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Foreword

In 1993, Environmental Performance Reviews (EPRs) of the United Nations Economic Commission for Europe (ECE) were initiated at the second Environment for Europe Ministerial Conference, in Lucerne, Switzerland. They were intended to cover the ECE member States that are not members of the Organisation for Economic Co-operation and Development (OECD). Subsequently, the ECE Committee on Environmental Policy decided to make them part of its regular programme. Since then, the Ministers affirmed their support for the EPR Programme, and decided in 2003 that the Programme should continue with a second cycle of reviews, and lately they formally endorsed the third cycle of reviews in 2011.

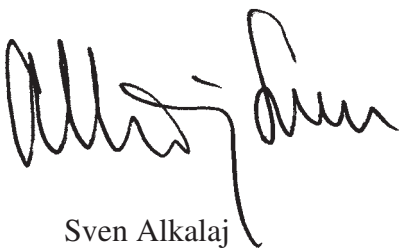
Through the peer review process, EPRs also promote dialogue among ECE member States and the harmonization of environmental conditions and policies throughout the region. As a voluntary exercise, an EPR is undertaken only at the request of the country concerned.

The studies are carried out by international teams of experts from the region working closely with national experts from the reviewed country. The teams also benefit from close cooperation with other organizations in the United Nations system, for instance the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP), as well as with the European Environment Agency (EEA), World Health Organization (WHO) and other organizations.

In 2010, the Government of Morocco requested ECE to conduct an EPR of Morocco. Although Morocco is not part of the ECE region, the ECE Committee on Environmental Policy agreed to carry out the environmental performance review of this country. This is the first EPR conducted by ECE beyond its region. In this regard, ECE sought the cooperation of the United Nations Economic Commission for Africa (ECA), which confirmed its willingness to cooperate in the implementation of the EPR process through its Sub-Regional Office for North Africa.

This is the EPR of Morocco published by ECE. This EPR also covers 13 issues of importance to the country related to policymaking, planning and implementation, the financing of environmental policies and projects, and the integration of environmental concerns into economic sectors, in particular agriculture, energy, health, industry, biodiversity and protected areas, water and waste management. The Morocco review was notable as it is the first country outside the region to request an EPR from ECE, and the process was undertaken in cooperation with the ECA.

I hope that this EPR will be useful in supporting policymakers and representatives of civil society in their efforts to improve environmental management and to further promote sustainable development in Morocco, and that the lessons learned from the peer review process will also benefit other countries of the ECE and ECA regions.



Sven Alkalaj
Executive Secretary
Economic Commission for Europe

Preface

The EPR of Morocco began in February 2012 with a preparatory mission. During this mission, the structure of the review report was discussed and the time schedule established. A review mission took place on 7-14 November 2012. The review team included experts from France, Portugal and Switzerland, together with experts from the ECE Secretariat and experts provided by ECA and UNEP.

The draft EPR report was submitted to Morocco for comment and to the ECE Expert Group on Environmental Performance Reviews for consideration in July 2013. During its meeting on 11 and 12 September 2013, held in Rabat, Morocco, the Expert Group discussed the report in detail with representatives of the Government of Morocco, focusing in particular on the conclusions and recommendations made by the international experts.

The EPR recommendations, with suggested amendments from the Expert Group, were then submitted for peer review to the nineteenth session of the ECE Committee on Environmental Policy on 24 October 2013. A delegation from Morocco participated in the peer review. The Committee adopted the recommendations as set out in this report.

The Committee on Environmental Policy and the ECE review team would like to thank the Government of Morocco and its experts who worked with the international experts and contributed their knowledge and assistance. ECE wishes the Government of Morocco further success in carrying out the tasks involved in meeting its environmental objectives, including the implementation of the recommendations in this review.

ECE would also like to express its appreciation to France, Portugal, Switzerland, ECA and UNEP for having delegated their experts for the review, and the UNDP for its support of the EPR Programme and this review.

Team of experts for the EPR of Morocco, 2012

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KEY ABBREVIATIONS

AFD	Agence Française de Developpement
AfDB	African Development Bank
AMITH	Association Marocaine des Industries du Textile et de l'Habillement
APC	Association Professionnelle des Cimentiers
BAT	Best Available Techniques
BDI	biological diatom index
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
CEPA	Communication, Education, Participation and Awareness
CFC	chlorofluorocarbons
CGEM	General Confederation of Moroccan Enterprises
CHMBM	Clearing House Mechanism on Biodiversity of Morocco
CMPP	Moroccan Clean Production Centre
CPI	Consumer Price Index
CR	Critically Endangered
CR	charge rate
CSR	Corporate Social Responsibility
DLV	discharge limit values
DNA	Designated National Authority
DNM	National Directorate of Meteorology
DPL	Development Policy Loans
DPSIR	Driving forces-pressures-state-impacts-responses
DRC	Directorate of Regulations and Control
ECA	Economic Commission for Africa
ECE	Economic Commission for Europe
EE	environmental education
EEA	European Environment Agency
EIA	environmental impact assessment
EIB	European Investment Bank
ELV	emission limit values
EN	Endangered species
ENP	European Neighbourhood Policy
EPR	Environmental Performance Review
ESD	education for sustainable development
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FDI	foreign direct investment
FEE	Foundation for Environmental Education
FEMIP	Facility for Euro-Mediterranean Investment and Partnership
FFEM	Fonds Français pour l'Environnement Mondial
FODEP	Fund for Industrial Depollution
GBNI	global biological normalized index
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	greenhouse gases
GIS	geographical information system
GISD	Global Invasive Species Database
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
HCFC	hydrochlorofluorocarbons
HCP	High Commission for Planning
HCWC	High Council for Water and Climate
HDI	human development index
IAS	Invasive Alien Species
IBA	Important Bird Areas
ICZM	Integrated Coastal Zone Management

IEA	International Energy Agency
IFI	international financial institutions
ILO	International Labour Organization
INDH	National Initiative for Human Development
IRESEN	Research Institute for Solar Energy and New Energies
ISED	integrated information system for environmental data
IUCN	International Union for Conservation of Nature
IVCM	integrated vector control management
KfW	Kreditanstalt für Wiederaufbau
MASEN	Moroccan Agency for Solar Energy
MEA	multilateral environmental agreement
MENA	Middle East and North Africa
MSW	municipal solid waste
NBC	National Biosafety Committee
NIP	National Indicative Programme
NT	Near Threatened species
OCP	Office Chérifien des Phosphates
ODA	Official development assistance
ODP	ozone-depleting potential
OECD	Organisation for Economic Co-operation and Development
OEPP	European and Mediterranean Plant Protection Organization
ONE	National Office of Electricity
ONEE	National Office of Electricity and Drinking Water
ONEM	National Environmental Observatory
ONEP	National Office of Drinking Water
ONSSA	National Office of Food Safety
OREDD	regional observatory of the environment and sustainable development
ORMVA	regional office for agricultural development
PAGER	Rural Drinking Water Supply Programme
PAH	polycyclic aromatic hydrocarbons
PANE	National Environmental Action Plan
PCB	polychlorinated biphenyls
PMV	Green Morocco Plan
PNA	National Programme of Sanitation and Wastewater Treatment
PNDM	National Municipal Solid Waste Management Programme
PNEEI	National Programme for Saving Irrigation Water
PNGDD	National Master Plan for Managing Hazardous Waste
POPs	Persistent Organic Pollutants
PPA	power purchase agreements
PPP	Purchasing Power Parity
PRTR	pollutant release and transfer register
RAET	regional academies for education and training
RBMP	river basin integrated management master plan
REIS	regional environmental information system
RES	renewable energy sources
SAMIR	Société Anonyme Marocaine de l'Industrie du Raffinage
SEA	strategic environmental assessment
SEIS	shared environmental information system
SIBE	Sites of Biological and Ecological Interest
SIE	Energy Investments Company
SMEs	small and medium-sized enterprises
SPM	suspended particulate matter
SSN	Species Survival Network
STAR	System for Transparent Allocation of Resources
STEP	Pumped Power Transfer Station Project
ToR	terms of reference
TPP	thermal power plants

UAA	utilizable agricultural area
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
VU	Vulnerable species
WBA	water basin agency
WEEC	World Environmental Education Congress
WHO	World Health Organization
WSI	Water Satisfaction Index
WWF	World Wildlife Fund
WWTP	wastewater treatment plant
YRE	Young Reporters for the Environment

SIGNS AND MEASURES

..	not available
-	nil or negligible
.	decimal point
$	dollar
Ci	Curie
GWh	gigawatt-hour
ha	hectare
kg	kilogram
kJ	kilojoule
km	kilometre
km^2	square kilometre
km^3	cubic kilometre
kgoe	kilogram of oil equivalent
ktoe	kiloton of oil equivalent
kV	kilovolt
kW	kilowatt
kWh	kilowatt-hour
l	litre
m	metre
m^2	square metre
m^3	cubic metre
MW	megawatt
ppm	parts per million
s	second
t	ton
toe	ton of oil equivalent
tofe	ton of fuel equivalent
TWh	terawatt-hour

CURRENCY CONVERSION TABLE

Year	dirham / US$
2000	10.63
2001	11.30
2002	11.02
2003	9.57
2004	8.87
2005	8.87
2006	8.80
2007	8.19
2008	7.75
2009	8.06
2010	8.42
2011	8.09
2012	8.63

Source: World Bank Databank (accessed 19 November 2013).

Executive summary

The Environmental Performance Review (EPR) of Morocco began in 2012. It analyses the progress made by the country from 2003 on environmental protection, and proposes recommendations on how Morocco can improve its environmental management and address recurrent environmental challenges.

Morocco was the fifth-largest economy in Africa in 2010 as measured by Gross Domestic Product (GDP). It is considered to have the most competitive economy in North Africa according to the World Economic Forum's 2012–2013 Global Competitiveness Index. This is a result of ongoing regulatory reform to improve the country's business environment, which has been the Government's consistent policy goal since 2005. This development was realized through a convergence of socio-economic issues and the adoption of sectoral strategies that provide better visibility and allow a gradual integration of the environmental component.

The economy is weighted towards services, which share in 2011 was 55.1 per cent of GDP, while industry's share was 29.9 per cent and agriculture produced 15.1 per cent. Agriculture, however, plays a bigger role in the country's economic development than its share of GDP would imply. This is because, first, it employs 44 per cent of the country's workforce and, second, any fluctuations in cereal production, e.g. due to drought, have a direct impact on the economic growth of the country in general.

Morocco has 75 per cent of the world's phosphate reserves. It is the world's biggest phosphate exporter (with 28 per cent of the global market) and third-biggest producer. The price fluctuations of phosphates on the international market can greatly influence Morocco's economy. Fortunately, the country's dependence on phosphate exports has shrunk in recent years as exports of manufactured and agricultural products, combined with the growth in tourism, have increased. On the import side, Morocco is dependent on imported fuel and the country's food import requirement can rise substantially in drought years.

Inflation has remained very moderate with an average annual rate of just below 2 per cent in recent years. Such a level of inflation can be partially explained by sizeable government subsidies designed to shield domestic prices of some foodstuffs and energy products from price hikes in international commodity markets. The unemployment rate has been relatively stable at around 9 per cent in recent years.

Policy framework for environmental protection and sustainable development

Since 2003 Morocco has been putting in place foundations for enhancing its environmental policy, which until then was very general and addressed primarily water management issues. Three important environmental laws were approved in 2003, namely laws on the protection and conservation of the environment, combating air pollution and environmental impact assessment. Despite progress made, the environmental legal framework remains underdeveloped and still inconsistent.

To accelerate progress on preventing pollution and restoring environmental conditions, the Government has established a number of national programmes. Among them, the National Municipal Solid Waste Management, the Programme National Programme of Sanitation and Wastewater Treatment, the National Programme for Collection and Disposal of Plastic Bags, the National Programme of Environmental Upgrading of Rural Schools, and the National Programme for Prevention of and Fight against Industrial Pollution.

The adoption of the National Charter for Environment and Sustainable Development, at the seventh session of the National Council for the Environment in 2011 has allowed Morocco to redouble its efforts to protect the environment and sustainable development. In fact, the operationalization of this charter is achieved by the enactment of the framework law on environment and sustainable development through the development of a national strategy on environment and sustainable development with all the economic, social and environmental aspects.

The Constitution adopted in 2011 also helped to give a new impetus to the process of the establishment of sustainable development. Structured around the universally recognized principles and enhanced by international

experience, this constitution serves as a reference. It stipulates the sustainable development as a right of every citizen.

Compliance and enforcement mechanisms

The environmental legal framework poses problems of implementation. Some laws are outdated; others lack secondary legislation to become effective and enforceable. Furthermore, the governing environmental laws do not provide explicit powers of inspection and enforcement to the main environmental authorities.

While there are environmental inspectors in Morocco, no system of compliance monitoring is in place. Resources dedicated to compliance are very modest. As a result, there is no programme of inspections, not even in highly industrialized regions such as Grand Casablanca. Site visits are mostly ad-hoc and driven by requests or complaints. A limited number of inspections were made, some following the environmental impact assessment procedures or as a result of the projects benefitting from funds related to industrial depollution.

Self-monitoring is just beginning to be implemented. Very few industries, apart from the cement industry and a few large enterprises, implement it. They perform their monitoring activities as a matter of internal corporate policy. There is, therefore, hardly any quantitative information that would permit understanding of the procedural and substantive impact of existing laws.

Due to a lack of compliance control, environmental authorities prioritize regulatory culture largely based on negotiations, consensus-building and voluntary approaches. Even if the impact of these approaches has proved to be positive, a qualitative analysis concluded that tools and resources of the Moroccan system of ensuring environmental compliance have limited opportunities to produce concrete results.

The current approach to compliance fails to address environmental challenges, which can gradually become economic and development challenges. The Government thus needs to reconsider its approach of establishing an incentive framework for higher environmental performance.

Monitoring, information and education

The system for monitoring, collecting and managing environmental information is in the process of development. However, the lack of a coherent legislative framework for environmental monitoring and assessment hinders this process, insofar that as the institutional arrangements, in particular regarding the sharing of information, remain below expectations .

The Constitution provides Moroccan citizens with the right of access to environmental information retained by the public administration. Currently environmental information is available at the Department of Environment.

Morocco carries out a multitude of activities promoting environmental education and education for sustainable development. Environmental education is integrated in the primary, secondary and high school curricula in the form of specific programmes. Universities offer graduate degrees on the environment and sustainable development.

Economic instruments and expenditures for environmental protection

The main instrument used in Morocco to create financial incentives for enterprises to shift to less polluting modes of industrial production are subsidies in the form of grants. Such grants are mainly provided under the umbrella of the industrial clean-up programmes.

Fines and sanctions for non-compliance with environmental standards (notably for air, water and waste), even if stipulated in the legislation, are not applied in general, and neither are emissions charges. This is a major missing incentive for promoting more environmentally friendly consumption and production patterns. Furthermore, there are no plans to introduce taxes on emissions of air pollutants. On the other hand, the regulations for the establishment of various taxes, even those that have been partially established by the legislation are slow to be implemented: e.g., fees for discharges, flows, direct and indirect deposits into surface or ground water.

The tariffs for various communal services are all regulated by the State. Their present setting does not ensure the recovery of operating costs, hence all services are subsidized to all users regardless of their financial status.

Similarly to communal services, petroleum products are subsidized to bring their price down. While this approach may shield the poor from price hikes in international commodity markets, it basically creates a system of environmentally harmful subsidies because it encourages overconsumption by keeping prices significantly low, and which can lead to a bias in industrial investments towards technologies based on intensive use of fuel oils.

Implementation of international agreements and commitments

Morocco has acceded to a number of global and regional multilateral environmental agreements (MEAs) and is actively developing its international environmental cooperation. To meet the requirements of the ratified MEAs, foreign assistance is being sought to design and assist in the execution of various programmes and action plans for strengthening implementation and compliance.

For the majority of MEAs, the national legal framework is not yet sufficiently developed to be in conformity with the norms, standards and concepts required by these agreements. Furthermore, where the legislation is in place, its implementation and enforcement is lacking.

Air protection

Air protection activities lack a comprehensive strategic vision. Therefore, despite a number of significant positive changes such as the introduction of cleaner fuels or halving SO_2 emissions by the country's only refinery, air quality, in particular in urban areas, remains a challenge.

Air emission data do not seem to be processed to serve as a basis for decision-making with regard to protecting the population against air pollution. So far, emission inventories have been validated for a few regions and it is expected that at the end of 2014 emission inventories will be available for the whole country.

The legislation in support of air protection lacks the implementing regulations, which are long overdue. In particular, the absence of sectoral emission limit values which are based on best available techniques is a drawback. In addition, no regulations are in place which would require warning the population about pollution peaks.

The authorities try to improve air quality through promoting a voluntary approach by industry and the handicrafts sector to applying emission limit values. While there is some initial success, sustainable results can only be achieved when there is a system in place that does not put anybody at a competitive disadvantage, which is not the case at the moment. A stricter command-and-control approach should be introduced, at least gradually, if air quality is to improve.

Water management

Morocco has limited availability of water resources and faces substantial challenges in this regard. The water volume that may be technically and economically exploitable reaches 80 per cent of current available resources. This level reveals the current national constraints on water issues and the challenges that are ahead regarding the urgency of an integrated water management approach.

Most of the problems in water management are connected with wasteful use of freshwater resources and discharges of untreated wastewaters. The public water supply systems and irrigation in Morocco are ineffective and water losses reach on average 35 per cent. The absence of regulations on limit values of wastewater discharges from certain industries values prevents the practical application of "user pays" and "polluter pays" principles.

Waste management

The economic costs of environmental degradation in Morocco are linked to the poor performance of the solid waste management system. A large proportion of waste is still disposed of in illegal dumpsites, often in or along streams or riverbeds and in areas where water resources are vulnerable, which causes soil and water pollution. Methane and other gas pollutants from illegal dumpsites, together with incineration of waste in kilns and bathhouses, are the major sources of air pollution.

The legislation adopted lays a foundation for consistent and sustainable waste management. Its implementation, unfortunately, is lagging behind. This is due to, among other things, the lack of expertise in waste management on many levels, including in the monitoring of landfills, the rehabilitation of landfills, and the control function at the local level over private enterprises in waste collection, clean-up and disposal. In addition, in a number of areas the necessary specific technical requirements and references are not present in the legislation to make it enforceable.

In addition, Morocco has not yet created a waste monitoring system. Studies to assess the impact of waste on the environment should be conducted to help establishing objective parameters and targets which are necessary to minimize the impact through the definition and implementation of corrective policy measures.

Biodiversity and protected areas

Despite the fact that Morocco has 68 key biodiversity areas forming part of the wider Mediterranean Basin biodiversity hotspot, of which two have been identified as being Irreplaceable Key Biodiversity Areas, various aspects of the biodiversity of Morocco remain uncertain. This situation is due to several knowledge gaps such as gaps relating to specific species or groups, genetic resources, and ecosystems or sites.

Streamlining existing data is a problem, because criteria used nationally do not necessarily correspond across assessments, or with criteria used on an international scale. To this end, taxonomists would be in high demand in Morocco, not only because of the gaps in knowledge on biodiversity issues, but also because some existing data may need to be re-examined.

Revisions of the protected area system have only recently been undertaken and the monitoring of effectiveness and progress has not yet been widely undertaken. It also appears that, in many cases, human resources within protected areas are too limited to be able to adequately manage protected area resources on the ground, while, with respect to some protected areas, assignment of protection has been little more than a paper exercise.

Illegal forest exploitation and illegal hunting are not primarily a consequence of lack of awareness, but are more fundamentally driven by poverty and by a lack of adequate socioeconomic alternatives. Therefore conservation initiatives in Morocco which fail to consider the short- and long-term socioeconomic dimension appear to be limited.

While there is progress in extending the network of protected areas and in building a suite of management and regulatory plans, policies and laws, there is also substantial evidence to suggest that practice falls short of set targets and objectives, with problems of enforcement and implementation. There is a lack of integrated management across different sectoral areas as a major limiting factor for effective biodiversity conservation, with disjointed initiatives and, in some cases, the setting of conflicting objectives by different authorities, with evidence also of competing agendas.

Health and environment

Morocco is undergoing an epidemiological transition characterized by a progressive decline in infectious diseases and an increase in chronic and non-communicable diseases. To this end, the Government is examining with growing interest the impacts of environmental degradation on public health. In particular, the Government sees poor housing, poor drinking water and poor solid waste management as causes for public health concerns.

The current legislative framework does not yet include the link between health and environment. However, the framework law on the National Charter for Environment and Sustainable Development sets a good foundation

for the implementation of cross-cutting actions needed to efficiently handle the health and environment interface.

An environmental health information system is still not in place. Furthermore, indicators on the basis of which an analysis will be carried out to establish better links between environmental degradation and health problems have not yet been identified.

Industry and environment

While industry is undergoing economic development, there is no evidence that this is a sustainable development at no increasing cost for the environment. There are no data available on the pollution level generated by industry. In addition, environmental self-monitoring by industry is only carried out on a voluntary basis.

The legal environmental requirements pertaining to industry do not correspond with the existing state of development (Dahir of 1914 on the regulation of unsanitary, inconvenient or dangerous industrial plants), are incomplete (laws on air, water and waste) or non-existent (legislation on major hazard prevention). Emission limit values and discharge limit values are still lacking, although the Government is in negotiation with the most polluting industries to set emission and discharge limit values to ensure that industrial facilities operate with acceptable impact on the environment. It is also unclear how industry can be incentivized to decrease water or energy consumption. In addition, the control of compliance is very limited.

With the existing legal and compliance enforcement gaps, limitation of pollution generated by industry depends mainly on the availability of funding under industrial clean-up programmes or on initiatives of industrial associations in convincing their member industries to adopt good environmental management practices. While these activities bear fruit and are recommended as additional measures, Morocco may not be able to address its environmental challenges in the longer term without introducing a relevant industry control regime based on coherent regulations.

Energy and environment

As a developing country, Morocco has a growing demand for energy. Energy consumption has been steadily increasing in every sector of the economy since 2003. The demand for energy is met mostly by fossil fuels, all of which are imported. This makes the country highly vulnerable to fossil fuel markets.

Growing energy production from fossil fuels, despite the use of better quality fuels, increases the pressure that the energy sector exerts on the environment. This cannot be checked quantitatively, however, as, similarly to other sectors, data on environmental pressures from the energy sector are very scarce.

At the same time, Morocco has great potential for generating energy from alternative –'green' – energy sources, in particular solar and wind but also hydro energy. Therefore, the Government wants with its energy strategy and programmes to increase the share of green energy to more than 42 per cent of installed capacity for electricity generation by 2020. Achieving this goal will depend on incentives, not available at the moment, being offered to private investors to attract them to financing green energy projects.

There is also great potential in Morocco for improving energy efficiency. This can be enhanced by more than 15 per cent and, in some sectors, such as building, reach as much as nearly 30 per cent. The National Programme for Energy Efficiency specifies a number of concrete measures to be applied in each of the three targeted sectors: building, industry and transport. Realization of the Programme's measures may, however, be delayed due to the absence of implementing regulations necessary for enforcing the law on energy efficiency.

Agriculture and environment

Agricultural activities currently exert high pressure on soil, water and biodiversity. This is mainly due to the uncontrolled use of and pollution from phosphates and nitrates and, in the case of water, also due to wasteful irrigation networks.

Water scarcity and loss of soil fertility impact highly on agricultural productivity. Productivity levels are decreasing in Morocco as technological progress is low and cannot offset the impact of climate change.

To address the environmental pressures (among others) in the agricultural sector, Morocco adopted an agricultural strategy – Green Morocco Plan – in 2008. The first fruits of implementation of the strategy are visible in growing areas of localized irrigation methods replacing conventional irrigation by gravity. Furthermore, the Government established a Fund for Agricultural Development which provides farmers with subsidies intended to encourage water savings and soil protection. The Government also holds awareness-raising campaigns to improve agricultural productivity, water conservation and the rationalization of the use of fertilizers by farmers.

INTRODUCTION

I.1 Physical context

The Kingdom of Morocco is located in North Africa. The country has a great range of elevation, from the highest point of Jebel Toubkal, which rises to 4,165 m, to the lowest point of Sebkha Tah, 55 m below sea level. A large part of Morocco is mountainous. The Atlas Mountains, running from the south-west to the north-east, are mainly located in the centre and south of the country and form a backbone of the country. The Rif Mountains are located in the north, stretching from the north-west to the north-east over the region bordering the Mediterranean Sea. Most of the south-east portion of the country is sparsely populated as part of the Sahara Desert.

Along the coast of the Mediterranean Sea the climate is warm, with dry summers and mild winters. Inland, the climate is more severe, getting hotter and more extreme closer to the Sahara Desert. Morocco's capital, Rabat, is on the Atlantic Ocean coast and has an average January low temperature of 8℃ and an average July high temperature of 28℃. By contrast, the city of Marrakech, which is located farther inland, has a January average low of 6℃ but much elevated average July high temperature of 37℃.

Average annual precipitation can reach more than 1,000 mm in the mountainous areas of the north but is less than 300 mm in the basins of the Moulouya, Tensift and Souss-Massa rivers, areas of the South Atlas Mountains and the Saharan zone. Typically there are two rain periods per year, one in the fall and one in winter. The number of rainy days varies from about 30 in the south of the country to near 70 in the north.

I.2 Political and administrative context

Morocco is a constitutional monarchy. The Constitution provides for a monarchy with a parliament and an independent judiciary. The Prime Minister is the head of the Government and executive power is exercised by the Government, although the King holds executive and legislative powers, including the power to dissolve the parliament and issue royal decrees called dahirs which have the force of law. In a conflict situation, the King's decision usually overrides that of the Government.

Legislative power is vested in the bicameral parliament. Since the constitutional reform of 1996, the legislature has consisted of two chambers. The House of Representatives (lower chamber) has 325 members directly elected for a five-year term; 295 of them are elected through a closed-list proportional representation system, while 30 seats are reserved for female representatives elected from the national lists consisting only of women. The House of Councillors (upper chamber) has 270 members indirectly elected for a nine-year term; 162 seats are elected by local councils, 81 by professional organizations and 27 by trade unions.

Parliament's powers were expanded under the 1992 and 1996 constitutional revisions. The powers include a say in budgetary matters, approving bills, questioning ministers, and establishing ad hoc commissions of inquiry to investigate the Government's actions. The lower chamber of the parliament may dissolve the Government through a vote of no confidence. The 2011 reforms, which transformed Morocco into a constitutional monarchy, also included the recognition of gender equality, established the Berber language as an official language on a par with Arabic (estimates of the number of Berber speakers vary from 28.4 per cent to 35 per cent of the population) and designated human rights as a core principle of the country.

On the political side, the reforms made the Prime Minister the head of the Government, selected by the King from the party that received the most votes in an election. The powers of the Prime Minister were also widened to include the right to choose and dismiss the cabinet members.

Administratively, Morocco is divided into regions governed by a "wali" nominated by the King, and further subdivided into prefectures and provinces. Each prefecture and province is partitioned into districts, municipalities or urban municipalities, and into "arrondissements" in some metropolitan areas. The districts can also be subdivided into rural municipalities.

To help the big urban units, such as Casablanca, meet the needs of their growing population and tackle the problems caused by urbanization, a new administrative level, the "wilaya", was created in 1981. Wilayas cover only urban areas and although, strictly speaking, this administrative level lies between the levels of regions and prefectures/provinces, it is often synonymous with regions or prefectures/provinces in common usage.

Photo I.1: Oasis

Morocco has a dual judicial system consisting of secular and religious courts. The secular system is divided into municipal and district courts, first instance courts, the appellate courts and the Supreme Court. In addition, the secular judicial system has special administrative tribunals, commercial courts, commercial courts of appeal and administrative courts of appeal. The 27 traditional religious Sadad courts are first instance courts for Muslim and Jewish personal law.

The highest judicial authority is the Supreme Court, which is divided into five chambers: civil, criminal, social, administrative and constitutional. There is also a special Court of Justice which can try officials if a two-thirds majority of the full parliament presses charges on them. Cases involving military personnel or certain matters pertaining to state security are handled by military courts. Judges are appointed on the advice of the Supreme Council of the Judiciary, which is the regulatory body for the judiciary and is presided over by the King.

I.3 Population, gender and poverty eradication

Demographic context

Morocco has a population of over 32 million people. Over the past decade Morocco has had steady population growth. The total population grew 7.3 per cent from 2003 to 2011. During the same period both the birth rate and the total fertility rate decreased, by 6.4 and 9 per cent respectively. Life expectancy was on the rise; both female and male life expectancy at birth rose by three years, and women can now expect to live about 4.5 years longer than men.

There has also been a change in the composition of age groups. Under-15-year-olds' share of the population diminished from 31.5 per cent to 27.6 per cent (a drop in numbers of 12.4 per cent), while the over-65 age group increased from 5 per cent to 5.5 per cent of the population (an increase in numbers of 10 per cent). This latter represents a significant increase, although from a very low initial level.

There has been very positive development in terms of infant mortality over the past nine years. Infant mortality decreased from 39.4 per 1,000 births in 2003 to 28.2 per 1,000 births in 2011 – a drop of 28.4 per cent.

Gender balance

While the laws are satisfactorily gender equal, progress towards gender equality has been slowed down by insufficient resources to oversee and implement the relevant laws, strategies and policies. This lack of evolution can be seen in the international gender index comparisons. In 2011, on the Gender Inequality Index of the United Nations Development Programme (UNDP) Morocco scored 0.510 (104th of 146 countries), and on the World Economic Forum's Global Gender Gap index, the country scored 0.5804 (129th of 135 countries). This seems to be an

indication that the laws do not fully translate to the everyday life of the female population.

Early childhood care and the treatment of children is not biased according to gender. The 2003–2004 Demographic and Health Survey of the International Finance Corporation found that the vaccination rates were almost similar (91.2 per cent of girls and 86.8 per cent of boys under the age of 2 had received all their basic vaccinations), there was virtually no difference in malnutrition rates, and under-5-year-old mortality rates were higher for boys than for girls.

School enrolment and attendance rates are slightly lower for girls than for boys (at secondary level, 36 per cent of girls and 39 per cent of boys attend) according to United Nations Children's Fund (UNICEF). However, the International Labour Organization (ILO)/UNICEF Understanding Children's Work project of 2004 found that, in rural areas, girls were 33 per cent less likely to attend school than boys, indicating a preference towards educating sons over daughters.

Although Moroccan women have had the same right to vote and stand for election as men since independence in 1956, they remain underrepresented in political life. In the 2011 elections women won 17 per cent of the seats in the lower house and 2.2 per cent of the seats in the upper house of parliament. In local council politics, a 2008 agreement between the Government and the major political parties stipulated that 12 per cent of local council seats (about 3,000 seats) would be reserved for women. Prior to this, less than 1 per cent of these seats were held by women, but in the June 2009 elections women won 3,421 seats.

Poverty eradication

Morocco's economic success combined with the measures to eradicate poverty have started to have an effect on its citizens' lives. The percentage of the population living in poverty, measured by the national income thresholds, declined from 15.3 per cent in 2001 to 8.9 per cent in 2007, and vulnerability from 22.8 to 17.5 per cent. The relative poverty threshold is 3,834 dirhams per year in urban areas and 3,569 dirhams per year in rural areas. Rural area poverty and vulnerability levels in 2007 were higher than national averages, at 14.4 per cent and 23.6 per cent respectively.

The objective of the poverty reduction policies has been to provide support and improve the purchasing power of the most disadvantaged. This has been done by economic and financial measures, such as neutralising the price increases on basic goods such as cereals, sugar and petroleum products by subsidies; increasing public sector salaries and pensions (by 600 dirhams); lowering income taxes; providing microcredits; increasing the minimum salaries (15 per cent increase in 2012); and providing subsidized health care and targeted local development programmes for poorer citizens and less developed areas.

The medical assistance programme for the most disadvantaged, which is paid for by the State and local authorities, provides completely or partially free medical services in public hospitals for people living under the poverty threshold or in insecurity – benefiting 8.5 million people. After a 2008 pilot project, the programme was extended to the whole country in 2012.

The 2005 National Initiative for Human Development (INDH) directly supports the local communities. Its first phase from 2006 to 2010 targeted 403 rural communities and 264 urban districts, achieving a 41 per cent decline in the poverty rate while creating 40,000 permanent jobs. The second phase of the INDH (2011–2015) is focusing on health, education, roads, water, sanitation and electrification, and aims to develop the mountain areas and rural communities where the poverty rate is higher than 14 per cent.

Morocco's human development index (HDI), calculated by UNDP, rose from 0.507 in 2000 to 0.582 in 2011, ranking Morocco 130th of 187 countries. Morocco belongs to the group of medium human development countries but its HDI is still below the Arab States' regional average of 0.641.

I.4 Economy

In 2010, as measured by Gross Domestic Product (GDP), Morocco was the fifth-largest economy in Africa. The country's economic policies placed it as the fourth most competitive economy in Africa and first in North Africa, according to the World Economic Forum's 2012–2013 Global Competitiveness Index. Available business opportunities and prevalent economic prospects made Morocco also the top-ranked African country for foreign direct investment (FDI) in 2011. Improving the country's business environment has been the Government's consistent policy goal, and since 2005 Morocco has implemented 15 business regulatory reforms. The World Bank's *Doing Business 2012*, which ranks economies in 10 areas of business regulation, found that by simplifying the construction permitting process, easing the administrative burden

of tax compliance and providing greater protections to minority shareholders, Morocco improved its business regulation the most compared with other global economies. It climbed 21 places compared with 2011, reaching 94th position of 183 economies studied.

The composition of the economy is weighted towards services which, in 2011, produced 55.1 per cent of GDP, while industry's share was 29.9 per cent and agriculture's was 15.1 per cent. This composition has stayed very stable throughout the past decade. Even though the economy has lately become more diversified, the agricultural sector plays a bigger role in the country's economic development than its share of GDP implies; firstly, because it employs about 44 per cent of the country's workforce and, secondly, because the occurrence of ever-threatening drought can dramatically affect the aggregate value added of agricultural, and especially cereal, production, which has a direct impact to the economic growth of the country in general.

Since 2003, annual GDP growth has been firmly positive; annual average growth from 2003 to 2011 was a respectable 4.8 per cent. During the same time period, GDP per capita, as measured by current prices and Purchasing Power Parity (PPP), increased by 59 per cent. Inflation has been at a very low level. As measured by the Consumer Price Index (CPI), inflation temporarily accelerated between 2006 and 2008 but returned to 0.92 per cent in 2011.

From 2003 to 2011, Morocco's export volumes increased by one-and-a-half times, but imports grew even faster and were 1.7 times higher in 2011 than in 2003. Workers' remittances, also an important part of Morocco's balance of payments, doubled during the same period to US$7.2 billion, a little over 7 per cent of the country's GDP.

Morocco has 75 per cent of the world's phosphate reserves. It is the world's biggest phosphate exporter (with 28 per cent of the global market) and third-biggest producer (with 20 per cent of global production). In 2011, Morocco produced 28 million tons of phosphates and 8.7 million tons of phosphate derivatives. The price fluctuations of phosphates on the international market greatly influence Morocco's economy. The country's dependence on phosphate exports has shrunk in recent years as exports of manufactured and agricultural products, combined with growing tourism, have picked up. On the import side, Morocco is dependent on imported fuel and the country's food import requirement can rise substantially in drought years, as happened in 2007.

Morocco's unemployment rate has been declining, although very slowly, since 2003. The registered unemployment rate stood at 8.9 per cent in 2011. A bigger problem for the economy in future might be the current account balance, which has deteriorated very quickly from being 2.15 per cent positive in 2006 to almost 8 per cent negative in 2011.

There was a temporary slowdown in FDI after the 2008 global financial crisis. However, international investors are clearly thinking that the Moroccan economy is on a steady footing, since FDI is again coming in, at the same speed as in 2003. Priority sectors for FDI are textiles, electronic components, offshore services and the labour-intensive tourism sector.

Morocco's economic growth is linked to the development of the European economy – Morocco's main export market – and performance of the domestic agricultural sector. GDP is expected to rise 4 per cent in 2013 and real GDP growth to an average 4.9 per cent in 2014–2017. The current account will remain in deficit until 2017, but it is likely that the rising inflows from both workers' remittances and services will help to reduce the shortfall, especially after 2014.

I.5 Environmental conditions and pressures

Air quality and air emissions

Air pollution has increased over the past 20 years. The main causes have been population growth, rapid urbanization combined with industrialization, and the doubling of the vehicle fleet since 1999. Air quality is a major concern in the urban agglomerations such as Casablanca and Rabat. In the Grand Casablanca region, road transport and electricity production are responsible for 50 per cent of the SO_2, 71 per cent of NO_x, 82 per cent of CO and 76 per cent of particulate matter emissions. The emissions from mobile sources are significant and are caused not only by the increasing number of cars but also because the vehicle fleet is ageing, lacks emission controls and has inadequate engine maintenance. To tackle emissions from mobile sources, in 2009, lead was removed from super fuel and the sulphur content of gas oil, which covers 80 per cent of car fuel consumption, was lowered from 10,000 ppm to 50 ppm.

Greenhouse gas emissions and climate change impacts

The country's carbon dioxide (CO_2) emissions have increased almost continuously since 1990, causing

total emissions to double over the past 20 years. Per capita CO_2 emissions closely followed the development of total emissions, although, compared with other countries, Morocco's per capita emissions are at a relatively low level (chapter 6). Both total and per capita emissions dropped slightly in 2009, which could be attributed to economic development in that year.

In 2008, Morocco's CO_2 emissions from energy use were 47.9 gigagrams (Gg), of which 35 per cent came from electricity and heat production primarily (70 per cent) produced by oil. Although Morocco has huge potential for producing renewable solar and wind energy, only 4 per cent of total energy production in 2008 came from renewable energy sources (RES).

The 2008 Energy Security Plan aims to reduce the country's dependence on foreign energy sources by increasing efficiency in general and using RES. The 2008 Mitigation Strategy sets an ambitious target of producing 12 per cent of primary energy and 42 per cent of electricity from RES by 2020.

The Moroccan economy might be at the beginning of a transformation to using more efficient production methods and producing less CO_2 per GDP unit (figure I.1). The CO_2 emissions per GDP unit have slowly diminished since 1995 but there has been a more rapid decrease since 2005, suggesting a decoupling of emissions and wealth creation.

Biodiversity in Morocco can be severely affected by climate change. The already reduced rainfall and longer and more frequent droughts have put forests and agriculture under severe stress, causing degradation of forest formations and loss of agricultural land. Observations recorded over the past four decades show that future climate trends, up until 2020, will include an increase in the average temperature of between 0.6°C and 1.1°C and a reduction in rainfall of 4 per cent when compared with 2000.

The general spatial weather pattern changes include an increase in the frequency and intensity of convective and frontal thunderstorms in the north and west of the Atlas Mountains and droughts in the south and east of the country, while the winter rains will be concentrated in a shorter period and the duration of snow cover will be shorter than before.

It is estimated that impacts of climate change would include a reduction in grain yields by 50 per cent in a dry year and 10 per cent in a normal year, an increase in the water requirements of irrigated crops of between 7 per cent and 12 per cent, and negatively affected animal production. Climate change will certainly have a negative effect on forest formations, productivity and biodiversity.

Water

The total available water resources in Morocco are estimated to be 22 billion m^3 of which 16 billion m^3 are currently utilized. There are huge annual differences in the availability of water – the long-term annual average is 22 billion m^3 but in 2008 and 2009 41 billion m^3 and 42 billion m^3 (respectively) were available.

Surface water represents two-thirds of the water resource potential. The huge annual fluctuations in availability have made it necessary to rationalize water supply.

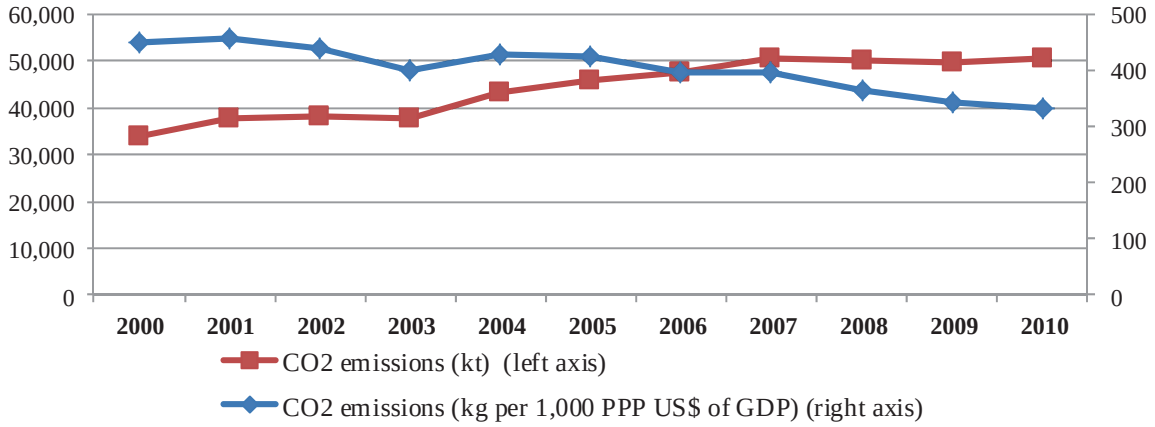
Because of the continuous population growth, Morocco's water resources per capita are diminishing. According to Aquastat, the Information System on Water and Agriculture of the Food and Agriculture Organization of the United Nations (FAO), the available water per person per year was 1,129 m^3 in 1992; this had diminished to 898.6 m^3 by 2011. The High Commission for Planning (HCP) estimated in its 2006 report "Prospective Maroc 2030" that population growth will cause this diminishing trend to continue in future and reduce to as little as 500 m^3/inhabitant/year by 2030.

According to the Department of Water of the Ministry of Energy, Mines, Water and Environment, during 2007–2008, the overall quality of surface waters was excellent at 6 per cent of the montitoring stations, good at 37 per cent, average at 18 per cent and poor or very poor at 39 per cent. Almost all stations with degraded water quality are located at rivers affected by urban and industrial discharges, such as the middle and downstream of Oued Sebou, downstream from Marrakech, and the lower reaches of the wadis of Tangier and Martil.

Currently, 6 million m^3 of seawater is desalinated annually in the desalination plants of Laayounne and Boudjour.

The amount of annually available groundwater is approximately 4 billion m^3 spread over 103 aquifers, of which 75 are close to the surface. The groundwater resources are relatively evenly distributed and water abstraction is rather easy and therefore can ensure the supply of water for rural communities.

Figure I.1: Carbon dioxide emissions, 2000–2010



Source: World Bank DataBank (accessed 1 November 2013).

The groundwater resources, strategically important for future economic development, are currently overexploited, at an alarming rate in some 20 aquifers. The water level is falling, by an average 2 m per year. During 2007–2008, the overall quality of groundwater was good at 28 per cent of the monitoring stations, average at 28 per cent and poor or very poor at 44 per cent. The most common reasons for groundwater degradation are strong mineralization and the presence of high levels of nitrates. The ground water is highly mineralized in Berrechid, coastal Chaouia, Beni Amir and Tafilalet, and high levels of nitrates have been measured in the aquifers of Témara, Meskala-Kourimate, Berrechid and Chaouia.

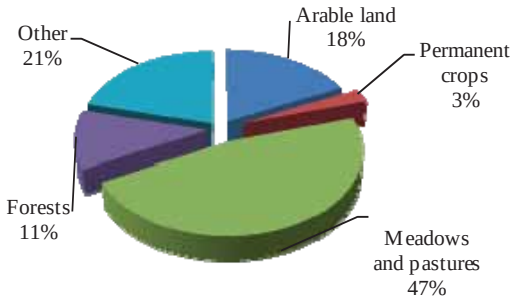
Urban wastewater discharges are estimated to be 500 million m^3 annually. Most (43 per cent) of this is released directly into the sea, while about 39 per cent is discharged into the water network (hydrographic system) and 27 per cent directly onto the soil. Industries release about 140,000 tons of oxidizable material annually, most (40 per cent) of it onto the ground. Agriculture affects the water system through fertilizer and pesticide use. On average, about 720,000 tons of fertilizers and 8,500 tons of pesticides are used annually in agriculture.

Land cover

Morocco has 80,000 km^2 of arable land, of which about 16 per cent is irrigated. With sufficient available land and the temperate Mediterranean climate, Morocco is one of the few Arab countries that have the potential to achieve self-sufficiency in food production. At the moment Morocco produces two-thirds of the grains it needs for domestic consumption (chiefly wheat, barley and corn).

The most important land ecosystems are the agricultural ecosystem and forests (figure I.2). The Saharan region has a desert ecosystem which, by its plant formations, is linked with steppe and forest ecosystems.

Figure I.2: Land use, per cent of total, 2011



Source: http://en.worldstat.info/Asia/Morocco/Land (accessed 1 November 2013).

