susceptible to climate change;
- Habitats are preserved;
- The fishing population carry out their activities in accordance with the standards of sustainable use;
- Diversification and increase in income for fishermen.
- Strong involvement of the population;
- Climate change taken into consideration in fishing sector policy;
- IEC programme carried out;
- DSFSC equipped with human and material resources;
- All the project activities carried out in the required time;
- The expected results achieved.

Duration

Five Years (2005-2009)

Funding

US\$ 1,337,000

Heading/Title of Project

The protection and reinforcement of the dune bar along the coastline in Nouakchott

Locality

The project is located in Nouakchott

Sector

Coastal ecosystems

Field

Coastal

Type

Social project

PIP Reference

Urban development programme

Rationale

In Nouakchott the sands of the coastal bar, the town's only natural protection against marine incursions during heavy storms, are currently over-exploited and the dune bar has been weakened in various places. This bar is also subjected to almost uncontrolled

developments which have strongly contributed to weakening it. The frequency and intensity of these storms will certainly increase as a result of climate change. In particular, they will result in heavy Flooding affecting most districts of the town. Nouakchott accommodates over 25% of the country's population, much of industry (fish processing, tourism, construction...etc), commerce and other socio-economic infrastructures.

Components and activities

Objectives

- To institute and make operational by 2006 a supervisory structure for the protection of the coastline bar;
- To reconstruct and cover in vegetation over 80% of the weakened structures of the coastline dunes by 2009;
- To create awareness among, and inform, 80% of the population of Nouakchott on the dangers and means of protection if the dune bar gives way.

Activities

Section: Institutional aspects

- Establishment of a multi-sectoral committee to consider a supervisory structure for the protection of the dune bar;
- Drafting and adopting of laws by the relevant authorities;
- Establishment of the supervisory structure (headquarters, staff, equipment, etc).

Section 2: Technical aspects

- Financial and technical study of the feasibility of dredging and reshaping the dune;
- Implementation of the study results;
- Monitoring of the work;
- Protection and reforestation by adapted species along 20 km of coastline;
- Technical studies on the problems of erosion in the south of the harbour;
- Implementation of the study results.

Section 3: Creation of awareness

- Elaboration of an IEC strategy adapted to the needs of Nouakchott on the aspect of climate change and the risks of the dune bar giving way;
- Implementation of IEC strategy through the various communication channels (radio, TV, press etc);
- Monitoring and assessment of the communication strategy.

Expected outcomes

Section 1:

- An operational supervisory structure is set up;
- Laws are drafted and adopted.

Section 2:

- The dune bar is dredged and reshaped;
- The protection and reforestation of the bar for 20km are carried out;
- The work is supervised.

Section 3:

- An adapted and operational IEC strategy is implemented through the various communication channels (radio, TV, press, etc) and is monitored.

Implementation

Administrative arrangements

The project will be steered by a small multi-sectoral structure led by a committee bringing together all the sectors involved in the implementation of the project

Risks and obstacles

The fixation of the sands of the bar might stop the sedimentary exchanges between the dune and the beach and the foreshore

Monitoring and assessment indicators

- Technical risk related to the choice of sedimentary material for reinforcing the bar;
- Difficulty in obtaining funding;
- Monitoring of the implementation of the project by the coordinators and the multi-sectoral committee.
- Monitoring of activities;
- Review midway through the process involving all the stakeholders;
- The coastal bar in Nouakchott has been reinforced and its ecosystem restored;
- Integrated management of the coastal dune;
- Supervisory structure is established;
- Laws taking into account climate change are drafted and adopted;
- IEC strategy is implemented;
- Strong community involvement;
- All the project activities have been achieved in the specified time;
- The expected results have been achieved.

Duration

Five Years (2005-2009)

Funding

US\$ 1,018,000

APPENDIX

LIST OF PERSONS AND EXPERTS INVOLVED

TASK MANAGERS:

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Mrs Nagia Mint Ahmed, NGO Chair

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Mr Mohamed Yile, Hodh Charghi Focal Point

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Economists: Assane Soumaré, Fah ould Brahim (ecosystem), Ainina ould A. Jellil (water), Ismail ould Sadegh (Livestock farming, forestry and agriculture)
Topic experts: Dr. Doumbia Baba (Livestock farming), M.A. ould Selmé (forestry), Sarr Djibril (surface water), Thièye Samba (underground water) Mohamed Fadel ould Aghdhafna (agriculture)
Ecosystem experts: M.A. ould Selmé (arid and semi-arid), Dr. Demba Marico (coastal and marine)
Synergy: Sidaty ould Dah
Creation of awareness and participation of the stakeholders: Gueye Birome and Sall Amadou
Workshops minutes: M.A. ould Selmé, Sidaty ould Dah
Meetings minutes: Gueye Birome and Sall Amadou