According to the HDR50 (50 ans de développement humain au Maroc et perspectives pour 2025), the forest environments are under simultaneous pressures from several factors. There is a persistent trend of diminishing forest areas caused by forest clearing for agricultural use; removal of wood products in excess of biological reproduction rates; overconsumption of herbaceous materials, leaves and fruits by animals; and the expansion of urban areas. Total forest surface is diminishing by about 31,000 ha annually, on average.

The degree of deforestation varies from one region to another but it can be very significant, e.g. the analysis of aerial photographs around Rif showed that annual forest losses were 5,000 ha. The forest area lost due to forest fires is relatively small, but it has been on a

continuous rise from an average 1,883 ha/year between 1960 and 1969 to 3,555 ha/year recently, an increase of 89.1 per cent since 1960–1969. The Rif and pre-Rif regions are most affected by the problem of forest fires.

The agricultural ecosystem, which includes 8 million ha of arable land and 21 million ha of rangelands, has two very different subsectors: the traditional sector is characterized by the use of old, long-established, diversified farming techniques and dominated by small-scale food farms employing about nine-tenths of the rural population; modern market- and agro-industry-oriented farming utilizes about 1.5 million ha and employs moderately intensive, mechanized agricultural methods.

The rapid population growth during recent decades has caused a downward trend in the availability of the utilizable agricultural area (UAA) per capita. The UAA increased from 0.32 ha/cap. in 1960 to 0.35 ha/cap. in 1990, thanks to the culture of clearing and area expansion, but dropped to 0.29 ha/cap. in 2008 and, if current trend continues, it will be about 0.22 ha/cap. in 2025. At the same time, the annual loss of agricultural land to ongoing urbanization was estimated to be 4,000 ha.

Of this land area, 45.75 per cent went to housing developments, 25 per cent to industrial use and infrastructure, and 12.5 per cent to tourism-related developments. A large part of this urban expansion is at the expense of irrigated, good quality agricultural land with high production potential. The increasing imbalance of population to available land and water resources is even more pronounced in mountainous areas and oases.

Urbanization is a threat to ecosystems, especially to the forests and agricultural areas. The urban population, which was 41 per cent of the total population in 1980, had risen to 57 per cent in 2011. Urbanization, together with the total population growth, has profoundly changed both the spatial and urban structure of Morocco. Urban sprawl and the transformation of rural villages to built-up areas often take place at the expense of good quality agricultural and forest land. According to the Ministry of Agriculture and Maritime Fisheries (MAPM), there are 63 projects of urban expansion around different cities with a land demand of 65,518 ha, of which 36,264 ha are farmland.

Soil

Wind erosion affects the surface soil in the areas where there are no natural barriers reducing the wind speed. Erosion of the soil is a threat to ecosystems and affects the agriculture and cultivation in the rangelands of the eastern highlands. About 300,000 ha are threatened by and susceptible to silting in the regions of Ouarzazate, Zagora and Errachidia. Wind erosion in these regions causes a loss of about 500 ha/year and is a threat to 25 per cent (65 km) of the irrigation canals in the Drâa Valley.

Secondary salinization is the most important form of soil degradation in irrigated areas, affecting about 160,000 ha or about 16 per cent of the country's irrigated land. Salinization is caused by multiple factors, such as arid climate, use of water charged with soluble salts, poor drainage, use of wasteful irrigation techniques and, to a lesser extent, the misuse of chemical fertilizers.

Biodiversity and protected areas

Morocco's geographical location in between the Mediterranean Sea, Atlantic Ocean and Sahara Desert has created particularly rich biodiversity with highly heterogeneous and complex ecosystems and habitats. The terrestrial ecosystems range from high forested and snow-covered mountains and the steppe regions to almost azoic deserts, while the aquatic systems range from alluvial plains, rivers and lakes to marine waters.

The total number of inventoried species exceeds 32,000 but could be higher because Morocco still has a large number of unexplored regions and there are a number of species groups on which there has been little or no systematic study. Of the total taxa, there are some 8,000 known species of flora. The largest group of flora is flowering plants. Mushrooms and lichens are represented by 820 and 700 species, respectively. Multicellular algae is a big species group including nearly 700 species, of which 489 are macro algae and nearly 200 are species of phytoplankton.

Moroccan fauna is rich and diverse. A total of 24,602 species have been identified. Wildlife is dominated by arthropods, which constitute 73 per cent of the total species (or 17,893 species) and nearly 75 per cent of arthropods (13,461 species) are insects. Far behind the arthropods are molluscs (2,249 species) and vertebrates (1,718 species) which account for 9 per cent and 7 per cent respectively of the total national biodiversity. Morocco has 10 national parks, of which the first was established in 1942 and the latest in 2008. Parks cover an area of 771,849 ha. In addition, there are three biosphere reserves integrating the conservation of biodiversity and its sustainable use.

Waste

Morocco generates over 6.5 million tons of municipal solid waste (MSW) annually, of which 5 million tons are produced in urban areas and 1.5 million tons in rural areas. On average, a person produces 205 kg of MSW per year. It is estimated that about 82 per cent of the urban population, and only 20 per cent of the rural population, are covered by waste collection services. A low collection rate has led to wild dumpsites and widespread littering. Where MSW collection is operating, its focus is on the cleaning of the waste-generating neigbourhood, with limited attention paid to waste disposal and recycling. The estimated annual volume of industrial waste generated in Morocco is about 1.57 million tons, of which 256,000 tons are hazardous waste.

PART I: POLICYMAKING, PLANNING AND IMPLEMENTATION

Chapter 1

POLICYMAKING FRAMEWORK FOR ENVIRONMENTAL PROTECTION AND SUSTAINABLE DEVELOPMENT

1.1 Introduction

Before 2003, most of the early programmes on environmental protection in Morocco were very general and primarily addressed water management issues. Since 2003, however, Morocco has put in place the foundations for a more diversified environmental protection policy and is increasingly placing emphasis on matters of sustainable development.

1.2 Environmental and sustainable development policy framework

The first National Environmental Strategy of Morocco was adopted in 1995, followed by the National Environmental Action Plan (PANE) in 2003. PANE offered an overview of the environmental situation of the country and was structured around the following priorities: protection and sustainable management of water resources, soil resources and nature; air protection and promotion of renewable energy; prevention of natural disasters and major technological risks; improvement of urban environment; and environmental management and communication. A very important part of PANE was a matrix containing actions, their foreseen costs and implementing government authorities. In terms of implementation, it called for the creation of a national committee of implementation and regular follow-up to the work undertaken.

PANE and the strategy were eventually abandoned due to lack of funding for their implementation and also the lack of clear priorities in the actions prescribed. There is no report on the implementation of either the strategy or the action plan. Without an obligation and clear mechanism for reporting on implementation of agreed actions by the relevant authorities, any new generation of strategic policy documents is likely to face similar implementation weaknesses.

Since the abandonment of the two strategic documents, no equivalent documents have been put in place. As a result, Morocco does not have a coherent national strategy and an action plan on the protection of its environment which involves all relevant public authorities and stakeholders. Only departmental environment-related programmes in specific areas are in place.

National Charter for Environment and Sustainable Development

Morocco has started to integrate principles of sustainable development into its sectoral policies. The National Charter for Environment and Sustainable Development has been proposed as a declaration of the country's intent to move onto a more sustainable path of development and growth by articulating the values and principles of environmental protection and sustainable development in all areas of socioeconomic development and by defining rights, duties and responsibilities of individuals and economic agents.

The Charter is the product of an open and participatory process. Two committees were established to develop the draft of the Charter: the National Commission composed of ministers and heads of departments; and the Standing Committee composed of high-level officials of various ministries and departments concerned, which was responsible for the operational coordination of the process. The draft Charter was submitted to a national process of consultation with key stakeholders and the public at large. The process of consultation has led to the formulation of recommendations included in the Charter. The final text of the Charter was approved by the National Council for the Environment at its seventh session that took place in 2011 under the chairmanship of the Chief of the Gouvernment. The National Council made recommendations concerning the methods and means for the operationalization of the Charter at the national, local and sectoral levels.

As a direct result of the adoption of the Charter in 2011, a draft law on the environment and sustainable development has been prepared by the Department of Environment. A second direct result is the preparation of a national environmental protection strategy and a

strategy for sustainable development. At the time of the review, these strategies were only at an early stage of preparation.

Strategy of the Department of Environment

In the absence of a national environmental strategy, the Department of Environment of the Ministry of Energy, Mines, Water and Environment has developed its own departmental strategy, the Strategy of Proximity, to guide its operations and planning at national and subnational levels. As part of this strategy implementation, the Department of Environment has been directly involved with projects at various levels (the "partnership approach"). This involvement takes the form of agreements (equivalent to memoranda of understanding) between the Department of Environment and local/regional counterparts. These agreements are a step in the realization of the Government's strategy to promote sustainable development through a participatory approach and partnership with stakeholders at the national, regional and local levels. Partnership agreements address a wide range of objectives, from the creation of urban and suburban recreational areas to raising awareness and environmental education. They address various priorities, such as water resources protection, biodiversity preservation, risk reduction, and wastewater and solid waste management. As part of these agreements, regions are expected to take an active part in the implementation of environmental programmes.

These partnership agreements are largely operating under framework agreements signed in 2009 by walis and council presidents of the regions of the country on the one hand and, on the other, by the Departments of Interior, Economy and Finance, Agriculture and Maritime Fisheries, Water and Environment and by the High Commission for Water, Forestry and Desertification Control. Within its environmental strategy the Department of Environment elaborated a number of programmes with the objective of strengthening the environmental performance of the country. These programmes are described hereunder.

National Programme of Sanitation and Wastewater Treatment

Inadequate sewage and wastewater treatment have resulted in the deterioration of the quality of water resources and the environment in general. As a response to this situation the National Programme of Sanitation and Wastewater Treatment (PNA) has been implemented since 2006. The Programme was revised in 2008 in order to improve the pace of its implementation, to incorporate treatment up to tertiary level with the reuse of treated wastewater and to recover wastewater discharged into the sea. Among its main objectives, the PNA aims to achieve a connection rate to sewerage systems in urban areas of 75 per cent in 2016, 80 per cent in 2020 and 100 per cent in 2030, to reach a volume of wastewater treated of 50 per cent in 2016, 60 per cent in 2020 and 100 per cent in 2030, and to have wastewater with tertiary treatment and reuse at 100 per cent in 2030.

By 2013 the PNA has increased the rate of connection to sewerage systems to 72 per cent (against 70 per cent in 2005). It has also increased the volume of treated wastewater to 272 million m^3 per year, which corresponds to 36.13 per cent of total wastewater, while in 2005 it was only 8 per cent. Of this 36.13 per cent, 21 per cent receives tertiary treatment.

National Municipal Solid Waste Management Programme

Morocco has experienced intensive urbanization in recent decades with increases in the amount of generated household waste. This has led to the proliferation of illegal dumpsites and non-sanitary landfills, which poses threats to public health and the environment. To manage this situation, in 2007, the Department of Environment initiated the National Municipal Solid Waste Management Programme (PNDM) in collaboration with the Ministry of the Interior. Among the key objectives of the Programme is the achievement of a collection rate of 85 per cent by 2016 et 90 per cent by 2020 et 100 per cent by 2030,, and the operation of MSW landfills covering all urban centres (100 per cent) by 2020. At the same time, the Programme aims to rehabilitate or close all non-sanitary landfills by 2020. The PNDM is on track to achieve some of the stated goals. For example, the collection rate has increased to 75 per cent in 2011 from 44 per cent in 2007. Progress has also been registered with regard to the creation of new landfills and the rehabilitation of existing ones (chapter 8).

National Programme of Environmental Upgrading of Rural Schools

The diagnosis of the environmental situation of rural schools conducted by the Ministry of Education showed that 14,911 of 17,785 schools lacked basic infrastructure for water supply and sanitation, with negative impacts on the health of students and the environment.

Photo 1.1: Tensift Haouz

For the improvement of this situation and to strengthen education on environment and sustainable development, a framework agreement between the, then, Secretary of State in charge of Water and Environment and the Ministry of National Education, Higher Education, Training and Scientific Research was signed on 11 September 2008 to launch a programme of environmental improvement of rural schools. The objective of the Programme is twofold. On the one hand, it aims to ensure the provision of water supply and sanitation in rural schools by building physical infrastructure. To this end, the Programme aims to establish a system of water supply in 14,911 schools and sanitary facilities (toilet and sink, septic tank) at almost all rural schools.

On the other hand, the Programme aims to strengthen students' education in the field of environment and sustainable development. To this end, it envisages the organization of environmental education activities in all rural schools through the establishment of environmental clubs in schools and the preparation of training materials for teachers. Between 2009 and 2011, work under this programme was undertaken in more than 1,000 rural schools.

National Programme of Environmental Upgrading of Mosques and Koranic Schools

Morocco has 45,000 mosques, the majority of which are located in rural areas. Among existing mosques and Koranic schools, 8,197 mosques and 84 schools have been considered in need of provision of basic water supply and sanitation infrastructure. On 25 March 2008, the, then, Secretary of State in charge of Water and Environment and the Ministry of Islamic Affairs and Endowments signed an agreement to implement the National Programme of Environmental Upgrading of Mosques and Koranic Schools. Between 2009 and 2011, more than 1,200 religious institutions benefited from this programme.

National Programme for Prevention of and Fight against Industrial Pollution

The National Programme for Prevention of and Fight against Industrial Pollution was launched by the Department of Environment in 2009, with the aim to promote the prevention of the generation of pollutants and wastes by industry (chapter 11).

The Programme covers processing industries, mines and quarries, handicrafts production, construction and public works, the energy industry, slaughterhouses and the recycling industry. It focuses on wastewater, solid waste and air emissions from these industries.

Phase I of the Programme resulted in the preparation of a framework document that describes the different phases of implementation of the Programme and priority actions to be implemented. In 2010–2011, a study of the Grand Casablanca region was made for

the collection of information and data on pollution in that region, which is the most industrially polluted in Morocco. The study also assessed pollution impacts on the environment and proposed a prevention action plan.

The Programme has the potential to make an important contribution in abating industrial pollution, although it has had little impact so far in real terms as it is still in its early stages.

Programme for industrial clean-up

This programme aims to facilitate the adoption by industrial enterprises of new technologies to treat industrial solid waste, liquid discharges and air emissions. To support the implementation of the programme, the Fund for Industrial Depollution (FODEP) has been created and so far has supported mostly wastewater treatment (chapters 4 and 11).

National Programme on Safe Management and Disposal of Equipment Containing Polychlorinated Biphenyls

This Programme aims to establish a regulatory framework for polychlorinated biphenyls (PCB) management, strengthening national capacity for safe disposal of equipment containing PCBs. The adoption and implementation of this programme results from Morocco's ratification of the Stockholm Convention on Persistent Organic Pollutants (POPs), as part of its commitment under this Convention.

The Programme has two pillars. The first pillar is implemented with the assistance of UNDP and the second with the assistance of the United Nations Industrial Development Organization (UNIDO).

Pillar I aims to strengthen the regulatory framework for the management of PCBs, strengthen national capacity for PCB management and identification of new sources of PCBs, and import equipment for environmentally sound disposal of PCBs in specialized centres.

Pillar II aims to establish the process for the identification of transformers contaminated with PCBs, set up local infrastructure for dismantling and decontaminating transformers, and strengthen capacity for the monitoring of PCB pollution.

With the start of this programme in 2010, the Commission on Polychlorinated Biphenyls was established by Decree No. 2-08-243. The Commission is responsible for the implementation of the Stockholm Convention in general and the PCB programme in particular. A draft regulatory framework for the safe management of PCBs is under way and efforts are made to raise awareness, inform and train various stakeholders on the safe management of PCBs at all stages of their life cycle. To this end, a website on POPs has been created with a section reserved for PCBs.[1]

National programme against accidental marine pollution

Morocco's coastline extends along both the Atlantic Ocean and Mediterranean Sea. This coastal area is a vital resource from both an economic and environmental (flora and fauna, and natural wetlands) point of view. However, the maritime transport of petroleum products and chemicals along the Moroccan coast increases the risks of potentially massive pollution. The programme against accidental marine pollution aims to strengthen national capacities to deal with such types of accidental marine pollution.

The programme has a strong training component on crisis management, branch control operations (maritime, air and land) and training of trainers. So far, a large number of training sessions have been organized. As part of training, and in accordance with the country's National Emergency Plan, the Department of Environment is required to organize, biannually, a simulation exercise ("SIMULEX") in collaboration with all relevant departments in order to test the operational preparedness and actual capacity of Morocco to face such types of situations. The Department of Environment, in collaboration with civil and military authorities concerned, has organized five exercises: in 2002 in Mohammedia, in 2004 in Nador, in 2006 in Agadir, in 2008 in Nador, in 2010 in Tangier and et in 2012 in El Jadida.

In addition to the training component, the Department of Environment identifies sites for the storage and disposal of pollutants resulting from marine pollution by hydrocarbons, identifies priority vulnerable areas for protection against marine pollution and updates the legal framework for the prevention of accidental marine pollution.

National Programme for Collection and Disposal of Plastic Bags

This Programme was initiated as a partnership between the Department of Environment and the Ministry of the Interior with the aim to organize campaigns to collect and dispose of plastic bags and

[1] www.popmaroc.gov.ma

also raise public awareness regarding more ecological alternatives to plastic bags. The Programme covers the period 2011–2012 (chapter 8).

National Water Strategy

The National Water Strategy has been developed in 2009 in order to give a new impetus to the water policy and support socioeconomic development. To address expected water deficits for the next 20 years, this strategy proposes to act on:

- Management of water demand and the use of water through an ambitious programme of conversion to drip irrigation and programmes to improve drinking water systems efficiency;
- Management and development of water supply through the continued mobilization of all surface water resources, but also increasing the use of unconventional water supply such as desalination of sea water and reuse of wastewater.

In order to ensure sustainable development of water resources, the Strategy proposes a series of actions of an environmental nature relating to:

- Protecting water resources quality and fighting against pollution through the accelerated implementation of the National Programme of Sanitation and Wastewater Treatment, and development of a national rural sanitation programme and a national programme of prevention of and fight against industrial pollution;
- Introducing a new mode of governance to protect overexploited groundwater;
- Protecting watersheds in order to combat soil erosion and siltation of hydraulic structures;
- Protecting oases, which are fragile areas and a cultural heritage;
- Preserving wetlands, natural lakes and protecting biodiversity.

National Initiative for Human Development

The National Initiative for Human Development (INDH) is the country's poverty eradication programme, launched by King Mohammed VI in 2005. Core objectives of the INDH are improving access to basic services, including education, health, transportation, water supply and sanitation, and environmental protection. The INDH has subsidized access to water supply for more than 10,000 households and connected 9,000 households to sanitation services. In total the project has benefited some 52,500 people (chapter 4).

National Charter for Planning and Sustainable Development

The 2004 National Charter for Planning and Sustainable Development is a framework strategy for the coherence of various sectoral policies and to increase their synergies. One of the principles of the Charter is the harmony between human beings and their environment, which requires that resource protection and the management of associated costs be basic criteria of development activities.

While promoting socioeconomic development and respect for and protection of the environment, the Charter identifies the legal vacuum in the planning and development of sensitive areas such as coastal areas, oases and mountainous areas. In the absence of a legal framework, strategies related to the protection of mountainous areas and oases have been developed.

National Physical Master Plan

Sitting on the National Charter for Planning and Sustainable Development, the National Physical Master Plan, lanched in 2004, promotes a consistent vision of territorial development. The Master Plan stipulates priority sectors and intervention areas requiring investment and promotion efforts in the medium and long terms. Based on the principles of social equity, economic efficiency and resource sustainability, the Master Plan identifies priority issues and the most pressing dangers and, at the same time, emphasizes the strengths of current development and where significant efforts need to be made. The Master Plan presents 51 proposals for improving land management, of which 28 are in six priority areas of intervention and seven are dedicated to sensitive areas (mountains and oases) and water management.

National Rural Development Strategy

In response to the challenges facing rural areas (i.e. delays in terms of development indicators), the Ministry of Housing, Town Planning and Urban Policy, having been assigned to rural development and in consultations with various stakeholders, developed a National Rural Development Strategy in 2009 with a horizon to 2020, based on the results of the previous strategy. The Strategy aims to respond to a series of national issues and priority goals for rural areas, which can be summarized as follows:

- Improving the attractiveness of rural areas and quality of life of the population

(improvement of living conditions and support through rural urbanization);
- Promoting the competitiveness of the rural economy (diversification of non-agricultural activities generating wealth and employment);
- Ensuring conditions for environmental sustainability (environmental conservation and management of rural areas, and enhancing natural and cultural heritage);
- Creating an environment conducive to promoting sustainable rural development process policy and institutional environment (creating a rural development institutional and regulatory framework, improving local governance and mobilizing the endogenous potential).

Almost 40 per cent of the Fund for Rural Development and Mountain Areas was dedicated to implementing the strategy through integrated territorial projects. The Ministry of Housing, Town Planning and Urban Policy helped finance 90 development projects in almost all regions between 2009 and 2012. The Ministry, in consultation with local stakeholders, is currently preparing agreements for 93 projects selected under the call for proposals launched by the Ministry in August 2012. Of these 93 projects, 20 are dedicated to sanitation, fighting against flooding and protecting land resources.

Strategy on Oases Management and Restoration

Following recommendations of the National Physical Master Plan and the 2004 National Charter for Planning and Sustainable Development, the Strategy on Oases Management and Restoration was developed to contribute to the fight against desertification by restoring the oases of southern Morocco. This will first develop measurement indicators for the development, rehabilitation and protection of the oases and set them in the context of national sustainable development. In contrast, the operational objective is to provide the country with nationally integrated planning and sustainable development of oases based on the following strategic actions:

- Streamlining the management of water resources and the necessary conversion of agriculture;
- Developing a new niche, Saharan tourism, with other sectors;
- Developing human capacities and increasing human resources;
- Improving regional coordination for transport and communications;
- Promoting urban policy in rural towns;
- Promoting sustainable development, a key concept for the protection of the environment;
- Redefining terms of reference to integrate new methods of planning and support and analytical tools, and decision-supporting institutions.

Two projects of territorial development of oases have been implemented: Tafilalet (2006–2014) and Drâa (2009–2012), the aim of which is to fight against poverty, desertification and silting, preserve natural resources, develop local products and improve living conditions.

Strategy on Planning and Sustainable Development of the Middle Atlas Mountains

The Strategy on Planning and Sustainable Development of the Middle Atlas Mountains has as its main objectives, to:

- Include the mountain areas in dynamic development;
- Establish an appropriate framework for:
  - Managing modes of involvement of various actors;
  - Establishing consistency between sectoral actions;
  - Providing stakeholders with a sustainable development concept.

The main recommendations are to:

- Preserve resources of national interest;
- Preserve the function of the "water tower" through:
  - Maintaining the vegetation layer;
  - Reducing erosion;
  - Controlling polluting economic activities.

These actions to protect water resources must be supported and financed by water users in order to:

- Optimize the development of regional resources for the sustainable benefit of the local population, landscapes and cultural attractions;
- Save this heritage as well as the urban historical heritage for the benefit of the population.

As part of the implementation of the Strategy, three territorial development projects in the Middle Atlas,

eastern Middle Atlas and Moulouya Valley started in 2009.

Other strategic documents

In 2006, Morocco adopted the National Strategy for Conservation and Sustainable Use of Biodiversity, in connection with the Convention on Biological Diversity (CBD). The Strategy analysed the state of biodiversity in the country and its socioeconomic importance, followed by an analysis of management scenarios and options for the development of a national report concerning biodiversity (chapter 9).

In 2006, Morocco also adopted the National Strategy for Protected Areas that provided the basis for changes in the protected area network (chapter 9).

The National Energy Strategy was adopted in 2009. It has four objectives: the security of energy supplies and energy availability, access to affordable energy for all, energy demand management and protection of the environment. Its ambitious target is to increase the share of renewable energy to a total of 14 per cent by 2020 (chapter 12).

1.3 Environmental legislation and implementation

Since 2003 Morocco has intensified its efforts to strengthen its national environmental legal framework and make it more effective. In 2003, the Moroccan parliament approved three important environmental laws: Law No. 11-03 on the Protection and Conservation of the Environment, Law No. 13-03 on Combating Air Pollution and Law No. 12-03 on Environmental Impact Assessment. Since then, many laws and implementing secondary legislation have been adopted. There are also a number of additional laws under development within the Department of Environment, including laws concerning coastal zone management and access to environmental information.

The legal framework for sustainable development is largely under establishment. Following the adoption of the National Charter for Environment and Sustainable Development in 2011, a draft framework law No. 99-12 on the National Charter for Environment and Sustainable Development, prepared by the Department of the Environment, has recently been adopted unanimously by the House of Representatives. It seeks as its primary objective to provide a legal basis for the principles, rights, duties and obligations contained in the National Charter and to determine the future direction of public policy in terms of strategies and programmes relating to the protection of the environment and sustainable development.

Law on the Protection and Conservation of the Environment

The 2003 Law No. 11-03 on the Protection and Conservation of the Environment introduced a wide range of environmental policy tools.

The Law is organized in seven chapters. Chapter 1 lays out the law's objectives, which include the protection of the environment against all forms of pollution and degradation, improving the living conditions of citizens, and providing the foundation for the country's legislative, technical and financial support for the protection and management of the environment. In the event of environmental damage, the law aims to ensure the rehabilitation of the environment and compensation of victims.

Chapter 1 also establishes the polluter-pays and user-pays principles. Chapter 2 covers human settlements. Chapter 3 covers soil and subsoil; fauna, flora and biodiversity; inland waters; air; marine (including coastal) resources; rural and mountainous areas; and protected areas. Chapter 4 deals with waste, discharges of pollutants, hazardous substances, noise and odours.

Chapter 5 covers management tools for environmental protection, including environmental impact assessment (EIA), norms and standards of environmental quality, economic instruments and environmental funds. Chapter 6 lays out the principles underlying environmental liability and rehabilitation of the environment. Chapter 7 contains final provisions, repealing previous laws and regulations that are contrary to the provisions of the Law.

Water management

The 1995 Law No. 10-95 on Water created nine water basin agencies (WBAs). The Law established the legal and regulatory instruments for the protection of water resources and hydraulic public domain. This law provides the standards of water quality, quality objectives, the inventory level of pollution permits for the discharge of wastewater, protection zones around points of water catchments; reuse of treated wastewater (chapters 2 and 7). The law contains a number of measures on the protection and conservation of water resources, wastewater discharge and the reuse of treated wastewater. Since 2005, Law No. 10-95 has been supplemented by two decrees. The first was the 2005 Decree 2-04-553 on

spills, discharges, and direct or indirect deposits into surface water or groundwaters. The second is the 2006 Decree No. 2-05-1533 on on-site sanitation. This decree aims to improve the living conditions of the population of communities with dispersed housing, and protect water resources (chapter 7).

Air pollution management

The 2003 Law No. 13-03 on Combating Air Pollution aims at prevention and reduction of emissions of air pollutants (chapter 6). Two implementing decrees have set standards for air quality (2009 Decree 2-09-286 setting standards for air quality and the procedures for air monitoring) and air emission limit values (ELVs) from stationary sources (2010 Decree 2-09-631 setting limit values for clearance, emission or discharge of pollutants into the air from stationary sources of pollution and the procedures for air monitoring).

Waste management

The 2006 Law No. 28-00 on Waste Management and Disposal aims at minimizing negative impacts of waste on human health and the environment. Several implementing regulations for this law have been adopted since it entered into force (chapter 8).

Environmental impact assessment

Although the principle of EIA had been introduced by the 2003 Law No. 11-03, the content of the EIA procedure was defined in the 2003 Law No. 12-03 on Environmental Impact Assessment. This Law was supplemented by the publication of two decrees, two ministerial orders and a joint circular. The 2008 Decree No. 2-04-563 on the functions and operations of the National Committee and regional committees on EIA covers mainly institutional aspects. It lays out the functions and operation of those committees and establishes their composition and operating procedures. It also defines the criteria determining whether an EIA is undertaken by the National Committee or a regional committee. The 2008 Decree 2-04-564 setting down the procedures for the organization and conduct of public hearings into proposals subject to environmental impact assessment covers mainly procedural aspects.

The 2010 Joint Order of the Secretary of State in charge of Water and Environment and the Minister of Economy and Finance No. 636-10 fixed the rates of remuneration for government services in relation to a public hearing. The 2009 Order of the Secretary of State in charge of Water and Environment No. 470-08 delegated sign-off of environmental acceptability to the regional authorities (walis). The 2009 Joint Circular of the Minister of the Interior and the Secretary of State in charge of Water and Environment No. D-1998 activated the above decrees that supplemented Law No. 12-03 on Environmental Impact Assessment.

Protected areas

The 2010 Law No. 22-07 on Protected Areas establishes categories of protected areas, defines the process of creating a protected area either at the initiative of central administration or at the request of local authorities, and determines the conditions for the development and management of the protected area (chapter 9).

Plastic bags

The current legal framework consists of the 2010 Law No. 22-10 on the Use of Degradable or Biodegradable Plastic Bags and Sacks and 2011 Decree No. 2-11-98 adopted for the application of Law No. 22-10. Two joint orders were issued under the 2011 Decree. The first was the 2011 Joint Order of the Minister of Industry, Trade and New Technologies, the Minister of Health and the Secretary of State in charge of Water and Environment No. 3166-11. The second was the 2011 Joint Order of the Minister of Industry, Trade and New Technologies, the Minister of Agriculture and Maritime Fisheries and the Secretary of State in charge of Water and Environment No. 3167-11.

Strategic Environmental Assessment

Morocco does not yet have a legal framework for strategic environmental assessment (SEA). The SEAs of the national municipal SWM programme and of the Morocco Green Plan (for agriculture) were carried out on an ad hoc basis. Similarly, the SEA of Tourism Vision 2020 is under way. It should be noted that the new draft law on the environment and sustainable development makes explicit references to SEA.

Accidental marine pollution

Decree No. 2-95-717 of 1996 establishes the organizational framework for the preparation for and the fight against accidental marine pollution. It provides in particular for the development of a national emergency plan aimed at establishing:

- An appropriate system for detecting and warning of massive marine pollution;
- The fast, efficient organization of and

coordinated prevention and control;
- Training for skilled personnel in the prevention of and fight against massive marine pollution by oil and other harmful substances.

Also in accordance with the Decree, the 2003 Order of the Prime Minister No. 3-3-00 aims at determining the conditions that trigger the alert in the event of accidental marine pollution, preparedness measures and the roles of different stakeholders.

Gaps in the regulatory framework

There is a lack of adequate regulation of the coastal and marine environment (except for accidental marine pollution). The sea is polluted by direct discharges of municipal and industrial wastewater generated by accelerated urbanization and industrialization of coastal areas. More than 80 per cent of industry is located in these areas. The law on coastal areas has been in preparation for several years, while, in the meantime, coastal management remains deficient. Specifically, Law No. 31-06 on the Development, Protection, Enhancement and Preservation of the Coastline was first prepared in 2006. Although the law was eventually adopted on 5 July 2011 by the lower chamber of the parliament it never moved into force. The draft law aims to promote a national policy for the protection and improvement of the coastline based on integrated coastal zone management. It foresees the strict regulation of construction and economic activities (including mining) along the coastline. It states the need to protect the quality of the sea water, through forbidding polluting discharges to the sea.

1.4 Institutional framework and administrative capacity

In terms of hierarchy and protocol, ministries are above State secretariats, which in turn are higher than high commissions and departments. The status of high commissions and departments is equal, with the difference that, as a general rule, high commissions report to the Chief of the Government, whereas departments are subordinated to ministries or state secretariats.

Ministry of Energy, Mines, Water and Environment

The Ministry of Energy, Mines, Water and Environment consists of three departments (since January 2012): the Department of Energy and Mines, the Department of Water and the Department of Environment. The latter two are directly linked to environmental protection and management and are discussed more extensively below.

Department of Environment

The Department of Environment is the national environmental authority responsible for developing and implementing national environmental policy. It is also responsible for the coordination of environmental protection at the national level. The national environmental authority has undergone numerous institutional changes and has fluctuated over the years (table 1.1). In terms of status within the hierarchy of national administration, the national environmental authority held its highest position between 1995 and 1997, when it reached the status of Ministry of Environment. In recent years, it has had the status of State secretariat under various ministries.

Between 2007 and 2012, the Department of Environment and the Department of Water formed the State Secretariat in charge of Water and Environment under the Ministry of Energy, Mines, Water and Environment. Since January 2012, the national environmental authority has no longer held the status of State secretariat.

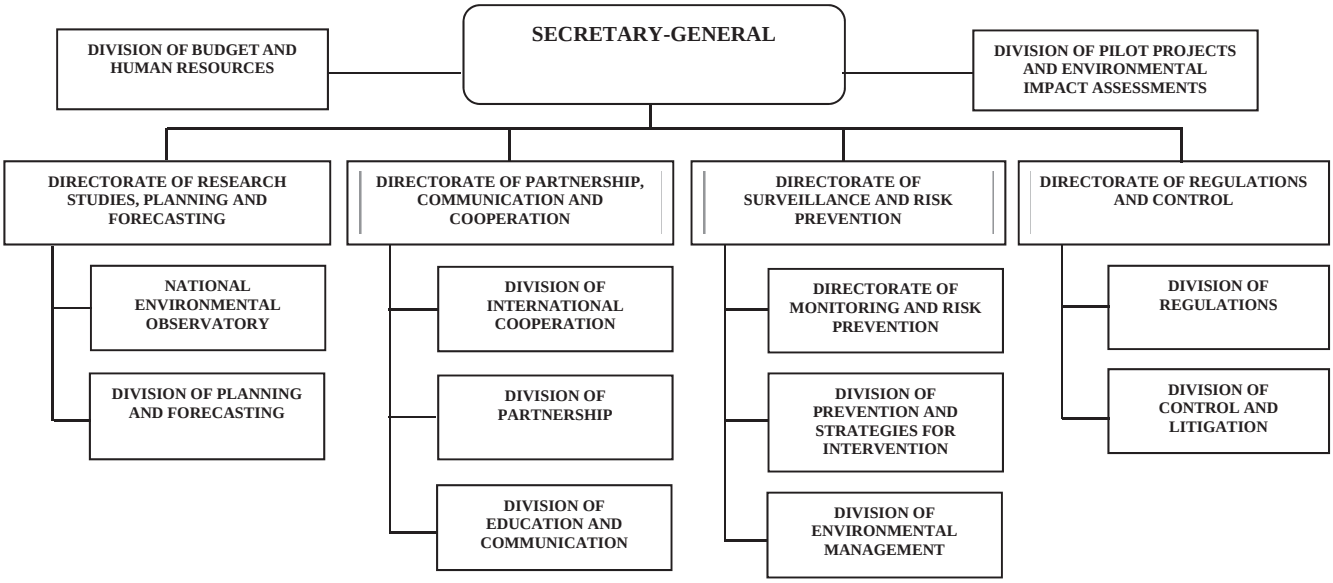
At the time of the EPR review, the national environmental authority had the status of a department of the Ministry, together with two other departments of very different substance and needs. The above institutional changes were not linked to a lowering of environmental priorities – indeed, their importance has been confirmed by the highest authorities of the country – but rather to political restructuring. Nevertheless, they do impact upon the institutional and operational ability of the national environmental authority in multiple ways because they result in a lack of institutional continuity which is felt in a number of ways, particularly in the regions. Furthermore, there is the risk that environmental protection, which is the core mission of the Department of Environment, may face competition from other powerful sectors under the umbrella of a multifaceted Ministry. For example, the website of the Ministry (www.mem.gov.ma) still reflects only two sectors, mining and energy, and has no direct link to the website of the Department of Environment or Department of Water, despite the fact that they have been part of it since 2007.

In terms of its structure, the Department of Environment is headed by a Secretary-General and comprises two divisions reporting directly to the Secretary-General, and four directorates (figure 1.1).

Table 1.1: Institutional status of the national environmental authority over time

1972	Division of Environment in the Ministry of Housing, Urban Planning and Tourism
1985	Division of Environment in the Ministry of the Interior
1992	Under Secretariat of State in charge of Environment at the Ministry of Interior
1995	Ministry of Environment
1997	Secretariat of State in charge of Environment in the Ministry of Agriculture, Infrastructure and Environment
1998	Secretariat of State in charge of Environment in the Ministry of Planning, Environment, Urban Planning and Housing
2002	Secretariat of State in charge of Environment in the Ministry of Land, Water and Environment
2004	Department of Environment in the Ministry of Land, Water and Environment
2007	Secretariat of State in charge of Water and Environment in the Ministry of Energy, Mines, Water and Environment
2012	Department of Environment in the Ministry of Energy, Mines, Water and Environment

Figure 1.1: Organizational chart of the Department of Environment



Source: Department of Environment, 2013.

Since 2007, a public service management system was gradually implemented within the Department of Environment, in order to strengthen the management culture through streamlining and harmonizing key work processes and procedures. ISO 9001 certification is envisaged. The development of a number of support tools is under way with a view to ensuring the integrated management of human and financial resources and information flows.

The total budget of the Department of Environment has increased since 2008, when a number of national environmental protection programmes (e.g. waste management, wastewater treatment) were started. At the same time, its operational budget remains limited and has even decreased since 2010, staying well below actual needs, especially after the creation of regional offices and the regional observatories of the environment and sustainable development (OREDDs).

At the time of the EPR, legal statutes concerning the operation of regional offices (external services) had not yet been adopted, despite article 18 of the founding decree of the Department of Environment which called for the creation of these offices. As a result, their operation is adversely affected and they are not yet clearly integrated into the structure of the Department of Environment. They report to the Directorate of Research Studies, Planning and Forecasting, although that is not reflected in the organizational chart of the Department.

The establishment of regional offices of the Department of Environment in effect started from scratch, following the separation in 2007 of the Department of Environment from the Ministry of Land, Water and Environment. Due to this separation, all regional offices (called inspectorates) were kept by the Ministry of Housing, Town Planning and Urban Policy. This was clearly a major setback for the environmental authority and its capacity to address environmental challenges at the regional/local level. Among the key functions of these regional offices are environmental inspections and ensuring compliance with environmental

legislation. Regional offices are also entrusted with technical support and advisory functions vis-à-vis local industries, and with raising awareness by organizing environmental campaigns.

The regional offices of ministries in Morocco can be either regional directorates (as is the case with most ministries) or hierarchically lower regional services. The regional offices of the Department of Environment have the lower hierarchical status of regional services. In addition to regional directorates or services, there are also provincial directorates or services that are based in other provinces of a region, i.e. not that of the region's capital. The provincial offices of the Department of Environment have the status of provincial services.

Regional observatories of the environment and sustainable development

The creation of regional observatories of the environment and sustainable development (OREDDs) in partnership with the regions of the country is aimed towards the gradual creation of local mechanisms that operate in favour of better integration of environmental considerations into economic activities at local level. The initiative involves key stakeholders in the region, whether public, private or business.

As this is a new initiative, it remains to be seen in practice how well OREDDs are able to perform the functions assigned to them. At the time of the EPR review, not all regions had operational regional observatories (chapter 3).

Department of Water

The main responsibilities of the Department of Water are:

- Planning and management of water resources;
- Mobilization and transfer of water;
- Research and evaluation of the quality of water resources and climate change;
- Weather monitoring and information on climate change;
- Prediction and monitoring of weather-related risks.

Since November 7, 2002, the Department of Water has held the status of State secretariat – as State Secretariat for Water until 2007 and State Secretariat for Water and the Environment, 2007–2011. Since January 2012, the Department of Water no longer holds the status of State secretariat.

The Department consists of three directorates: the Directorate General of Hydraulic, the Hydraulic Facilities Directorate and the Directorate of Research and Water Planning. The National Directorate of Meteorology (DNM) is subordinated to the Department of Water. In November 2012, the Department employed 2,865 staff members, of which 859 were employed by the DNM.

Water basin agencies are in charge of the implementation of water policy under the Department of Water, in accordance with the provisions of Law No. 10-95. Water basin agencies are responsible for assessing, planning, managing and protecting water resources and granting authorizations and concessions on the use of water in the public domain.

The National Office of Drinking Water (ONEP) manages production facilities and water treatment, and ensures the delivery of drinking water in some jurisdictions.

Although the DNM is under the Department of Water, it conducts studies and measurement of atmospheric pollution. Its main tasks, however, are related to observations and forecasts of weather and climate.

Ministry of the Interior

Representation of the Ministry of the Interior is done through a network of regions (wilaya) and provinces or prefectures. At the central level, two branches of the Ministry of the Interior are involved in environmental management. The first is the General Directorate of Local Authorities, which prepares and coordinates plans and development programmes in areas such as communal hygiene, water, sanitation and solid waste. Due to its responsibilities in wastewater and waste management, this General Directorate is involved in marine pollution from land-based sources. The second is the General Directorate of Civil Protection, which is responsible for protection measures and rescue of people and property in cases of natural or human-caused disasters. The Directorate also promotes risk prevention.

Ministry of Agriculture and Maritime Fisheries

The Department of Agriculture of the Ministry of Agriculture and Maritime Fisheries is responsible for developing and implementing government policy in agriculture and has a wide range of responsibilities related to the management of soils, plants, farming and livestock. The Department also oversees the use

of water resources for irrigation, conducts studies for the development of agriculture and livestock, monitors and controls the quality of plant and animal products intended for human or animal consumption and provides training for farmers (chapter 13).

Ministry of Health

The Ministry of Health is responsible for the prevention against risks to health, health education, promotion of healthy lifestyles, health checks and the provision of preventive, curative or palliative and rehabilitation. Similarly, it is responsible for the development of legal instruments and standard norms related to health and the environment (chapter 10).

Ministry of Housing, Town Planning and Urban Policy

Since 2007, the Ministry of Housing, Town Planning and Urban Policy is responsible for housing, urban development, spatial planning and rural development. It plays a key role in the preparation of master plans for urban development. The Ministry also monitors indicators relating to the housing sector. Each regional inspection publishes annually an assessment of the housing sector in that region. These assessments summarize key demographic and socioeconomic data for each region. In addition, they provide an update on the development and different characteristics of the housing sector.

Ministry of Tourism

The Ministry of Tourism is responsible for the promotion of tourism and the management of infrastructure in sites of particular environmental importance for the country's biodiversity. As the creation of resorts for seaside and mountain tourism can cause significant damage to coastal and mountainous sites, the Ministry contributes to the development of management plans for these resorts and monitors the development of tourist areas and construction activities undertaken there.

High Commission for Water, Forestry and Desertification Control

The High Commission for Water, Forestry and Desertification Control reports directly to the Chief of the Gouvernment. It is the primary institution dealing with biodiversity in Morocco. The High Commission's mission is to develop and implement government policy in the areas of conservation and sustainable use of forest resources and pastures, and the development of hunting, fishing, nature reserves and parks. Moreover, it coordinates the establishment of institutional mechanisms for the preparation, implementation, monitoring and evaluation of government policy to combat desertification. Finally the High Commission is mainly responsible for coordinating the development and implementation of management plans for wetlands and nature reserves and parks (chapter 9).

National councils

At the national level, the country relies on a number on consultation bodies – notably, the National Council for the Environment, the Higher Council for Planning, the High Council for Water and Climate (HCWC) (chapter 7) and the National Forest Council – which provide platforms for dialogue and technical expertise. These councils are not intended to act as mechanisms for coordination among government institutions.

The National Council for the Environment was created in 1980 and restructured in 1995. It has five specialized committees, namely:

- The Committee on human settlements;
- The Committee on the protection of nature, natural resources and natural disasters;
- The Committee on legal and international issues;
- The Committee on prevention and combating pollution and nuisances;
- The Committee on culture, information, communication and education.

The National Council for the Environment provides a forum for consultation, cooperation and dialogue among key stakeholders. It is normally chaired by the national environmental authority. Representatives from other ministries serve as members. NGOs, professional associations and private sector entities are invited to participate. The Department of Environment provides the secretariat for the National Council for the Environment through a dedicated unit under the Division of Planning and Forecasting.

All studies and projects of laws and regulations affecting the environment, as well as projects and programmes that may affect the environment, are submitted to the National Council for the Environment for its opinion. Its role, in this sense, is consultative. Since its reorganization in 1995, the National Council for the Environment has met seven times. Some of these meetings were highly symbolic. For example, at its 2002 session, the first national report on the state of the environment in Morocco was presented and the National Environmental Action Plan (PANE) was adopted. At its 2007

session, important environmental programmes (the National Municipal Solid Waste Management Programme and the National Programme of Sanitation and Wastewater Treatment) were presented to it, together with the methodology for development of the National Strategy on Sustainable Development. At its 2009 session, the departmental strategy of environment (Strategy of Proximity) was presented to it by the Department of Environment. At its 2011 meeting, chaired by the Prime Minister, the National Charter for Environment and Sustainable Development was endorsed. The National Council for the Environment is a body with high political visibility. At the time of this review, there were considerations to rename it as the national council for the environment and sustainable development.

The High Council for Water and Climate has not met since 2001.

1.5 Conclusions and recommendations

During the process of institutional change in the past, the status of the national environmental authority has changed from a ministry to that of a State secretariat and then to that of a ministerial department, among a few others, in a multifaceted Ministry of Energy, Mines, Water and Environment. Thus, the promotion of environmental protection and sound environmental management is located within a ministry with very different and sometimes competing interests. At the same time, the highest authorities in the country have solidly prioritized environmental protection and sustainable development. As a result, the Department of Environment's competences are expanding.

Performing some of its functions, e.g. ensuring environmental protection or promoting sustainable development in various sectors, requires an appropriate status, one that grants broader capability for initiating and facilitating interministerial and intersectoral cooperation. The current status of the national environmental authority seems to be too low for this. The low status of the environmental authority also weakens the enforcement of environmental legislation. Due to the frequent institutional changes, the representation of the national environmental authority in the regions has been weakened in terms of both status and capacity. As a result, it does not have full representation in all regions of Morocco, and often its presence is too weak for effective implementation of its mandate. In terms of status, its regional offices are not ranked as regional directorates but, rather, as hierarchically lower regional services. Even worse, it appears that the Department's regional services do not yet have a recognised formal legal status.

Recommendation 1.1:
To enable the national environmental authority to ensure environmental protection and promote sustainable development, the Government should:

(a) Consider restoring the status of the national environmental authority to that of a ministry;
(b) Ensure the active participation of the national environmental authority in the new institutional structures on sustainable development to be created at the national level;
(c) Raise and formalize the status and strengthen the capacity of the national environmental authority's regional offices;
(d) Promote better coordination among and greater effectiveness of the work of the High Commission for Water, Forestry and Desertification Control and the national councils (i.e. the National Council for the Environment, the High Council for Water and Climate, and the National Forest Council).

Although the number of projects managed by the Department of Environment has increased, long-term improvements in environmental management and protection require sound development of a policy framework that can establish continuity and predictability of national environmental policy for both domestic and international audiences. At the time of the review, two strategic policy documents relating to the environment that were adopted were no longer in use: the 1995 National Environmental Strategy and the related National Environmental Action Plan (PANE). The strategy of the Department of Environment, although an important policy document, cannot replace a coherent and comprehensive national environmental strategy. Thus, a discontinuity existed at the time of the review. The possibility of policy discontinuities and unpredictability in a core policy area, such as that of environmental policy, is clearly not facilitating more effective long-term environmental management or protection.

Recommendation 1.2:
The Government should:

(a) Further promote the development of a National Strategy on Environment and National Strategy on Sustainable Development, and their submission to the Gouvernment for adoption;
(b) Ensure adequate financing for the implementation of these national strategies and establish clear reporting mechanisms

and reporting obligations for the implementation of their objectives.

The country has not yet introduced strategic environmental assessment (SEA) in its national legislation. The fact that there are explicit references to SEA in the new draft law on the environment and sustainable development is positive.

Recommendation 1.3:
The Government should adopt the necessary legislation for the introduction of strategic environmental assessment.

Law No. 31-06 on the Development, Protection, Enhancement and Preservation of the Coastline was adopted by the parliament. Similarly with all other laws that were not published before the inauguration of the new Government, it was resubmitted for interministerial consultation, and, hence, it is not in force.

Recommendation 1.4:
The Government should finalize the Law on the Development, Protection, Enhancement and Preservation of the Coastline and, once it has been adopted by the parliament, ensure its implementation through the integrated management of coastal zones.

Chapter 2

COMPLIANCE AND ENFORCEMENT MECHANISMS

2.1 Introduction

Morocco has several "historical layers" of environmental regulation and went through several phases of institution-building. Some of the legal acts relevant for environmental management date back to 1914, even though most of the legal framework has been gradually updated since the mid-1990s. The resulting mix of obsolete and relatively modern legal acts poses problems of consistency and general applicability. While most of the principal instruments for environmental compliance assurance (such as environmental assessment, permitting, compliance monitoring, enforcement and compliance promotion) are available, capacity for their implementation remains limited. Efforts are made in Morocco to address capacity problems and adopt strategic planning that would allow for a more effective use of available resources.

Given the need to seriously reshuffle the legal bases, resources allocated to compliance assurance remained modest. A lack of compliance assurance has further reduced the effectiveness of the Moroccan legal framework for environmental management. Recognizing the need to enhance compliance and align national compliance assurance approaches with international practice, the Government has recently defined and started the implementation of measures to strengthen the country's compliance assurance system.

2.2 Institutional arrangements and capacity for compliance assurance

Ministry of Energy, Mines, Water and Environment

The Department of Environment within the Ministry of Energy, Mines, Water and Environment has the mission to ensure the coordination of environment management actions of the Government at the national level. The mandate of the Department was enlarged by the 2000 Decree No. 2-99-922 on the organization and responsibilities of the Secretary of State in charge of Environment. It now includes tasks such as environmental monitoring, environmental impact assessment (EIA), and pollution prevention and mitigation, including "undertaking inspection/control actions that are assigned to it by law". Within the Department of Environment, two bodies have functions relevant for ensuring environmental compliance.

The Division of Pilot Projects and Environmental Impact Assessments implements project-level environmental assessment procedures in accordance with the Law on EIA No. 12-03 and its implementing regulations.. Among other functions, the Division acts as the secretariat of the national EIA committee and coordinates and assists the activity of all regional EIA committees. The EIA committees' main responsibility is to ensure the implementation of the EIA procedure for development projects which are subject to it, including the screening stage, the scoping stage and analysis of the EIA report. The EIA committees provide their opinion on the environmental acceptability of projects to the competent authority (the Department of Environment for large investment projects worth more than 200 million dirhams, transboundary projects and projects concerning more than one region, and the regional authorities for other development projects).

The Directorate of Regulations and Control (DRC) is responsible for environmental compliance monitoring and enforcement. The DRC has two divisions: the Regulations Division and the Control and Litigation Division. However, the governing environmental laws do not provide explicit powers of inspection and enforcement to the main environmental authority (chapter 1). The environmental inspectors employed by the Department of Environment are not part of the list of officials having powers for independent compliance monitoring and enforcement. This makes a difference, e.g. in the water sector, where the 1995 Law No. 10-95 on Water clearly identified the competent enforcement authority (the Water Police) and granted respective powers to the personnel of this authority.

Without either adequate regional representation or powers for independent, proactive compliance monitoring and administrative enforcement, the activity of the Department of Environment has long been limited to responding to requests from other governmental authorities and providing compliance promotion and awareness-raising. In order to overcome some of these problems, the Department of

Environment's capacity and regional coverage have been reinforced.

Following the government policy of enhancing capacity at the subnational level, the Department of Environment launched its own Proximity Strategy that led to the establishment in 2008 of regional and provincial units. Their tasks include, among others: (i) monitoring of compliance with environmental regulations at local level; (ii) technical assistance for the implementation of cleaner production industrial projects; and (iii) communication with and awareness-raising among local partners. The creation of these units also pursued the goal of strengthening the implementation of EIA procedures at the regional level. Through these units, the Department of Environment operates in all regions as well as in all provinces of the country. The regional units do not have the status of legal entities (chapter 1). A draft of the joint order of the Ministry of Public Function and Modernization of the Administration and the Ministry of Economy and Finance on the latter subject has still not been approved. To further enhance the regional outreach of the Department of Environment, regional observatories of the environment and sustainable development (OREDDs) were created, in partnership with the regional authorities. Their main task is environmental data collection and analysis in support of decisions at the subnational level.

In 2011, the DRC had 32 staff members; only 11 of them work at the Control and Litigation Division, including six inspectors. Six other persons having inspection duties are assigned to other subdivisions of the Department of Environment. The mix of educational background of inspectors is adequate, comprising chemists, biologists, chemical engineers and lawyers. At the subnational level, human resources of the Department of Environment remain quite scarce, with 38 operational officers in place, including 13 inspectors. The Department's operational budget remains limited and even decreased during recent years. The budget granted to the DRC in 2011 amounted to 1.5 million dirhams or about US$170,000, which is well below the real needs.

Information exchange among different subdivisions of the Directorate is sporadic. Since 2009, the DRC has maintained a database containing information on gendarmerie reports on environmental offences, inspection reports, self-monitoring reports, parliamentary questions and public complaints. The information from different databases kept within the Department of Environment is integrated by the National Environmental Observatory.

Other institutions

Besides the Department of Environment, several other sectoral agencies have mandates that are relevant for environmental compliance assurance. Despite the recent merger of the water and environment fields under one large umbrella (the Ministry of Energy, Mines, Water and Environment), water management remained a distinct domain with its own permitting, compliance monitoring and enforcement activities. The water basin agencies (WBAs) have large responsibilities for inland water resources management and protection, including water permitting and inspection (by the Water Police). The management of biological resources, including biodiversity conservation, and natural areas is covered by the High Commission for Water, Forestry and Desertification Control. The High Commission also formulates and implements the forest policies. Through an extensive network of regional services, it deals with forest management, including issuing authorizations, inspections and forest law enforcement. Besides, it has regulatory and control functions on hunting and inland fisheries (granting licences), and manages the protected areas, including the wetlands. The High Commission has a corpus of paramilitary agents (forest guards armed on duty) with a clear mandate. They have the right to book offenders and present the cases in court.

The environmental legislation gives an important place in compliance monitoring and enforcement to the national military and paramilitary forces. This may involve units of the Navy, Gendarmerie Royale or Civil Protection. Those units consist of officers who report offences in environmental law within their fields of responsibility.

The Gendarmerie Royale has special environmental brigades in every of the country's regions. Those brigades establish police reports and impose penalties, mostly for minor offences such as unauthorized garbage disposal, selling pesticides without authorization or even selling meat in improper sanitary conditions. The copies of those official reports (2,000 to 3,000 annually) are sent to the DRC for information. Apart from involvement through the Gendarmerie Royale and Directorate of Civil Protection, the Ministry of the Interior exercises supervision over the development activities of the local authorities and can thus influence decisions on all local affairs, including environmental management.

Several other governmental bodies have a role in environmental regulation and compliance assurance. The Ministry of Equipment and Transport has

responsibilities for the management of classified industrial installations and quarries, as well as for setting environmental standards for transport units. The Ministry of Energy, Mines, Water and Environment, through its Energy and Mines Directorate, and the Ministry of Industry, Trade and New Technologies, establish and monitor the implementation of environmental standards in the industrial sectors in their fields of responsibility. The Ministry of Agriculture and Maritime Fisheries is responsible, inter alia, for the protection and conservation of the marine environment; to this end, it monitors and inspects coastal fishing using a corpus of sea agents, and can establish fishing bans.

The 2002 Charte Communale increased the prerogatives of the local authorities/councils, giving them the competence to enforce parts of the legislation concerning urban development, household waste and green areas. Most often they are the interface between the citizens and the authorities and deal with people's complaints. The president of the communal council has administrative enforcement powers. (S)he can issue permits, injunctions or prohibition orders, or other municipal bylaws. Specifically, (s)he watches over compliance with urban planning regulations and delivers construction permits and operation permits for classified industrial installations (class 2) and checks on their compliance with requirements. The transfer of competencies to the local level was not accompanied by sufficient resources transfer; consequently, the local authorities often have a tendency to rely on governmental bodies and their regional/provincial arms.

Certainly, a high diversity of actors allows for sectoral specialization, which may be beneficial for the management of environmental issues. However, such diversity can also result in inefficiencies resulting from overlaps of mandates, fragmentation of resources and lack of coherence in decision-making, which seems to be the case in Morocco.

The multitude of actors and the fragmentation of the environmental compliance assurance field, as well as the predominance of a sectoral approach, bring about the need to put in place coordination mechanisms at all levels of decision-making. At the environmental sector level, the partnership approach adopted by the Department of Environment aimed at establishing a cooperation framework based on dialogue and participation of all stakeholders. Specifically, partnership agreements for the implementation of environmental projects have been concluded between the Department of Environment and different partners. Framework agreements with the country's regions were signed in 2009. This also resulted in 449 specific and thematic agreements having been concluded so far with the prefectures and provinces. Finally, partnership agreements with economic operators and with NGOs have been signed. Against the background of a lack of legal, technical and financial resources, this massive use of partnership agreements allows the DRC to strengthen its impact on the ground. There are no prosecutors or courts specialized in environment issues. Some efforts are made to increase environmental awareness and capacity to deal with environmental cases.

2.3 Scope of regulation

Morocco has a history of regulating different areas of industrial environmental impacts and natural resources management dating back to 1914. Since the 1990s, significant efforts have been made to modernize the legal framework and build institutions capable of putting policy objectives and legal requirements into practice.

Cross-cutting environmental legislation

The 2003 Law No. 11-03 on the Protection and Conservation of the Environment provides for a whole arsenal of environmental policy tools, including EIA and environmental standards. While the principle of EIA of development projects was introduced by Law No. 11-03, the content of the EIA procedure was defined in the 2003 Law No. 12-03 on Environmental Impact Assessment.

It introduced new obligations for developers, such as the responsibility of identifying and addressing environmental impacts in order to obtain a construction permit. This covers both urban and industrial developments. Permits are issued for construction, commissioning, operation and decommissioning of an economic object. Law No. 11-03 stipulates that the development consent and construction permit can only be issued if the environmental impacts of the construction are considered. They should be refused if the construction and operation present a danger for the environment, as well as public safety, well-being and health (art. 6).

Law No. 11-03 makes any person or legal entity undertaking activities related to the storage, transportation or use of harmful or dangerous substances or operating a so-called "classified industrial installation" liable for physical and material damage related to those activities. Such a liability is involved even if there is no evidence of offence. Besides, in the event of environmental degradation, the restoration of the environment will

be the responsibility of the operator. If the incumbent is not able or willing to restore the environment to the status quo, the administration can do so at the expense of the offender.

Water quality regulation

The 1995 Law No. 10-95 on Water delegates most of the responsibilities in the water field to water basin agencies (WBAs). The WBAs deliver water use authorizations and concessions as well as water discharge authorizations. The latter define the discharge point, the duration of permit validity (maximum 20 years), the discharge limit values (DLVs), the discharge fee, sampling modalities and parameters, etc. Permit-holders are to pay a water use fee and a discharge fee. Industries are charged according to so-called "pollution units" discharged, calculated on the basis of releases of several basic pollutants (mainly suspended matter, organic pollution and heavy metals).

Even though the polluter-pays principle is legally stipulated, it is not applied in practice due to the lack of complementary regulations defining, inter alia, the DLVs and yield purification devices, both pieces of secondary legislation being needed in order to calculate the value of the discharge fee for industries.

Law No. 10-95 does not establish concrete DLVs, despite the central role of this policy instrument in the national system of water quality management. It took 10 years to pass the complementary 2005 Decree No. 2-04-553 on spills, discharges, and direct or indirect deposits into surface water or groundwaters, which defines the procedure of setting "general and specific" DLVs. This is done by joint order of the relevant government authorities (including interior, water, environment, handicrafts and industrial authorities). Dating from 2005, a list of 33 general limit values is reportedly still awaiting approval.

In parallel, the sectoral DLVs approach was established. It consisted of adopting less stringent emission standards for specific types of wastewater (table 2.1). Thus, 17 years after the adoption of Law No. 10-95, only five specific DLVs have been approved, namely for: (i) domestic wastewater; (ii) the pulp, paper and cardboard industry; (iii) the sugar industry; (iv) the cement industry; and (v) hot-dip galvanizing. Some 30 other industrial sectors are still in the process of developing and coordinating their sectoral limit values. Besides undermining the application of the polluter-pays principle stated by the Law on Water, this situation creates unfairness between the industrial sectors. In its article 13, the 2005 Decree No. 2-04-553 stipulates the need to review DLVs once per decade or every time that the protection of water quality or the evolution of technologies so requires. This creates the opportunity to set stricter water quality requirements if the conditions in the receiving water body necessitate it. In practical terms, however, such a revision of DLVs would be very difficult to do due to the slow law-making procedure.

Another element of the protection of water resources from pollution is the water quality standards established by ministerial orders in 2002 and 2003. Currently, the following standards are available: (i) the quality standards for surface waters intended for drinking water production; (ii) the quality standards for waters intended for abstraction of irrigation water; (iii) the quality standards for fishing waters; and (iv) the water quality classification system for surface waters. The latter classification scheme comprises five quality classes assigned on the basis of evaluation of 41 water quality parameters. The system is used mainly as a water quality assessment tool but does not seem to serve as a planning and management tool. Overall, however, emphasis is put on DLVs.

Air quality regulation

The 2003 Law No. 13-03 on Combating Air Pollution enacts several tools for limiting activities that affect air quality, including emission limit values (ELVs). The 2010 Decree No. 2-09-631 setting limit values for clearance, emission or discharge of pollutants into the air from stationary sources of pollution and the procedures for air monitoring, establishes (quite strict) "general" ELVs that no pollution source can exceed. However, those values would not apply to installations subject to (less stringent) sectoral ELVs set by joint orders of the Ministry of Environment and the relevant sectoral ministry.

Currently, sectoral ELVs are being negotiated for a number of industries, including the cement industry, the production of phosphoric and sulfuric acids, the fertilizer industry, the oil refineries and the steel industry. For now, none of the set ELVs is reported to be enforced. To make some of its requirements effective, Law No. 13-03 is still awaiting a number of bylaws concerning, inter alia: (i) the grace periods granted to existing pollution sources for complying with requirements of the law; (ii) the circumstances in which the administration can take urgent measures to stop a pollution situation; and (iii) the areas where air quality standards and emission standards apply.

Photo 2.1 : Oued Oum Er-Rbia donwstream of Khenifra

Table 2.1: Comparison of discharge limit values for domestic wastewater from urban settlements in Morocco and the European Union

Parameter	Joint Order No. 1607-06 setting specific limit values on domestic discharges of 25 July 2006		European Union's Urban Wastewater Treatment Directive 91/271/EEC
	DLVs applicable during years 7–10 for existing discharges	DLVs (grace period 10 years for existing discharges)	
BOD5, mg/l	300	120	25
COD, mg/l	600	250	125
Total suspended solids, mg/l	250	150	35

Note: Facilities are given a grace period of 10 years to achieve compliance. At the same time, as of the seventh year after adoption of this Order, the DLVs indicated in column 2 are to be applied.

Emissions from mobile sources are regulated by the 1998 Decree No. 2-97-377 updating the 1953 Order on the Road Police. The Decree sets ELVs for carbon monoxide (4.5 per cent) and smoke (opaqueness maximum 70 per cent). The text defines the verification procedures and technical conditions and states the possibility of unannounced pollution checks on the road. This text was never actually put into practice.

Morocco has recently revised the list of marketable fuel products. Thus, diesel 350 ppm was replaced in 2009 by diesel 50 ppm (i.e. ultra-low-sulphur, Euro 4). Two-star petrol has not been marketed since 2005. Since 2009, only two fuels are marketed through the national service station network: diesel 50 ppm and unleaded super. The country's alignment to international product standards will have a beneficial effect on air quality, notably in urban areas.

Waste management

The 2006 Law No. 28-00 on Waste Management and Disposal introduces the classification of waste and regulates all the activities related to waste management. It deals with administrative procedures for controlled landfills as well as for treatment and incineration units, all these activities being subject to EIA and permitting (chapter 8).

Industrial regulation

The construction and operation of industrial installations is still governed by the Dahir of 25 August 1914 on the Regulation of Unsanitary,

Inconvenient or Dangerous Industrial Plants. This law, adopted a century ago, aimed at protecting the neighbourhood from the dangers and nuisance related to industrial factories. The text categorizes industrial installations into three classes according to the nature of their activity and the inconveniences they present in terms of public safety and hygiene.

It stipulates that class 1 and 2 installations can not be open without a permit delivered by the competent (government or local) authority, while class 3 unit operators have to declare their intention to the local authorities before starting the activity. The list of installations as such was introduced by an Order of the Prime Minister in 1933 and, despite several updates, remains largely unchanged.

The law exhibits several inadequacies that can be summarized as follows:

- Pollution risk prevention measures are not adapted to the actual economic context;
- There are no specific legal measures concerning the protection of the environment;
- Enforcement measures against non-compliance are not having any deterrent effect.

No provisions exist for the prevention of industrial accidents. The list is clearly obsolete and does not correspond to the actual production patterns and technologies used by the industrial sector.

Mining regulation

The first legal requirements regarding the exploitation of quarries date back to 1914. The current construction boom, fuelling anarchic extraction activity, is posing the problem of associated environmental impacts. Quarrying in the riverbeds is regulated by Law No. 10-95 on Water and is subject to permitting by WBAs, and is relatively well controlled. Regulation of quarrying on sites located outside the public water domain is the responsibility of local authorities (provincial quarry commissions), according to a circular of 1994. The scope of regulation by the two authorities is partly overlapping.

To overcome this overlapping and to modernize the legal framework, the 2002 Law No. 08-01 on the Exploitation of Quarries was adopted. It has a strong environmental component and, among other matters, requires an operator to present quarterly environmental reports and authorizes the administration to prescribe site closure and permit withdrawal in the case of non-compliance. The Law remains at the stage of good intentions due to a lack of implementing decrees. As a result, the competent authorities continue to manage this sector on the basis of a simple circular letter (Joint Circular of the Ministers of the Interior, Public Works and Agriculture No. 87 of 8 June 1994 on quarries' opening, exploitation and inspection)**.** In 2013, a draft law on quarries and its implementing regulations were submitted to the Secretary-General of the Government for adoption.

Gaps in the regulatory framework

There is a lack of adequate regulation of the coastal and marine environment (except for accidental marine pollution). The seafront is polluted by direct discharges of municipal and industrial wastewater generated by accelerated urbanization and industrialization of the coastal zone. More than 80 per cent of the industries are located in these areas. The law on the coastal area has been in preparation for several years; in the meantime, coastal management remains deficient.

The sectoral approach in the development of law often leads to legal gaps and is narrowing the scope of regulation. The scope of the Law on Water, for example, is limited to inland waters and the text makes almost no reference to the coastal area and wetlands. It thus turns out to be partial and can hardly be adapted to the integrated management of the entirety of the country's water resources.

Other gaps are a lack of regulation of soil resources and noise. The former is particularly important for a country severely affected by desertification and where some 4,000 ha of productive land is taken from agriculture every year. Also, the country lacks a legal framework concerning public information and participation in environmental issues. The general public's involvement in natural resources management and protection remains minimal. However, a draft law No. 31-13 on access to information is currently under development.

More than the absence of legal coverage of certain areas, environmental regulation is hampered by the lack of or severely delayed secondary legislation. This directly affects the effectiveness of the implementation of law. An important challenge of implementation stems from the country's peculiar linkages between primary and secondary legislation. Laws require massive layers of secondary legislation to become effective. For example, the Law on Water already has a constellation of 72 bylaws (27 decrees and 45 orders) and is still far from being effective.

2.4 Regulated community

According to 2009 statistics reported by the Ministry of Industry, Trade and New Technologies, the country's industrial community was composed of 7,854 members, of which about 2,900 (37 per cent) were located in the Grand Casablanca region, which hosts a mix of large, medium-sized and small enterprises (refineries, power plants, big manufacturing industries, but also brickworks, oil works, potteries, small quarries, etc.). The list of industries with significant environmental impacts also includes cement production, phosphates treatment, fertilizer production, steel, waste incineration units, mining, and combustion plants of all sizes. The number of industrial units has been steadily growing over the last decade. Industrial activities are associated with air and water pollution, waste generation, including hazardous waste, and other impacts. Industrial accidents have contributed to environmental contamination and are becoming increasingly common.

The classification of industrial installations is based on the Dahir of 25 August 1914 on the Regulation of Unsanitary, Inconvenient or Dangerous Industrial Plants. The classification used – introduced by an Order of the Prime Minister in 1933 – is clearly obsolete and sometimes even unusable in the current context. Nevertheless, it remains the only reference document regarding industrial enterprises classification. According to this classification, there are 562 types of industrial installations in Morocco, including:

- 134 types of class 1 (most dangerous);
- 255 types of class 2;
- 173 types of class 3 (least dangerous).

No reliable evidence of the number of industrial installations in different classes exists. The Ministry of Industry, Trade and New Technologies has a complete register of industrial and commercial enterprises but data concern only social and economic characteristics (turnover, number of employees) and do not contain technical indicators on enterprises' activities (production processes, raw materials, fuel used).

The lack of reliable data on the large industrial installations is mostly related to the change of the administrative authority responsible for issuing permits for class 1 installations, effected in the wave of decentralization. The 2002 Order No. 368-02 of the Minister of Equipment delegated the powers to grant the opening and operation permit for class 1 installations to the prefects (walis) of the regions. Before 2002, this permit was issued by the Ministry of Equipment and Transport from the centre. Obviously, this succession of responsibilities resulted in a loss of valuable information, which normally lays the foundation of any compliance assurance activity planning and execution.

This information gap mostly concerns permits delivered before 2002, with the exception of a dozen installations that voluntarily underwent the EIA procedure before the enactment of the 2003 Law No. 12-03 on Environmental Impact Assessment. On enactment of that Law, class 1 installations became subject to EIA. Furthermore, the permit can be issued only upon receiving the decision of the central environmental authority of the project's environmental acceptability.

Thus, information about new class 1 installations is available at the Department of Environment and can be used for inspection planning, among other things. At the same time, the information flow between the communal councils – who are in charge of permit-issuing for or registration of class 2 and class 3 installations – and the Department of Environment has to be improved. This could be done, for example, through the Department's external services and/or the OREDDs.

Other entities in the regulated community include wastewater treatment plants (WWTPs) and waste landfills. In 2005 there were 69 municipal WWTPs but only 29 were operational, although 235 urban centres had a sewerage network. The latest data show that there were 71 WWTPs in 2012. This indicates that only about 20 per cent of wastewater is actually treated. The remaining 80 per cent is being released directly, without any treatment, into rivers (32 per cent) and the sea (48 per cent, often directly on the beachfront or through the oueds), and onto the soil (20 per cent). A vast sanitation and wastewater treatment programme worth 50 billion dirhams (some US$6 billion) was launched in 2008, which aims to reduce pollution from household discharges by 50 per cent by 2015.

Information on other (non-industrial) segments of the regulated community is scarce. Further efforts are needed to identify and profile this community.

2.5 Environmental assessment tools and permitting

Environmental impact assessment

EIA practice has gone through three phases over the last two decades. The first phase, from 1994 to 2003,

was characterized by EIA development on a voluntary basis, either by some project developers, or as requested by donors or international donors, or for reasons relating to the sensitivity of a particular project's location, or for arbitration of conflicting views regarding land use. The second phase began in 2003 with the adoption of Law No. 12-03 on Environmental Impact Assessment. Even in the absence of regulations supporting the application of this Law, a procedure to examine the EIA studies was established at the national level. The third phase began in 2008 with the enactment of several secondary legislation acts pertaining to Law No. 12-03, by which the EIA procedure has acquired its current shape (figure 2.1).

The projects subject to EIA procedure are submitted to the National Committee on Environmental Impact Assessment or the regional EIA committees, which are in charge of reviewing the EIA studies and giving their opinion on the "environmental acceptability" of the projects subject to EIA procedure. The EIA committees gather together the representatives of the main government authorities as statutory members and may invite other participants, e.g. representatives of water basin agencies, professional unions and communes, and technical experts: in total, some 20 persons are to participate in every EIA committee meeting. Calling upon external technical expertise becomes more and more necessary, especially for large industrial or infrastructure developments. For example, in 2011, the National Committee on EIA asked for external expertise on a project in the steel industry, in order to ensure that a well-founded and informed decision be made. However, mobilizing experts is rather difficult given the budgetary constraints and slow administrative procedures required.

The decision is then issued by the government environmental authority for large-scale (more than 200 million dirhams), interregional and transboundary projects, or by the prefect of the region for smaller scale projects. The developers of projects subject to EIA can initiate the procedure for obtaining a permit only after a decision on the environmental acceptability of the project has been obtained from the competent authority. The categories of projects subject to EIA procedure are listed in the annex to the Law: these include the classified installations of class 1, as well as other infrastructure, industrial, agriculture and aquaculture projects. The Law requires a public hearing to be organized for those projects. The concerned population's viewpoint must be taken into account in the project's environmental assessment through public hearings. The application of the EIA procedure requires great efforts in terms of organization, adoption of a structured approach and capacity-building of various stakeholders.

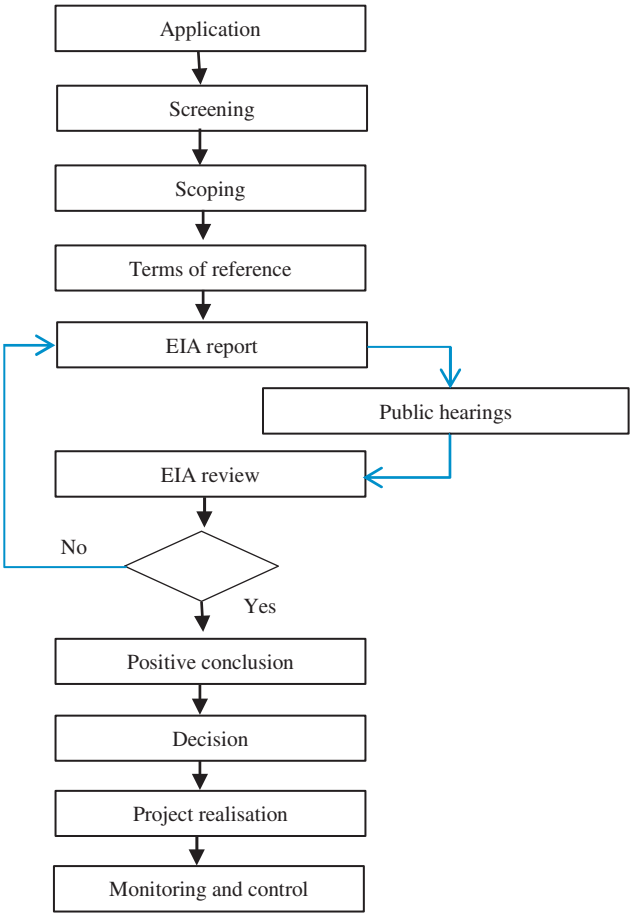
The EIA procedure, as it is currently implemented, includes: (i) the screening stage; (ii) the scoping stage; (iii) the drafting of the EIA report; and (iv) the analysis of the EIA report and decision on the environmental acceptability of the project. The majority of procedures recommended in the EIA assessment are based on the provisions of the regulations. However, these procedures include some steps that are not explicitly specified in the regulations and rely on practices used at the national level and the EIA process at the international level, including the steps of screening and scoping.

In practice, ToR templates are prepared and made available to the proponent by the Department of Environment; some of them are very general. The final version of the ToR is thus prepared by the consultancy firm hired to prepare the EIA report. No special certification is needed for consultancy firms to perform EIA studies, which was thought to have a negative impact on the quality of EIA reports prepared. Recently, the approval of consultancy firms in the field of the EIA system has been set up through the 2013 Order No. 13-2053 on amendment of the list of approval of natural or legal persons performing services for studies and project management in the areas of public procurement, which came into force in November 2013.

Given the importance of the participation of the EIA committees in the screening and scoping phases, the practical procedures applied involve them at the earlier stages, despite this being not explicitly stipulated by law. In fact, the EIA committees are actively involved in the analysis of the project note (so-called projet review) and can convene scoping meetings, especially in the case of complex, large or singular projects. All this makes the system work more efficiently but, on the other hand, it creates a discrepancy between legal requirements and their practical implementation.The screening project list annexed to Law No. 12-03 has significant gaps since a number of relevant project types are not included, e.g. oil and gas pipelines, water supply schemes, wind energy parks and quarries other than for sand/gravel.

Since the list is nondiscretionary in character it opens a wide door to a number of important development projects for escaping from the EIA procedure. Between 10 and 20 per cent of such projects are estimated to avoid the EIA.

Figure 2.1: Current practice of the EIA process in Morocco



Source: Department of Environment, 2013.

To fill this legal gap, in practice the EIA procedures manual states that "any project which … risks causing negative impacts on the environment can be subject to an EIA, even if it is not explicitly mentioned in that list" – which is yet another example of an attempt to compensate for the insufficiencies of the law. Another gap is that the critical threshold of the project is not mentioned in the list, unlike in the EIA Directive of the European Union (EU), for example. Both cases leave ground for arbitrary decisions.

Law No. 12-03 does not specifically require an analysis of proposed project alternatives, including the "no-project" alternative. Here again, implementation practice goes ahead of the legal text and the EIA committees request such an analysis from the proponents; consequently, a few cases of changing the project siting were reported.

Other inconsistencies in Law No. 12-03 regard the non-compliance response. For example, the time given to the offender for achieving compliance after official notification is not stipulated (art. 15). Equally, it is not clear who has the right to ask the court to request the termination or suspension of the activity (art. 16).

A 2007 study by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) estimated that the EIA procedure was not sufficiently effective, pointing to the mediocre quality of many of the prepared EIA reports, which are particularly insufficient at the subnational level. The legally established deadlines for assessment were very tight while expertise in often rather specialized areas of technical knowledge was not available. To fill the gap, a training programme was developed and implemented from 2009 with the support of GIZ, in order to strengthen the capacities of members of the National Committee and regional committees on EIA and also consultancy firms involved in this area. More than 20 workshops were organized at national and regional levels. The public hearings obligation – introduced by Law 12-03 and procedurally established in 2008 by government decree – is now (since 2012) applied in all regions. Nevertheless, some sectoral ministries and project promoters complain about the length and complexity of procedures. To address such problems, regional EIA

committees were created in 2008 and budget allocated for hiring external reviewers when necessary. Procedural guidelines were developed and training provided in support of EIA implementation at the subnational level. An information system was put in place to manage information on the EIA procedure. Future plans for further EIA improvement include the development of sector-specific directives, extension of training programmes, establishment of stricter, ISO-certified internal quality control procedures and more systematic follow-up within compliance monitoring programmes. In the context of the latter, it has to be noted that the outcomes of the EIA procedure are the key benchmarks for conducting compliance assessment, given a very weak permitting procedure.

Permitting

Permits are issued for construction, commissioning, operation and decommissioning of an economic object. Their delivery may be subject to environmental requirements. Law No. 11-03 stipulates that the development consent and construction permit can only be issued if the environmental impacts of the construction are considered (art. 6).

The system of environmental permits for large industrial installations does not exist in Morocco in the form it exists in most industrially advanced countries. The construction and operation of industrial installations is authorized under the conditions of the Dahir of 25 August 1914. The law stipulates that class 1 and 2 installations cannot be open without a permit delivered by the competent authority (currently, the wali or the communal council, respectively). After the enactment of Law No. 12-03, obtaining a decision of environmental acceptability became a precondition for the delivery of a permit for projects which are subject to EIA (it does not mean, however, that a project, having obtained environmental acceptability, would automatically be granted the permit). This authorization process does not specifically involve the environmental authorities. As a result, the EIA report – notably, the environmental impacts mitigation measures – became the key reference for checking compliance. Besides the regulation of industrial installations, elements of a media-specific permitting system exist in Morocco. Several environmental laws mention the need to have authorizations for emitting pollutants or at least to declare such emissions.

Law No. 10-95 on Water stipulates that any direct or indirect discharge of wastewater is subject to an authorization delivered by the WBA(s). The permit states the discharge site, the sampling details, the applied DLVs, the period of permit validity (maximum 20 years), etc. All authorized wastewater discharges are subject to a discharge fee the value of which is set by joint interministerial orders. Permit procedures are adequate and well established (figure 2.2). Permits are granted, but, without established legal requirements on DLVs, the whole construction of water quality regulation remains without support and the same goes for the application of the polluter-pays principle. In fact, the permits that are currently issued by the WBAs leave the part related to wastewater discharges empty.

Concerning the regulation of ambient air quality, Law No. 13-03 on Combating Air Pollution bans the release of any pollutants able to affect human health and the environment and which exceed the existing air quality standards. However, the Law does not require all pollutant emissions to be subject to an authorization issued by the Government environmental authority, as does the Law on Water in stipulating that any discharge of wastewater be subject to a permit delivered by the WBA. The factual renouncement of the use of the permitting system as a pollution control tool is drastically limiting the capacity of the public authorities to combat air pollution, which is the declared aim of this Law. In this situation, the only palliative that could be used by the administration would be to monitor compliance with the air pollution mitigation measures by those development projects that have received environmental acceptability following the EIA procedure.

According to the 2006 waste legislation, industrial, hazardous, medical and pharmaceutical wastes can only be treated in specialized installations upon obtaining an authorization in accordance with Law No. 28-00 on Waste Management and Disposal. The authorization application must be accompanied by the decision on environmental acceptability following an EIA. The collection and transport of hazardous waste are subject to an authorization issued by the administration for a maximum of five years (renewable).

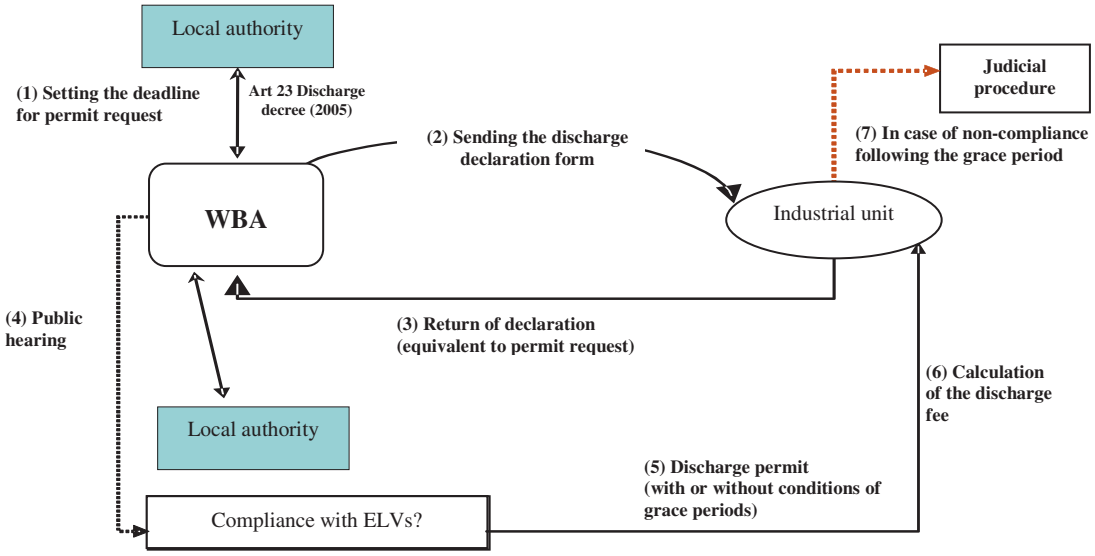
The opening and closure of controlled landfills of class 2 (industrial, medical, pharmaceutical wastes) and class 3 (hazardous waste) are subject to an authorization delivered by the administration after a public inquiry, and publication on the notice board of the joint implementation agreement and the wali of the region or the governor of the prefecture or province concerned, and in accordance with Law No. 28-00.

Table 2.2: Key quantitative information on the EIA procedure, 2009–2012

Year	National level			Regional level		
	Reviewed EIA	Accepted EIA	No. of public hearings	Reviewed EIA	Accepted EIA	No. of public hearings
2009	100	37	..	98	50	..
2010	49	39	..	398	160	..
2011	42	33	3	743	438	89
2012	37	17	20	590	342	335

Source: Department of Environment, 2012.
Note: Public surveys began in 2011.

Figure 2.2: Authorization procedure applied to wastewater discharges not connected to wastewater treatment plants



Source: Bouregreg and Chaouia Water Basin Agency.

2.6 Compliance assurance instruments

Compliance promotion through voluntary actions

The Department of Environment considers compliance promotion to be an important tool for better environmental management. This stems from the understanding that better knowledge of environmental requirements is a prerequisite for regulatory compliance. The Department of Environment's strategic approach to environmental management is based on the development of multiple partnership agreements, including with private sector actors and the NGO community. The agreements concluded with the private sector focus, in the majority of cases, on the adoption of cleaner production and better environmental compliance. Within this process, agreements were signed, for instance, to protect air quality. Notably, such an agreement was signed in July 2008 with cement producers through their professional association.

Corporate initiatives on environmental issues have been emerging over the last decade. Many of them are channelled through the General Confederation of Moroccan Enterprises (Confédération Générale des Entreprises Marocaines) (CGEM). Under the GGEM's umbrella, a corporate social responsibility label (Label RSE) was established in 2006 in line with the international standard ISO 26000 (box 2.1). The label was adopted by many different players beyond the productive sector, including banks and public authorities, and helped to extend private sector action on environmental matters. A first national conference on corporate social responsibility was held in 2011.

The Moroccan Clean Production Centre (CMPP), created in 2000 through a public–private partnership between the Ministry of Industry, Trade and New Technologies and the CGEM, plays an important role in assisting industries to understand the environmental regulatory requirements and thus promoting compliance. It undertakes, inter alia,

regulatory compliance diagnoses and supports the development of sectoral DLVs. The development of a "second generation" of partnerships with private sector actors has been launched recently. Notably, this includes the renewal of the partnership agreement with the Association of Cement Producers with a focus on waste incineration and the ongoing discussion of the draft agreement with CGEM. The latter foresees further efforts for bringing industry in compliance with environmental requirements and promoting cleaner production. Another draft agreement under finalization concerns cooperation with the Confederation of Transport. Plans exist to enhance such partnerships, particularly with the aim of promoting a green economy.

Self-monitoring

The operator of an industrial installation is obliged to put in place self-monitoring systems in order to generate information that would demonstrate whether they are or are not in compliance with environmental requirements. For air emissions, for example, the following criteria pollutants have to be monitored: sulphur dioxide (SO_2), total suspended particles (TSP), NO_x, lead, carbon monoxyde (CO) and cadmium content in dust. The cement industry is the most advanced in establishing environmental self-monitoring systems (box 2.2). The main lesson learnt by the cement industry is the feasibility of self-monitoring. Efforts are still needed to replicate this positive experience in other sectors.

Validation of the operator's self-monitoring system is obligatory and performed by environmental authorities. A special register is approved as part of this procedure. The register should contain:

- Information on the nature and quantity of emissions;
- Emission concentrations – measured and estimated;
- Measurement and sampling methods used as well as the operating regime of the installation during the measurements;
- Conversion coefficients, where applicable;
- The date of the last calibration of equipment and the frequency of metrological verifications.

The operator is obliged to disclose self-monitoring data at any moment at the request of the competent authority. These data are to be reported annually to environmental authorities; however, this is often not the case. Gaps in self-monitoring data registers are not unusual, if a register exists at all. Since 2009, just 18 reports on self-monitoring have been received and stored in a DRC database. This is a rather low figure when compared with the total number of industrial installations.

Self-monitoring obligations are variably defined in different legal texts: for example, they are formulated as rather optional in the air legislation (2010 Decree No. 2-09-631), clearly mandatory in the waste legislation (2009 Decree No. 2-09-284 setting the administrative procedures and technical requirements for landfills), or required indirectly as in Law No. 12-03 on Environmental Impact Assessment. This is introducing ambiguity in and eroding the coherence of the corpus of environmental legislation towards self-monitoring as an important regulation principle.

Inspection

Compliance may also be verified based on inspection by the competent authority. Efforts made to ensure regulatory compliance are largely insufficient. The 25 environmental inspectors (including 13 inspectors who work at the subnational level) do not have the time, material resources or sufficient technical competence to ensure compliance monitoring, especially given the ever-increasing technological complexity of production. There is no annual inspection programme and the site visits are mostly ad hoc and driven by various requests or complaints. A limited number of planned inspections concern follow-up checks of installations which have obtained environmental acceptability following an EIA (table 2.3) or projects which have benefited from FODEP funds; they may also include thematic inspections of, e.g. hospital waste incinerators or landfills. The unplanned inspections usually respond to requests from authorities at all levels, citizens' complaints or parliamentary questions. Since 2008, the Department of Environment has received over 300 complaints concerning various environmental issues, such as waste management, water sanitation, noise, air pollution, etc.

These inspections are always joint actions undertaken in close cooperation with the local authorities, representatives of the sectoral ministry and other concerned authorities. It is difficult to have a clear idea about the overall effectiveness of those inspections. Until recently, the inspector's main role was as advisor to the regulated community. The public authorities favour the approach based on negotiating partnerships, voluntary agreements and commitments, while compliance monitoring and enforcement of regulatory requirements seem not to receive sufficient support.

Box 2.1: The CGEM's corporate social responsibility label (Label RSE)

The CGEM label for corporate social responsibility is a solemn recognition of the respect of enterprises of their commitment to uphold, defend and promote the universal principles of social responsibility and sustainable development in their economic activities, their social relations and, more generally, in their contribution to value creation. Through this initiative, the CGEM endeavours to promote productive investment attractiveness and long-term growth that lies, henceforth, in human development, respect for fundamental rights of the individual and the rule of law, quality of employment conditions, regulation of professional relations, protection of the environment, transparency and effectiveness of competition rules.

The frame of reference of the CGEM label is the charter of social responsibility of the CGEM, adopted in December 2006 by the National Enterprise Council. This charter is defined in accordance with the fundamental principles of the Constitution of the Kingdom and the stipulations of international conventions relating to fundamental human rights, the protection of the environment, good governance and fair competition.

Box 2.2: Environmental self-monitoring by the cement industry in Morocco

The operation of the cement industry provides a good example of responsible conduct with regard to self-monitoring and environmental management more generally. Cement installations are subject to a number of emission standards (total dust, HCl, HF, VOC, SO_2, NO_x, some heavy metals, dioxins and furans). Continuous measurement of most of these pollutants is performed. Periodically, control sampling and measurement is conducted by reference laboratories. There is a procedure for verifying and calibrating the measurement equipment itself, not only the results of measurement. All these make self-monitoring systems reliable and credible.

Table 2.3: Regional distribution of EIA follow-up inspections by sectors during 2010 and 2012

Region	Sector	No. of inspected installations
Grand Casablanca	Oil industry	4
	Brickworks	
	Chemical industry	
Marrakech Tensift El Haouz	Wastewater treatment plants	8
	Wind power installations	
Tadla Azilal	Fisheries	2
	Cement production	
Tangier Tétouan	Wastewater treatment plants	7
	Wind power installations	
	Medical waste treatment	
	Chemical industry	
Souss Massa Drâa	Wastewater treatment plants	4
	Landfill	
	Tourism	
Rabat Salé Zemmour	Waste management	5
	Tourism	
	Textile industry	
Chaquia Ourdigha	Cement production	5
	Food industry	
	Steel industry	
Total		**35**

Source: Directorate of Regulations and Control, 2012.

However, partnerships and inspection are not conflicting but follow rather complementary approaches, as international, and also Moroccan, regulatory practice suggests (box 2.3). The Department of Environment is now discussing the possibility of granting environmental inspectors the right to at least establish reports of non-compliance and forward them to judicial authorities. Several studies and guidelines already exist in support of a future inspection programme. A sustained effort has to be made to put in place real inspection of classified industrial installations. The establishment of an inspection programme, especially on the principle of risk-based inspection, is likely to be hampered by the absence of data on industrial installations.

Box 2.3: Regulation of industrial pollution: the case of the Berrechid area

The Berrechid industrial area/park is located 30 km from Casablanca, in the intervention zone of the Bouregreg and Chaouia Water Basin Agency. The industries located there have long discharged their untreated wastewater with high loads of organic matter and suspended solids into the river network. Some of these discharges cross populated areas, thus causing nuisance and public health problems. Despite the existence of regulatory requirements banning the discharge of raw wastewater into the surface waters or into the communal sewer, no sanctions were applied for law/contract infringements. The LIFE Eco-Biz project financed by the Italian Government (which began in 2006) aimed to develop a wastewater management strategy and install effluent treatment units at local industrial enterprises. A supervision committee comprising local stakeholders was established, an energetic legal awareness campaign was undertaken among the industries, and financial incentives were proposed to incite them to treat their wastewater. The results of these activities were rather limited, with poor adherence by the industries and a single pollution mitigation project implemented.

Being confronted with this situation in 2010, the Water Police started legal procedures in order to identify and close down the underground water sources used by the industries, in virtue of the requirements of the Law on Water (art. 114). For years, all industries in the Berrechid area used deep wells without due authorization from the WBA, a practice which has long been tolerated by the water administration. Blocking the regularization of underground wells by the WBA would have entailed a severe and sometimes unbearable impact on industrial activity. The activity of the Water Police was fully supported by the local and provincial authorities via the meetings of the supervision committee and direct contact with the operators. In parallel, significant financial stimuli were offered to the industries through the FODEP and the WBA. As a result, the commitment of industries has increased significantly and works have since been initiated at 13 industrial WWTPs; most of those units are already operational. This has allowed for the treatment of more than 2,000 m^3 of industrial effluents per day. After the upgrading of all remaining industrial WWTPs, the entire industrial area is to be connected to the urban sewerage system.

In conclusion, tangible results were obtained and a significant step forward in combating industrial pollution was made when a package of coercive and incentive measures was applied, combined with an active awareness campaign aimed towards industrial operators and strong support from the local authorities.

Source: Bouregreg and Chaouia Water Basin Agency, 2012.

Profiling of each installation is a matter of urgency and would need to contain general and technical information, as well as data on the compliance history of the installation. Gathering such information will be a first step towards establishing a pollutant release and transfer register (PRTR). Such a register will bring the benefit of enabling priority-setting for environmental inspection of industrial installations. The available quantitative information confirms limited coverage for compliance monitoring of environmental requirements by the government authorities in Morocco. Inspections are very rare, even in highly industrialized areas such as Grand Casablanca. In 2011, about 40 inspections were undertaken by the central environmental authority and some 60 control actions by its regional services, which are very small numbers, especially when compared with other enforcement authorities with prerogatives in the environmental field, e.g. the Gendarmerie Royale or the forest guards. It is rather obvious that Morocco has scattered compliance monitoring activities but not a compliance monitoring system. Real political will will help change this situation.

Non-compliance response

Cases of environmental non-compliance may be recorded by several actors: (i) police officers; (ii) agents/inspectors commissioned and appointed by the administration; (iii) agents under oath; and (iv) multidisciplinary groups created by the authorities with a view to inspecting, detecting and recording offences. If there is evidence of non-compliance, minutes (procès verbal) are prepared by the controlling authority and sent, within a maximum 10 days, to the relevant judicial authority. In Morocco, only judicial authorities have the right to impose a sanction. It has to be noted that the judicial branch in Morocco presents multiple ramifications that sometimes create dilemmas in terms of which authority should be addressed to impose a sanction. Those revealing non-compliance have to go to court to testify their conclusions, which makes the procedure quite burdensome and may be a reason for tolerating many small offences.

In principle, warnings and orders to comply can be issued through an administrative procedure. Non-compliance with such warnings is then addressed through the court. A judicial action can also be launched by the victim (natural person) in a case of environmental pollution, provided that there is evidence of damage. Cases of traditional civil liability are thus possible and considered relatively easy to pursue. The available tools to respond to non-compliance are relatively diverse. They include, for example, fines, seizure of property, interdictions to

carry out professional activities, imprisonment and even the death sentence. The last two types of response have never been applied. The level of fines established in the environmental legislation seems to be modest. There are important differences in the level of fines addressing air and water pollution issues. Fines for water pollution vary between 200 dirhams and 5,000 dirhams (thus being rather negligible) while fines for air pollution can go up to 200,000 dirhams (some €20,000). Fines are applied only to natural persons. The enforcement tools vis-à-vis legal persons are either seizure of property and revocation of permits, or reputational sanctions.

There are no statistical data on environmental non-compliance and responses to such non-compliance. This makes environmental enforcement very opaque.

2.7 Conclusions and recommendations

The available information does not make it possible to assess the level of environmental compliance in Morocco in quantitative terms. However, a qualitative analysis leads to the conclusion that, with current strategies, instruments and resources, the Moroccan system of environmental compliance assurance has limited chances to deliver bold results. While some of the basic regulatory requirements related to pollution from industrial installations have been in place for a century and the legal basis for environmental management has been in constant positive evolution, compliance monitoring and enforcement has been a very marginal preoccupation of Moroccan authorities. This is explained in part by the regulatory culture being largely based on negotiations, consensus-building and voluntary approaches. Other factors might have been the need to put in place a modern regulatory system, a task that attracted most of the administrative resources over recent years. At the same time, there are strong signals that the current approach to compliance fails to address environmental challenges that are gradually becoming economic and development challenges. The Government thus needs to rethink its approach to establishing an incentive framework for higher environmental performance.

A great part of the compliance assurance problems are rooted in the fact that the Moroccan environmental legislation remains partly obsolete, with significant gaps and largely unenforceable. Enforceability is of particular concern. Multiple secondary acts that further explain the legislation are lacking. Their development, in some cases, takes decades, during which the law remains just a piece of wishful thinking. The laws on water and on air are eloquent examples in this regard. Many of the legal requirements do not approach, by far, the strictness and ambition of good international practice. There is hardly any quantitative information that would permit understanding of the procedural and substantive impact of existing laws.

Recommendation 2.1:
The Government should align national regulatory requirements for large installations, emission limit values for air and water, and environmental liability regimes with good international practices by:

- *(a) Making a detailed assessment of remaining secondary legislation that must be developed and closing the gaps identified;*
- *(b) Aligning procedural requirements of environmental laws with good international practice;*
- *(c) Adopting and systematically using better regulation principles, such as simplicity, enforceability, feasibility and participatory development;*
- *(d) Introducing and monitoring indicators of environmental compliance.*

Stronger focus needs to be put on EIA and permitting, i.e. the translation of general legal requirements into requirements for specific projects or installations. While EIA procedures have been legally binding since 2008, their application remains unsystematic. Particularly sporadic is the use of public hearings. The delegation of the EIA function to the subnational level helped to increase the number of projects undergoing environmental scrutiny, although capacity problems at the subnational level still need to be addressed. The scope of EIA is insufficient, with projects that are likely to have significant impacts escaping the EIA procedure. As concerns permits, these exist only for some media. Integrated permitting of large installations is not applied at all. While some sector-specific requirements are under development, they mostly concern large and medium-sized installations and are less adapted to small and medium-sized enterprises.

Recommendation 2.2:
The Ministry of Energy, Mines, Water and Environment should improve the current EIA procedures and adopt modern permitting practices, in order to effectively enforce the existing EIA procedures, and in particular their public participation element. In particular, the Ministry should:

- *(a) Review the list of projects subject to EIA and adjust the respective annex to Law 12-03;*

(b) Systematically review actual EIA practices at the subnational level and provide quality control, quality assurance and capacity development, where needed;
(c) Review the classification of industrial installations, possibly using the European Union's relevant legislation as a benchmark;
(d) Introduce environmental permits for emissions of pollutants and waste generation to ensure compliance, with integrated environmental permitting when enterprises need a permit for more than one medium.

While there are environmental inspectors in Morocco, it cannot be said that there is any system of compliance monitoring. Site visits are mostly ad hoc and their number does not compare, by far, to the size of the regulated community. Inspection planning (to the extent it exists at all) is not based on risk analysis. Resources dedicated to the compliance monitoring function are very limited and, in the majority of cases, this function suffers from being sacrificed because of competing tasks carried out by the respective officials. As concerns the regulated community, self-monitoring is just beginning to get under way and is hardly used by industry apart from the front-running cement industry and a few large enterprises, mostly with foreign capital.

Recommendation 2.3:
The Ministry of Energy, Mines, Water and Environment should give higher priority to compliance monitoring by:

(a) Delegating adequate powers and resources to the corps of environmental inspectors, which should be strengthened, particularly at the subnational level;
(b) Making a comparative analysis of national and international environmental legislation, with a view to improving the effectiveness of relevant national legislation in addressing cases of non-compliance;
(c) Agreeing on an enforcement strategy that is guided by the principle of proportionality, with responses to non-compliance applied in accordance with the enforcement pyramid;
(d) Establishing a system of planned, risk-based verification of compliance with at least annual inspection of installations posing high risks;
(e) Making self-monitoring and self-reporting standardized requirements clear and unambiguous, and phasing them in in all sectors.

Several compliance promotion tools are currently used by the Government. In some cases, they bear fruit, e.g. the cement sector's environmental performance was substantially improved based on dialogue with government authorities. There are important corporate initiatives and supporting institutions, such as the Moroccan Clean Production Centre. Nevertheless, compliance promotion is not sufficient as scope and existing activities are rather scattered. The effectiveness of some voluntary tools raises questions. There are no tools that would involve the public putting pressure on industry to perform better, while reputational sanctions may be quite effective due to the country's culture.

Recommendation 2.4:
The Government should continue to facilitate voluntary measures by private sector actors while, in parallel, enabling indirect environmental regulation and enforcement by non-governmental actors, such as insurers, banks and the general public. To this end, the Government should:

(a) Further develop sector-specific guidelines in support of environmental compliance and provide capacity-building;
(b) Establish a web-based platform that would bring together all promotional and awareness-raising compliance materials;
(c) Strengthen its partnership with the Moroccan Clean Production Centre and help it to extend its activities to small and medium-sized enterprises;
(d) Periodically analyse the results of voluntary agreements in order to increase their effectiveness and terminate those that have not achieved their goals;
(e) Promote voluntary disclosure of environmental management practices by enterprises and establish an environmental performance rating of industries based on the information disclosed.

Chapter 3

ENVIRONMENTAL MONITORING, INFORMATION AND EDUCATION

3.1 Environmental monitoring

Air quality

The network for stationary monitoring of air quality was established in Morocco in 2003. It included two pilot stations in Casablanca-Mohammedia. Since 2005, the monitoring network has been continuously improving. In November 2012, the national air quality monitoring network included 29 automatic stations in 15 cities and four mobile laboratories.

The "operability" of individual air monitoring stations is a challenge, however. It is not clear how many of the fixed stations are actually operational throughout the year. In 2011, the annual air quality bulletin presented information for only 17 stations. According to weekly bulletins available for Casablanca-Mohammedia, in February 2012, all seven stations were operational, while in April of the same year, only four stations were operational and in November 2012, only three stations. The challenges in keeping the stations operational most often included technical problems, i.e. failures in telephone connections with the stations and power cuts.

Air quality parameters being measured by the operational stations are CO, SO_2, total hydrocarbons, PM_{10}, NO_x and O_3, as well as the meteorological parameters such as humidity, wind and temperature. Sometimes there are gaps in measuring some of these parameters (e.g. in 2012, the Essaouira station did not measure SO_2 and NO_2).

There are a number of ongoing projects and programmes to strengthen the air quality monitoring network. These include a pilot project in Grand Casablanca that was launched in November 2011 for a period of 20 months. The project's budget of €526,000 is co-financed by Morocco and France. The project aims at developing a high-resolution system for prediction/forecasting of air quality. Another project aims at developing air emissions inventories for major cities.

A long-term plan for extending the air quality monitoring network, which was prepared by the Department of Environment in 2009, aims at covering the majority of cities and settlements with more than 200,000 inhabitants and those with high levels of industrial and tourism activity. According to this plan, the air quality monitoring network should include 102 fixed stations covering 35 cities by 2020. The implementation of the established targets is lagging, however. For instance, in 2012 it was planned to have 48 fixed stations in total in 18 cities, whereas there were actually 29 stations covering 15 cities that year.

Water

Since 1984, the Department of Water has been building a water quality monitoring network to assess and determine the quality of surface waters and groundwater. In 1990, the network capabilities were assessed and reconsidered in order to take into consideration new developments in water use and water pollution. Since then, and to better meet the needs of integrated management of water resources, the network has steadily expanded to cover new regions and be more representative.

During 2000–2001, 28,400 physico-chemical and bacteriological analyses on 740 sampling points were carried out. During 2002, water quality data analysis included the analysis of sediments of the main river courses. In 2003 and 2008, the assessment of water quality included the biological quality of surface waters through both the biological diatom index (BDI) and global biological normalized index (GBNI). In 2013, the network includes:

- 213 surface water sampling stations including 60 primary stations, 114 substations and 39 dam reservoirs;
- 531 groundwater stations spread over 45 aquifers.

The parameters analysed for surface water are:

- Physical parameters: temperature, pH, conductivity and turbidity;
- Pollution parameters: suspended solids, biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), dissolved oxygen, salinity, total nitrogen and total

phosphorus;
- Chemical parameters: ammonia (NH_4^+), nitrate ions (NO_3^-), nitrite ions (NO_2) and phosphate (PO_4^{3-}), sodium (Na^+), potassium (K^+), chlorine (Cl^-), sulfate (SO_4^{2-}), calcium (Ca^{2+}), magnesium (Mg^{2+}), bicarbonate (HCO^{3-}), carbonate (CO_3^{2-}), alkalinity, total alkalinity (TA) and total hardness;
- Adverse elements: phenols, total hydrocarbons and total iron;
- Heavy metals: As, Cd, Co, Cr, Cu, Hg, Ni, Pb (depending on pollution source points);
- Bacteriological parameters: faecal coliform, total coliforms and faecal streptococci.

The parameters analysed for groundwater are:

- Physical parameters: temperature, pH, conductivity and dry residue;
- Chemical parameters: total iron, Mo, NO_2^-, NO_3^-, NH_4^+, Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, SO_4^{2-}, HCO^{3-}, CO_3^{2-}, Mn^{2+};
- Heavy metals: Cr, Cd, Co, Cu, Pb, Ni, As, Hg (depending on pollution source points);
- Bacteriological parameters: faecal coliform, total coliforms and faecal streptococci.

Measurements in artificial reservoirs have been made in 34 of the 120 reservoirs available in 2006.[2] The following parameters were analysed at three levels of depth: temperature, turbidity, suspended solids, pH, conductivity, dissolved oxygen, NO_3^-, NO_2^-, NH_4^+, total phosphorus, manganese, total iron, selenium and chlorophyll "a".

Groundwater samples were collected from 400 points in 36 aquifers (of more than 80 in total) covering all major watersheds. The parameters analysed include pH, temperature, conductivity, potassium permanganate ($KMnO_4$), Na^+, K^+, Cl^-, SO_4^{2-}, Ca^+, Mg^{2+}, HCO_3^-, CO_3^{2-}, Fe, Mn, alkalinity, total alkalinity, total hardness, faecal coliform and faecal streptococci. In addition, study of the pollution of groundwater has also assessed the adequacy of the monitoring network in place and concluded that it was quite sufficient.

Data collected are checked, processed and stored in the geographical information system (GIS) SIG-Qualité-Eau. This system was established in 2010 and is based on a database at the central level which, to date, includes nearly 427,000 samples. In order to respond to water management by water basins, a version per basin was developed. Transferring data from water basin authority (WBA) databases to the central database is in progress.

Since 2004, the measurement of water quality has been carried out by the WBAs (box 3.1) in accordance with the Law No. 10-95 on Water. The measurement frequency is variable depending on the type of network monitoring objectives, the aquifers or rivers and the available budget. During 2002–2008, the total number of analyses reached 114,350, of which 52,607 were on surface water, 51,825 on groundwater and 9,918 on dam reservoirs.

Bathing water

Monitoring of bathing waters was initiated in 1993, covering 18 beaches; by 2012, the monitoring network covered 141 beaches (39 on the Mediterranean coast and 102 on the Atlantic coast). The number of monitoring points of bathing waters increased from 331 in 2003 to 354 in 2012.

Bathing water quality is monitored according to the Moroccan Standard NM 03.7.200. The microbiological parameters monitored are faecal coliforms and faecal streptococci. The classification of bathing waters comprises four categories, namely: waters of a good quality for bathing; waters of an average quality for bathing; momentarily polluted waters; bad quality waters. The results of monitoring are presented in a biennial report on the quality of bathing waters. The report also includes the quality of sand (litter, chemistry and mycology) of the main beaches in each of the three zones of bathing water monitoring: the Mediterranean zone (between Saida and Tangier), the North Atlantic zone (between Tangier and Essaouira) and the South Atlantic zone (between Agadir and Dakhla).

Monitoring in other relevant areas

There appears to be no monitoring of soil, noise, vibration and radioactivity in Morocco. In a few instances when the border/customs control asked for assistance in identifying the radioactivity level of suspicious cargos, the Department of Environment was unable to help as it has no special technical equipment for measuring radiation levels.

Morocco does not monitor its biodiversity, including forests. At the same time, statistical reporting does include some data related to biodiversity, such as in an area containing protected areas and biological reserves, the status of selected species of fauna and flora, and trends in forest development.

[2] In 2012, there were 128 dams in total, while 17 were under construction.

Photo 3.1 : Earth Day, Department of Environment, 2012

Box 3.1: Bouregreg and Chaouia Water Basin Agency

Currently, the network monitoring water quality in the water basin of Bouregreg and Chaouia is composed of 123 measurement points: 32 measurement points for surface water, 52 for groundwater, 20 for springs, 9 for dams, 3 for natural lakes and 7 for wetlands and the Biological and Ecological Interest Sites. The monitoring programme is carried out with a frequency analysis of two campaigns per year for all measurement points. Since 2013, the Agency began to realize environmental analysis through the assessment of BDI and GBNI on eight measurement points. The annual monitoring report on the quality of water is available on the website of the Agency (www.abhbc.com or www.abhbc.ma).

As part of the monitoring of the performance of WWTPs, and to control the compliance of wastewater discharges with DVLs for domestic wastewater, the Agency has implemented since 2009 a control network of releases from WWTPs. This programme is carried out with a frequency of four campaigns of analysis per year. In the long term, the network will be extended and control all points of pollution in the basin, and will concern the control of groundwater close to landfills and areas of discharge of industrial wastewater. Currently, 14 WWTPs are monitored, and the analysis parameters are mainly flows, pollution parameters, nutrients, heavy metals and bacteriology, depending on the nature of pollution.

In addition to the annual water quality monitoring programme and pollution control, and in accordance with the provisions of the Law on Water and 1998 Decree No. 2-97-787 on water quality standards and the inventory of the degree of water pollution, the Agency has conducted two inventories of the level of pollution.

Source: Bouregreg and Chaouia Water Basin Agency.

Analytical laboratories

The National Laboratory of Studies and Pollution Monitoring under the Department of Environment is the main laboratory involved in environmental monitoring. It is involved mainly in the analysis of bathing water samples. It carries out limited activities related to the analyses of air and water quality, typically upon demand from industries/enterprises.

The Laboratory applied for ISO accreditation in 2012 and expects to be accredited during 2014. While waiting for its accreditation, the Laboratory outsources the analysis of samples to accredited private laboratories. There are more than 100, various laboratories in the country, of which only a few are accredited according to the ISO standard. The Laboratory cooperates with specialized national laboratories including those for public health, nuclear research and development, hygiene and drinking water.

The Ministry of Health has a network of 40 laboratories of epidemiological diagnostic and environmental health (LEDEH) of the National Institute of Hygiene. The LEDEH provide the technical support to the programmes on environmental health, i.e. to evaluate drinking water and food quality with a view to ensuring health security at the national level. The Ministry of Health Action Plan (2008–2012) includes activities to upgrade and further develop the regional LEDEH. More than 5.6 million dirhams were allocated for this purpose.

Analysis of water quality is carried out either by the laboratories of WBAs or by accredited private laboratories.

3.2 Legal, policy and institutional framework related to environmental monitoring

Legal framework

Air

The legislative framework is provided in the 2003 Law No. 13-03 on Combating Air Pollution complemented by two decrees: the 2009 Decree No. 2-09-286 setting standards for air quality and the procedures for air monitoring (including pollutants to be monitored), and the 2010 Decree No. 2-09-631 setting limit values for clearance, emission or discharge of pollutants into the air from stationary sources of pollution and the procedures for air monitoring. Furthermore, the former decree stipulates the establishment of permanent regional committees in all regions that have air quality monitoring networks, with a view to their deciding on a number of monitoring-related issues such as the location and maintenance of monitoring stations (stationary and mobile), data collection and reporting, and public information, and preparing an annual report on air quality at the regional level.

In addition, it establishes a national committee to oversee the observation and monitoring of air quality, including the establishment of a national programme on protection and monitoring of air quality, coordination and harmonization of work by the regional committees, establishment of the data collection procedure, and preparation of an annual report on air quality at the national level.

Water

The legislative framework of relevance to water quality evaluation is provided in the 1995 Law No. 10-95 on Water and the 1998 Decree No. 2-97-787 on water quality standards and the inventory of the degree of water pollution. According to the Law on Water, WBAs are in charge of water quality monitoring.

Standards of water quality under the Law on Water have already been published and the process of realization of the inventory level of pollution is established by 1998 Decree No. 2-97-787. Water quality norms, including the quality classification systems, are established by joint orders of the authorities responsible for environment and for equipment, in consultation with the authorities responsible for public health as well as other concerned ministers (depending on the norm). Norms should be revised every 10 years at least and more often when necessary. Accordingly, water quality norms and the quality classification systems were established by the following joint orders: 2002 No. 1275-02 establishing the quality classification system for surface waters; 2002 No. 1276-01 establishing the quality standards for waters destined for irrigation; 2002 No. 1277-01 establishing the quality standards for surface waters used for the production of drinking water; and 2003 No. 2027-03 establishing the quality standards for fishing waters. These orders also stipulate the procedures for sampling, analysis and quality evaluation. WBAs are the implementation bodies.

The inventory of the degree of pollution of surface water and groundwater should be undertaken every five years, at least, by the WBA in consultation with relevant government institutions, such as the authorities in charge of agriculture, equipment, energy, environment, industry, the interior, public health and mines. Results and data of the inventory should be included in the inventory records that are stored by the WBA as well as being made available to the State, public institutions and local communities. In addition, the WBA should establish maps of groundwater vulnerability to pollution. A comprehensive synthesis report, including the vulnerability maps, should be prepared by the WBA for broad public use. The WBA should update inventory records and vulnerability maps every five years. Quality standards constitute the technical specifications and the physical, chemical, biological and bacteriological characteristics parameters for water courses, sections of water courses, canals, lakes or ponds, depending on their use. They should be established by joint orders of governmental authorities in charge of water and environment, in consultation with the authorities in charge of the interior, agriculture, public health, industry, energy and mines.

Soil

The legislative framework related to the protection of soil, including the subsoil and the resources contained therein, is provided in the 2003 Law No. 11-03 on the Protection and Conservation of the Environment. However, the provisions therein do not include monitoring or assessment of soil quality. Currently, there is a draft law on soil protection, which has some monitoring components.

Noise and vibration

The 2003 Law No. 11-03 on the Protection and Conservation of the Environment stipulates general provisions related to noise and vibration. The Law also stipulates that legislative and regulatory provisions establishing limit values for noise and vibration, as well as measurement systems and means of control, should be adopted. There is no evidence that such legislative and regulatory provisions and norms have been developed and put in place.

Radioactivity

A draft law on nuclear and radiological safety has recently been prepared to provide the country with a comprehensive legal framework, fully compliant with international conventions and standards in this area to which Morocco has subscribed. This draft law also seeks to establish an agency on nuclear and radiological safety, which will be responsible for providing control of compliance with the law and follow-up regulations.

Biodiversity

The 2003 Law No. 11-03 on the Protection and Conservation of the Environment stipulates general provisions related to specially protected areas, parks, nature reserves and protected forests. These provisions do not include monitoring-related issues, however. The 2010 Law No. 22-07 on Protected Areas stipulates that the competent authority, in cooperation with local associations and concerned members of the public, is in charge of the management of the protected areas, including of control and monitoring, in particular with a view to preventing harmful anthropogenic activities.

Policy framework

Air

The ongoing Qualit'Air Programme, launched in 2002, evaluates the health impact of air pollution. Its programme for the region of Grand Casablanca started in 2009, for an estimated period of five years. The programme aims to identify the correlation exposure/risk between the morbidity and mortality indicators of the local population and its exposure to the air pollution (daily levels of O_3, SO_2, NO_2 and PM_{10}), at the same time taking into account a number of co-factors (e.g. daily temperature and humidity, the daily number of influenza and pollen exposures).

In accordance with Decree No. 2-09-286 setting standards for air quality and the procedures for air monitoring, and to address the problems related to air pollution, the Department of Environment commissioned a study for developing a national programme to combat atmospheric air pollution. The national programme would provide a framework for developing, inter alia, a strategy for atmospheric air monitoring.

Water

The protection of water resources quality is a major strategic objective of the National Water Strategy for 2010–2030, which recognizes the significant delay by Morocco in this area. The Strategy is based on sound knowledge of water resources quality and pollution sources, and the proposal of a programme of prevention of and combating pollution.

Other relevant types of monitoring

No information was provided to the EPR team regarding policy documents covering monitoring of soil, noise, vibration, radioactivity and biodiversity.

Institutional framework

To ensure the efficient collection and management of environmental information across the country, the National Environmental Observatory (ONEM) was established in 1994 as a division within the Department of Environment. Its role is to ensure the continuous monitoring of the state of the environment, in order to improve knowledge and develop decision-making support tools for environmental protection and sustainable development.

Also, given the Strategy of Proximity adopted by the Department of Environment, it was necessary to adjust priorities, the mode of intervention and the institutional framework to the new context, particularly through the establishment of new organizational structures and decentralized bodies able to effectively monitor and prevent environmental problems, including through the

collection and management of environmental information at regional and local levels.

In this context, in 2009, the National Programme for Implementation of Regional Monitoring of the Environment and Sustainable Development was launched, in partnership with the regional authorities. Its aim was to set up a new local institutional architecture encouraging the creation of space for interaction, coordination and convergence of environmental monitoring. Thus, the OREDDs were established, as an extension of the ONEM at the regional level.

The OREDDs should establish and oversee regional environmental information systems, manage the collection and processing of data, maintain regional databases, steadily develop regional reports on the state of the environment and develop tools to support decision-making on the environment.

OREDDs are created through partnership agreements among all stakeholders, and co-financed by the Department of Environment and regional/local authorities. Each will have an office with a staff of one to three people, including a director. In order that they enjoy their own legal status, a joint decision is expected by the Ministry of Finance, Ministry of the Interior and Department of Environment to sign a framework convention at the national level giving the OREDDs the status of a public interest group.

OREDDs are administered by an assessment and guidance committee, chaired by the Minister of Environment or his/her representative, and established as representatives of local authorities and local communities, decentralized government departments and public institutions, and members representing the university and research institutions, the private sector and civil society.

In addition, eight thematic committees have been created to support the work of OREDDs in accordance with environmental themes covered in a given region. These committees consist of representatives of the competent authorities and national and local government institutions, as well as local businesses, research institutions and civil society. They are invited by the OREDD Director as often as necessary to perform a given activity, e.g. to prepare the report of the state of the environment or undertake specific thematic studies. These thematic committees will complete specific indicators and environmental data acccording to their respective theme (e.g. pollution of air, water, waste) and submit them to the OREDD.

Air

The monitoring of air quality is carried out by the National Directorate of Meteorology (DNM). Until 2007, the air quality monitoring network was managed by DNM jointly with the Department of Environment (Directorate of Monitoring and Risk Prevention). In 2007, management of the network was entrusted, via a memorandum of understanding (MoU), solely to DNM, given its extensive expertise and technical skills.

Information provided in weekly and annual bulletins is useful, although some gaps occur in the production of both bulletins.

Water

The main institutions in charge of water measurements are the Department of Water and the WBAs. Other actors, such as the Ministry of the Interior, the High Commission for Water, Forestry and Desertification Control, and the National Office of Electricity and Drinking Water (ONEE) complement the picture regarding water measurement institutions. These institutions seem to be cooperating.

Monitoring of the quality of bathing waters is carried out jointly by the Department of Environment and the Department of Equipment of the Ministry of Equipment and Transport. The Department of Environment is in charge of monitoring the quality of waters in the North Atlantic zone, while the Department of Equipment is in charge of the Mediterranean seaside zone and the South Atlantic zone.

Soil

The National Agency for Land Conservation, Land Registry and Mapping oversees a number of issues related to the conservation and registry of land, as well as the establishment and amendment of national topographic maps of all scales. Information and data concerning the production and processing of minerals are collected and managed by the Directorate of Mining Development, while data concerning export are collected and managed by the Office of Exchange. The Ministry of Agriculture and Maritime Fisheries is in charge of the soils used for agriculture.

Noise and vibration

The National Laboratory of Studies and Pollution Monitoring within the Department of Environment acquired the technical material necessary for

assessing noise nuisance/pollution in open spaces, and has installed the equipment within a partnership framework with a higher education institution. However, due to a lack of staff in the Laboratory, this equipment is not being used.

Biodiversity

The main governmental authority in charge of biodiversity protection is the High Commission for Water, Forestry and Desertification Control.

3.3 Environmental information and data reporting

Statistical data

The 1968 Law No. 370-67 on Statistical Studies provides the legal basis for national statistics. At the same time, there is no specific legal framework governing environmental statistics. A draft law on statistical information is under preparation. The High Commission for Planning (HCP) is the national authority in charge of statistics, including environment-related statistics. The Coordinating Committee of Statistical Studies was the statistical advisory body in charge of the coordination and promotion of statistical studies, as well as of data exchange and ensuring consistency of methodologies and results. The Committee is chaired by the Chief of the Gouvernment or their representative. HCP provides the secretariat to the Committee. However, the Committee is not very active (it meets only rarely).

Dedicated compendia of environmental statistics are compiled and published to facilitate access to and understanding of environmental statistics. Some environmental statistics are generated by the Department of Planning, while others are collected from relevant authorities. Two compendia on environmental statistics have been published thus far, in 2002 and 2006. The 2006 compendium was an updated version of the 2002 compendium.

The HCP has subsequently introduced a chapter on the environment in the structure of the Statistical Yearbook of Morocco, which includes environmental statistics and water quality, sewerage, waste and treatment, pollution of air, soil and forest resources and biodiversity.

In addition, the HCP, which produces a regular basis a comprehensive macro-economic data disaggregated and consistent with international standards, also envisages the establishment of satellite accounts, the progressive development of indicators and environmental and economic data on some natural assets.

Database management

At the national level, environmental database management is the prerogative of ONEM, within the Department of Environment. ONEM is structured into three services reflecting its mandate: Statistical Survey and Data Collection, Research and Project Evaluation, and Environmental Databases. For the last few years, ONEM has been in the process of enhancing its capacity to better deliver on its mandate.

One activity pursued by ONEM in 2011–2012 was the development of a national environmental information system and creation of a national environmental portal. During 2012, ONEM was working on the establishment of a national network for gathering and sharing environmental information.

The development of an integrated information system for environmental data (ISED) has been ongoing since 2010. Assessment of the current management of environmental information and data showed the following challenges that needed to be addressed during the development of the ISED:

- Information is available in various electronic formats and some only in paper form;
- Most of the existing data are not structured and were developed according to a sectoral approach (bodies develop and maintain environmental information and databases relevant to their work), which hinders their accessibility;
- Data managed include not only information related to environmental media, resources and pollution, but also information related to issues such as legal matters, control, prevention, prospects, standards, partnerships, expertise and scientific research;
- The structures of databases are heterogeneous, which hinders their merging and integrated use.

ONEM collected all the available databases, and inputs data into a unified database that will be part of the future ISED. At the same time, ONEM plans to establish a network of data exchange with a view to connecting all actors involved in producing data as well as data users.

Ongoing development of the ISED follows the shared environmental information system (SEIS) principles.

The information is structured following the DPSIR (Driving forces-pressures-state-impacts-responses) approach developed by the EEA. At the same time, there is no concrete policy document to outline the necessary activities for an efficient elaboration and subsequent implementation of the ISED.

Concerning the establishment of regional databases, ONEM has been working on the development of regional environmental information systems (REIS) since 2011. Each REIS would be based on a list of regional indicators and datasets. The first REIS was finalized for the Marrakech region. The system was being tested at the end of 2012 with a view to making it active online by 2014. The development of a national web portal to serve as a central gateway for providing environmental data is also planned for 2014.

Environmental indicators and their use

ONEM has established a national list of environmental indicators. As a first step, ONEM identified most relevant environmental indicators from various indicators and data sets (e.g. those of EEA, multilateral environmental agreements to which Morocco is a Party) and compiled them into a set of environmental indicators clustered according to environmental topics. The relation to DPSIR is indicated for each indicator.

ONEM has also developed a regional set of indicators to be used by each region with a view to ensuring comparability between the regions. This set contains 263 indicators, clustered into four areas: socio-human framework (population – 13 indicators, health – 7, waste – 21, sanitation – 15, education – 6, cultural and historical heritage – 2, policies and action plans – 16); economic conditions (economy – 11, agriculture – 11, fishery – 8, industry – 10, energy – 11, tourism – 5, handicrafts – 7, mines and quarries – 11); settlements and land (habitat and urbanism – 9, transport – 20); and environment (water – 20, air – 9, soil – 6, forest – 10, biodiversity – 18, coast and sea – 8, natural disasters and technological accidents – 5, climate – 4).

Overall, the current set of indicators is large and it seems difficult to ensure the collection of necessary data to populate all the indicators. A data validation system/mechanism, as a prerequisite for ensuring the accuracy and comparability of data, is lacking.

To measure the progress achieved in sustainable development, a set of 65 indicators has been selected by the National Committee on Indicators for Sustainable Development from a total of 130 indicators identified for the Mediterranean countries. The national set of indicators for sustainable development comprises 16 indicators related to population and society, 13 to settlements and land, 18 to economic activities and sustainability, and 18 to environment. These indicators are used to prepare the national report on sustainable development.

Publication of environmental data

The air quality index "Atmo Maroc" is calculated daily on the basis of four parameters (SO_2, NO_2, O_3 and PM_{10}). This index has a quantitative/qualitative scale of 10 colours, ranging from very good (10; deep green), good (9 and 8; light green), average/medium (7 and 6; yellow), moderate (5 and 4; orange), poor/bad (3 and 2; red) and very poor/bad (1; deep red). The air quality values are being compared with the national thresholds/limit values for information and for alert, as well as with the WHO limit values.

The air quality information is compiled by DNM into weekly and annual bulletins. Weekly bulletins present: aggregated data per station per six air quality parameters and the three meteorological parameters; the statistics for the four parameters per week and their daily evolution; and the Atmo Maroc index per day. Annual bulletins include: aggregated annual figures per station per each of the measured parameters; the annual Atmo Maroc index; an overview of pollution thresholds per four pollutants and per station for issuing information and alerts; and an overview of the operation rate per pollutant and per station, and the explanation of technical problems encountered by certain monitoring stations.

The weekly bulletins are distributed to the relevant local decision-making authorities. The annual bulletins are distributed to a large number of local and national authorities and institutions. Also, for each measurement campaign of the mobile stations, (laboratory) synthesis reports are prepared and distributed to relevant authorities. Recipient institutions include the Royal Palace, the Department of Internal Affairs, the wilayas (prefectures and provinces), town halls, councils of regions, city councils and urban community councils, the Directorate of Civil Protection, the Department of Health, the Department of Environment, the Department of Transport, the Department of Energy and Mines and the Department of Industry. The bulletins are also made available on the DNM extranet and require credentials (user name and password) to be accessed. DNM provided all of the above recipient authorities with individual credentials for accessing the bulletins.

Indicator-based assessment reports, including state-of-the-environment reports

The Department of Environment produced the first national report on the state of the environment in 2001. This report covered environmental areas such as water, air, soil, biodiversity, coastline, waste and health. It also contained chapters on environmental policies; institutional, legal and financial aspects; international relations; and information, education and communication. However, the report was rather descriptive; it was not indicator based.

In 2010, the Department of Environment launched the preparation of a series of reports on the state of the environment at the national and regional levels. As a result, the national and 16 regional reports were produced. The above reports are available on the website of the Department of Environment.

The national report covers air, seawater, inland water, soil, coastline, forest, wetlands, oases, biodiversity, waste, and health and the environment. It also provides a diagnosis of environmental governance, national environmental programmes, observation and monitoring tools, the environmental legislation framework, financial mechanisms and incentives, tools, communication and environmental education, public access to environmental information and international cooperation. Regional reports include a general overview of the region, an overview of socioeconomic activities in the region, a diagnosis of environmental problems caused by regional development, and proposed actions and perspectives for the sustainable development of the region.

Environmental data are not made available on the Internet. So far, metadata about existing environmental databases is available on the website of the Department of Environment. It is planned to make environmental data available online.

The Department of Environment launched the production of regional reports on the state of the environment based on the DPSIR model. The first, pilot report was produced in 2012 for the region Rabat-Salé-Zemmour-Zaër. This report provides a comprehensive overview of the state of the regional environment. The report is not yet available on the website.

Data are validated by all stakeholders involved in the collection and exchange of information set up during the integrated environmental assessment at the regional level. At this level, approval by the Guidance and Assessment Board is considered as validation.

Regarding sustainable development, an indicator-based national report on sustainable development has been produced regularly since 2003 with the first report, followed by the second in 2006 and the third in 2011. In 2012, preparations for a fourth report commenced. During the development of the fourth report, the set of indicators will be revised and adapted. A dedicated report was prepared for the Rio+20 Conference in 2012, providing an overview of progress the country achieved in promoting sustainable development over 20 years.

National and regional reports are mostly produced in French and Arabic. Some of the reports that are produced for the international level are also translated into English. Other environmental reports and studies produced by the Department of Environment are being made available on its website.

Use of environmental information in decision-making

No evidence was provided to the EPR team to demonstrate how the available environmental information is used to support informative and science-based decision-making. Some initial activities to develop necessary policies have been initiated by the Department of Environment, DNM and the Department of Water; however, they are still at the inception stage.

For example, DNM, in cooperation with Météo France, is working on developing the scenario-modelling software MOCAGE Maroc[3] and Pollu-Risk[4] with a view to supporting the decision-making process by providing timely information on foreseen near-future developments related to air quality. This would enable the establishment of a forecasting and alert system with a view to informing the population, especially at-risk groups (children, the elderly and vulnerable people), in a timely manner about air pollution, as well as to take the necessary actions to diminish it (e.g. by limiting the number of cars on the streets on certain days). The pilot testing is carried out in Grand Casablanca.

3.4 Availability of and access to information

According to the 2011 Constitution, citizens have the right of access to information retained by the public

[3] Atmospheric Chemistry Model for Large Scale (MOCAGE Maroc) – prediction/forecast of health-impact pollutants concentration in the air (up to three days).

[4] Pollu-Risk – simulation of point source release of pollutants and their diffusion in the event of accidental releases.

administration, elected institutions and public service bodies. To implement this provision, two laws are being drafted, one on access of the public to information, and another on access of the public to environmental information. For the last few years, the Department of Environment has made laws under development available to the public for comment.

The Department of Environment has an environmental information centre, which is open to the public. The centre regularly follows the main newspapers and magazines in both Arabic and French, and makes electronic copies of environment-related articles (some 1,500 in 2011) publicly available on its website. The website of the Department of Environment is expected to evolve into a portal, since most of the national programmes and activities related to the environment have their own websites. The plan is to gradually connect all these websites into a user-friendly portal. One challenge is to ensure timely updating of the website, as well as to maintain it technically.

The Department of Environment conducts press conferences and organizes scientific and technical events to promote its activities. Communication activities also include active participation in major national events, such as organizing exhibitions and side events – four major exhibitions per year.

The communication unit of the Department of Environment is understaffed, with basically one person carrying out communication activities. Among communication activities are TV advertisements to raise public awareness about ongoing activities to mitigate environmental pollution. A partnership memorandum was concluded with the National Radio and TV Society that includes the production of 100 TV advertisements of two to three minutes each, as well as 48 ecology broadcasts/shows per year, of 26 minutes each.

As one example, the TV advertisement against using plastic bags was to be broadcast over a few months in 2013. A number of other advertisements were to follow (one per year): promoting the national chart on environment and sustainable development, promoting the protection of the coastline, promoting the national programme on household waste and reusable fabric bags, and on climate change, noise nuisance and air pollution.

Public requests for specific environmental information are treated by the service for requests of the Department of Environment as well as the OREDDs, as appropriate.

3.5 Environmental education and education for sustainable development

The Government has undertaken several reforms to improve access to education and reduce regional differences in the provision of education. The Education Decade was launched in 1999. The education system in Morocco is composed of preschool, primary, secondary (college and qualifying levels) and higher education. There are public and private institutions at all education levels.

Legislation and policy framework

Although no law explicitly provides for the implementation of environmental education (EE) and education for sustainable development (ESD), Morocco is actively engaged in promoting this education at all levels. The 2003 Law No. 11-03 on the Protection and Conservation of the Environment serves as a legal framework for the activities related to EE and ESD carried out by the Department of Environment.

The policy framework for promoting EE and ESD includes the 1999 National Charter for Education and Training and the 2011 National Charter for Environment and Sustainable Development, as well as a number of MoUs concluded between relevant EE and ESD stakeholders.

MoUs were concluded between the Ministry of National Education and other ministries and departments, paving the way for a number of national programmes, such as the Environmental Upgrading of Rural Schools Programme (MoU between the Ministry of National Education and the Ministry of Energy, Mines, Water and Environment). Furthermore, MoUs were concluded in 2008 between the Ministry of National Education and the High Commission for Water, Forestry and Desertification Control, the National Office of Drinking Water (ONEP) and the National Office of Electricity (ONE).

Also, a number of MoUs were concluded with NGOs, e.g. with the Mohammed VI Foundation for Environmental Protection on Young Reporters for the Environment in 2002 and on the Eco-Schools programme in 2010 (box 3.2), and partnership agreements with the Association of Teachers of Life and Earth Sciences in 2000 and the Association for Animals and Nature Protection since 1998.

At the regional level, EE and ESD activities carried out by the Department of Environment in cooperation with the Ministry of National Education are also

supported by regional MoUs which have been signed between regional offices of relevant departments since 2009.

The National Programme of Environmental Upgrading of Mosques and Koranic Schools provides the framework for integration of environmental protection and sustainable development issues into the curricula of Koranic schools, as well as into the teachings and preaching of imams in mosques.

The National Programme of Environmental Upgrading of Rural Schools focuses on providing the necessary infrastructure for water and sanitation in rural schools. The subsequent establishment of environmental clubs and training of trainers on EE are important components of this programme. Four million dirhams are allocated for this programme annually. From its inception in 2007 until 2010, 300 environmental clubs were established in rural schools, including provision of the technical equipment and audio and video materials necessary for their functioning.

Regional training was organized to develop the capacity of some 500 educators involved in the activities of environmental clubs. In addition, the Department of Environment contributed to various EE activities initiated in several schools and summer camps. An EE mobile station, "Environmental Caravan", was purchased to support EE and ESD activities more efficiently. Environment and water awards were organized in some rural schools to designate the best productions related to environmental matters by students at primary school level.

Institutional framework

Two ministries govern education: the Ministry of National Education (in charge of preschool, primary and secondary education) and the Ministry of Higher Education, Scientific Research and Executive Training. An important step in promoting EE and ESD has been the establishment of the Directorate in charge of Education for Environment and Sustainable Development in the Ministry of National Education. In addition, the Ministry of Habous and Islamic Affairs oversees the Koranic schools (also known as traditional schools), and the Ministry of Employment and Vocational Training oversees the institutions for vocational training.

Other government institutions, such as the Ministry of Energy, Mines, Water and Environment (in particular, its Department of Environment), the High Commission for Water, Forestry and Desertification Control, and the National Office of Electricity and Drinking Water (ONEE) take an active part in promoting knowledge in their respective areas of work and integrating it into the educational curricula.

The Department of Environment has established a Service on Educational Programmes and Training within the Communication and Education Division that is actively engaged in promoting EE and ESD in partnership with other relevant institutions as mentioned above, but also with the Ministry of Tourism and the Ministry of Agriculture and Maritime Fisheries.

Since 2009, within the framework of promoting EE, the Department of Environment, in cooperation with the Ministry of National Education, has launched a large training programme on EE and ESD for educators in the rural schools across all regions of Morocco. The training course comprises theoretical and practical components. The theoretical component is aimed at raising the awareness of course participants about the environmental issues at the national and local levels, by using the DPSIR model. It includes the following themes, with a focus on regional specifics: sewerage, solid waste, air pollution, vegetation cover and deforestation, desertification and oasis, and biodiversity.

The practical component is focused on developing and applying practical activities by means of "pedagogical sheets" for each activity and related educational tools adapted to the needs of educators/beneficiaries, aimed at improving the integration of environmental issues into teaching. The trainers conducting these courses have extensive experience in the education field and advanced experience in environmental issues.

Furthermore, within the framework of cooperation with Germany, the Department of Environment, in close collaboration with all stakeholders from relevant sectors, has developed a training strategy for environment-related jobs/professions. The sector-related issues are under the leadership of the respective sectors while the cross-cutting issues are led by the Department of Environment. In this regard, a priority implementation action plan is under development, aimed at launching training in 2013 on the following cross-cutting themes: information, raising awareness and EE; audit and control; and monitoring and observation.

Box 3.2: Programmes of the Foundation for Environmental Education in Morocco

In 2002, Morocco joined a programme of the Foundation for Environmental Education (FEE) – the Young Reporters for the Environment (YRE), an international network of youth engaged in environmental journalism and ESD, operating in more than 25 countries. All Morocco's 720 senior secondary schools (qualifying level, lyceums) of the 16 regional academies for education and training (RAETs) participate in the YRE programme, focusing on biodiversity, climate, waste, water, energy, transport and solidarity. YRE was also linked to the national competition for young photographers. Each year, both photography and reporting competitions hold annual awards ceremonies for the winners at the national or regional level. Subsequently, the national winners participate in the FEE international contest, receiving awards every year since 2003. The 10th contest, in 2011–2012, was particularly successful, focusing on the theme "Green Economy and Sustainable Consumption" and gathering together some 2,000 pupils, 64 written reportages and 359 photographs.

Morocco joined the international Eco-Schools programme of FEE in 2006 at the initiative of the Mohammed VI Foundation for Environmental Protection. The Eco-Schools programme supports the creation of enabling conditions in schools for embracing EE and ESD, with a view to raising awareness and developing student knowledge and behaviours towards improving the environment in both the school and local community. The pilot phase of Eco-Schools in Morocco was launched in 2006 in 17 primary schools covering 8,471 pupils distributed under nine RAETs.

The implementation phase, 2010–2013, comprises the participation of an additional 230 primary schools every new school year, i.e. by the end of 2013, 690 schools were expected to be participating in Eco-Schools. The implementation shows good progress: by 2012, there were 676 primary schools representing all 16 RAETs; 79 of these schools had received the Eco-Schools Green Flag. This is awarded after one year of good Eco-Schools performance, including the successful implementation of the programme (establishing an Eco-Schools Committee to encourage and manage the programme, including developing an action plan; providing environmental curriculum to pupils that includes hands-on opportunities for pupils to improve and empower the school and community; and developing an eco-code which outlines the school's values and objectives alongside student goals). The Morocco Eco-Schools focus on six priority areas: water, energy, waste, food, biodiversity and solidarity.

Schools

Preschool curricula also include thematic classes dedicated to environment-related issues. In addition, teachers are encouraged to make reference to environmental protection issues as often as possible.

EE is integrated into primary, secondary and high schools in the form of specific programmes (box 3.2), e.g. the Eco-Schools programme focused on primary schools, Young Reporters for the Environment in secondary education and the National Programme of Environmental Upgrading of Rural Schools.

Higher education and scientific research

A total of 216 university education programmes (at bachelor's, master's and doctoral levels) related to environment and sustainable development are provided by several universities, such as University Hassan II in Casablanca and Mohamemdia. Several universities offer a master's degree on environment and sustainable development (e.g. University Mohammed V at Souissi in Rabat). In addition, the master's degree in social development offered by University Mohammed V at Rabat-Agdal includes environment and sustainable development studies.

At least 15 courses of study for engineers and specialized technicians in environmental sciences are offered by several higher education institutions other than universities, involving over 1,000 students. Courses of environmental studies comprise a wide range of studies directly and indirectly related to the environment, as follows: (a) Environmental Sciences, Environmental Engineering; (b) Sustainable Development, Local Development; (c) Renewable Energy; (d) Sanitation, Wastewater and Waste Treatment; (e) Biodiversity Conservation and Management, Sustainable Management of Agricultural Soil; (f) Management and Development of Sensitive Areas, Natural Risks Management; (g) Management of Territorial Heritage; (h) Exploration and Use of Water Resources, Irrigation and Water Control, Hydro-informatics; (i) Sustainable Use and Development of Marine Environment, Marine Environment and Pollutant Transfer; (j) Environment and Health, Hygiene and Environment; (k) Environment and Society, Urban Dynamics, Suburbia and Sustainable Development; (l) Industrial Processes and Sustainable Development; (m) Tourism and Environment; and (n) Climate Change.

Scientific research on the environment occupies an important place in the national strategy for scientific research until 2025, as evidenced by the following:

- Of the eight national research priorities, six relate to the issue of environmental protection and sustainable development: (i) knowledge, preservation and enhancement of natural resources; (ii) environment and sustainable development; (iii) improving the quality of life; (iv) agriculture in difficult

conditions; (v) biotechnology; and (vi) risk management;
- Of the 10 areas of expertise (national research networks), four are working on topics closely related to the environment and sustainable development: Division of Water and Environment Skills, National Study and Research Network on the Local and Regional (RELOR), National Network of Science and Technology of the Sea, and Moroccan Network of Medicinal and Aromatic Plants;
- Approximately 105 of 982 research structures (laboratories, research centres and teams) accredited by the 15 universities are working on topics closely related to environment and sustainable development issues;
- Two UNESCO Chairs – on Environment and Sustainable Development and on Sustainable Water Management – have been created;
- Several programmes and research projects aimed at environmental protection and sustainable development have been completed or are in progress.

At least five academic research structures work on the topic of education on the environment and sustainable development. Theses are prepared in this way by other universities.

Training and retraining of specialists and civil servants

Capacity-development of lawyers, managers, economists and others on environmental issues is carried out by the Department of Environment as part of the implementation process of several environmental programmes, such as the National Municipal Solid Waste Management Programme, the National Programme of Sanitation and Wastewater Treatment and the National Programme on Rural Electrification. For example, waste managers (engineers and technicians) received training organized by the Department of Environment in cooperation with the Ministry of the Interior. A number of training for auditors, controllers and inspectors are planned for 2013–2016.

The Department of Environment conducts an annual training programme to develop the capacity of civil servants in the area of environmental project management. Some 100 people are trained annually.

Non-formal and informal EE and ESD

There is a multitude of non-formal and informal activities related to EE and ESD carried out by the Department of Environment in cooperation with the Ministry of National Education and other relevant institutions, as well as with NGOs and other civil society organizations. A key partner in promoting such activities is the Mohammed VI Foundation for Environmental Protection.

The Department of Environment is organizing a special training programme for children (training of trainers among children). This programme includes training in its environmental information centre of a number of children selected from the rural schools (usually those who have leadership capacities and are active in the environmental clubs), who, in turn, train the children in their respective schools in the framework of the National Programme of Environmental Upgrading of Rural Schools.

The Centre of Study and Research of Values under the Ministry of Habous and Islamic Affairs is engaged in the integration of environmental and sustainable development concerns into the activities of mosques and Koranic schools. Among other activities, the Centre produces monthly magazines for children promoting EE and ESD (e.g. each magazine tells a new story of the two main characters, a boy and a girl, who are faced with and have to take actions to resolve various situations related to the protection of the environment, social inclusiveness and respect for diversity). In recent years, a large number of environmental NGOs have emerged that are active in promoting EE and ESD.

Rabat was one of the cities selected to host the 40th anniversary of Earth Day in 2010. As part of this event, Morocco launched the National Charter for Environment and Sustainable Development as well as organizing a number of events to raise awareness about the environment and sustainable development-related issues, involving broad participation by civil society.

The Hassan II Award for the Environment, established in 1980, is awarded for activities and initiatives supporting environmental protection, natural and cultural heritage, and the improvement of citizens' lives. Participants include researchers, NGOs, the mass media, and economic actors. The award's financial remuneration is 300,000 dirhams split into three categories. The 10th anniversary of the award was celebrated in 2010.

Financing

EE and ESD activities are generally financed through the State budget. The private sector and international community also support such activities, mostly

through related projects that are carried out by NGOs active in EE and ESD.

For example, for the implementation of the EE programme component establishing environmental clubs in rural schools, and for the training of facilitators for these clubs, the allocated resources amounted to 16 billion dirhams in 2009–2012. A similar amount of money has been allocated for continuing these activities in 2013–2016.

International cooperation

Morocco is engaged in many international activities related to EE and ESD. It participates actively in the EU initiative, Horizon 2020. As part of this initiative, "ESD at University: Theory and Practice" was organized on 23–24 April 2013 at University Mohammed V at Souissi in Rabat. The training was targeted at university teachers and was attended by over 50 teachers, who received training completion certificates.

The 7th World Environmental Education Congress (WEEC) was held in Marrakech 9-14 June 2013. The Congress focused on the theme, "Environmental Education in Cities and Rural Areas: Seeking Greater Harmony".

A UNESCO Chair in Environment and Sustainable Development and a UNESCO Chair in Sustainable Management of Water have been established within the Faculty of Arts and Humanities at University Mohammed V Adgal in Rabat.

3.6 Conclusions and recommendations

Air and bathing water are the two media that are being regularly monitored in Morocco. Water measurements in non-bathing surface waters and in groundwaters have been made sporadically. A robust legislative framework for monitoring and a comprehensive assessment of environmental media (air, water, soil and biodiversity) are lacking. There are a number of policy tools developed by UNECE (such as guidelines on air, water, biodiversity and soil contamination monitoring) and other international organizations and institutions that could be used by Morocco in its work on developing the environmental monitoring and assessment system.

The current structure in the Department of Environment is not appropriate to establishing and implementing a comprehensive environmental monitoring system. Efforts are being made to develop a shared environmental information system in Morocco. At the same time, there is no concrete policy document that outlines the necessary activities for efficient elaboration and subsequent implementation of such an information system.

Recommendation 3.1:
The Ministry of Energy, Mines, Water and Environment, in cooperation with other relevant public authorities, including regional environmental bodies, should draft legislation on environmental monitoring, assessment and reporting on all environmental media (air, water, soil and biodiversity), waste, noise and vibration, and radioactivity, to support national and international reporting obligations. The legislation should address data quality, classification issues and monitoring. It should also designate a technical institution to address, among other things, the development and coordination of all environmental monitoring activities at the national level, as well as overseeing such activities at the regional level.

The development of an integrated information system for environmental data (ISED) has been ongoing since 2010. It generally follows the shared environmental information system (SEIS) principles. The information is structured following the DPSIR (driving forces-pressures-state-impacts-responses) approach. At the same time, there is no concrete policy document that outlines the necessary activities for efficient elaboration and subsequent implementation of an ISED. For instance, an adequate data validation system or mechanism, as a prerequisite for ensuring the accuracy and comparability of data, is lacking.

Recommendation 3.2:
The Ministry of Energy, Mines, Water and Environment, in cooperation with other relevant public authorities, including regional environmental bodies, and other stakeholders, should continue working towards the establishment of an integrated environmental information system that should provide relevant comprehensive, accurate and publicly accessible information on the state of the environment. Future steps should include:

(a) Establishment of standards to regulate methodologies and procedures in the collection of, access to and protection and uniformity of environmental data and information in the related institutions and the country as a whole;
(b) Preparation of appropriate secondary legislation on different environmental areas related to data acquisition and sharing between the Ministry and other stakeholders;

(c) *Identification of a core set of environmental indicators to support decision-making;*
(d) *Creation of a nationwide multi-media (i.e. covering releases to air, water and land) pollutant release and transfer register (PRTR), which should constitute publicly accessible online inventories of pollution from point and diffuse sources.*

Morocco is on a good path towards ensuring the availability of and access to environmental information. The environmental information centre of the Department of Environment is open to the public and makes electronic copies of environment-related articles available on its website for public use.

The website of the Department of Environment is expected to gradually evolve into a user-friendly portal, since most of the national programmes and activities related to the environment have their own websites. One challenge is to ensure timely updating of the website, as well as to maintain it technically. Furthermore, an effective legislative framework on public access to environmental information has not yet been completed by Morocco.

Recommendation 3.3:
In order to implement provisions of the Constitution related to access to environmental information, the Ministry of Energy, Mines, Water and Environment should speed up the drafting of the law on public access to environmental information and promote its adoption by the parliament.

Morocco carries out a multitude of activities promoting environmental education (EE) and education for sustainable development (ESD). EE is integrated into the primary, secondary and high school curricula in the form of specific programmes. Education and training courses of study related to the environment and sustainable development are provided by several universities. Some universities offer a master's degree on environment and sustainable development.

The Department of Environment conducts an annual training programme to develop the capacity of civil servants in the area of environmental project management. Some 100 people are trained annually. There is, however, no comprehensive strategy and related action plan on ESD.

Recommendation 3.4:
The Ministry of National Education, the Ministry of Higher Education, Scientific Research and Executive Training, and the Ministry of Habous and Islamic Affairs, in cooperation with the Ministry of Energy, Mines, Water and Environment, the High Council for Education and other relevant public authorities, media representatives, NGOs and other stakeholders, should coordinate the development of a national strategy for environmental education and education for sustainable development.

Chapter 4

ECONOMIC INSTRUMENTS AND EXPENDITURES FOR ENVIRONMENTAL PROTECTION

4.1 Introduction

The economic context

Morocco is a middle-income country with a population estimated at 32.5 million in 2012, up by 3 million compared with 2003. Although Morocco's economic growth has been adversely affected by the global economic crisis in 2008–2009, its economic performance over the past decade was, overall, positive. Real gross domestic product (GDP) rose at an average annual rate of 4.6 per cent during 2003–2011. Real GDP per capita (in national currency units) rose by about 35 per cent over the same period. Inflation has remained very moderate with an average annual rate of just below 2 per cent, although this partly also reflects sizeable government subsidies designed to shield domestic prices of some foodstuffs and energy products from price hikes in international commodity markets. The unemployment rate has been relatively stable at around 9 per cent in recent years. The poverty headcount ratio at the national poverty line corresponded to 8.8 per cent of the population in 2008, which suggests that there is a sizeable segment of the population that is economically and socially vulnerable.

The economy has become more diversified over the past decade, with services being the dominant sector. Tourism has become a major source of foreign currency, with total revenues amounting to some US$7.5 billion in 2011, which corresponded to some 9 per cent of GDP. Manufacturing had a share of some 18 per cent of GDP in 2010. But agricultural activity remains a very important sector, with a share of 15 per cent of overall GDP and about 40 per cent of total employment. There was considerable progress in privatization of State-owned enterprises over the past decade, leaving as main exceptions the utility sector (water, electricity and public transport) and the natural resource sector. The income generated in the private sector accounted for about 76 per cent of gross national income in 2009. Privatization and an improving business environment were associated with a sizeable inflow of foreign direct investment (FDI). In the World Bank's *Doing Business 2012* report, Morocco climbed by 21 places – compared with the 2011 report – to the rank of 94th of 183 countries. Morocco has signed the OECD Declaration on International Investment and Multinational Enterprises, which provides a framework for the operating principles of these entities, including as regards environmental and social progress. The 2008 National Pact for the Development of Industry for the period 2009–2015 aims to expand activities, notably in the sectors of off-shoring, automobiles, aerospace, electronics, textile and leather, and agro-business. The Pact is designed to promote overall economic growth via higher industrial investments and the creation of some 220,000 jobs.

Competitiveness and green growth

The Government's main goal is to achieve sustained economic growth, which is a necessary condition for further improvements in the well-being of people. At the same time, sustained economic growth has to be aligned with the need to ensure sustainable development, as regards both social and environmental progress and adaptation to climate change. Morocco has been witnessing increasing pressures on natural resources and environmental degradation against the background of expanding economic activity and rapid population growth. The costs of the environmental damage are considerable and, according to the Ministry of Trade and Industry, correspond to 8 per cent of GDP. Conversely, this points to the enormous environmental, social and health benefits that can be reaped by taking effective action to remedy the situation.

Promoting green growth involves, inter alia, promoting investments that help build an infrastructure that is more respectful of the environment and the scarcity of natural resources. Against this background, the Moroccan authorities have, in recent years, launched sectoral development programmes that are closely associated with major infrastructure investment projects. These were launched in the water supply and sewerage sector (notably wastewater treatment), the energy sector (promotion of renewable energy and energy efficiency), the agricultural sector (less water-intensive crops and more efficient irrigation systems), and the solid waste sector (waste collection

and disposal). There is, moreover, the National Strategy for the Development of Logistical Competitiveness 2010–2015 which aims at strengthening the competitiveness of different transport modes and modernizing the transport infrastructure.

These programmes are currently at the core of Morocco's efforts to promote the transition to a green economy. At the same time, these various programmes are associated with important opportunities for the creation of income and employment. This is also emphasized in the government report on the green economy issued in 2012. Major challenges, besides financing, are the integration of these programmes with policymaking at the national, regional and local levels, as well as creating a more conducive environment for the enterprises to engage in "green investments" and the development of "green products".

Under the framework of the MENA-OECD Governance Programme for 2011–2015,[5] the Ministry of Housing, Town Planning and Urban Policy organized a meeting on "green growth and regional development" in partnership with OECD and national partners to exchange and discuss appropriate methods and effective practices to encourage jurisdictions to adopt and promote competitiveness through a green economy approach. The meeting endorsed the establishment of the focus group MENA/OECD Green Growth and Territorial Development, led by Morocco, which has developed a roadmap to promote green growth in the region.

4.2 Economic instruments

The 1995 Law No. 10-95 on Water was the first legal provision in Morocco to call for the application of the polluter-pays and user-pays principles. The 2003 Law No. 11-03 on the Protection and Conservation of the Environment also explicitly calls for the application of the polluter-pays principle. It also stipulates the use of financial and fiscal incentives designed to improve environmental protection. It provides, moreover, for the creation of a national environmental fund, the resources of which are to be used to support environment-related investment programmes.

Air pollution charges

The 2003 Law No. 13-03 on Combating Air Pollution does not contain any provisions for the introduction of special payments for the emission of air pollutants. But there are regulations concerning emission standards, the control of emissions and ELVs for stationary sources, which were introduced in 2009–2010 (chapter 6). The Law also stipulates that investments of enterprises designed to reduce or prevent pollution can benefit from financial incentives, including tax breaks and partial or complete exoneration of customs duties for the purchase of cleaner technologies in line with conditions established in the annual government finance laws. The Law (chap. 5, arts. 13-21) stipulates also the application of sanctions and pecuniary fines in the case of non-compliance with established air pollution regulations, but these have so far not been applied.

Water sector charges

Water sector charges comprise charges for water abstraction, water supply and sanitation, and irrigation. In addition, there are legal provisions, although still incomplete, for the application of water pollution charges. Water pollution charges are used for depollution operations according to Law No. 10-95 on Water.

Water abstraction charges

Water abstraction charges have to be paid to the WBAs which, since the promulgation of the 1995 Law on Water, are the major actors concerning the management of raw water resources, supported by the Department of Water (chapter 7). The WBAs are public institutions that are legally and, in principle, financially autonomous. The major financial resources of the WBAs originate from the tariffs for water abstraction and for the discharge of used water, as well as fees for the extraction of sand and gravel within the perimeters of the public water basin domain (domain publique hydraulique, DPH) and government subsidies.

The tariff system for water abstraction distinguishes four water usage categories: production of hydroelectricity, irrigation, public water and industrial water supply. Tariffs are specified in terms of kWh for the hydropower sector, and based on volumetric charges for the other three use categories (table 4.1). Hydroelectric power stations with an

[5] The Initiative on Governance and Investment for Development is a regional effort, initiated and led by countries in the Middle East and North Africa (MENA) region. It promotes broad reforms to enhance the investment climate, modernize governance structures and operations, strengthen regional and international partnerships, and promote sustainable economic growth throughout the region.

installed capacity of less than 300 kW are subject to a flat charge of 250 dirhams per annum. As is the case for the other parts of the water sector, tariffs are established by means of government orders.

The tariff for water used for production of hydroelectricity was established in 1998 (1998 Joint Order No. 520-98) and has not been changed since. In a similar vein, the tariff for abstraction of water to be used for irrigation has remained unchanged since 1998 (1998 Joint Order No. 548-98). The tariff for water used for public drinking water supply was modified in 2003 (2003 Joint Order No. 2283-03), establishing a level of 0.02 dirham/m^3 until 2005 and 0.04 dirham/m^3 from 2006. The current tariff for water used for industrial purposes was established in 2005 (2005 Joint Order No. 2565-05).

The WBAs collect the fees for water abstraction; the revenues are to be used for financing their operations as well as for subsidizing projects aimed at water pollution abatement and conservation of water resources. However, overall, the extent of self-financing of the WBAs has remained limited. A large proportion of the activities of the WBAs is being financed by State subsidies, given that tariffs applied are not covering the operating and maintenance costs for the raw water production infrastructure. Moreover, as noted above, there is, as yet, no application of tariffs for discharge of used waters into surface waters or underground sources.

Tariffs for water supply and sewerage services

The Communal Charter (2002 Law No. 78-00) gives responsibility for the establishment and management of public communal services to local governments. Besides water supply and sewerage services, these services also comprise waste collection and disposal, electricity supply and street lighting. For organizing these services, the communes are given four options: (i) own direct management; (ii) establishing an independent public company to which the management of the corresponding service is delegated; (iii) delegation to the National Office of Drinking Water (ONEP) (for water services); and (iv) delegation of services to a private provider. The legal basis for the latter is the 2006 Law No. 54-05 on the Delegated Management of Public Services. Public–private partnerships can also be used for the construction and operation of infrastructure (such as water sector infrastructure).

Many urban communes have opted for multi-service companies that combine water supply and sewerage services with electricity distribution. In the rural areas and a number of small urban communes, moreover, electricity supply is operated by the National Office of Electricity (ONE). In April 2012, ONEP was formally merged with ONE to form a new government agency, the National Office of Electricity and Drinking Water (ONEE). ONEE maintains ONE and ONEP as its two main branches. The merger is based on Law No. 40-09, which was adopted in September 2011.

Drinking water and sewerage services across the country are currently operated by 13 independent public companies, four private companies and ONEP. Direct management of communal water services has practically disappeared. ONEP is a State-owned independent company that is the major national water producer and, when rural water supply is included, also the dominant national water distributor. It delivers water to 416 urban settlements, 198 small rural settlements and more than 3,500 camps and nomadic villages.

Some 30 per cent of subscribers to water services in urban areas are serviced by the public utilities and ONEP, and some 40 per cent by private companies. Private water operators have been engaged in the four major agglomerations (Casablanca, Rabat, Tangier and Tétouan) based on long-term concession contracts. They are also in charge of electricity distribution to final consumers. The first concession contract was established in Casablanca in 1997, followed by Rabat in 1999, and Tangier and Tétouan in 2002.

The 1995 Law on Water (art. 37) states the application of the user-pays and polluter-pays principles in the whole water sector. All water tariffs are regulated by the State (i.e. an interministerial committee); there is no independent regulator. Tariff setting is based on the 2000 Law No. 06-99 on the Freedom of Prices and Competition, which defines circumstances under which prices are not subject to market forces. The Law was amended by the 2010 Law No. 30-08. In the case of delegated management of water services to private companies, the modalities of tariff setting are detailed in the delegation contract, and tariffs set by the public delegating authority subject to approval by the Ministry of the Interior. But it appears that principles of tariff setting defined in delegation contracts are not automatically applied by the local governments.

Photo 4.1: Lane of Kasbah of the Udayas, Rabat

Table 4.1: Water abstraction charges, 2012

Water use	Unit	dirham	US$
Production of hydroelectricity	dirham/kWh	0.02	0.0025
Irrigation	dirham/m^3	0.02	0.0025
Drinking water/population	dirham/m^3	0.04	0.0049
Industrial production	dirham/m^3	0.02	0.0025

Source: *Guide de lecture des lois environnementales*, janvier 2011, p. 19.
Note: Exchange rate: US$1 = 8.1 dirhams

The tariff system distinguishes four types of use categories: domestic use, preferential use (public baths and standpipes in rural areas[6]), industrial use, and hotels. The tariffs for the domestic use category (households and public administration) are based on a block system with four nationwide uniform consumption ranges (0 to 6 m^3 per month; more than 6 m^3 to 20 m^3; more than 20 m^3 to 40 m^3; and more than 40 m^3). For the other use categories, a uniform volumetric tariff per m^3 of water is applied. In addition to the volumetric fee, there is also a fixed annual connection cost.

Tariffs set differ significantly among municipalities (and therefore water companies). This partly reflects the sometimes markedly different wholesale tariffs at which the water companies have to purchase drinking water in the wholesale market from ONEP (table 4.2). As regards the small settlements, however, where the distribution of water is ensured by ONEP, there is a uniform tariff applied to all of them. The wholesale tariff applied by ONEP includes a national solidarity contribution (surtaxe) of 0.75 dirhams/m^3, which was established in 1985. It is designed to offset the operating losses incurred by ONEP in small settlements, where the uniform tariff applied generally does not allow recovery of production costs due to the absence of economies of scale.

A major rationale is to stem population migration to urban areas by providing affordable access to water supply. Water distribution companies must, moreover, pay a second tax to ONEP. This is the PAGER tax; the revenues are earmarked for contributing to the financing of the rural water supply network. The tax amounts to 5 per cent of the wholesale tariff (excluding the national solidarity contribution). Both taxes are tantamount to a cross-subsidization of water consumers in rural areas by urban consumers. The wholesale tariff (excluding these taxes) can also be assumed to contain an

[6] The categories included are (in French) “bains maures” and “bornes fontaines”.

implicit subsidy of water distributors to ONEP, given that ONEP has to pay only 0.04 dirhams (US$0.005) per m^3 for water abstraction to the WBA, which is only a very small (on average some 1 per cent) share of the wholesale tariff.

Wholesale and retail drinking water tariffs were established in 2006 and have not changed since. There is a similar strong variation in retail tariffs among the municipalities as is the case for wholesale tariffs. To illustrate, the lowest block tariffs for domestic drinking water use range from 1.30 dirhams (US$0.16) in Meknès to 3.81 dirhams (US$0.47) in Oujda. The tariffs for industrial water use range from 2.23 dirhams (US$0.275) per m^3 to 10.13 dirhams (US$1.25) in those locations (table 4.2).

The lowest block tariff is considered to be a social tariff, which is significantly cross-subsidized by the higher tariffs in the other blocks, mainly the third and fourth block. The official rationale is to ensure affordability of adequate water supply for vulnerable groups of persons, i.e. poor households. This tariff is set at a level that is significantly below the wholesale price at which distribution companies can buy their water. On average, the social tariff is some 25 per cent below the wholesale price (table 4.2). But the "social tariff" is not targeted at the low-income households; rather, it benefits *all* private households as well as the public administration. The large majority of poor households, moreover, have a monthly water consumption that is higher than the maximum allowed in the first consumption block.

Table 4.2: Drinking water tariffs, 2012, dirhams/m^3 (excl. VAT)

Municipality	Producer tariff (m^3/month)	Retail tariffs (m^3/month)					
		Domestic uses		Industry	Public baths	Hotels	Average tariff (all uses)
		1. block 0-6 m^3/ month	Average tariff				
Autonomous boards							
Agadir	3.84	2.95	7.55	5.77	6.21	8.34	6.65
Beni Mellal	2.39	2.61	5.07	7.05	6.73	8.56	5.34
El Jadida	4.20	3.09	7.05	6.23	6.88	9.00	7.09
Fès	3.05	1.95	5.52	5.32	5.61	7.63	5.76
Kenitra	4.14	2.32	4.62	4.46	4.88	5.82	4.77
Larache	2.96	1.74	4.44	3.57	3.74	4.78	4.49
Marrakech	3.02	1.70	5.62	5.40	5.73	8.02	6.09
Meknès	2.41	1.30	3.20	2.23	2.18	3.71	3.18
Nador	3.01	2.13	5.41	5.23	6.01	7.05	5.38
Oujda	3.52	3.81	7.37	10.13	9.77	12.18	7.59
Safi	3.96	3.32	6.04	7.14	7.82	10.87	7.03
Settat	2.19	2.63	5.18	5.56	5.81	6.88	5.43
Taza	3.07	2.15	5.57	6.07	5.85	7.63	5.55
ONEP (Small centres)		2.37	5.37	6.68	7.20	6.68	6.14
Delegation contracts							
Casablanca	4.34	2.92/2.99	7.18	7.24/8.07	7.21	..	7.95
Rabat	4.34	2.13/2.43	6.31	6.56	6.56	..	7.30
Tangier	2.86	2.52/2.43	6.59	5.32	5.28	..	7.57
Tétouan	2.85	2.53/2.76	6.38	..	..	..	..
Memorandum item:							
Average of tariffs above	3.30	2.45/2.48	5.80	5.88/5.93	6.09	7.65	6.08
Average of tariffs above in US$	0.41	0.303/0.306	0.72	0.726/0.732	0.75	0.94	0.75

Source: ONEP, direct communication *Revue Stratégique du Programme National d'Assainissement*, mai 2008, Annex 4, p. 101.
Casablanca: Lydec (https://client_Lydec_ma/site.fr/tranches-de-facturation_et-tarifs).
Rabat; Tangier, Tétouan: Veolia (www.client.veoliaenvironnement.ma/Tanger/votreFacture).
Notes: Tariffs applied since April 2006. For tariffs under delegation contracts, the first figure refers to April 2006; the second is the current tariff.
Producer price is the price at which ONEP sells drinking water to distribution companies.
The producer price includes the 5 per cent supplementary tax PAGER and the supplementary tax (0.75 dirhams/m^3) for the small centres serviced by ONEP.
Average retail tariffs for domestic uses and for all uses for each municipality are calculated using the corresponding consumption structure of 2007. All other average tariffs are unweighted arithmetic averages.

Table 4.3: Sewerage tariffs, 2012, dirhams/m^3 (excl. VAT)

Municipality	Private households		Industry	Public administration	Public baths	Unweighted average
	1. block 0 to 6m^3	Average tariff				
Autonomous boards						
Agadir	0.51	1.56	3.04	2.00	1.37	1.99
Beni Mellal	0.51	0.97	3.06	2.55	3.06	2.41
El Jadida	0.55	1.26	3.04	3.25	3.04	2.65
Fès	0.51	1.18	3.04	2.54	3.04	2.45
Kenitra	0.54	1.37	3.06	3.25	3.06	2.69
Larache	0.30	0.78	1.50	1.50	1.50	1.32
Marrakech	0.82	1.64	4.00	4.30	4.30	3.56
Meknès	0.51	1.26	2.54	2.54	2.54	2.22
Nador	0.51	1.29	3.06	2.55	3.06	2.49
Oujda	0.30	0.59	1.80	1.50	1.80	1.42
Safi	0.60	1.08	2.40	1.50	2.40	1.85
Settat	0.80	1.49	3.90	3.90	3.90	3.30
ONEP						
20 centres	0.56	0.99	2.25	1.40	2.25	1.72
29 centres	0.75	1.32	3.00	2.50	3.00	2.46
Delegation contracts						
Casablanca	0.37/0.91	..	..	..	..	..
Rabat	0.67	..	..	..	..	..
Tangier	0.38	..	..	..	..	..
Tétouan	0.37	..	..	..	..	..
Memorandum item:						
Average tariff	0.54/0.56	1.20	2.84	2.52	2.74	2.33
Average tariff in US$	0.067/0.069	0.15	0.35	0.31	0.34	0.29

Source: 2006 Order No. 427-06 fixing the rates of sanitation fees, as amended by the 2006 Decree of the Minister Delegate to the Prime Minister in charge of Economic and General Affairs No. 1295-06
Revue Stratégique du Programme National d'Assainissement, mai 2008, annex 4, p. 101.
Casablanca: Lydec (https://client_Lydec_ma/site.fr/tranches-de-facturation_et-tarifs).
Notes: Tariffs applied since March 2006. ONEP tariffs are uniform tariffs for groups of small towns and villages.
Casablanca: The first figure (0.37/m^3) for the first consumption block is a special social tariff that is only applicable in the case that the total water consumption does not exceed 8 m^3/month. It was introduced in 2011.
Average tariffs for private households: weighted average based on 2007 consumption structure.
Other average tariffs are unweighted arithmetic averages.
Figures in US$ were calculated using the exchange rate: US$1 = 8.1 dirhams.

The tariffs in the lowest block are therefore a source of considerable losses for the water companies, which have been estimated at some 1.75 billion dirhams (US$215 million) per annum in recent years.

In Casablanca, for example, the water company (Lydec) purchases the drinking water at a price of 4.34 dirhams per m^3, the highest in the country. The current social tariff (first consumption block) is 2.99 dirhams or 68.9 per cent of the wholesale price. This compares with a cost recovery level of 7.89 dirhams/m^3 in 2009.

Water metering is standard for urban areas, but it appears that water theft is quite common and not straightforward to sanction. The bill collection rate is, in general, quite high. Given that water tariffs have not changed since 2006, tariff collection has declined in real terms by some 11 per cent in 2012 (compared with 2006). This was beneficial for the final consumers but it dampened growth of revenues in real terms for water companies. This was offset, however, by the generous energy subsidies that have been provided by the Government.

Average drinking water tariffs appear to be quite high in some municipalities (e.g. Casablanca and Rabat), allowing the water companies to recover operating costs; but this is not the case in many others, which depend for their financial viability on subsidies. Investments in the water supply and sanitation infrastructure of water companies (except for the private operators) also depend, in general, strongly on support from international financial institutions (IFIs) (loans and grants).

The tariff structure for sewerage services is similar to that for drinking water. There is a progressive, three-block tariff for private households (0 to 8 m^3, more than 8 m^3 to 20 m^3, and more than 20 m^3 per month) and a uniform tariff per m^3 for other users. As is the case for drinking water tariffs, sewerage tariffs vary significantly among the municipalities, which partly also reflects the differences in quality standards and associated technologies of wastewater treatment. As is the case for drinking water tariffs, sewerage tariffs for most water companies, including those operated by ONEP, were last revised in 2006. There is, however, no sewerage tariff harmonization for the locations serviced by ONEP, in contrast to tariffs for drinking water consumption (table 4.3).

Sewerage tariffs are very low compared with drinking water tariffs. The average sewerage tariff is 2.3 dirhams (US$0.28) per m^3, only about one third of the average drinking water tariff (tables 4.2 and 4.3). A tariff analysis of 42 wastewater treatment systems operated by ONEP around 2006 showed that the sanitation tariffs allowed recovery of only about 70 per cent of the operating costs, excluding depreciation allowances, financing costs and costs of maintenance of the infrastructure.

The total costs of wastewater collection and treatment were at that time estimated at 10.6 dirhams (US$1.31) per m^3. In other words, given the general increase in major cost items for wastewater management, there has been an increasing gap between the actual tariffs and the level required for ensuring recovery of operating costs, let alone maintenance and depreciation. In a more general way, the financing of the operating costs of sewerage services has also relied on the cross-subsidies from other activities operated by water companies (electricity supply) in many municipalities and, where feasible, from drinking water revenues, or government subsidies. For ONEP, an important source of cross-subsidies has also been the revenues originating in the wholesale market for drinking water.

Besides tariffs for sewerage services, new subscribers in urban areas have to pay a "first settlement fee" (Participation au premier établissement – PPE), which is designed to be a contribution to the investment costs of extending the network to buildings not connected so far.

As these fees are often not affordable for average income earners, let alone poor households, there is a government programme that provides reimbursable loans over a period of 7 to 10 years. Given that this is not financially feasible for poor households, the Government has launched a special subsidy scheme within the framework of the National Initiative for Human Development. The programme, which is supported by the World Bank, is applying the concept of "output-based aid". This means that the operator has to pre-finance the establishment of the connection and is reimbursed once the agreed "output" has been delivered. A pilot project was launched in 2007 with the goal to connect some 11,000 households to the water network in poor areas of the municipalities of Casablanca, Meknès and Tangier. The pilot project was funded through a US$7 million grant by the Global Partnership for Output-Based Aid. It is implemented by the corresponding water companies. The project got off to a slow start but, by 2011, the grant made available by the Global Partnership for Output-Based Aid was fully committed. Some 10,500 households obtained subsidized access to water supply and some 9,000 households were connected to sanitation services. In total, the project benefited some 52,500 people.

Tariffs for irrigation water

Irrigated agriculture is a major priority in Morocco, both to meet the needs of a growing population and as a source of export revenues. Irrigation accounts for the large bulk (some 90 per cent) of water consumption in Morocco. The Ministry of Agriculture and Maritime Fisheries is in charge of defining and implementing the agricultural policy, of which irrigation is a key element against the backdrop of increasing water shortages (chapters 7 and 12).

About 70 per cent of agricultural land is irrigated by large scale public irrigation systems (Grande hydraulique). The remainding 30 per cent of irrigated land is serviced by small and medium-scale irrigation systems. The latter are largely managed by private water users associations. There are nine large-scale public irrigation systems that were developed for each of the major river/water basins. Each of these irrigation systems is managed by a regional service of agricultural development.

The regional services are quasi-autonomous public institutions with their own budget. They are overseen by the Ministry of Agriculture and Maritime Fisheries (administrative and technical matters) and the Ministry of Economy and Finance (financial matters). The 1969 Agricultural Investment Code (art. 16) established a framework for cooperation between the State and the farmers in the area of irrigation policy. It stipulates that the State finances the costs of the construction of dams and irrigation networks, as well as the necessary on-farm

equipment. Farmers, in turn, are obliged to participate in these costs (after the completion of the investments) with a share of up to 40 per cent. This participation is based on two elements.

The first is a land improvement tax, which is motivated by the increased value of the land on account of the connection to the irrigation network. This tax was initially set at 1,500 dirhams per ha of irrigated land; it was increased in 1984 by some 30 per cent to reflect the increase in the average costs of the irrigation networks. The tax has since remained unchanged. Given that the associated expenditures can be substantial, the Government offers payment facilities, which enable farmers to spread their contribution over a period of 17 years, with a grace period of four years, at a given interest rate.

The second element is an annual volumetric fee for the use of irrigation water, which is to cover the operating costs of the network, including maintenance costs and depreciation. Cost recovery is also to be ensured by billing a minimum water consumption of 3,000 litres, even if the actual consumption is lower. Although these principles were established in 1969, payments for use of irrigation water were only introduced at the beginning of the 1980s.

The volumetric tariff that allows for full cost recovery is labelled "equilibrium tariff" and it is calculated on the basis of a special formula. In principle, the tariff is regularly adjusted for inflation. There is a supplementary charge to cover the energy costs in case water has to be pump-lifted. The last increase in irrigation water tariffs entered into force in March 2009 and was within a range of 4 per cent to 15 per cent depending on the irrigated perimeter and the type of irrigation network. Most of the new equilibrium tariffs are slightly below 0.30 dirham (US$0.0037) per m^3. But the supplementary charges due to energy costs for pumps, were they to apply, are in some cases higher than the "equilibrium tariff" (table 4.4).

The revenues from the volumetric water tariff are collected by the corresponding regional office for agricultural development (ORMVA). The tariffs for irrigation water were progressively increased over the past decade or so, and bill recovery rates have apparently improved. But the situation with regard to cost recovery differs among the various perimeters.

The issue is being rendered complex given that in certain perimeters (Loukkos, Gharb) water is abundant, and its actual use is insufficient to justify the sizeable infrastructure investments made in the past.

An increase in tariffs could therefore risk a reduced demand for irrigation rather than an improvement in water productivity. In other perimeters (Tadla, Mouloya, Doukkola, Souss-Massa), water available is not sufficient to meet the demands of the crops. But, on average, the operating costs in these perimeters are largely covered by the irrigation tariffs. Higher tariffs would, therefore, be tantamount to a supplementary tax on irrigated land on top of the recovery of the operating costs.

In a more general way, however, the financial sustainability of many irrigation networks depends on State subsidies, given that the applied tariffs do not allow recovery of the current operating costs, let alone maintenance and depreciation.

Water effluent charges

The 1995 Law No. 10-95 on Water establishes that any discharge of wastewater into surface or ground waters which is likely to adversely affect the water quality is subject to a permit, which is to be issued by the corresponding WBA (chapters 2 and 7). Any discharge of wastewater is, moreover, subject to payment of a fee. It is noteworthy that the Law on Water covers only inland water sources and not the seawater beyond the coastline, which receives the large bulk of wastewater discharges.

The modalities for obtaining a permit and the general rules for establishing the effluent charge rates were established by the 2005 Decree No. 2-04-553 on spills, discharges, and direct or indirect deposits into surface water or groundwaters. The Decree distinguishes between domestic wastewater[7] and industrial wastewater. It stipulates that any discharge of wastewater is subject to specific ELVs for pollutants. Where specific limit values have not been established, general limit values apply. But general limit values have not yet been published. And specific limit values for discharge of water pollutants have, so far, been established only for domestic wastewater (2006 Joint Order No. 1607-06) and four sectors of manufacturing industry:

- The sugar industry (2006 Order No. 1608-06);

[7] The term "domestic", in this context, covers households, hotels, administrative entities, hospitals and social institutions, as well as small enterprises and laboratories with a water consumption of less than 10 m^3 per day.

Table 4.4: Tariffs for irrigation water

Regional service/Tariff zone	Equilibrium tariff	Supplementary tariff	Total tariff	
	dirham/m^3	dirham/m^3	dirham/m^3	US$/$m^3$
Gharb				
Beth (incl. relevage)	0.29	0.05	0.340	0.042
Souss-Massa				
Souss Amont	0.27	0.41	0.680	0.084
Issen assolé	0.70	0	0.700	0.086
Doukkala				
Boulaoune	0.26	0.25	0.510	0.063
Loukkos				
Merja	0.27	0.16	0.430	0.053
Moulouya				
Garet	0.27	0.34	0.610	0.075
Tadla	0.25	0	0.250	0.031
Ouarzazate	0.25	0	0.250	0.031
Tafilalet	0.25	0	0.250	0.031
Oued Mellah	0.27	0	0.270	0.033
Haouz				
Haouz (central)	0.30	0	0.300	0.037

Source: Ministry of Agriculture and Maritime Fisheries, *Situation de l'Agriculture Marocaine*, No. 9, November 2011, table 26, p. 77.
Note: Tariffs in force as from 5 March 2009.
Exchange rate: US$1 = 8.1 dirhams.

- The pulp, paper and cardboard industries (2006 Order No. 1606-06);
- The cement industry (2009 Order No. 1447-08);
- Hot galvanizing of metal surfaces (2010 Order No. 862-10).

In order to give industry sufficient time to prepare for the imposition of effluent charges, they were to be applied to companies that existed at the time of issuing the corresponding orders in 2006, only as from 17 August 2011.

The payments for the discharge of polluted domestic wastewater are proportional to the volume of water consumption, whereas the calculation of payments for the discharge of industrial wastewater is based on the concept of pollution units (box 4.1). The level of the charge rate (CR) per measurement unit of domestic and industrial wastewater was set by the 2006 Joint Order No. 1180-06 determining the pollution charge rates applicable to wastewater discharges and defining the pollution unit. It establishes, at the same time, an annual revision of the charge rate up to a specific target level for the year 2016 (table 4.5). In 2012, the charge rate for the discharge of used domestic water was set at 0.30 dirhams (US$0.0037) per m^3, up by 25 per cent compared with 2011. The corresponding charge for industrial wastewater is also 0.30 dirhams but *per pollution unit*, twice the amount charged in 2011. Whereas the charge rate for domestic wastewater is to remain unchanged until 2016, the official target is to progressively raise the charge rate for industrial wastewater to 0.70 dirhams (US$0.0086) by 2016.

The bills for the wastewater discharges within the perimeters of their competences are to be collected by the WBAs from the operators of WWTPs (mainly operated by ONEP and private companies that have a corresponding concession), or directly from the company that is directly discharging wastewater without being connected to a wastewater treatment network. The revenues collected are to be used by the WBAs for providing financial and technical assistance for water pollution abatement measures.

However, this legislation on water effluent charges, which goes back to 2006, has not been implemented so far due to lack of implementation regulations. An important point of disagreement is who will have to carry the financial burden for the wastewater discharges, i.e. whether the operators of the WWTPs will be allowed to pass these costs on to the users of their services. This, in turn, would require a corresponding adjustment of the structure and level of water supply tariffs, which are regulated by the government. If operators were not allowed to pass these costs on, this would adversely affect their profit margins and, related to that, their investment capacity.

Box 4.1: Methodology of calculation of the payments for the discharge of industrial wastewater

For calculating the payments for discharges of industrial wastewater, Morocco employs the concept of pollution units (PUs). These are defined as the weighted sum (expressed in kg/year) of BOD, COD, total suspended solids and a number of heavy metals (2006 Joint Order No. 1180-06):

(1) PU = 0.6 MO + 0.15 MES + 6.5 ML (all variables are expressed in kg/year) and where

PU = number of pollution units;
MO = (2 BOD5 + COD)/3, where BOD5 = biochemical oxygen demand during five days; COD = chemical oxygen demand;
MES = total suspended solids;
ML = sum of quantities of specified heavy metals, such as zinc, chrome, nickel, copper, arsenic, lead, cadmium and mercury.

Besides the number of pollution units, the total bill for industrial wastewater discharges is also influenced by a coefficient (E) that measures the effectiveness of a specific wastewater treatment plant (WWTP) in terms of removal of pollutants (in per cent) before the treated water is channelled to surface water or groundwater bodies.

The total payment (P) for wastewater discharges is accordingly calculated as follows:

(2) P = PU x CR x E.

In the case of absence of a WWTP the total charge due is

(3) P = PU x CR.

Table 4.5: Water effluent charges, 2006–2013

Type of used water	Unit	2006	2007	2008	2009	2010	2011	2012	2013
Domestic	dirham/m^3	0.07	0.07	0.15	0.15	0.24	0.24	0.30	0.30
Industrial	dirham/PU	0.01	0.01	0.05	0.10	0.15	0.15	0.30	0.30
Memorandum item:									
Domestic	US$/$m^3$	0.009	0.009	0.019	0.019	0.030	0.030	0.037	0.037
Industrial	US$/PU	0.001	0.001	0.006	0.012	0.019	0.019	0.037	0.037

Source: 2006 Joint Order of the Minister of the Interior, the Minister for Land Use Planning, Water and the Environment, the Minister of Finance and Privatization, the Minister of Industry, Trade and the Upgrading of the Economy, the Minister of Energy and Mines and the Minister of Tourism, Crafts and the Social Economy No. 1180-06 determining the pollution charge rates applicable to wastewater discharges and defining the pollution unit.
Note: PU = pollution unit.
Data in national currency units were converted into US$ using the average annual exchange rate of 2011 (US$1 = 8.1 dirhams).

It is noteworthy, moreover, that, in general, existing WWTPs only have the technical capacity to process domestic wastewater, but not industrial wastewater. The possibility of accepting industrial wastewater is largely subject to the condition of pre-treatment at the source of pollution. But there is not yet a legal basis on which to obligate industries to treat their effluents prior to discharge into natural water bodies (chapter 7).

The 1995 Law on Water also contains provisions (chap. XIII, s. II) for penalties and fines to be imposed in the case of violations of water sector regulations, e.g. unauthorized wastewater discharge. But these fines have not been applied so far, because of the lack of corresponding implementing legislation.

Municipal waste charges

The 2006 Law No. 28-00 on Waste Management and Disposal stipulates that municipal waste services are subject to a user charge. The level of the charge is to be determined by the municipal council, subject to approval by the corresponding competent supervisory State body (arts. 37 and 69 of the Municipal Charter). A specific fee for waste services has not, however, been introduced so far. Instead, the 2007 Law No. 47-06 on Local Government Finances established a municipal services tax, which has as its tax base the imputed rental value of the buildings in which persons live.

The tax has to be paid, however, by the owner of the apartment/house and not by the person renting it

(unless it is implicitly or explicitly included in the monthly rent to be paid). The tax has, moreover, no specific counterpart because it covers all the communal services provided (waste management, street cleaning, public lighting, maintenance of parks). The tax is collected by the State treasury and then distributed to the communes, but it is not strictly earmarked for the financing of communal services.

Given the lack of adequate capacities of local governments, the provision of municipal waste services has been increasingly delegated to specialized private enterprises over the past decade. The delegation of management is typically based on longer term contracts, which are subject to tendering procedures. The contract specifies the obligations of the companies, including investments to be undertaken, and the annual fees to be paid to them by the local authorities. In the first half of 2012 there were 95 urban municipalities, accounting for some 70 per cent of the total urban population, which had signed delegation contracts with specialized private companies.

The aggregate annual costs of the corresponding waste collection services amounted to some 1.58 billion dirhams (US$195 million), with an average charge per ton of 391 dirhams (US$48.30). This compares with a cost of some 200 dirhams per ton (US$24.70) in urban communes where waste services are directly organized by the local government. The sizeable difference appears to be largely on account of the different levels of quality of services provided. About 80 per cent of the domestic market for solid household waste (collection, transport discharge to landfills) is controlled by four subsidiaries of international companies.

The financial sustainability of urban waste services appears to have improved in recent years against the background of an increased collection rate of the municipal services tax, which became operational in 2008. In 2011, revenues collected amounted to 2.64 billion dirhams (US$325 million), up from 1.2 billion dirhams (US$148 million) in 2008. In fact, the aggregate operating budget of the local governments during 2008–2011 was in surplus.[8]

Urban communes with more limited revenues have been supported, moreover, by direct government subsidies within the framework of the National Municipal Solid Waste Management Programme and the repartition of VAT revenues. From 2008 to 2011, the programme financed 10 per cent of the waste collection costs of private operators. Nevertheless, there are frequent cases of late payment of waste-related invoices by municipalities and an associated accumulation of arrears.

Eco-tax on plastic packaging

The Law on Finance for 2013 introduced an environmental tax on sales, factory output and imports applicable on plastics and articles thereof falling within chapter 39 of the harmonized system which came into force is planned from the beginning of 2014 and which revenue will be allocated to the National Fund for the Environment. There is no explicit mention of whether the tax will also be applied to plastic packaging imported

Financial guarantees and fines

Law No. 28-00 (art. 45) stipulates that an exporter or importer of waste must have insurance or provide a financial guarantee designed to ensure the financing of the costs of remediation in the case of accident and/or pollution generated by the waste. In a similar vein, a financial guarantee is required for the operation of installations of treatment and processing of hazardous, industrial, medical and pharmaceutical waste. There are provisions for fines in the event of non-compliance with the established legal standards. Article 81 of Law No. 28-00 stipulates that 20 per cent of the collected fines are to be allocated to the National Environment Fund. There is, however, no published information on whether these fines are applied at all and, if they are, what the revenues are. The 2010 Law No. 22-10 on the Use of Degradable or Biodegradable Plastic Bags and Sacks specifies mandatory standards for plastic bags, below which domestic production, import, sale or free distribution are forbidden. These standards do not, however, apply to plastic bags for agricultural and industrial use and for waste collection. Non-compliance with the Law is subject to sanctions. The domestic production of substandard bags is subject to a fine that can range from 0.2 million dirhams (US$0.025 million) to 1 million dirhams (US$0.123 million). There is no public information on the application of these fines.

Electricity distribution tariffs

The National Office of Electricity (ONE) is in charge of implementing the national electricity supply policy subject to the approval of the Ministry of Energy, Mines, Water and Environment (chapter 11). ONE has a public monopoly in electricity generation and transmission but, since the late 1990s, it has concluded power purchase agreements (PPAs) with

[8] In 2011, the surplus amounted to 7.563 billion dirhams (US$0.934 billion).

private companies, which are restricted to supplying power solely to ONE. Electricity distribution in urban areas is mainly ensured by municipal operators as well as private operators. ONE is in charge of electricity distribution in rural areas as well as in a small number of urban centres. Electricity tariffs are regulated by the Government. There is no independent energy regulator. The tariffs applied by the municipal utilities and ONE to their clients are established and revised by order of the Prime Minister based on a proposal of the Interministerial Price Commission. The tariffs applied by the private electricity distributors are established and revised according to the rules stipulated in the corresponding delegation contracts.

There have been a number of tariff reforms since 1996, mainly designed to increase financial incentives for energy savings by industry, households and other users. Tariffs for all groups of end-users are typically progressive block tariffs. For industry, there are, inter alia, dual-rate tariffs that depend on the time of the day (peak load time or off-peak), voltage level and annual hours of consumption. In agriculture, there is a so-called "green tariff" that distinguishes between summer and winter time. Household tariffs depend only on monthly consumption (table 4.6). Within the framework of the National Programme for Energy Efficiency (Programme National d'Economie d'Energie) launched in July 2008, the Government established a bonus system (the so-called "-20-20 model") for final consumers who are clients of municipal utilities or ONE, in order to create incentives for reducing energy consumption. Any reduction of monthly electricity consumption by at least 20 per cent compared with the same month of the preceding year benefits from a bonus equivalent to the value of the 20 per cent of the electricity saved.

The value of the bonus is the product of the electricity saved (in kWh) times 1 dirham, which is tantamount to 20 per cent of the difference in the monthly electricity bills. The bonus is deducted from the bill in the following month. This scheme has also been joined by the four private electricity suppliers in Casablanca, Rabat, Tangier and Tétouan. A special tariff, which was introduced for end-users in rural areas in 2002, allows the purchase of electricity using prepaid, rechargeable electronic cards. The minimum purchasing value is 20 dirhams. This allows clients in rural areas to align their electricity purchases with the development of their revenues and actual needs. There is a uniform tariff per kWh which, however, differs among user groups, such as households, commerce, etc. The system, which was only applied to clients of ONE in rural areas, has been progressively extended to other parts of the country (notably the suburbs of large towns) since March 2009. The rationale is that it allows consumers to better control their electricity consumption bill, and electricity companies can be sure that electricity supplied has already been paid for.

Table 4.6: Electricity tariffs for domestic users

Block	kWh	dirham/kWh	US$/kWh
1	0-100	0.901	0.111
2	101-200	0.969	0.112
3	201-500	1.054	0.130
4	above 500	1.441	0.178

Source: ONE (www.one.org.ma).
Notes: Prices established in February 2006, VAT excluded.

In order to improve their price competitiveness, industrial companies were granted a cumulative tariff reduction amounting to 34 per cent between 1997 and 2004. These were, however, partly reversed by tariff increases in 2006 and 2009 that were motivated by the rise in international fuel prices. While private households saw their tariffs increase by 7 per cent from July 2006, they were exempted from the increase in tariffs for industry and other end-users in 2009. In other words, tariffs for private households and small commercial enterprises that are serviced by municipal utilities and ONE have not changed since mid-2006. The financial position of ONE has been weak in recent years.

This largely reflects the persistent disparity between rising production costs due to higher fuel prices and the regulated transmission and distribution tariffs. In the event, ONE has been selling its electricity to distributing companies and end-users at a price below production cost. This led to a massive operational deficit of 2 billion dirhams (US$247 million) in 2011. Morocco now has the lowest electricity tariffs in the MENA region, for both domestic and industrial use. The upshot is that the long-term financial viability of ONE will hinge on adequate tariff reform. The Government has announced the ambitious target of increasing the share of renewable energy (wind, solar and hydro) within the country's total installed electricity generation capacity to 42 per cent by 2020 (chapter 12). But the incentive measures for the development of renewable energies have so far remained limited. Thus, there are no feed-in tariffs or quotas foreseen for supporting the development of renewable energies.

But well-designed subsidies are, in general, a necessary condition for renewable energies (notably solar) to be financially sustainable, given that the

associated costs are well above those of fossil fuels. Currently, electricity from renewable sources can only be connected to the national grid (medium and high voltage) at conditions that are determined by the State regulator.

Motor vehicle-related fees and taxes

There has been a significant extension of the road network over the past decade or so. Roads are the dominant mode of transport, by far, accounting for more than 90 per cent of passenger traffic and 75 per cent of freight transport. Motor vehicle owners and road users are subject to a number of taxes and user charges, which are partly channelled to the Special Road Fund for the construction and maintenance mainly of national roads. These include, notably, the annual tax on motor vehicles and the axle load tax for trucks. Fuel taxes are also allocated to the Special Road Fund.

Annual tax on automobile vehicles

The annual tax on motor vehicles, established in 1953, must be paid annually by vehicle owners. Up to 2009, the tax depended on three factors: the fiscal horsepower (HP) of the vehicle, the type of petrol used (gasoline or diesel) and the type of owner (physical person or legal person). There were four HP classes for cars owned by physical persons and two for vehicles owned by legal persons.

A reform that entered into force at the beginning of 2010 abolished the distinction between physical and legal persons by introducing a uniform tax for each of the four fiscal HP categories. The level of the tax continues to depend also on the type of motor fuel used. There are a number of exemptions from the tax, which include, notably, vehicles for common public transport of persons, utility vehicles with a weight of more than three tons, taxis, tractors and motor cycles. An exemption for vehicles older than 25 years, which was introduced in 2010, has been abrogated as of 2013. The payment of this tax is strictly controlled, and a corresponding sticker (vignette) to be put onto the windscreen is legal proof of payment.

The tax rate that was applied until 2009 had been unchanged since 1996. Given the sizeable cumulative rate of inflation, there was, consequently, a significant decline in the tax in real terms. The reform of the tax in 2010 significantly increased the difference in tariffs for vehicles of more than 11 fiscal HP compared with vehicles below that threshold. This can be seen as tantamount to a stronger emphasis on the polluter-pays principle. This feature has become even more pronounced with the further strong increase in tariffs from the beginning of 2013 (table 4.7).

An interesting feature is that the tax which is applied to vehicles with diesel motors is much higher, at least by a factor of two, compared with vehicles using gasoline.[9] The rationale for this sizeable difference is not obvious. Thus, as of 2013, the tax for the top HP class (15 or more HP) for a vehicle with a diesel motor amounts to 20,000 dirhams (about US$2,470), whereas the corresponding tax for a vehicle using gasoline is only 8,000 dirhams (US$988). In 2011, the revenues from the vignette amounted to about 1.51 billion dirhams (some US$194 million), up from 1.44 billion dirhams (US$184 million) in 2010. The total number of vehicles subject to the tax was some 2.3 million, of which 60 per cent used diesel.

Vehicle first-time registration tax

At the time of their first registration in Morocco, all vehicles are subject to a one-off registration tax (taxe d'immatriculation). Up to 2009, the tax depended on the fiscal HP and age of the vehicle (below or above five years.). The tax had not changed between 1996 and 2009. As of 2010, the tax was simplified and now depends only on the fiscal HP class. There was a significant increase in the registration tax in 2012, when it more than doubled for each tax class compared with 2010 (table 4.8). The annual revenues amounted to some 770 million dirhams (US$95 million), up from 730 million dirhams (US$90 million) in 2010.

Axle load tax

This annual tax was introduced in 1989, and it is applied to motor vehicles used for the transport of goods and passengers. The tax serves as a kind of user fee designed to compensate, at least partly, for the (anticipated) damage done by heavy vehicles to the road network. The tax is, with some exemptions, applied to all vehicles with a total laden weight above three tons. The tax, which was last modified according to the 2004 Finance Law No. 26-04 for the fiscal year 2005, ranges from 800 dirhams (about US$99) to 11,000 dirhams (US$1,358) per annum. The maximum tax is applied to vehicles with a total permitted load of more than 40 tons. Revenues are earmarked for financing road maintenance works.

[9] The exception is small utility vehicles (pick-ups) owned by private persons, for which the tariff is independent of the type of petrol used.

Table 4.7: Annual tax on automobile vehicles, dirhams

Vehicle category by fuel	Date effective	Fiscal horsepower (HP)			
		less than 8	8 to 10	11 to 14	15 and over
Petrol	1.1.2010	350	650	2,000	4,000
	1.1.2013	350	650	3,000	8,000
Diesel	1.1.2010	700	1,500	5,000	10,000
	1.1.2013	700	1,500	6,000	20,000

Source: Ministry of Finance and Privatization, General Directorate for Taxation, General Tax Code 2010 and 2012, art. 262.

Table 4.8: Vehicle registration tax, dirhams

Year	Fiscal horsepower (HP)			
	less than 8	8 to 10	11 to 14	15 and over
2009	1,000	2,000	3,000	4,000
2012	2,500	4,500	10,000	20,000

Source: Ministry of Finance and Privatization, General Directorate for Taxation, General Tax Code 2010 et 2012, art. 252.
Note: Tax to be paid on first registration of vehicles that are subject to the annual tax on automobiles. Tax for 2012: effective as from 17 May 2012.

Coach tax

There is a tax on coaches for public transport of passengers, which depends on the nature of the coach. The revenues are allocated to the local authorities.

Fees for technical inspection of vehicles

All motor cars are subject to regular technical inspections in Morocco. In general, there are annual technical visits, which commence five years after the first registration in the case of new motor vehicles. Buses and vehicles used for public urban transport have to undergo an inspection twice a year. Trucks with an authorized charge of at least 3.5 tons are subject to annual inspection from the date of their registration. Motorcycles have been subject to technical inspections only since 2012. The inspections include a pollution test, but only where the engine fuel used differs from the one indicated in the car documents.

The fees for the technical inspection depend on the vehicle category; they range from 200 dirhams (US$24.70) for light vehicles to 400 dirhams (US$49.40) for heavy vehicles with a permitted total charge of at least 15 tons, and buses/coaches.

Additional fees apply when additional technical visits are necessary. The fees are specified in the *Cahier des charges* No. 143/SecMin/06 of 14 December 2006 of the Ministry of Equipment and Transport. It is noteworthy that there is no special vignette to be put onto the windscreen which certifies that the inspection has indeed been carried out and which would facilitate police control of conformity with the rules. All vehicles subject to technical inspections are also subject to a separate inspection tax, which also varies with the fiscal HP size. It ranges from 30 dirhams (US$3.70) to 100 dirhams (US$12.35). The revenues from the latter tax are allocated to the regional authorities. The inspections focus mainly on traffic security; there is no assessment of compliance with environmental pollution standards.

Fees for use of national motorways

The National Motorway Company of Morocco was established in 1989 for the purpose of constructing, maintaining and operating motorway infrastructure. The company, which operates on the basis of concession contracts, is under the technical supervision of the Ministry of Equipment and Transport and under the financial supervision of the Ministry of Finance and Privatization. The use of motorways is subject to payment of a road toll; the revenues are allocated to financing the activities of the National Motorway Company. Tariffs depend on the length and height of vehicles as well as the number of axles. Vehicles are categorized into three tariff classes. Revenues from user fees amounted to 1.525 billion dirhams (about US$188 million) in 2010, up from 1.004 billion dirhams (US$124 million) in 2007. User fees accounted for 91.4 per cent of total revenues of the National Motorway Company in 2010.

Motor vehicle scrapping premium

Against the backdrop of steady economic growth and a growing population, the number of registered motor vehicles has increased significantly over the past decade or so. In 2011, the total number of road motor vehicles was 2.95 million, up from 2.3 million in 2007. Some 70 per cent of these vehicles are passenger cars. Along with the strong growth in the number of vehicles, there has been strong growth in the consumption of motor fuels.

At the same time, the average age of the motor vehicle fleet is quite high. In 2008, nearly three-quarters of vehicles had an age of more than 10 years, and only 8 per cent were less than five years old. The average age of the passenger car fleet was 17.5 years in 2005. Given that aged cars generally perform less well as regards traffic security and air pollution, the Government has launched a subsidy programme designed to create incentives for the scrapping of old vehicles.

In 2008, the Government established a fund endowed with 400 million dirhams (US$49.4 million), designed to stimulate the rejuvenation of the vehicle fleet (trucks, buses, taxis) with a scrapping premium. However, in view of controversies about the modalities of the scrapping premiums for buses and taxis, only the programme for trucks was eventually launched for the period 2008–2011. It has been managed by the Ministry of Equipment and Transport. Only trucks with an age of more than 15 years and a minimum authorized charge of 8 tons were eligible for the programme. The Government hoped to replace about half of the approximately 12,500 vehicles that met these criteria. The two main principles of the support scheme were the definitive withdrawal from circulation of the vehicle and a procedure for its demolition, and replacement of the retired vehicle by a new one with a permitted total charge of at least 15 tons.

The total planned budget for 2008–2010 was 510 million dirhams (US$63.75 million). A further 170 million dirhams were allocated for the year 2011. Although the premiums were increased twice, the programme was not very successful. Only some 600 new trucks were purchased with the support of the scrapping scheme, so that only 11 per cent or so of the available funds were actually spent.[10] This happened despite the National Federation of Road Transport (Fédération nationale de transport routier) supporting the scheme by concluding an agreement with a local truck dealer, a bank and an insurance company in order to create more conducive financing conditions for truck transport operators.

A major obstacle was that the scrapping premium was not high enough to entice transport operators, given that the selling prices of the old trucks in the second-hand market were generally significantly higher than the subsidies offered. Another constraining factor was that the merchandise road transport sector is dominated by small, often single-person companies that have no culture of financing their investments by borrowing from banks. And banks, in turn, considered these companies too risky for lending to, given their weak cash flow and asset base. The Government plans to increase the scrapping premium within the framework of the 2012 Finance Law. But this does not address the problem of transport operators having limited access to bank financing.

Import restrictions

Given that a large number of second-hand cars are being imported, the Government has established a maximum age of five years for these cars as of the beginning of 2011. This was motivated by the goal to reduce urban air pollution. But the measure was, at least partly, also designed to protect domestic vehicle producers from competitive pressures associated with the import of second-hand cars. Imported second-hand cars with an age of less than five years have to undergo a technical inspection before they can be officially registered.[11] Some rejuvenation of the passenger car fleet has also been due to the introduction of locally produced small cars by foreign companies since the mid-1990s.

Subsidies for petroleum products

Since the beginning of the 1940s, the Moroccan authorities have been operating a subsidy system designed to shield industry and households from price surges for a number of primary products in international markets. The scheme is managed by the Compensation Fund (Caisse de compensation), which operates under the responsibility of the Chief of the Government and, by delegation, under the responsibility of the Ministry of Economy and Finance. It currently covers petroleum products (gasoline, diesel and fuel oils) as well as flour and sugar. The administered prices for these products to be paid by the final consumers are established in

[10] Renouvellement du parc des poids lourds : la prime à la casse sera augmenté pour la troisième fois, *La Vie Economie*, 15 October 2012 (www.lavieeco.com).

[11] Decree No. 2-10-321 establishing the road code for vehicles.

special government regulations. In 2011, price subsidies for petroleum products amounted to 44.55 billion dirhams (US$5.5 billion), corresponding to 5.5 per cent of GDP (table 4.9). The cumulative subsidies during the period 2006–2011 amounted to 117.7 billion dirhams (US$14.5 billion). The extent of subsidization differs among the various petroleum products. The share of the subsidy in the cost recovery price (in 2011) was 21 per cent for gasoline and about 35 per cent for diesel. This share amounts to some 60 per cent for some types of fuel oils and to 67.7 per cent for butane gas (table 4.10).

Against the background of a price surge in the international oil markets in the early months of 2012, the Compensation Fund had to increase its subsidy expenditures to levels that were significantly higher than planned in the State budget. In June 2012, in order to avoid a much higher than planned State budget deficit, the authorities decided to significantly increase retail prices of petroleum products, with the exception of bottled butane gas. Gasoline prices were increased by some 20 per cent, diesel prices by some 10 per cent and industrial fuels by some 27 per cent. The expected resource savings through to the end of 2012 are estimated at some 4.5 billion to 5 billion dirhams (US$0.55 billion to US$0.62 billion). This corresponds to some 10 per cent of total subsidies for petroleum products planned for 2012.

Table 4.9: Subsidies for petroleum products, 2006–2011

Year	Value of subsidies		
	dirham billion	US$ billion	Per cent of GDP
2006	7.41	0.91	1.30
2007	10.70	1.32	1.70
2008	24.20	2.99	3.50
2009	7.16	0.88	1.00
2010	23.71	2.93	3.10
2011	44.55	5.50	5.50

Source: Caisse de compensation, direct communication.
Note: Petroleum products comprise gasoline, diesel, fuel oils and butane gas.
Exchange rate: US$1 = 8.1 dirhams.

The whole subsidy scheme has become more controversial in recent years. It is somewhat paradoxical that subsidies for fuel products accompany strong fiscal charges of some importance (VAT and a so-called domestic consumption tax (taxe sur la consommation intérieure) on the same fuel products, which helps to partly offset the costs in the government budget. And while the major rationale for the subsidies is to protect the purchasing power of final consumers with low incomes, the fact is that the subsidies are available to all, i.e. including the better-off.

Thus, the 20 per cent of households with the highest incomes receive some 75 per cent of the government subsidies for diesel and gasoline. And the 20 per cent of households at the bottom of the income scale receive only 1 per cent of the subsidies. Industry also benefits substantially from the subsidy scheme. In 2011, one third of the total fuel oil (fiouls) subsidies of 4.5 billion dirhams (US$0.555 billion) went to the State-owned monopoly OCP (previously Office Chérifien des Phosphates) and private industry, and two-thirds to ONE, the National Office of Electricity.

More generally, the subsidy scheme encourages overconsumption by keeping prices of petroleum products significantly below the cost recovery level. At the same time, this installs a bias in industrial investments towards technologies based on intensive use of fuel oils. Moreover, in the context of limited State budget resources overall, the funds used for subsidizing fuel are drawing resources away from key sectors such as health, education and basic infrastructure. It is now generally acknowledged that the system of fuel subsidies (as well as food subsidies) should be reformed with proper focus on low-income households. The reform could be inspired by the new medical assistance scheme, which, based on well-defined eligibility criteria, ensures access to medical treatment for the poor.

Mineral extraction levies

The mineral extraction sector is subject to a number of fees and taxes, which are, however, purely revenue-raising instruments. There are no legal provisions that introduce environmental considerations into this activity. The contribution of the Moroccan mining and quarrying sector to GDP corresponded to 5.2 per cent in 2011, up from 2.3 per cent in 2009, i.e. it has become an increasingly important source of export revenues. The large bulk of mining output is accounted for by phosphates. In fact, Morocco is among the world's largest producers and the leading exporter of crude phosphates. The extraction of phosphates is controlled by OCP. A phosphate extraction tax was introduced in 1992, amounting to 34 dirhams (US$4.20) per ton of crude or processed phosphate that was exported. However, the tax was abolished in 2008.

The exploitation of mineral resources other than phosphate is controlled by the National Office of Hydrocarbons and Mines.

Table 4.10: Specific price subsidies for petroleum products, 2011

	Gasoline	Diesel	Fuel No. 2	Fuel ONE	Fuel Special	Butane gas
	dirham/litre		dirham/ton	dirham/ton	dirham/ton	Bottle 12 kg
Price excl. subsidy	12.9	11.1	6,049.8	5,848.3	7,126.5	123.7
Maximum retail price	10.2	7.2	3,678.0	2,384.8	2,600.9	40.0
Subsidy	2.7	3.9	2,371.8	3,463.5	4,525.6	83.7
Share of subsidy in price (per cent)	21.0	35.3	39.2	59.2	63.5	67.7
Memorandum item:						
Maximum retail price in US$	1.3	0.9	454.1	294.4	321.1	4.9

Source: Caisse de compensation, direct communication.
Note: Price excluding subsidy = cost recovery price.
Exchange rate: US$1 = 8.1 dirhams.

In contrast to the phosphate sector, private sector companies participate in the extraction of other minerals (e.g. barite, salt, zinc, lead) on the basis of joint ventures with the National Office of Hydrocarbons and Mines. The current regulatory framework goes back to 1951; a new mining code has been under development for several decades. Companies engaged in the sector are subject to a fee of 2,000 dirhams (US$247) for an exploration permit and 7,000 dirhams (US$864) for an exploitation permit, as well as an annual tax of 6,000 dirhams (US$740) in the case of long-term concessions (up to 75 years).

These levies were established in 1957[12] and have not changed since. Supplementary levies apply on renewal of permits and concessions. Since 2004, the mining sector has benefited from total exoneration of VAT paid on purchases of diesel used by road freight transport vehicles. A "depletion allowance" (provision pour reconstitution de gisement) for the mining sector was abolished in 2008. It allowed mining companies to accumulate funds – free of tax up to 50 per cent of taxable profits – for creating a social fund (20 per cent), which was based on investments in one-year treasury bills, and for covering the costs of mining rehabilitation (80 per cent). This measure has potentially adverse consequences for the self-financing of mining companies and, above all, for workers who have to be dismissed on the closure of mines.

Quarries extraction tax

The tax base for this tax is the volume of extracted substances. The tax rate varies from 5 dirhams (US$0.62) to 25 dirhams (US$3.10) per unit of measurement (ton; m^3) depending on the type of substance. The revenues are collected by the State treasury; 90 per cent are allocated to the budget of the communes where the activities are located and the remainder goes to the budget of the regional authorities. The current legislation concerning environmental impact assessment, damage liability and responsibility for the financing of rehabilitation at the end of exploitation activities is insufficient.

The 2002 Law No. 08-01 on the Exploitation of Quarries (adopted in 2007) contains general provisions concerning these issues, but its entry into force was contingent upon the issuing of implementation legislation, which has not occurred. The sector is, therefore, still mainly governed by a law adopted in 1914. However, a new draft law appears to be in the pipeline, designed to settle these issues. It is likely to be adopted in the course of 2013.

Forestry exploitation

Forest and hunting management are assigned to the High Commission for Water, Forestry and Desertification Control. The strategic objectives of forest management are defined in the National Forest Programme and include, besides nature conservation and protection of biodiversity, the production of wood for industrial processing and to contribute to the socioeconomic development of the population living in rural areas. The forest sector accounts for about 1 per cent of GDP in Morocco. The High Commission organizes annual sales of wood for cutting based on public tenders.

These sales are subject to a special Forest Fund tax, which corresponds to 20 per cent of the base price, i.e. excluding all taxes and charges. It was introduced in 1986. Of the total revenues collected from the base price, 80 per cent are allocated to the budgets of the communes where the corresponding plots of land are located and the remainding 20 per cent is allocated to the national Forest Fund (Fonds Maroc Forêts). In

[12] 1957 Decree No. 2-57-1647 setting down certain rules to implement the provisions of the mining regulations relating to institutional charges or renewal of mining permits, the annual concessions fee, and obligations relating to works undertaken by mining concessionaries and permit-holders.

2010, total revenues collected from the sales of wood amounted to some 357 million dirhams (US$44 million). It is noteworthy that in 2008–2010, the budget of the Forest Fund represented more than 80 per cent of the investment budget of the High Commission. As of 2009, there is also a tax on the import of wood products, which is channelled to the Forest Fund. The total planned budget of the Forest Fund amounted to 300 million dirhams (US$37 million) in 2012. The revenues allocated to the Forest Fund are earmarked for the financing of afforestation, silviculture and improvement of the forest domains, as well as research.

Hunting fees

The basic legal rules for hunting are established in the 1923 Dahir on hunting, which was last modified in 2006 by Dahir No. 53-06. The law is supplemented by an annual order that specifies the dates of the hunting season, special rules concerning the hunting of certain species (such as boar), and charges to be paid. The basic fee for a hunting licence is 150 dirhams (US$18.50) for nationals and 1,000 dirhams (US$123.50) for foreign tourists.

Sanctions are imposed in the event of non-compliance with the established rules. To illustrate, the fine for hunting without a licence amounts to 3,000 dirhams (US$370), that for hunting outside the official season is 8,000 dirhams (US$990), and the hunting of protected species is subject to a fine of 14,000 dirhams (US$1,730). These fines are minimum amounts, which were established in 1993. Revenues from hunting permits and fines are allocated to a special national Hunting Fund (Fonds de la chasse), the main aim of which is to invest in the rehabilitation of hunting areas and nature conservation, including afforestation.

There is also a special programme under which certain hunting areas can be leased by hunters. (This is based on a special hunting leasing law.) The leasing agreement obligates hunters to invest in the conservation and habitat rehabilitation of the hunting lands according to an annual management plan approved by the High Commission.

This programme is also associated with the creation of employment in rural areas. The revenues from these leasing programmes are also allocated to the Hunting Fund. In the 2011–2012 hunting season, the revenues of the Hunting Fund amounted to some 32.8 million dirhams (US$4 million), an increase of 8 per cent over the preceding hunting season.

4.3 Environmental expenditures and their financing

As a middle-income country, Morocco has largely been able to generate its public financial resources internally. Official development assistance (ODA), accordingly, plays a much less prominent role than in low-income countries. The government budget has a separate chapter for the Department of Environment, in respect of both recurrent and investment expenditures. However, no information on the corresponding effective expenditures was made available. The budget allocations for environment-related expenditures are widely dispersed among various government departments and ministries, including the Department of Water; the High Commission for Water, Forestry and Desertification Control; the Ministry of Agriculture and Maritime Fisheries; the Energy Department; and the Ministry of the Interior. There is a functional classification of government budget expenditures according to major areas in which the State is involved, but there is no separate category for environmental protection expenditures. The external financial assistance (grants and loans) received by Morocco is, moreover, integrated into the government budget. This means that domestic funding cannot be distinguished from foreign funding of programmes and projects at the programme budget level.

The 2012 Finance Law No. 115-12 for the fiscal year 2013 allocated 820 million dirhams (US$101 million) to the investment budget of the Department of Environment, of which about 75 per cent were allocated to the financing of the National Programme of Sanitation and Wastewater Treatment (400 million dirhams) and the National Solid Waste Management Plan (230 million dirhams). The total investment budget of the Department of Environment corresponds to some 2 per cent of the total State investment expenditures.

Financing mechanisms

National Environment Fund

The National Environment Fund was formally established as a special account in 2007 Finance Law No. 38-07. It is managed by the Department of Environment and has been endowed annually with funds from the general government budget.

Fund for Industrial Depollution

The Fund for Industrial Depollution (FODEP) was established with support from the German Kreditanstalt für Wiederaufbau (KfW) which, since

1998, has provided three grants with a total financial envelope of 240 million dirhams (US$29.6 million). The goal of the Fund is to provide financial incentives for small and medium-sized enterprises (SMEs) to invest in pollution abatement and control measures, as well as solid waste projects. Only enterprises with a total balance sheet of less than 400 million dirhams (US$49.3 million) are eligible. The maximum level of investment cost per individual project per company is 15 million dirhams (US$1.85 million). In the case of a joint project of several enterprises, the maximum investment cost amounts to 30 million dirhams (US$3.7 million).

The FODEP is managed by the Department of Environment and supports the financing of projects by means of non-reimbursable subsidies, which – depending on the type of project – can range from 20 per cent to 40 per cent of total project value. The minimum self-financing share for the company is 20 per cent. Any shortfall of funds must be mobilized in the banking sector. Up until May 2012, 114 projects had been supported with a total project value of 635 million dirhams (US$78 million), of which FODEP grants accounted for 242 million dirhams (US$30 million), corresponding, on average, to 38.5 per cent of total project value. The large bulk of projects in terms of number, project value and grants were in the wastewater sector (table 4.11). Overall, the total cumulative investment funds invested since 1998 were relatively small, corresponding to less than 0.1 per cent of GDP in 2011. Cumulative FODEP grants corresponded to 0.03 per cent of GDP in 2011.

Voluntary mechanism for the depollution of industrial water

This is a financing mechanism that became operational in 2011. The goal is to finance projects (within the framework of the National Programme of Sanitation and Wastewater Treatment) that reduce discharges of polluted water by means of the installation of water treatment equipment at the WBA or industrial company level. The fund is supported by EU grants totalling 100 million dirhams (US$12.4 million) over the period 2011–2013. In a similar vein to the FODEP, grants are provided within a range of 20 per cent to 40 per cent of total project value. In 2011, 25 projects with a total value of 321 million dirhams (US$39.6 million) were supported with grants totalling 30 million dirhams (US$3.7 million), complemented by an additional subsidy of 76 million dirhams (US$9.4 million) from the government budget. The latter amount was planned to be transferred from the National Environment Fund but, as this was not feasible given the lack of operational rules, the contribution was directly transferred from the general budget.

Energy Development Fund

The National Renewable Energy and Energy Efficiency Plan was launched in February 2008. In 2009, an Energy Development Fund was established to support the new national strategy for the development of the production of electricity from renewable energy sources and the improvement of energy efficiency. Part of the resources of the Fund will be used for rehabilitation of the production capacities of ONE.

The Fund has an initial endowment of US$1 billion. The shareholders of the Fund are Saudi Arabia (US$500 million), the United Arab Emirates (US$300 million) and the Hassan II Fund (US$200 million). The Fund also obtained significant financial support of US$125 million from the Clean Technology Fund under the United Nations Framework Convention on Climate Change. But important governance, institutional and administrative issues still need to be resolved before the Energy Development Fund can become operational.

Municipal Equipment Fund

The Municipal Equipment Fund, which has existed since 1959, is a public sector bank that specializes in the financing of local government investment projects. Eligible project areas include, inter alia, basic services such as urban development, urban transport, rural electrification, sanitation and access to water supply and solid waste management, and green urban spaces. The Fund is administered by a board of directors, which is chaired by the Minister of the Interior. The board is composed of representatives of the central government administration, the General Manager of the Caisse de Dépot et de Gestion and eight elected representatives of the local authorities. Local authorities that borrow funds from the Fund have to meet a number of conditions concerning their financial sustainability. These generally include a self-financing ratio of at least 20 per cent of the cost of the project, which can also take the form of in-kind contributions such as land purchased for the project. Loans can be granted for a period of up to 15 years. Since its creation, the Fund has granted more than 30 billion dirhams (US$3.7 billion at the average annual exchange rate of 2011) of loans in favour of the local communes. Total annual loan disbursements amounted to 1.6 billion dirhams (US$198 million) in 2011.

Table 4.11: Fund for Industrial Depollution

Environmental domain	No. of projects	dirham (million)		% of project value
		Project value	FODEP grant	
Wastewater discharge	93.0	558.0	216.0	38.7
Atmospheric air pollution	47.0	47.0	18.0	38.3
Solid waste	6.0	30.0	8.0	26.7
Total above	114.0	635.0	242.0	38.1
Memorandum item:		US$ million		
Total above	114.0	78.0	30.0	38.5
Per cent of GDP in 2011		0.08	0.03	

Source: Fund for Industrial Depollution.
Note: Status at end of May 2012. Figures are rounded. Exchange rate: US$1 = 8.1 dirhams.

The large bulk of this (67.3 per cent) was allocated to urban development. Loans related to investments in sanitation services, wastewater treatment and solid waste management amounted to 78.7 million dirhams (US$ 9.7 million) or 4.9 per cent of total loan disbursements in 2011. In 2010, the total disbursement related to the latter areas amounted to 96.4 million dirhams (US$11.9 million), corresponding to 5 per cent of the total loan disbursements of 1.93 billion dirhams (US$238 million). The overall role of the Fund in the areas of wastewater and solid waste management was, however, relatively small, given that the corresponding loan disbursements corresponded to only 0.3 per cent of total government expenditures in 2010 and 2011.

It is noteworthy that the Fund has established a partnership agreement with the World Bank designed to provide technical and financial support to local communes for the setting up of clean development mechanism (CDM) projects in the municipal waste sector, viz. the collecting of biogas from landfills and its conversion into renewable energy.

Main sectoral policies and programmes

National Initiative for Human Development

The National Initiative for Human Development (INDH) is a programme that was launched by King Mohammed VI in 2005 with the focus on reducing poverty, vulnerability and social exclusion. It has been supported by loans from the World Bank. The first phase of the INDH, 2006–2010, had total budget support of some US$1.7 billion, which was raised to US$2.1 billion for the second phase, 2011–2015. Among the activities of the INDH is improving the conditions of access to basic infrastructure services such as education, health, roads, water supply and sanitation, and environmental protection. The Initiative has, inter alia, co-financed connections to water supply and sanitation networks in informal settlements in major cities. Pilot projects were developed by the private water companies in Casablanca, Tangier and Tétouan as well as the public utility in Meknès, using output-based assistance. This project was also supported by subsidies from the Global Partnership for Output-based Aid, a World Bank programme.

National Programme of Sanitation and Wastewater Treatment

The National Programme of Sanitation and Wastewater Treatment which was established in 2005, aims to increase the connection rate to sewerage networks in urban areas to 75 per cent by 2016, to 80 per cent by 2020 and to 100 per cent by 2030, and to reduce the pollution from wastewater discharges by 50 per cent by 2016, by 60 per cent by 2020 and 100 per cent by 2030. The programme envisages constructing WWTPs for 330 human settlements. The aggregate investment costs are estimated at 50 billion dirhams (US$6.16 billion) up until 2020. The Programme covers 206 urban communes and is to be implemented by the municipal water utilities and ONEP (50 per cent to 70 per cent of financing costs) and the local governments (30 per cent to 50 per cent).

The main financing sources are State budget funds, as well as grants and loans from international donors. Part of the State budget resources are collected in the National Sewerage and Wastewater Fund (Fonds National d'Assainissement Liquide et d'Epuration des Eaux Usées), which is managed as a special account by the Ministry of the Interior. To this, general State budget resources as well as allocations of an earmarked share of VAT revenues are to be added. Any shortfall of resources at the local government level is, in general, also compensated for by State budget funds.

Table 4.12: State financial support for the National Programme of Sanitation and Wastewater Treatment, million dirhams

Source	2008	2009	2010	2011	2012	Total
FALEEU	363	458	463	331	530	2,145
Allocations from VAT	70	47	58	61	70	306
General State budget	0	86	151	53	0	290
Total above	433	591	672	435	600	2,731
Memorandum item:						
Total in US$ million	53.5	73.0	83.0	53.7	74.1	337.2

Source: Department of Environment, 2012.
Note: FALEEU = Fonds National d'Assainissement Liquide et d'Epuration des Eaux Usées.
Exchange rate: US$1 = 8.1 dirhams.

In all, these resources for the PNA amounted to 2.7 billion dirhams (US$337 million) in 2008–2012 (table 4.12). Private concession holders that operate water supply and sanitation under delegated management contracts are not supported by the PNA but have to undertake the corresponding investments within the framework of the delegation contract. Apart from its major sanitary and environmental benefits, it is estimated by the Government that the PNA will have a fiscal impact of 300 billion dirhams (US$37 billion), create 10,000 jobs in the sector of engineering and public works, and contribute to the development of tourism in Morocco.

National Solid Waste Management Programme

The National Solid Waste Management Programme was launched in 2006, designed to improve the collection, transport, treatment and disposal of solid household waste and similar waste. Estimated costs amount to 37 billion dirhams (US$4.6 billion) over the period 2006–2021. It is planned that the local governments, including the local private waste operators, will finance about three-quarters of the necessary investments.

Other financing sources are revenues from a landfill tax (redevance d'enfouissement), revenues from landfill-related CDM projects and State subsidies, as well as foreign financial assistance. In 2008–2011, State budget subsidies for the Programme amounted to 1.8 billion dirhams (US$223 million). The Programme has been supported by a World Bank Policy Development Loan of US$400 million.

National Programme for Saving Irrigation Water (PNEEI)

This programme is an integral part of the agricultural strategy Morocco Green Plan, which was adopted in 2008. The PNEEI aims to achieve the conversion to localized irrigation of about 555,000 ha of land during the period up until 2015. This would increase the total surface of land endowed with localized irrigation to 700,000 ha, corresponding to about 50 per cent of all irrigated land.

The expected benefits are substantial water savings, lower vulnerability of irrigated agriculture to climate change and an increase in water productivity. The total costs are estimated at some 37 million dirhams (US$4.6 million), of which 30 million dirhams are for fixed investments and the remainder for technical assistance and capacity-building. The project is supported, inter alia, by loans from the European Investment Bank (EIB) and the World Bank.

The major domestic source of financial support for irrigation-related investments is the Agricultural Development Fund (Fonds de Developpement Agricole). It has revised its subsidy policy to achieve better targeting of the main goals of the new Government strategy with regard to irrigation. Subsidies range from 80 per cent to 100 per cent for localized irrigation investment, and 50 per cent for complementary irrigation projects (such as development of water basin storage capacity).

Rural Water Supply Programme

The Rural Drinking Water Supply Programme (PAGER) was launched in 1995 to increase the rate of access to drinking water for the rural population. It has two operating principles: the use of simple technologies and the participation of beneficiaries in all stages of the projects. The access rate to drinking water was raised from 14 per cent in 1995 to 92 per cent in 2012 in rural areas.

Clean Development Mechanism

Morocco has great potential for carbon finance from Clean Development Mechanism (CDM) projects. In April 2012, there were 39 projects, of which eight were registered and 13 at the validation stage.

Among the eight registered projects, five are in the wind energy domain. The remainder are solar photovoltaic, waste management and biomass energy projects. Total carbon emission reduction credits of the registered projects amount to 1.05 million tons/year. Given the depressed state of the international carbon market (some US$4 per ton), this corresponded to only some US$4 million/year at the end of January 2013.

Foreign financial support

Total official development assistance (ODA) to Morocco corresponded to 1 per cent of GDP in recent years. ODA related to general environmental protection (including waste management) had a share of only 1.67 per cent in total ODA disbursements in 2003–2011, while water supply and sanitation had a share of 9.8 per cent (table 4.13). There are bi-annual donor co-ordination meetings organized by the Government in the environment sector, but this is mainly about the sharing of information rather than joint planning and implementation (chapter 5). The Department of Environment maintains a register of bilateral and multilateral projects that are managed by the Department. The total value of projects that were being implemented in 2011 and beyond is €109 million (table 4.14). But environment-related projects are also managed by other government entities, such as the Department of Water and various ministries.

Multilateral assistance

African Development Bank

The African Development Bank (AfDB) has been involved in the financing of a number of drinking water supply and sewerage investment projects going back to the 1970s. There were three active projects in 2012, with a total loan portfolio of about US$500 million. AfDB also provided a loan of US$85 million relating to the environmental upgrading of the national refinery SAMIR, which is the main supplier of refined petroleum products on the Moroccan market, covering more than 90 per cent of market needs. The Bank has also been instrumental in the provision of a grant of €1.89 million by the African Water Facility for improving water resources management in the Haouz basin in 2009–2012, and the operational aspects of this project. The AfDB hosts the facility on the request of the African Ministers' Council on Water.

European Union

The EU is the major multilateral donor of funds to Morocco. Since 2007, cooperation between the EU and Morocco has been organized within the framework of the EU's European Neighbourhood Policy (ENP). Specific assistance in major economic and social sectors has been specified in the National Indicative Programme (NIP) for 2007–2010 and 2011–2013, with environmental protection being a priority in both. The programme for 2007–2010 committed €15 million for the FODEP. Furthermore, €35 million were allocated for sewerage treatment in support of the implementation of the PNA. A first tranche of €30 million had already been allocated under the 2006 NIP.

The environmental projects within the framework of NIP 2011–2013 focus on the integration of environmental standards (including ISO 14001 and environmental audits) in economic activities and support for sustainable forest policy. The total funds committed amount to some €87 million, corresponding to 15 per cent of the total commitments for NIP 2011–2013. There is also financial support provided within the framework of the initiative Horizon 2020, which aims to substantially reduce the pollution of the Mediterranean Sea by tackling the major polluting sources (municipal waste, urban wastewater and industrial effluents). The cooperation between the EIB and Morocco has been taking place under the Facility for Euro-Mediterranean Investment and Partnership (FEMIP). In 2012, the EIB provided a loan of €42.5 million for the National Programme for Saving Irrigation Water of the Green Morocco Plan (Plan Maroc Vert (PMV)), for financing the conversion of some 21,500 ha of the existing public irrigation network into localized systems.

Global Environment Facility

The Global Environment Facility (GEF) has been supporting a range of projects in Morocco related to climate change and biodiversity. The three major projects under implementation in 2012 are:

- Middle Atlas forest restoration project (GEF grant of US$0.965 million);
- Safe management and disposal of PCBs – Pillar I and II (US$4.65 million);
- Updating of National Biodiversity Strategy and Action Plan, development of a national clearing house mechanism, capacity assessment for the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity (US$0.21 million).

Table 4.13: Official development assistance (gross disbursements), US$ million

Sector	2003	2004	2005	2006	2007	2008	2009	2010	2011
General environmental protection	10.30	9.28	11.57	12.00	11.37	45.33	40.89	25.53	11.51
Water supply and sanitation	47.03	73.39	118.69	158.63	82.84	121.22	122.34	145.16	173.15
Total ODA (all sectors)	520.65	598.07	922.30	1,110.14	1,345.94	1,405.29	1,415.58	1,447.84	1,885.18
Memorandum item:									
ODA as per cent of GDP									
General environmental protection	0.02	0.02	0.02	0.02	0.02	0.05	0.04	0.03	0.01
Water supply and sanitation	0.09	0.13	0.20	0.24	0.11	0.14	0.13	0.16	0.17
Total ODA (all sectors)	1.05	1.05	1.55	1.69	1.79	1.58	1.56	1.60	1.90

Source: OECD DAC database; creditor reporting system (www.stats.oecd.org).
Note: Gross disbursements = general environmental protection incl. waste management/disposal.

Table 4.14: Foreign-financed projects monitored by the Department of Environment

Project	Donor	Period	US$ million
Air quality surveillance	Monaco	2001-2011	0.72
Environmental policy	GIZ Germany	2002-2013	4.95
Integrated waste management	GIZ Germany	2002-2013	5.94
Industrial pollution	GIZ Germany	2002-2013	3.96
Household waste	GIZ Germany	2002-2013	4.95
Industrial depollution (FODEP)	KfW Germany	2009-2012	6.43
Capacity-building	EPA	2004-2011	0.14
Coastal area rehabilitation	MAP	2007-2011	0.53
Support for national sanitation programme and industrial depollution	EU	2010-2013	61.68
Climate change adaptation	JICA/UNDP	2009-2011	4.32
PCB management	GEF/UNDP/UNIDO	2009-2012	4.29
Pilot project solid waste management	The Netherlands	2010-2011	0.16
Development of national clearing house	GEF/UNDP	2010-2012	1.88
Institutional support for sanitation	MEDA	2007-2012	38.55
Climate change adaptation	GIZ/Germany	2011	1.48
Environment and INDH	GEF/UNDP	2012-2015	0.40
Total above			140.36

Source: Department of Environment, direct communication.
Note: Only projects active in 2011 and beyond.
EPA = United States Environment Protection Agency
GEF = Global Environment Facility
GIZ = Deutsche Geselleschaft für Zusammenarbeit (German International Cooperation)
KfW = Kreditanstalt für Wiederaufbau
JICA = Japan International Cooperation Agency
MAP = Mediterranean Action Plan
MEDA = Euro-Mediterranean Partnership
UNDP = United Nations Development Programme
UNIDO = United Nations Industrial Development Organization

Among the approved but not yet operational projects are the development of energy efficiency codes for buildings (grant of US$3 million) and a project on participatory control of desertification and poverty reduction in the arid and semi-arid high plateau ecosystems of eastern Morocco (US$6 million).

World Bank

The World Bank has supported Morocco with, inter alia, Development Policy Loans (DPLs) in the area of solid waste management, including the development of CDM projects (chapter 5). The first two tranches of €100 million each were made available in 2009 and 2011.

Two more tranches of the same size are envisaged. In a similar vein, a DPL of US$205 million has been allocated to different components of the PMV, such as irrigation water management. The Bank has also provided loans for the development of the water supply and sewerage sector, as well as a grant of US$7 million for a pilot programme on results-based aid designed to subsidize the connection of 1,200 low-income households to the water supply and sanitation network in Casablanca, Meknès and Tangier.

Bilateral assistance

France

France is the major provider of bilateral financial assistance to Morocco. The main focus of the activities of the Agence Française de Developpement (AFD) in Morocco is strengthening the competitiveness of the economy as well as the social sector, along with the promotion of sustainable development and nature conservation. The AFD projects are generally co-financed by the Fonds Français pour l'Environnement Mondial (FFEM). Environment-related projects financed in recent years (2009–2011) include:

- Support for the Solar Energy Plan: a loan of €100 million, complemented by a subsidy of €0.3 million for the first phase of the Ouarzazate project;
- Support for the second pillar (saving of irrigation water) of the Green Morocco Plan (PMV): a loan of €50 million, complemented by a subsidy of €0.3 million;
- National Programme of Sanitation and Wastewater Treatment (PNA): a loan of €20 million for the National Office of Drinking Water (ONEP);
- Water programme of OCP: a loan of €180 million to support a project with the goal that, despite a doubling of production volumes until 2020, OCP will abandon the abstraction of groundwater in favour of the re-use of treated wastewater and the use of desalinized sea water.

The AFD has also been contributing to the financing of a project that aims at the conservation of the Tafilalet oasis (one of the largest in the world). The global costs of the project are estimated at US$4.35 million, of which the FFEM finances 43 per cent. The project is co-financed by domestic resources, as well as the United Nations Development Programme (UNDP) and the Principality of Monaco.

Germany

GIZ has been operating an environmental programme for Morocco on behalf of the German Federal Ministry for Economic Cooperation and Development since 2002. The project is planned to be operated till 2017. Among the main components are technical assistance in the areas of design and implementation of environmental legislation, environmental education (the development of a handbook) and the integrated management of industrial and dangerous waste. GIZ has also promoted the domestic capacities for integrated water resources management within the framework of the programme Support to Integrated Management of Water Resources. It has also been active in the area of capacity-building for the design of legislation and support mechanisms for the development of renewable energy sources and the improvement of energy efficiency.

The Kreditanstalt für Wiederaufbau (KfW) has been providing loans for investments in renewable energy projects (wind and solar), water supply and sanitation, and sustainable industrial production. Industrial pollution abatement has been facilitated with grants totaling €25 million for the FODEP, which was established with the help of KfW in 1998. A major current project is the construction of the solar power station at Ouarzazate, which will use concentrated solar power (CSP) technology. It is supported by a loan of €150 million and a grant of €15 million. The construction of a windpark in Essaouria is supported with two loans of about €130 million. The rehabilitation of hydropower plants is financed with loans of €61 million.

4.4 Conclusions and recommendations

Morocco has made some progress as regards the use of economic instruments designed to create incentives for more environmentally friendly behaviours by households, businesses and other entities. A major lack is air pollution charges and effluent charges for major pollutants. The legal framework for water pollution charges (effluent charges) has been established, but the implementation regulations remain to be finalized. General ELVs will be published by the end of 2013 and ELVs for about 30 industrial activities are currently under negotiation with relevant industries. Moreover, the legislation does not cover the discharges of used water into the sea, which accounts for the large bulk of wastewater discharges. There are no plans to introduce taxes on emissions of air pollutants. Fines and sanctions for non-compliance with environmental standards (notably air, water and

waste) are stipulated in the legislation but, in general, they are not applied.

The main instrument used in Morocco to create financial incentives for enterprises to shift to less polluting modes of industrial production are subsidies (grants), mainly under the umbrella of the Fund for Industrial Depollution and, more recently, the "Voluntary mechanism for the depollution of industrial water".

Recommendation 4.1:
The Government should:

(a) Take the necessary measures for the effective implementation of pollution charges for the discharge of wastewater into surface water;
(b) Develop the necessary secondary legislation for the application of monetary fines, at an adequate level, for non-compliance with environmental standards established in the corresponding legislation;
(c) Evaluate the impact of environmental regulations concerning industrial air pollution and the potential role that could be played by a tax on emissions of major pollutants.

Municipalities have been assigned the legal responsibility for the provision of communal services (waste, water supply and sewerage, and electricity supply) but the operational responsibility has been predominantly transferred (based on delegation contracts) to autonomous public utilities, private companies, or ONEP (in the case of water services) and ONE (electricity).

Tariffs for these various services are all regulated by the State. There is notably no independent national regulator for water services and the electricity market. Tariff setting in many urban and rural communes does not ensure the recovery of operating costs, which makes operators dependent on state subsidies. This, in turn, endangers the financial sustainability of these services. In the water sector, moreover, the block tariff system for domestic water uses leads to a massive subsidy for the well-off households given the level of the lowest block tariff, which does not allow recovery of even the wholesale price of water.

Agriculture is a key sector of the Moroccan economy. The Green Morocco Plan launched by the Government aims at strengthening the role of the sector by shifting to higher-value-added products and less water-intensive crops. This, in turn, will require mobilizing important financial resources for the necessary investments including in the irrigation systems. These investments make it even more important to ensure that tariffs for irrigation water are at a level that allows the recovery of operating costs (including maintenance and renewal investments) to ensure the financial sustainability of the irrigation networks, which is not the case in many perimeters.

Recommendation 4.2:
The Government should:

(a) Establish an independent national regulator for water sector services (drinking water, sewerage, irrigation), as well as for the electricity markets;
(b) Implement a (gradual) tariff reform designed to improve cost recovery and ensure the financial sustainability of the water sector services operators;
(c) Introduce a system of targeted social assistance for low-income households that cannot afford the reformed tariff structures, in order to ensure that they have adequate access to water supply, sewerage and electricity.

The Moroccan Compensation Fund has for a long time been operating a subsidy scheme for a range of petroleum products (motor fuels, fuel oils and butane gas) as well as some foodstuffs (sugar, flour). As regards petroleum products, this is basically a system of environmentally harmful subsidies because it encourages overconsumption by keeping prices significantly below the cost recovery level and leads to a bias in industrial investments towards technologies based on intensive use of fuel oils. As regards private households, moreover, the main beneficiaries of the subsidies are those in the upper income groups rather than the poor. In addition, in a context of limited State budget resources overall, the funds used for subsidizing petroleum and food products are drawing resources away from important sectors such as health, education and basic infrastructure. The magnitude of the subsidies is considerable, which has serious implications for the planning and sustainability of government finances.

Recommendation 4.3:
The Government should:

(a) Reform the subsidy scheme operated by the Compensation Fund to ensure – via direct income transfers – the effective targeting of financial support to low-income households;
(b) Develop a strategy for the phasing out of fuel subsidies.

The current legal framework for dealing with environmental impacts in the quarrying sector is insufficient. There is, moreover, no obligation for the operator to deposit a financial guarantee that will be reimbursed once the rehabilitation of the corresponding area has been completed as agreed.

Recommendation 4.4:
The Government should draft the necessary legislation (law and application regulations) for ensuring proper environmental impact assessment before the start of quarrying operations, as well as adequate rehabilitation measures (based on the deposit of a financial guarantee) at the end of the operations.

Financing the manifold environmental programmes and projects in a context of tight budget constraints has been a major challenge for the Moroccan Government, despite having access to significant foreign financial funds (loans and grants). It is, however, deplorable that the National Environment Fund, which was legally established based on the 2003 Law on Environmental Protection, has not yet become operational due to the lack of adequate secondary legislation concerning issues such as management, project selection, eligibility criteria and funding details.

Recommendation 4.5:
The Government should:

(a) Make the necessary arrangements for the National Environment Fund to become fully operational soon;
(b) Endow the Fund with adequate resources to be able to effectively contribute to the urgently needed progress on environmental protection matters.

Chapter 5

IMPLEMENTATION OF INTERNATIONAL AGREEMENTS AND COMMITMENTS

5.1 Introduction

Morocco is a party to over 100 multilateral environmental agreements (MEAs) on environmental protection and sustainable development (annex I). It has developed a legal and policy framework in order to implement its commitments under MEAs. The laws and regulations adopted in recent years are mainly based on the provisions and principles contained in MEAs to which Morocco is party. The MEAs also serve in terms of setting the priorities for the country's international cooperation.

5.2 Global multilateral environmental agreements

Convention for the Protection of the Ozone Layer

Morocco has developed a legal framework to ensure the implementation of its obligations under the Convention for the Protection of the Ozone Layer (Vienna Convention) and its Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol). A system of licences and permits for the import and export of ozone-depleting substances (ODS) has been established. There are regular national training sessions organized by the Ministry of Industry, Trade and New Technologies. The sessions are aimed at the staff of the Ministry, the Moroccan Clean Production Centre (CMPP) and the United Nations Industrial Development Organization (UNIDO).

By 2008, Morocco had completely phased out the use of chlorofluorocarbons (CFCs). The use of methyl bromide was reduced significantly from 524.8 ozone-depleting potential (ODP) tons in 2005 to 50.9 ODP tons in 2011. At the same time, the use of hydrochlorofluorocarbons (HCFCs) increased from 21.2 ODP tons in 2000 to 78.8 ODP tons in 2011. The HCFCs replaced the CFCs as a refrigerant and propellant in aerosol cans, considered to be somewhat less destructive to the atmosphere.

A UNIDO environmental project carried out in Morocco since 2001 has allowed the country to meet its commitments under the Montreal Protocol and secured substantial benefits for local farmers by phasing out one particular pesticide – methyl bromide – which is banned as an ODS. To support the phasing-out process, UNIDO helped the Moroccan Government to set up the Technology Transfer Centre in Agadir, where farmers can learn about alternative technologies and how to use them. The Centre has been instrumental in disseminating alternatives, providing technical assistance and necessary training, and solving problems encountered by growers.

Morocco is fulfilling its reporting obligations under the Vienna Convention; pursuant to article 7, since 2001, regular annual reports on consumption of ODS have been submitted to the United Nations Environment Programme (UNEP) Ozone Secretariat.

Convention on Biological Diversity

Morocco has been a party to the Convention on Biological Diversity (CBD) since 1995. The country has appointed the Department of Environment as the national focal point who has been active in taking the necessary steps to implement the Convention. In 2004, Morocco adopted the National Strategy for Conservation and Sustainable Use of Biodiversity and Action Plan. Morocco ratified the CBD's Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization in 2013.

Morocco submitted national reports to the Convention's Secretariat in 2003, 2005 and 2009. Thematic reports on mountain ecosystems and protected areas, and a voluntary report on the implementation of an expanded programme of work on forests have also been prepared and submitted.

The Committee on Biodiversity incorporates representatives of several agencies and institutions in Morocco (chapter 9). The Committee is tasked with drafting national legislation relating to biodiversity conservation and access to genetic resources. In terms of biodiversity conservation, the 2010 Law No. 22-07 on Protected Areas was promulgated and a standard master plan for protected areas was elaborated. On information and awareness-raising, a centre for information exchange on biodiversity has

been established (chapter 9). Some of the tangible results of the country's activities on biodiversity protection are:

- Establishment of more than 154 biological and ecological sites and 10 national parks;
- Nomination of 24 Ramsar[13] sites;
- Restocking programmes and restoration of extinct species;
- Establishment of gene banks;
- Development of management plans for certain areas and threatened species.

In the framework of the CBD implementation process, Morocco has received technical and scientific assistance of some US$85 million. The main actions carried out and results achieved during the period 2009–2012 are:

- Development of the National Strategy on the Mechanism of Exchange of Information on Biodiversity (2009), with financial support from Belgium;
- Organization of several training workshops on information and advocacy on biodiversity, with the support of Gesellschaft für Internationale Zusammenarbeit (GIZ) of Germany;
- Celebration of the International Year of Biodiversity (2010), with some 35 activities organized by different governmental bodies and institutions;
- Celebration of International Biodiversity Day each year. Every year in May, the Department of Environment organizes a workshop on the theme chosen by the CBD Secretariat and proposes to the Minister that this day be celebrated in one of the provinces of the country;
- Establishment of the competent biosafety authority (Office of Food Safety, ONSSA – Office National de Sécurité Sanitaire des Produits Alimentaires);
- Organization of a workshop on Access to Genetic Resources and Benefit Sharing and Intellectual Property Rights (2011, Marrakech), with the support of GIZ.

Morocco has participated in all the Conferences of the Parties to the CBD. It has also participated in the majority of intersessional meetings. Morocco was a board member of the 11th Conference of the Parties.

[13] Under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention).

Cartagena Protocol on Biosafety

Biotechnology remains a politically sensitive issue in Morocco. The heavy dependence of Moroccan agricultural exports on the EU market generates concerns within the Government and among producers that official acceptance of biotechnology products in Morocco may devastate this export.

Morocco ratified the Cartagena Protocol on Biosafety to the CBD (Cartagena Protocol) in 2011. Two national reports on the implementation of the Protocol have been prepared. It has not yet been determined which entity in the Moroccan Government will take the lead in implementing the Cartagena Protocol. This responsibility might be shared by the Office of Food Safety and the Ministry of Energy, Mines, Water and Environment.

There is no legislation in Morocco regarding the introduction, use and marketing of genetically modified organisms (GMOs). De facto imports of biotech seeds for planting are currently not allowed into Morocco and a "GMO-free" certificate is required for customs clearance. Certificates provided by breeders and unofficial bodies are accepted. There is mandatory registration of any new planting seeds before the Ministry of Agriculture and Maritime Fisheries tests the new variety and provides its approval.

The Government announced that seed imported under the Temporary Admission Regime (i.e. imported to produce crops locally and process them for re-export) must be "GMO free". This decision clearly aims to reduce EU importers' fear of GMO products and officially claims that Morocco does not accept GMO seeds. GMO labelling is not required but, for products that are used directly for human consumption, especially canned corn, importers print "GMO free" on the label to avoid being asked to provide a "GMO-free" certificate.

In 2005, the National Biosafety Committee (NBC) was established by the decision of the Prime Minister. Its members include representatives of the:

- Ministry of Agriculture and Maritime Fisheries;
- Ministry of Trade and Industry;
- Ministry of Health;
- Department of Environment;
- Ministry of the Interior;
- High Commission for Water, Forestry and Desertification Control;
- Direction of Customs.

The NBC is purely advisory in nature. It is in charge of GMO issues in the area of agriculture and the food industry. The role of the NBC is to provide advice as to the use, handling, transportation, import, distribution and marketing of GMOs. The NBC holds two sessions a year and extraordinary sessions if requested by the chair. The NBC is assisted by subcommittees that can study special scientific and legal issues, or any subject related to biosafety.

Convention on International Trade in Endangered Species of Wild Fauna and Flora

Morocco has been a party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1975. Pursuant to article IX of the Convention, each Party must designate at least one Management Authority to administer the permit system and at least one Scientific Authority to give its opinion on the effects of trade on the status of the species. In Morocco, the implementation of the Convention is ensured by the High Commission for Water, Forestry and Desertification Control. The scientific authorities are represented by the Scientific Institute of Rabat, the Agronomic and Veterinary Institute Hassan II, the National School of Forest Engineers and the National Fisheries Research Institute.

The High Commission for Water, Forestry and Desertification Control, CITES' focal point, ensures regular review, monitoring and strict enforcement, within the limits of national jurisdiction and resources available, decisions by the CITES Conferences of the Parties and meetings of its committees.

Most species of animals listed in the CITES appendices are protected by national law and their trade is prohibited. In 2011, Morocco adopted Law No. 29-05 on the Protection of Flora and Fauna Species and Control of their Trade. In 2009, a CITES training session for officials operating at customs border posts was organized by the World Wide Fund for Nature (WWF) and Species Survival Network (SSN) in collaboration with the High Commission for Water, Forestry and Desertification Control. The High Commission, in partnership with the International Technical Assistance Program of the United States Department of Interior and the United States Embassy in Rabat, organized a regional workshop on capacity-building of scientific authorities on implementation of CITES. Held in 2009, this workshop was intended for CITES scientific authorities in countries of the MENA region and was facilitated by trainers from the United States Fish and Wildlife Service and the CITES Secretariat. Another training session was held in 2011 as part of Moroccan–American cooperation in the implementation of CITES. This was designed for customs officials operating at two border posts in Casablanca and Tangier.

Morocco has not entirely fulfilled its reporting obligations under CITES. Based on the requirement of article VIII, paragraph 7, of the Convention:

- Morocco has to submit an annual report on its CITES trade, containing a summary of information on, inter alia, the number and type of permits and certificates granted, the States with which such trade occurred, the quantities and types of specimens, and the names of species as included in appendices I, II and III. The annual reports for 2005–2010 were submitted. The deadline to submit the report for 2011 (31 October 2012) was not met.
- Morocco has to submit a biennial report on legislative, regulatory and administrative measures taken to enforce the Convention. The report for 2003–2004 was submitted in 2006, the report for 2005–2006 in 2007. The reports for 2007–2008 and for 2009–2010 have not yet been submitted.

Convention on Wetlands of International Importance especially as Waterfowl Habitat

The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) came into force for Morocco on 20 October 1980. The High Commission for Water, Forestry and Desertification Control is the designated administrative authority for the Convention in Morocco. The national focal point was appointed from the same institution. The national focal point for the Scientific and Technical Review Group was appointed from the Scientific Institute.

The Government's national focal point for Communication, Education, Participation and Awareness (CEPA) is based in the Moroccan Centre for Humid Areas. The non-government national focal point for CEPA is based in the Research Group for the Protection of Birds in Morocco.

The roles and responsibilities of these national focal points were discussed at the first meeting of the CEPA Panel in 2006 and endorsed by Standing Committee at its 35th meeting. The major roles and responsibilities of the CEPA national focal points are to:

Photo 5.1 : Chellah

- Provide leadership for the development and implementation of a wetland CEPA programme at an appropriate level (national, subnational, local) as described in the CEPA Resolution and annexed programme;
- Be the main points of contact on CEPA matters between (a) the Secretariat and the Contracting Party, and (b) between Contracting Parties;
- Assist in the practical implementatio of CEPA at the national level and in national reporting on CEPA activities to the Ramsar Conferences of the Parties;
- Ensure a high, positive, public profile for the Ramsar Convention and its conservation and wise use goals;
- Be active spokespersons for wetland CEPA;
- Establish and maintain any contacts, networks, structures and mechanisms necessary to ensure the efficient communication of information between relevant actors at all levels and in all sectors.

In 2005, Morocco designated 20 new Ramsar sites across the country in addition to its four existing sites. The total area of its Ramsar sites now amounts to 272,010 ha and covers a variety of wetland types, including some which are identified as being underrepresented in the List of Wetlands of International Importance, and which Parties should give high priority to designating: these include mountain wetlands and seagrass beds. The Aguelmams Sidi Ali-Tifounassine and Lacs Isly-Tislite sites, for instance, comprise a complex of mountain lakes, two of which are the highest lakes in North Africa, situated at more than 2,000 m in the High Atlas mountain range and which are among the southernmost representatives of the lacustrine mountain ecosystems of the temperate paleo-arctic bioregion.

Many sites comprise river estuaries and salt marshes, which play a very important role as refuge, resting and wintering sites for migratory birds, especially for those which are endangered. Some coastal sites exhibit great natural beauty, with their inclusion of marine lagoons, sea cliffs, sandy beaches and rocky shores, harbouring high invertebrate, mollusc, planktonic and mammalian biodiversity, and hosting charismatic species such as the Mediterranean monk seal, loggerhead turtle and different dolphin species.
A number of sites also include artificial wetland types, such as dam reservoirs, oases associated with irrigated palm plantations and salt works, which play an important socioeconomic role and host some significant species such as endemic fish and plants or waterbirds, such as waders. Some sites are relatively pristine, such as the Zones Humides de Souss-Massa, which are part of a national park, while others, including the Complexe du bas Tahaddart, have suffered from high rates of development and are

therefore in more need of stringent conservation measures.

Convention on the Conservation of European Wildlife and Natural Habitats

Morocco is one of four non-member States of the Council of Europe that has acceded to the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), having acceded in 2001. The High Commission for Water, Forestry and Desertification Control is the national focal point for this Convention.

In 2008, the Standing Committee of the Bern Convention considered, on a legal level, Morocco's implementation of the Convention. The Secretariat's report for the meeting identified a number of gaps and inconsistencies in Morocco's legal framework for nature protection. For instance, flora species listed in annex I to the Bern Convention were not subject to a specific legal framework. It was not ensured that the time periods when hunting is allowed match the needs of migratory species.

As regards the integration and consideration of the protected areas in planning policies and development (arts. 3.2 and 4.2 of the Bern Convention), the impact on biodiversity has to be more thoroughly assessed during EIA studies (Law No. 12-03 on Environmental Impact Assessment). The report also found that the existing legal provisions were not well enforced.

Convention on the Conservation of Migratory Species of Wild Animals

Morocco ratified the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) in 1993. The High Commission for Water, Forestry and Desertification Control has been designated as the Management Authority of the Convention. Morocco has joined the relevant agreements and memoranda in the framework of the Convention:

- Agreement on the Conservation of Cetaceans of the Mediterranean and Black Seas (ACCOBAMS);
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA);
- Memorandum of Understanding concerning Conservation Measures for Marine Turtles of the Atlantic Coast of Africa;
- Memorandum of Understanding concerning Conservation Measures for the Slender-billed Curlew;
- Memorandum of Understanding concerning Conservation Measures for the Eastern Atlantic Populations of the Mediterranean Monk Seal (Monachus monachus);
- Regional Memorandum of Understanding on the Conservation of African-Eurasian Birds of Prey.

United Nations Framework Convention on Climate Change

Morocco ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1995, and its Kyoto Protocol in January 2002. The country prepared its first national greenhouse gases (GHG) inventory in 1994. Morocco has established three national GHG inventories corresponding to years 1990, 1994 and 1999. He developed the Initial National Communication in 2001 and presented to the COP 7 in Marrakesh in October of the same year. As part of its work for the Second National Communication published in 2010, two inventory calculations were established for the years 2000 and 2004. Currently, Morocco has started the preparation of the Third National Communication which should allow the calculation of GHG inventories for 2008 and 2012 and the consolidation of the institutional framework in Morocco to produce inventories every two years starting in 2012, especially with a legal basis vis-à-vis the parties involved in the implementation of these inventory operations.

In 2001, Morocco hosted the 7th Conference of the Parties to the UNFCCC, which resulted in the Marrakech Mechanism on Clean Development. Morocco has joined the Arab Regional Initiative on climate change and the Africa–EU initiative on climate change.

Morocco supports the multilateral negotiation process of a new regime on climate change as a follow-up to the Kyoto Protocol. Morocco advocates actions that take into account the shared and different responsibilities and capacities.

Morocco has established a National Committee on Climate Change and a National Council for a Clean Development Mechanism (CDM). The country has submitted two national communications. The first showed that Morocco is vulnerable to climate change and needs an adaptation strategy, especially for its water resources, soil and shores.

The National Plan against Global Warming was launched in 2009. The Plan includes three types of measures: mitigation, adaptation and transverse

measures. The Department of Environment manages the following mitigation measures under the Plan:

- Promotion of the CDM established under the Kyoto Protocol;
- Incentives to carry out GHG emissions inventories;
- Draft proposals for green taxation for electrical equipment and for energy efficiency in existing buildings.

Adaptation measures in Morocco basically rely on the National Water Strategy launched in 2009 and on some elements of the Morocco Green Plan for agriculture, launched in 2007.

In 2009, the Ministry of Agriculture and Maritime Fisheries launched Halieutis Plan 2020, which aims to ensure the sustainability of fishing and improve the performance and competitiveness of this sector. The National Fisheries Research Institute (INRH) works on measures concerning the vulnerability and adaptation to climate change of the fisheries sector, namely on:

- Assessment of impacts of climate change on the distribution and abundance of marine species, particularly species of harvested fish;
- Study of the impacts of climate change on the structure and functioning of marine ecosystems;
- Study of reorganization or modification of fishing practices due to changes in species dynamics.

Morocco is among the most active countries in the North African region in CDMs. A portfolio of 40 projects and programmes has been developed, of which eight projects are registered at the CDM Executive Board with a potential reduction of GHG emissions estimated at 5.4 million tons of CO_2 equivalent per year.

United Nations Convention to Combat Desertification

Morocco ratified the United Nations Convention to Combat Desertification (UNCCD) in 1996. In 2001, the country adopted the National Action Programme to Combat Desertification.

Legal and regulatory measures have been taken to ensure the preservation and sustainable management of forest resources, notably the decree establishing compensation for deferred grazing in reforestation areas, and the 2007 Law No. 1-06 on the Sustainable Development of Palm Plantations and the Protection of Date Palms.

Given the importance of safeguarding and developing the oases of argan trees, the National Agency for the Development of Oasis Zones was established in 2011. This agency is tasked with protecting and developing oases areas and the argan tree in line with the sustainable development principle.

The Reforestation Plan and the National Strategy for Control and Monitoring of Forest Health was adopted in 2009 for 15 years. This document covers actions in such areas as:

- Afforestation with autochthone species;
- Introduction of new species resistant to drought;
- Monitoring of forest vitality;
- Protection against soil erosion.

The implementation is under way of the National Action Programme to Combat Desertification, adopted in 2001 for 20 years. A project of planting one million date palms by 2015 was launched in the oasis Tafilalet (budget of 1.25 billion dirhams). This project has set targets for the protection of palm groves, and the recovery and rehabilitation of oases, by planting 2.9 million palm trees by 2030 (total budget of 3.23 billion dirhams).

Convention on Persistent Organic Pollutants

Morocco ratified the Convention on Persistent Organic Pollutants (POPs) (Stockholm Convention) in 2004. The project to provide initial assistance to Morocco to meet its obligations under the Convention was implemented in 2002–2004. The project was financed by the GEF (US$0.497 million) and co-financed by the Government of Morocco (US$0.060 million). The project financed the initial preparation of the Persistent Organic Pollutant National Implementation Plan (NIP).

The NIP was published in 2006. It presents the national policy concerning POPs and main actions that the country intends to achieve in accordance with the Convention provisions, namely to phase out POP sources and to remediate POP-contaminated sites in the country.

Morocco failed to submit its initial national report by 31 July 2007. According to its second national report, submitted on 1 June 2010, the country is facing some difficulties in putting the NIP into operation, namely, the allocated funds were not sufficient, it was difficult to engage all stakeholders in its

implementation and there is a lack of necessary expertise and technology.

In 2000–2004, Morocco made an inventory of the POPs pesticides, polychlorinated biphenyls (PCB) equipment, and unintentional releases of dioxins and furans. The inventory showed the following results:

- Elimination of 40 tons of DDT and related waste in July 2013 with financial and technical support from WHO and FAO;
- There were 573 PCB power transformers in 2005, containing some 200 tons of PCBs. The volume of transformer-contaminated oil, in the sense of the Convention (i.e. containing more than 50 ppm of PCB), was around 3,500 tons;
- The annual releases of dioxins and furans were estimated to be 235 g-TEQ.[14]

Projects under Pillar I and Pillar II of the National Programme on Safe Management and Disposal of PCBs have been implemented in Morocco since 2009. The projects are financed by the GEF (US$4,648 million) and co-financed by the Government (around US$10 million). The projects' objectives are:

- Strengthening the legal and administrative framework for PCB management and disposal;
- Management of identified PCB oils and PCB-contaminated wastes and equipment in a manner that minimizes human and environmental exposure to PCBs;
- Environmentally sound disposal of identified PCBs and soils contaminated with PCBs.

At the end of the first project, a fully operational waste disposal facility able to handle PCB waste and contaminated soils will be established. Alternatively, the PCBs containing waste will be exported for disposal.

In 2012, the Disposal of Obsolete Pesticides including POPs and Implementation of Pesticides Management Programme, with a total budget of US$29.23 million (US$3.5 million from the GEF and US$25.73 million co-financing by the Government) was approved by the GEF Council.

[14] Because dioxins encompass such a broad class of compounds that vary widely in toxicity, the concept of toxic equivalence (TEQ) has been developed to facilitate risk assessment and regulatory control.

Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade

Morocco became a party to the Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam Convention) in 2011. The Department of Environment serves as the Designated National Authority (DNA) for Industrial Chemicals, and the National Office of Food Safety (ONSSA) serves as the DNA for Pesticides. Two official focal points have been appointed in the Department of Environment. The Commission on Agricultural Pesticides was established in 2001. It is empowered to:

- Study, propose and advise on all technical, scientific and legal matters submitted to it by the departments concerned with pesticides;
- Consider the risks inherent in the use of pesticides and propose appropriate solutions;
- Propose legislative and regulatory measures concerning the importation, manufacture, formulation, possession, trade, traffic and use of pesticides;
- Give its opinion on the certification of agricultural pesticides that are subject to approval.

The Technical Evaluation Committee of Pesticides for Public Health was established in 2010. Its mission is to study and give opinion to the Ministry of Health on:

- Applications for authorization to introduce to the market pesticides for public health and sanitation use;
- Applications for registration of pesticides for agricultural use;
- All matters relating to the management of pesticides.

There is also a technical advisory committee for chemicals. Morocco has already sent responses[15] on 29 chemicals to the Secretariat of the Convention. In 2012, Morocco held a workshop on the national implementation of the Rotterdam Convention, to

[15] Article 5 of the Convention sets out the obligations of Parties with respect to notifying the Secretariat of their final regulatory actions to ban or severely restrict a chemical for health or environmental reasons. If a Party takes a final regulatory action to ban or severely restrict a chemical for health or environment reasons, it shares the information with all Parties by notifying the action to the Secretariat.

train 33 national stakeholders on the key obligations of the Convention and identify elements for a national strategy for implementation. The workshop identified:

- A lack of regulations specifying the procedure for importing hazardous chemicals;
- A lack of information on hazardous chemicals.
- Difficulties in the implementation of the annex III responses to the Convention.

The workshop recommended, in particular, to:

- Strengthen the work of the technical advisory committee for chemicals until its institutionalization;
- Increase the capacities of the DNAs;
- Institutionalize the Technical Evaluation Committee of Pesticides for Public Health by expanding its mandate for chemicals management at the national level;
- Develop a law on chemicals.

Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal

Morocco ratified the Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention) in 1995. The Ban Amendment to the Basel Convention (Decision III/1) was approved by Morocco in 2004. The Division of Surveillance and Risk Prevention of the Department of Environment serves as the Competent Authority responsible for receiving notifications of the transboundary movement of hazardous wastes or other wastes, and any information related to it, and for responding to such notifications.

In 2005, Morocco transmitted a communication to the Convention Secretariat concerning its national definition of hazardous wastes. Morocco fulfils its reporting obligations under the Convention. The latest national report was submitted in 2009. Data from the report on transboundary movements of hazardous and other waste is given in table 5.1.

The 2006 Law No.28-00 on Waste Management and Disposal regulates the transboundary movement of waste. According to this law, the export of hazardous waste is subject to an authorization issued by an importing country. In 2008, the national waste classification and the list of hazardous wastes were determined by Decree No. 2-07-253. Morocco restricts the import of hazardous and other wastes for recovery and final disposal. According to Law No. 28-00, the import of hazardous waste is prohibited if there is no facility for its disposal. The import of non-hazardous wastes is allowed if the wastes are managed in an environmentally sound manner and an import authorization has been provided. Morocco restricts the transit of hazardous and other wastes in accordance with the Basel Convention requirements.

5.3 Cooperation in regional multilateral environmental agreements

Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean

Morocco ratified the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) in 1980. Morocco is a party to all seven protocols to the Convention (annex I). The last one, the Protocol on Integrated Coastal Zone Management in the Mediterranean (ICZM Protocol) was ratified in 2012. Morocco held the Presidency of the Bureau of the Contracting Parties to the Barcelona Convention for the biennium 2010–2011 and hosted the 16th Meeting of the Parties in Marrakech in 2009. Morocco was a member of the Steering Committee of the Mediterranean Commission on Sustainable Development. The country is fulfilling its reporting obligations under the Convention. During the past decade, the country has made a number of steps to implement the provisions of the Convention:

- In the framework of the Priority Short and Medium Term Environment Action Programme, three projects (Nador, Berkane and M'Diq) have been completed in the Moroccan Mediterranean between 2005 and 2008 to promote sustainable use of coastal areas through the implementation of Action Plans on Integrated Coastal Zone Management (ICZM);
- The Coastal Area Management Programme in Central Rif was developed in 2008–2010. Following the completion of the Programme, recommendations and actions on natural, cultural heritage and sustainable tourism, and on territorial development and governance, were proposed;
- A number of awareness-raising workshops were organized to promote the concept of ICZM at all levels;

Table 5.1: Generation and transboundary movements of hazardous wastes and other waste, 2006

		tons
Generation	Hazardous waste under art. 1(1)a (annex I: Y1-Y45) of BC	131,000
	Hazardous waste under art. 1(1)b of BC	Not reported
	Total amount of hazardous waste	131,000
	Other waste (annex II: Y46-Y47 of BC)	6,500,000
Export	Hazardous waste	780
	Other waste	Not reported
Import	Hazardous waste	0
	Other waste	Not reported

Source: Basel Convention Country Fact Sheet: Morocco.
Note: BC = Basel Convention
Y1-Y45 = Categories of waste to be controlled

- Between 2006 and 2009, the High Commissioner's Office for Planning prepared a study entitled Integral Littoral Audit, which serves as a tool and framework for the establishment of an integrated management system for coastal areas;
- Several Mediterranean cities in Morocco (e.g. Tangier and Tétouan), have developed master plans for planning and development of the coastline;
- A network of observation points has been established at 39 beaches to monitor bathing waters in the Moroccan part of the Mediterranean Sea (chapter 3). Competent authorities (Ministry of Equipment and Transport, and Department of Environment) publish a detailed biennial report on the quality of bathing waters;
- The National Fisheries Research Institute has installed three observation points in the Mediterranean (Tangier, Nador and M'Diq). In the event of an accident, the Institute alerts the media to inform the public about the contamination of seafood in the affected area.

The draft law No. 81-12 relating to management of the littoral was adopted in 2011. Similar to all other laws that were not published before the inauguration of the new Government, it was decided to resubmit it for interministerial consultation (chapter 1).

5.4 International cooperation

European Neighbourhood Policy

The EU and Morocco signed an association agreement in 1996 which entered into force in 2000. The agreement constitutes the legal framework for relations between the EU and Morocco. In 2004, and in parallel with the Euro-Mediterranean cooperation process launched in Barcelona in 1995, the EU developed a European Neighbourhood Policy (ENP), which establishes a new framework for relations between the EU and its neighbours, including those in the Southern Mediterranean. Morocco was among the first countries of the Mediterranean to sign a Neighbourhood Action Plan with the EU. The Plan includes 85 actions, including three explicit actions on environment:

- Promote good environmental governance;
- Prevent and combat the deterioration of the environment, protect human health and promote the rational use of natural resources, in line with the National Environmental Action Plan and Johannesburg Summit undertakings;
- Enhance cooperation on environmental issues.

Morocco has already submitted five progress reports on the implementation of the ENP (2006–2010). Several bilateral agreements on environment have been signed by Morocco, including with Brazil, China, Egypt, France, Jordan, Portugal, Spain, Tunisia, Turkey, and the United States of America.

Bilateral agreements

Dynamic cooperation was established with the EU, Germany, France, Japan, Spain and the United States of America. To monitor the implementation of the bilateral agreements, joint steering committees are established. The environment is also included as a priority area of bilateral cooperation agreements with Germany and Japan.

International financial assistance

Global Environment Fund

Since the accession of Morocco to the Global Environment Facility (GEF) in 1994, 23 national

projects for a total amount of nearly US$100 million have been funded. Morocco has also participated in more than 33 regional and global projects involving several recipient countries. The Department of Environment serves as the national focal point of the GEF.

Over the period 2006–2010, which corresponds to the fourth replenishment of the Facility's fund (GEF 4), and through a broad participatory process, a portfolio of eight national projects totalling nearly US$23 million was approved for Morocco in the areas of climate change, biodiversity, chemical pollutants and ICZM. Morocco participated in four regional projects under GEF 4.

For the fifth replenishment of the fund (GEF 5) covering the period 2011–2014, six environmental projects are funded under the System for Transparent Allocation of Resources (STAR), for a total amount of around US$16 million. Several other projects are being developed outside STAR with a budget of nearly US$8.75 million, to support the implementation by Morocco of environmental conventions for which the GEF provides the financial mechanism. Table 5.2 provides more details (as of June 2012) on the projects funded by the GEF.

World Bank

The World Bank has supported projects in three environmental domains: solid waste management, integrated management of coastal zones and climate change. Three Development Policy Loans (DPLs) support the Government of Morocco in implementing its National Solid Waste Management Programme. The specific objectives of this support include improving the governance of the solid waste sector, promoting sustainable waste management services, and management of the environmental and social dimensions of the sector. The first loan of €100 million was granted by the World Bank in 2009, the second loan of €100 million was granted in 2011 and the third loan (DPL3) of €100 million was granted on 14 February 2013. DPL3 aims to:

- Strengthen governance, particularly demand-side governance, in the sector by improving accountability, transparency and access to information, and by providing citizens and civil society with new and effective opportunities for engagement and voice;
- Anchor long-term institutional and financial sustainability of the sector in line with the new decentralization agenda;
- Upgrade the country's environmental monitoring and control system;
- Develop a financially viable and socially inclusive waste recycling sector.

DPL3 aims at creating and ensuring efficient and effective operating conditions in the institutions in charge of monitoring, control and sanction for violation of the environmental rules, norms and standards established by current laws and regulations. This general mandate to monitor compliance and enforce environmental laws, regulations and standards (referred to as the "environmental control mandate") falls within the competences of several different public entities at the national and local levels, with no effective coordination mechanism in place.

The World Bank supports a national project led by the Department of Environment on ICZM in Morocco. The timeframe of the project is 2012–2017. The total project budget is some US$25.2 million, of which some US$5.2 million is a GEF grant (table 5.2). Project activities focus on: (1) strengthening strategic planning and measures of ICZM and adaptation to the impacts of climate change; (2) developing a pilot co-management of the conservation of fragile ecosystems and natural resources, and of the improvement of the quality of life of coastal communities, based on the services and products offered by the best-preserved ecosystems.

Several projects on climate change have been completed or are under implementation, and aim at:

- Strengthening the governance framework of climate change in Morocco;
- Developing an information system on GHG emissions;
- Adaptating to climate change and natural disasters in coastal cities;
- Helping Morocco to develop market-based instruments to reduce GHG emissions.

Evaluation of international environmental projects

In 2012, at the request of and in close cooperation with the Department of Environment, UNDP prepared a study that assessed the international cooperation projects in terms of their implementation and alignment with the priorities of the Department. The projects coordinated or managed by the Department of Environment were reviewed in two groups: those projects that started after 2005, and those that started before 2005 but which have been, or will be, completed after 2005. The coverage of the projects, the nature of the assistance and budgets were assessed.

Table 5.2: International projects funded by the GEF

Project	Implementing agency	GEF funds (US$)	Co-financing (US$)	Status
Elaboration of a National Climate Change Strategy and Action Plan	UNDP	140,000	0	CEO approved
Integrated Solar Combined-cycle Power Plant (formerly Solar-based Thermal Power Plant)	IBRD	43,200,000	70,460,000	Under implementation
Market Development for Solar Water Heaters	UNDP	2,965,000	2,400,000	Project completion
National Capacity Self-Assessment (NCSA) for Global Environmental Management	UNDP	200,000	50,000	IA approved
Energy and Environmental Upgrading of the Industrial Park of Sidi Bernoussi Zenata, Casablanca	IBRD	750,000	11,150,000	Project closure
Energy Efficiency Codes in Residential Buildings and Energy Efficiency Improvement in Commercial and Hospital Buildings in Morocco	UNDP	3,000,000	12,610,000	IA approved
The Middle Atlas Forest Restoration project	UNDP	965,345	2,112,800	Under implementation
Middle East and North Africa Development (MENARID) Participatory Control of Desertification and Poverty Reduction in the Arid and Semi-arid High Plateau Ecosystems of Eastern Morocco	IFAD	6,000,000	19,035,200	IA approved
Market Transformation for Energy Efficient Lighting in Morocco	UNEP	889,091	3,915,000	IA approved
Mainstreaming Global Environmental Aspects in the Planning and Monitoring Processes of the National Human Development Initiative (INDH) in Morocco	UNDP	460,000	200,000	CEO approved
Integrating Climate Change in Development Planning and Disaster Prevention to Increase Resilience of Agricultural and Water Sectors	IBRD	4,345,450	100,000,000	CEO endorsed
MED Integrated Coastal Zone Management - Mediterranean Coast	IBRD	5,181,820	20,000,000	CEO endorsed
Energy Efficiency in the Industrial Sector	AfDB	2,730,000	8,855,000	Council approved

Source: Department of Environment, 2012.
Note:
AfDB = African Development Bank
CEO = Chief Executive Officer
IA = Implementing agency
IBRD = International Bank for Reconstruction and Development
IFAD = International Fund for Agricultural Development
UNDP = United Nations Development Programme

The main findings of the study are:

- Background documents on international environmental policy are lacking;
- The lack of project implementation indicators and reporting makes it more difficult to assess the relevance of projects;
- There is a lack of feasibility studies carried out even before project implementation, for targeting and identifying potential risks and constraints that would impede the achievement of results;
- Some projects on capacity-building do not correspond to the real needs and/or priorities of the Department of Environment or its partners.

5.5 Conclusions and recommendations

Morocco has acceded to a number of global and regional environmental agreements and is actively developing its international environmental cooperation. To meet the requirements of the ratified agreements, various programmes and action plans have been developed and foreign assistance has been sought to support formulation and implementation of these programmes and action plans. National environmental legislation is often not yet in conformity with international norms and concepts, and often neither implemented nor enforced.

Overall, Morocco is fulfilling its reporting obligations under the multilateral environmental agreements (MEAs). However, with regard to some conventions, the country failed to meet the deadlines or to submit some regular reports. For example, the biennial reports on legislative, regulatory and administrative measures taken to enforce the CITES for 2007–2008 and 2009–2010 were not submitted. Morocco did not meet the deadline for submission of the annual report on its CITES-relevant trade for 2011. It has failed to submit its initial national report under the Stockholm Convention.

Recommendation 5.1:
The Government should improve its reporting under the multilateral environmental agreements to which Morocco is a party, or in accordance with Morocco's obligations thereunder, where necessary.

Morocco has been a party to the Cartagena Protocol on Biosafety to the Convention on Biological Diversity since 2011. However, the country has not yet determined which entity in the Moroccan Government would take the lead in implementing the Cartagena Protocol. In addition, there is no approved legislation in Morocco regarding the introduction, use and marketing of GMO materials. Joining the ECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters and its Protocol on Pollutant Release and Transfer Registers would allow the country to obtain know-how and experience on access to information and on implementation of pollutant release and transfer registers (PRTRs).

Recommendation 5.2:
The Government should:

(a) Accelerate the establishment of a legal framework on biosafety;
(b) Consider accession to the ECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters and its Protocol on Pollutant Release and Transfer Registers.

The country is already building synergies with biodiversity-related agreements. The experience would bring benefits if it were applied to other environmental agreements, especially due to the fact that Morocco has ratified more than 100 MEAs.

Recommendation 5.3:
The Government should continue building synergies in its efforts to implement the various multilateral environmental agreements to which it is a party.

PART II: POLLUTION AND NATURAL RESOURCE MANAGEMENT

Chapter 6

AIR PROTECTION

6.1 Introduction

Over the period 2003–2012, the population of Morocco increased by 10.4 per cent while its urban population increased by 18 per cent, with a strong urban concentration in coastal zones (94 per cent of the population in Laâyoune-Boujdour-Sakia El Hamra, 92 per cent of that in Grand Casablanca and 83 per cent of that in Rabat-Salé-Zemmour-Zaër is urban). Economic activities, such as energy production and industries, are mostly concentrated in these zones, thus triggering the rapid development of road transport traffic. As a result, in addition to the industrial sector, the transport sector is becoming a main contributor to emissions into air, in particular of sulphur dioxide (SO_2), nitrogen oxide (NO_x), particulate matter (PM) and volatile organic compounds (VOCs), which also produce ozone pollution – a major source of pollution in urban and suburban zones – when exposed to sunlight.

A 2003 World Bank assessment estimated the damage caused by particulate matter on the order of ~10 micrometres or less (PM_{10}) (both indoor and outdoor air pollution) on health and quality of life in Morocco at €346 million a year, or 1.03 per cent of GDP in 2000. Total damage associated with climate change caused by GHG emissions was about 0.9 per cent of GDP. Up until now, no more up-to-date assessment has been produced.

In terms of health impacts, epidemiological studies were carried out by the Department of Environment in cooperation with the Ministry of Health and conducted in two heavily polluted zones, Casablanca (Casa-Airpol, 1998–1999) and Mohammedia (Mohammedia-Airpol 2001–2002). These showed a significant increase of diseases (asthma crisis, respiratory diseases and infections, night coughing) linked to air pollution (SO_2, NO_x, PM_{10} and black carbon, and ozone). A new survey, carried out by the Mohammed VI Foundation for Environmental Protection, is being carried out in the increasingly polluted Grand Casablanca (Casa-Airpur), with results expected to be published by the end of 2013. It is only since the early 2000s that the authorities, realizing the importance of all these adverse impacts, started to take action to combat air pollution.

6.2 State and determinants

Trends in emission levels

Air pollutants

The most exhaustive estimate of national emissions dates back to 2004 (as reflected in the second national communication to the United Nations Framework Convention on Climate Change (UNFCCC), 2010) and is no longer meaningful in 2012 due to the country's significant socioeconomic development and, in particular, the growth of the transport sector. As stationary emissions from industry are not monitored, trends in emission levels cannot be easily established, except locally when there is a campaign to establish an air emission inventory (cadastre).

In 2008, the Ministry of Equipment and Transport carried out a study to assess the pollution from the main polluting sectors in urban zones (table 6.1). In 2005, the reference year of the study, overall SO_2 emissions were generated chiefly by thermal power plants (TPPs) and refineries (60 per cent) and industry (29 per cent), NO_x by TPPs and refineries (40 per cent) and diesel vehicles (31 per cent), and particulates (PM_{10}) by TPPs and refineries (79 per cent), industry (12 per cent) and diesel vehicles (7 per cent).

However, significant changes have occurred since 2005: the number of new TPPs has increased, as has the number of vehicles, while, at the same time, cleaner fuels have been introduced, there are more modern cars on the road and the Société Anonyme Marocaine de l'Industrie du Raffinage (SAMIR) refinery has halved its large SO_2 emissions. Given all these dynamics, the overall situation of urban zones in 2012 is decidedly different than it was in 2005, and it is not possible to give an accurate picture of the situation.

At the regional level, more recent data on emission levels (table 6.2a) are being produced in the annual bulletins on air quality of the National Directorate of Meteorology (DNM). They show that emission levels in big cities often exceed emission limits, especially for total suspended particles (TSP).

Photo 6.1 : Rush hour, Casablanca

Table 6.1: National air emissions inventory in urban zones, 2005

Selected activities	SO_2		NO_x		Total suspended particles	
	ton/year	%	ton/year	%	ton/year	%
Industry	68,057	28.7	13,685	15.0	8,530	12.0
Thermal power plants and refineries	141,880	59.9	36,911	40.0	54,276	79.0
Road transport	20,651	8.7	35,096	37.0	5,032	7.0
of which : gasoline vehicles	693	0.3	6,032	6.0	0	0.0
diesel vehicles	19,958	8.4	29,064	31.0	5,032	7.0
Residential/tertiary sector	6,189	2.6	7,662	8.0	774	1.0

Source: Ministry of Equipment and Transport, Air quality study, 2008.
Note: The inventory is based on air pollution measurements in the four main cities, i.e., Casablanca, Fès, Marrakech and Rabat.

Greenhouse gases

The second national communication to UNFCCC (2010), with data from 2004, shows that the energy sector, including transport, was responsible for 52 per cent of GHG (expressed as CO_2-equivalent) emissions; agriculture, including forestry, was responsible for 36 per cent, industry for about 7 per cent and solid waste for 5 per cent. Methane, solid waste and nitrogen dioxide (NO_2) were mostly produced by agriculture.

Because of its strong economic growth, Morocco is experiencing a rapid increase in GHG emissions (annex I). However, compared with its neighbours, Morocco is a relatively low CO_2 producer at the moment. In 2008, CO_2 emissions (not including other potent GHGs) were 1.58 tons per capita annually (t/cap./year). In comparison, CO_2 emissions in 2008 were 48.6 t/cap./year for Qatar, 18.5 t/cap./year for the United States of America, 9.8 t/cap./year for Libya, 6.1 t/cap./year for France, 4.1 t/cap./year for Algeria, 2.4 t/cap./year for Tunisia and 2.3 t/cap./year for Egypt.

Pressures

As previously noted, air pollution is mostly due to TPPs, refineries, transport and industry, including the residential and tertiary (such as handicrafts) sectors (table 6.1). Transport is becoming an increasingly significant contributor.

Table 6.2a: Annual average concentration values in selected cities, 2011

Selected cities	Selected automatic stations	SO_2 µg/m^3	NO_2 µg/m^3	PM_{10} µg/m^3
Agadir		4	18	75
Casablanca	Casa-CHU	20	4	42
	Casa-ONCF	27	37	160
	Casa-Wilaya	9	5	118
	Casa-Sidi Othman	9	6	64
	Casa-Jahid	45	58	105
El Jadida		41	18	36
Fes		28	26	85
Marrakech	Jamae Lafna	18	41	81
	Mhamid	8	27	70
	Dawdiate	8	16	109
Mohammedia	Khansâa	9	6	117
	Prefecture	10	2	182
Salé		12	54	31

Source: National Directorate of Meteorology, 2012.
Note: Red values in the table indicate exceedances.
Casa-CHU = Casablanca, Centre Hospitalier Universitaire
Casa-ONCF = Casablanca, Office National des Chemins de Fer du Maroc.

Table 6.2b: Annual average Moroccan and WHO concentration limit values

		SO_2 µg/m^3	NO_2 µg/m^3	PM_{10} µg/m^3
Moroccan limit values	Human health protection	99.2 percentile of daily mean values of 125	98-percentile of daily mean values of 200 50 annual mean	90.4-percentile of daily mean values of 50
	Ecosystem protection	20 annual mean	30 annual mean	
WHO limit values	Human health proctection	20 24-hour mean 500 10-minute mean	40 annual mean 200 24-hour mean	20 annual mean 50 24-hour mean

Source: 2009 Decree No. 2-09-286 setting standards for air quality and the procedures for air monitoring; WHO.

Thermal power plants and refineries

Electricity production in Morocco is generated mainly from TPPs burning coal (63.4 per cent of electricity production in 2007), gas (14.4 per cent) and fuel oil (14.1 per cent); the rest comes from hydropower plants (4.6 per cent), wind and other sources (chapter 12). TPPs are a significant source of air pollution. There is no detailed inventory of these emissions. According to the second national communication to UNFCCC (2010), in 2004, TPPs accounted for 19 per cent of SO_2, 21 per cent of total NO_x and 33 per cent of CO_2 emissions nationally. This sector is also a major contributor of heavy metals (lead and cadmium) emissions and of suspended solids.

There are two main TPPs, both burning coal: one located at Jorf Lasfar, Doukkala-Abda region, generating 60.7 per cent of the national electricity production, and one in Mohammedia, producing another 20 per cent. In 2004, the Mohammedia TPP was responsible for 36 per cent of SO_2, 33 per cent of NO_x, 28 per cent of CO_2, 52 per cent of PM_{10}, 70 per cent of lead and 43 per cent of cadmium emissions in the Casablanca region.

There are no national sectoral standards for TPP air emissions. The major production companies are certified ISO 14000 (e.g., the JELC company managing the Jorf Lasfar TPP) and are supposedly following international air emission standards. In 2010, JELC undertook an EIA for the extension of the Jorf Lasfar plant in accordance with Law No. 12-

03 on Environmental Impact Assessment. According to that EIA, emissions into air were to be subject to online monitoring. However, no data have been published or made available on these emissions.

The SAMIR refinery located in Mohammedia contributed 22 per cent of the total SO_2 emissions for the whole Casablanca region in 2004 and was a serious air pollution hotspot. It was producing diesel at 1,000 parts per million (ppm) SO_2 content and leaded gasoline for the national market. In 2004, a partnership agreement was signed with the Government to produce unleaded gasoline and diesel at 50 ppm SO_2, with the objective to reduce air emissions in the transport sector by 760 tons per year (t/year) of lead and 54,000 t/year of SO_2. At the same time, the related modernization of the production plant resulted in a reduction of the plant's SO_2 emissions by around half in 2010, as compared with 2004 (figure 6.1). Although the emissions are now meeting the general emission limits set by the authorities, the plant still generates around 50 t/day of SO_2.

Industry

In 2009, there were about 7,841 stationary industrial sources of air pollution in the country. They are concentrated in the industrial areas of Sai, Jorf Lasfar, Casablanca, Kenitra and Mohammedia, all of them along the Atlantic coast. Air pollution is mostly generated by chemical plants (including fertilizer production), the textile, food and feed industries (including sugar and oil production), and metallurgic plants.

According to the latest national communication to UNFCCC (2010), in 2004, industry was emitting 59 per cent of SO_2, 6.5 per cent of NO_x, 0.6 per cent of VOCs and 24 per cent of CO_2.

There is no inventory of industrial plants with their related air emissions. According to the Dahir of 25 August 1914 and its associated 1933 Order of the Prime Minister , industrial plants must be registered, but there are no permits for releasing emissions, including to the air. As Law No. 13-03 on Combating Air Pollution lacks implementing regulations, there are also no obligations regarding the quality of air emissions.

Industrial plants are neither monitoring nor reporting their emissions, which explains the lack of information on air pollution generated by industry. An exception is cement plants equipped with automated analysers installed inside their chimneys, which periodically report on emissions to the Department of Environment based on a partnership agreement.

Transport

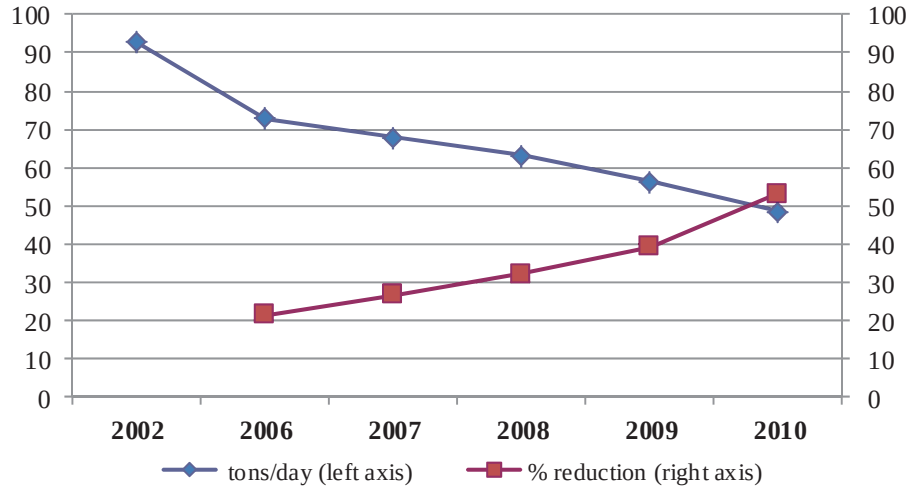
In 2010, the national fleet numbered 2,791,004 vehicles, of which 783,479 were commercial vehicles, 1,976,172 passenger cars and 31,353 motorbikes. Transport activities across the country have increased by an average 4 per cent to 5 per cent per year over the past decade, the rate of increase reaching 9 per cent per year in Rabat for the period 2003–2006 and 15 per cent per year in Marrakech for the period 2000–2008.

In the early 2000s, the fleet was characterized by ageing vehicles (often second-hand, imported cars), a general lack of engine maintenance, a lack of technical checks and emission controls due to insufficient means for emission controls, and the use of low-quality fuels with high lead and sulphur content (e.g. 1,000 ppm SO_2 diesel). This resulted in seriously increasing pollution with high emissions of SO_2, NO_2, VOCs, ozone, lead, particulate matter and GHGs. However, progress has been made over the past 10 years; the share of vehicles more than 10 years old has decreased from 75.4 per cent in 2004 to 59.7 per cent in 2008 and 56.9 per cent in 2009.

In 2005, the share of the transport sector in national air emissions in urban zones was 37 per cent of total NO_x, 9 per cent of SO_2 and 7 per cent of total suspended solids (table 6.1). There are no more recent data on national air emissions from transport. Over 50 per cent of the vehicles are concentrated in the zone of Rabat-Casablanca. The air pollution problem is exacerbated in urban zones with high traffic (Casablanca, Mohammedia, Rabat and Marrakech).

For instance, in 2005 in Rabat, the transport sector was generating 79 per cent of total NO_x,14 per cent of which came from gasoline vehicles and 65 per cent from diesel vehicles; and 34 per cent of total SO_2, including 33 per cent from diesel vehicles. In total, the sector was generating 5,700 t/year of NO_x and about 3,400 t/year of SO_2. Rabat is largely an administrative city, one in which industry is much less predominant than in cities like Casablanca, and where the traffic is dense. The public transportation system is well developed in Rabat and is responsible for 4.3 per cent of NO_x, 10.5 per cent of SO_2 and 4.8 per cent of TSP emissions from transport. In 2007, data collected in air emission monitoring stations in Rabat showed that WHO air quality standards were frequently exceeded in high road traffic zones.

Figure 6.1: SAMIR refinery: SO2 air emissions



Source: SAMIR, 2012.

Handicrafts sector

The handicrafts sector is especially well developed in Morocco: 2 million people are living on craft activities, producing 20 per cent of GDP. Among the wide range of craft activities, pottery production, which uses some thousand pottery kilns, is a main contributor to air pollution.

Traditionally, pottery kilns use wood, but, because of its increasing price, potters are tempted to burn wastes, including old tyres, used oils and other unconventional combustibles. Such practices are extremely polluting, causing heavy emissions of black carbon, suspended solids and unburned chemical by-products (dioxins, furans, polycyclic aromatic hydrocarbons (PAHs)).

As the pottery workshops are usually located in the centres of the old cities, harmful emissions are generated in close contact with the population and put human health at risk. Epidemiological studies have shown a related, significant increase in respiratory diseases (chapter 10). On top of this, hammams and bakeries with traditional ovens using similar types of combustibles are also generating the same kinds of emissions in city centres.

The state-of-the-environment report produced in 2012 for the Rabat-Salé-Témara region by the Regional Observatory for the Environment and Sustainable Development (OREDD) contains a plan of action to reduce air pollution. Its main objective is to replace 100 per cent of the traditional ovens with cleaner gas ovens over the period 2012–2014.

The plan is to be jointly implemented by the Ministry of Handicrafts, the FODEP and the potters themselves.

Indeed, for some time now the State has tried to encourage potters to use gas ovens, but the craftsmen are reluctant to change their traditional methods and few results have been obtained so far. In addition, replacing an oven is a significant investment for those in professions that are often close to the subsistence line. Of the 118 pottery kilns registered in the Saada-Marrakech production site, only 24 per cent are gas burning, in spite of the assistance programmes offered by the State.

In 2011, an agreement was signed between the Department of Environment (through the National Environment Fund), the Ministry of Handicrafts and the Partnership-for-Progress Agency, for funds from the United States Millennium Challenge Account with a view to providing financial assistance to the pottery sector in the cities of Marrakech and Fès. The objective is to replace 200 traditional ovens with gas ovens. The National Environment Fund will provide 20 million dirhams (about €2 million), covering 40 per cent of the project cost; the Partnership-for-Progress Agency will contribute another 30 per cent to 40 per cent; and the potters are expected to cover the remaining 20 per cent to 30 per cent of the cost. This represents significant progress compared with previous assistance plans, which failed because the burden left on the potters was too heavy. However, even 20 per cent might be unaffordable for them if the cost of the ovens is too high (Morocco does not produce these ovens; they are imported from Italy or Spain). Attempts are being made to develop less expensive ovens within the country.

Agriculture

The agricultural sector is mainly a source of GHGs (methane (CH_4) from cattle and N_2O from cattle and fertilizers). According to the second national communication to UNFCCC (2010), 233,000 tons of CH_4 and 60,000 tons of N_2O were emitted in 2004. POPs are also emitted, as well as chemical pollutants and dust (i.e. PM), but accurate data do not exist and even estimates on the quantities generated are highly uncertain.

6.3 Air quality

Although continuous measurements of SO_2, NO_x, carbon monoxide (CO), PM_{10}, ozone and total hydrocarbons (an approximation for VOCs) have been collected from the automatic stations of the air monitoring network since 2003, no overall picture of the air quality in the country has been published. Data are reported in various bulletins and reports but not analysed or consolidated at the national level. A comprehensive analysis of air quality that can be used as a basis for decision-making with regard to population protection is lacking.

Air monitoring

In November 2012, the national monitoring network for air quality included 29 automatic stations covering 15 cities, and four mobile laboratories. The objectives of the monitoring network are to measure, predict and inform the authorities and the public on air quality, the ultimate goal being to provide a basis for decision makers to take emergency decisions when concentrations of toxic elements are at a level that might affect human health.

The automatic stations are located in the major cities (1 in Agadir, 1 in Benslimane, 13 in Casablanca-Mohammedia, 2 in El Jadida, 1 in Essaouira, 1 in Fès, 1 in Kenitra, 1 in Khouribga, 3 in Marrakech, 2 in Rabat-Salé, 1 in Safi, 1 in Settat and 1 in Tangier). Six parameters are monitored (CO, SO_2, ozone, total hydrocarbons, NO_x and PM_{10}). Ultimately, the aim is to cover all sites with a population above 200,000 inhabitants or with important industrial or touristic activities. The extension of the network will take into account the needs defined through the air emission inventories (cadastres). At the moment, as the cadastres have not all been completed, it is not possible to say whether the network is adequate.

Mobile laboratories are used for specific, localized measurements anywhere in the country, mostly in urban zones in response to a complaint, and also to define relevant sites for additional automatic stations.

In 2004, a monitoring network was set up with two automatic stations and a mobile laboratory. Since 2007, the air quality network has been under the responsibility of the DNM, owing to its capacity to acquire and process data in real time. The DNM provides weekly and annual electronic information bulletins for every station to institutional partners. It also publishes annual bulletins compiling and analysing the situation over each region and highlighting the main features. For example, the 2010 bulletin for the Casablanca region provided statistics on exceedances, which, for the main pollutants, would have triggered information and warning procedures if the legislation and related system were in place (the corresponding decree has not yet been adopted). This information is useful as a basis for taking measures for protecting the population (table 6.3).

Moreover, every day, the DNM issues information on air quality in the form of index values for every monitoring station. This index on air quality – with a scale from 1 (very good) to 10 (very bad) – takes into account four parameters ($S0_2$, NO_2, ozone (O_3) and PM) to qualify the pollution grade. The Joint Order of the Ministry of Energy, Mines, Water and Environment and the Ministry of Health on the setting the index on air quality is awaiting official publication.

The DNM is also developing predictive models to assist in the management of accidental emissions (pollution-risk system) and in making appropriate decisions and taking relevant measures in such an event. The system has been tested and is operational across the Casablanca region, and should be extended to other places. Another ambition of the DNM is to be able to predict air quality three days in advance to assist in making early decisions (for instance to regulate traffic during heavy periods).

Emission inventories

Emission inventories (also called cadastres) are elaborated by the Department of Environment. So far emission inventories have been validated for six regions, a few others are in their final phase and all regional inventories will be issued by the end of 2014. Benslimane, Casablanca, Essaouira, Khouribga, Marrakech, Rabat, Salé, Settat, Tangier and Témara all have validated emission inventories.

Table 6.3: Number of days when air emission values triggered information and warning procedures, Casablanca monitoring stations, 2011

Pollutants		Selected automatic stations						
		Casablanca					Mohammedia	
		CHU	ONCF	Wilaya	Jahid	Sidi Othman	Khansâa	Prefecture
SO_2	Information threshold: above average 350 µg/m³/hour	2	31	0	15	0	4	4
	Warning threshold: above average 550 µg/m³/hour	0	7	0	4	0	1	0
O_3	Information threshold: above average 200 µg/m³/hour	38	0	110	9	0	0	56
	Warning threshold: above average 400 µg/m³/hour	0	0	36	4	0	0	24
NO_2	Information threshold: above average 250 µg/m³/hour	0	1	0	1	0	0	1
	Warning threshold: above average 400 µg/m³/hour	0	0	0	0	0	0	0
PM_{10}	Information threshold: above average 150 µg/m³/hour	0	46	3	1	2	6	49
	Warning threshold: above average 200 µg/m³/hour	0	17	0	0	0	0	17

Source: National Directorate of Meteorology, 2012.
Note: CHU = Centre Hospitalier Universitaire
ONCF = Office National des Chemins de Fer du Maroc

These inventories are the result of a participatory approach at the regional level in which regional and local administrations, local industries and associations, the DNM and the OREDDs take part, with the Department of Environment acting as coordinator.

A first report establishes the baseline situation; the data it contains on air emissions and the location of emission sources are to be updated on a regular basis, taking stock of changes in air emissions but also of the economic development in a given territory. Cadastre reports are based on an in-depth analysis of all data (aggregated and disaggregated) from the DNM, from self-reporting by industry and from various measurement campaigns, such as traffic and urban pollution monitoring.

At the moment, Morocco is tackling this first step to establish the baseline situation in the country. Databases and information gathered on air are further used by the regional observatories in their own reports.

As a follow-up to the first Casablanca cadastre report, issued in 2008 and based on 2004 data (table 6.4), an action plan to reduce air pollution was developed in 2009 and is currently being implemented. Under it, actions are taken to reduce industrial air emissions from large industrial facilities such as those of the National Office of Electricity (ONE), the Lafarge cement unit, the SAMIR refinery, Maghreb Steel and Société Cherifienne d'engrais et produits chimiques (SCE). The objective is to reduce emissions of CO_2 (by 9.3 per cent), SO_2 (79.5 per cent), NO_x (40.5 per cent), CO (68.7 per cent) and TSP (58.7 per cent), by 2015.

The cost of implementing the action plan was estimated at 53.7 billion dirhams (approximately €4.8 billion). Inventories already issued have not yet entered into a process of regular updating.

Since the self-reporting and self-monitoring of large sources of combustion is not yet performed in a regular manner, the Central Laboratory of the Department of Environment, with its mobile monitoring station and modern laboratory equipment, plays a key monitoring role. In the context of targeted campaigns or controls in response to complaints, it provides data on air emissions that complement the DNM data, both being used to establish the emission cadastres.

Table 6.4: Air emissions in the Grand Casablanca region, 2004

	Tons							kg		
	SO_2	NO_2	CO	CO_2	CH_4	TSP	NMVOC	Benzene	Pb	Cd
Road transport	9,299	10,405	22,999	1,765,256	174	2,185	4,131	135,907	328	6
Air transport	17	203	254	54,805	2	0	18	0	0	0
Electricity generation	24,525	9,312	434	2,287,235	34	4,665	116	7	2,897	37
Oil products treatment	15,001	1,363	635	815,530	26	252	3,104	5	38	10
Manufacturing industry	19,952	5,714	2,299	2,328,107	32	1,048	1,711	6	735	21
Residential	63	752	1,465	1,075,313	2	791	62	9,981	114	10
Solvents	0	0	0	0	0	0	7,475	0	0	0
Solid waste	0	0	0	0	62,565	0	0	0	0	0
Total	**68,857**	**27,750**	**28,086**	**8,325,946**	**62,835**	**8,942**	**16,616**	**145,907**	**4,112**	**84**
Emissions										
kg/habitant	19.00	7.60	7.70	2,293.00	17.30	2.50	4.60			
µg/habitant								40.18	1.13	0.02
t/km^2	57.00	23.00	23.20	6,888.90	52.00	7.40	13.70			
kg/km^2								120.70	3.40	0.10

Source: Cadastre des émissions de la Region de Grand Casablanca, 2009, p. 132.
Notes: Cd = cadmium; NMVOC = non-methane volatile organic compound; Pb = lead

Self-monitoring by the industrial sector

Although Law 13-03 on Combating Air Pollution requires it, self-monitoring by industrial enterprises is not performed, except by a few industrial companies of international importance that are ISO 14000 certified and have to publish this environmental information in their annual reports. The SAMIR refinery and cement companies such as Lafarge and Holcim are among this group. As sectoral emission limits have not been set, and because the Department of Environment's environmental control body remains weak, the Department is following a partnership approach with industry, striving to make companies follow the general emission limits and negotiating with companies to get them to monitor and report their emissions.

6.4 Policy objectives and management practices

Strategies, programmes and plans, and national targets

As at the end of 2012, there is no integrated national strategy for air protection, nor any other policy document that includes national strategic lines for an integrated vision of air protection. The Qualit'Air Programme, initiated by the Mohammed VI Foundation for Environmental Protection in 2002, set up monitoring stations in a number of big cities and introduced a few relevant laws: Law No. 11-03 on the Protection and Conservation of the Environment, Law No. 12-03 on Environmental Impact Assessment, and Law No. 13-03 on Combating Air Pollution (box 6.1). As of 2012, the Qualit'Air Programme is still the only official programme recognized at the national level and able to mobilize various ministries and partners to work together towards common goals.

A national air protection programme is planned as a component of the Department of Environment's Progressive Strategy for Upgrading the Environmental Situation, and it is currently being elaborated in cooperation with relevant departments and institutions. The Strategy also includes a new National Programme for Prevention of and Fight against Industrial Pollution (chapter 11). This draft programme plans to identify pollution sources and to evaluate their impact on the environment, and is backed by financing tools to finance projects for reducing pollution, including air pollution. So far, the integration of air protection concerns in the economic sector is uneven. The Mohammed VI Foundation for Environmental Protection launched a survey in 2005 on the road traffic between Kenitra and El Jadida to raise awareness of air pollution by the transport sector.As a significant share of vehicles in the country did not comply with national exhaust standards, with only a 57 per cent compliance rate, a series of corrective actions was recommended, such as the introduction of cleaner fuels, improved technical controls of car engines, the improvement of technical control centres and training of their staff, and a progressive renewal of the fleet. Following this survey, the Ministry of Equipment and Transport launched an action plan for the period 2005–2008 with four objectives (cleaner fuels, improved urban circulation plans, cleaner vehicles and air quality monitoring), which have all been implemented.

Box 6.1: Mohammed VI Foundation for Environmental Protection

The Mohammed VI Foundation for Environmental Protection, a key actor in initiating and promoting actions for the protection of public health, was a pioneer in raising awareness of the adverse impact of air pollution in Morocco. Established in 2001, it has been behind a series of urgent actions in this field: regulations to upgrade diesel quality, a campaign on vehicle exhaust gas in Kenitra-El Jadida, an awareness-raising campaign targeting the public, setting up automatic air monitoring stations in a few main cities and purchasing a mobile laboratory. The Foundation also initiated a few relevant laws, including Law No. 13-03 on Combating Air Pollution, and set up the Qualit'Air Programme and the voluntary Carbon Compensation Programme to reduce GHGs. The approach of the Foundation is to point out acute environmental problems and open the way to finding solutions through its activities. It does not intend to institutionalize its role and hands on to appropriate partners the continuation of its actions in the long term. For instance, in 2007, responsibility for monitoring stations was given to the DNM to be part of its monitoring system.

Source: Mohammed VI Foundation for Environmental Protection, 2012.

The Ministry further integrated strategic lines on air protection in the Strategy for the Transport Sector for 2008–2012 and 2012–2016. However, these actions were not integrated in a comprehensive approach and have not been coordinated with other ministries in order to optimize their effects and avoid duplications or gaps. The 2008 Strategy for the Transport Sector for the period 2008–2012 called for urban transport to be improved and for a policy of cleaner transport to be put in place.

It also defined a series of concrete actions to achieve these goals, most of which have been implemented, such as: the introduction of financial incentives to replace old vehicles (from 2008, for scrapping commercial trucks over 15 years old); a ban on the import of second-hand vehicles more than five years old, from 2011; financial contributions to improve the technical control centres and an upgrade in the quality of the technical controls; the organization of training for the staff of the control centres from 2008 to 2012; and the introduction of cleaner fuels and of mandatory unleaded gasoline and diesel at 50 ppm SO_2 in January 2009.

The Strategy also promoted the improvement and development of public transportation systems in cities, urban traffic plans and other longer-term actions for a more sustainable transport system. The 2012 Strategy for the Transport Sector (for 2012–2016) is proceeding further towards the development of a sustainable transport sector, and puts emphasis on road, rail and tramway infrastructure. The 2010 National Strategy for the Development of Logistical Competitiveness 2010–2015 promotes multimodal transport for the transport of goods, with the goal of reducing the tons per kilometre (t/km) of transported goods by 35 per cent and the CO_2 emissions by 30 per cent by 2015, and also promotes more fluid traffic flows in cities and on roads.

Legal framework

Legislation to protect air started to develop in 2003 with the enactment of Law No. 13-03 on Combating Air Pollution, which targets all emissions into the air from stationary and mobile sources, except from military activities or ionizing agents (regulated under a specific law). The Law forbids the discharge into the air of polluting elements beyond authorized limits to be set by specific implementing regulations and controlled by a mandated authority. Two other laws of 2003 also include important principles for protecting air quality.

Law No. 11-03 on the Protection and Conservation of the Environment introduces the polluter-pays principle, and calls for the development of air quality monitoring networks, including monitoring and reporting obligations for polluters, and for the setting up of economic and financial instruments for assisting in financing protection measures. Law No. 12-03 on Environmental Impact Assessment ensures that new projects comply with the regulations on air emissions. Together, the three laws (11-03, 12-03 and 13-03) contain all the necessary principles to ensure Morocco's compliance with international air protection standards.

The related implementing regulations are developing very slowly, however. While standards for air quality and the procedures for setting up the air monitoring network were adopted in 2009 (Decree No. 2-09-286) and general limit values for air emissions from stationary sources and their control were adopted in 2010 (Decree No. 2-09-631), other decrees – such as on an air quality index, on disclosure of information on air quality, and on alert and emergency threshold values necessary to set up an alert system for human health protection – are still in draft form. A National Committee on Air Monitoring and Surveillance, foreseen in Decree No. 2-09-286, was established in 2013 within the Department of Environment and

includes all the relevant governmental institutions involved in air monitoring.

Decree No. 2-09-631 provides general air ELVs from stationary sources and mandates the government departments concerned to jointly set sectoral limits. So far, however, specific air ELVs for the most polluting economic sectors (cement factories, oil refineries, TPPs, phosphate production, fertilizer production, waste incinerators, metallurgy, brick and ceramic factories, food industries using sugar, oil factories and plastics production) are only in the drafting stage, or, at best, have been completed but are still awaiting adoption. Pending the adoption of relevant sectoral ELVs, there are two voluntary initiatives in place to use sectoral limit values for the refinery and cement sectors. The limit values applied through these voluntary agreements are based on international recommendations.

Taking into account sector-specific financial and technical constraints, Decree No. 2-09-631 allows stationary source operators a grace period of from up to two to five years to comply with the ELVs set. The length of the grace period will be fixed in consultation with the government departments concerned. For sectors for which specific limit values have not yet been set, operators must comply with the general limit values established in Decree No. 2-09-631 pending the adoption of sectoral limit values. The Decree also calls for inspection of stationary facilities; however, self-monitoring and self-reporting are voluntary. Law No. 13-03 not only prohibits the generation and discharge of polluting air emissions above the allowed limits, but also calls for the introduction of clean technology and provides for a system of control and sanctions.

However, as sectoral emission limits have not yet been set and the control body of the Department of Environment is not strong enough to exercise control functions, the administration favours a partnership approach with industry, and encourages voluntary measures through the signing of partnership agreements. This approach is also applied to small manufacturers (handicrafts industry) where, for social reasons, the administration is reluctant to adopt a control-and-sanction approach.

Regulations do not impose any obligation on registered industrial plants to declare the pollution they discharge. A few branches of large industry, such as the cement industry (Association Professionnelle des Cimentiers (APC)), electricity producers (ONE), phosphate industry (OCP) and a few others, have signed a partnership agreement with the environmental authorities. In Morocco, most industrial plants are small and medium-sized industries that do not measure or report their air emissions.

A number of regulations related to air have also been issued by other ministries/administrations. The transport sector promulgated a series of decrees on the quality of fuels (in 2009) and vehicle exhaust gas quality and control (in 1998). There is also an order of 2001 on the control of equipment measuring the exhaust gas opacity from diesel vehicles, four orders regarding vehicle noise and four orders regulating vehicle engine condition with regard to exhaust gas. Emission thresholds for exhaust gas are set at 4.5 per cent for CO from gasoline-driven vehicles, and at 70 per cent for exhaust opacity (PM content) from diesel vehicles. This is higher than the European standards (at 3.5 per cent and 65 per cent, respectively). Morocco has introduced the EURO 4 system for the certification of new cars or imported cars. Therefore, only vehicles put into service after 2005 (and not exceeding certain thresholds of emissions) meet this standard. Other recent relevant decrees include decrees on the management of used oils (in 2011) and on solid waste treatment and incineration (in 2012).

Institutional framework

Ministry of Energy, Mines, Water and Environment

The Department of Environment of the Ministry of Energy, Mines, Water and Environment is responsible for the strategic and programmatic approach regarding air pollution management. It elaborates laws and related implementing regulations in collaboration with other ministries. It also establishes air emission inventories (cadastres). The National Laboratory of Studies and Pollution Monitoring, with one mobile automatic station, measures air emissions in response to complaints from the public regarding industrial or handicrafts enterprise pollution, or to respond to demands from the industrial sector to check or audit their emissions.

The DNM, within the Department of Water, is responsible for the air quality monitoring network. Its local regional offices maintain automatic stations. It is also in charge of validating and transmitting the information to all partners interested in obtaining this information to facilitate their own decision-making. The DNM is building its air quality forecasting capacity and developing predictive models to assist in the management of accidental emissions. At the regional level, the recently created OREDDs are becoming an important forum for gathering

environmental information, compiling it and using it to establish regional environmental action plans (chapter 1). They are using the air emission cadastres in particular as one information element. Conversely, they also provide information input to the cadastres.

Other ministries

The Ministry of Health, with its Directorate of Epidemiology, carries out surveys and studies on the impact of air pollution on human health, and defines toxicity thresholds. The Ministry participated in the Casablanca and Mohammedia Airpol surveys in 1998–1999 and 2001–2002 respectively (chapter 10), and are currently conducting a new assessment, the Airpur study in Casablanca, with results expected by mid-2013. The Ministry of Equipment and Transport is also active in trying to reduce emissions generated by the sector and to develop strategic lines, legislation and actions in that regard. The Ministry of Handicrafts works to modernize traditional activities that are generating emissions in urban zones. However, there is no interministerial body or process that aims at integrating actions to reduce air emissions throughout various economic sectors in a coordinated manner.

Economic instruments and voluntary agreements

In Morocco, there are no taxes to penalize the emission of air pollutants, but economic incentives and tax exemptions do exist to encourage investment in projects that prevent air pollution or include air protection measures. The Department of Environment follows a participatory and voluntary approach to the reduction of industrial pollution, and has concluded voluntary agreements with some industrial subsectors. For example, a partnership was signed in 2011 with the pottery sector to co-finance the shift of 200 pottery kilns from wood to gas in two cities, Fès and Marrakech.

Also, to support the programme for industrial clean-up, the Fund for Industrial Depollution (FODEP) was created to provide industrial enterprises with financial subsidies up to a maximum of 40 per cent of the total costs of their clean-up projects (chapters 4 and 11). Fifteen projects for reducing air pollution have been financed through the FODEP, amounting to some 47 million dirhams (roughly €4.22 million). These projects cover a vast array of industrial activities, including cement plants, smelters, battery production and the food and feed industries (table 6.5).

Most of the abatement projects are of the downstream type, and very few are integrated. For instance, in 2000, 17 million dirhams were spent on baghouses in the Lafarge Meknès cement factory, including a contribution of 6.8 million dirhams from the FODEP (table 6.5). The baghouses were designed for 99 per cent efficiency for PM removal, but data on the effective removal rate and efficiency have not been published. In 2007, the National Environment Fund was created to assist in the environmental upgrading of small industries, for example in the regions of Chaouia-Ouardigha, Marrakech-Tensift-Al Haouz and Souss-Massa-Drâa.

Table 6.5: Projects for air pollution abatement financed through the FODEP

Company	Activity	City	Project cost dirham
Lafarge 2	Cement	Meknès	17,047,150
Cimar Marrakech	Cement	Marrakech	8,203,524
Betomar	Quarry	Benslimane	3,047,087
Africa Cables 1	Batteries	Casablanca	2,685,000
Lever Maroc	Detergent	Casablanca	2,623,580
Cimar Safi	Cement	Safi	1,997,160
CMOE	Gypsum	Safi	1,955,106
Mafoder 1	Steel smelters	Casablanca	1,933,823
Africa Cables 2	Batteries	Casablanca	1,545,574
Nora preserves	Olive oil	Sbaa Ayoune	1,451,400
Sonacar	Cardboard	El Jadida	1,404,444
Colorado	Painting	Aidn Sbaa	820,746
Tantasar	Fishmeal	Tan Tan	788,549
Sovapec	Fishmeal	Tan Tan	783,666
Bouchra Ceramics	Pottery	Safi	720,291

Source: Fund for Insustrial Pollution, 2012.

6.5 Conclusions and recommendations

There is a lack of a comprehensive strategic vision for protecting air quality in Morocco, and separate actions are initiated by different ministries and other actors without a common national direction, an integrated view, and the prioritization and harmonization of actions. A strategic vision and programmatic framework would be of key importance when developing sectoral air protection policies. The planned air protection programme is urgently needed if the country wants to protect its population and the environment from the adverse effects of air pollution. Such a national programme is necessary for the environmental authorities to coordinate the information flows and actions with the other ministries and departments involved, e.g., the Ministry of Industry, the Ministry of Equipment and Transport; the Ministry of Handicrafts; the Ministry of Energy, Mines, Water and Environment; and the Ministry of Health.

Recommendation 6.1:
The Ministry of Energy, Mines, Water and Environment, in cooperation with relevant stakeholders and taking stock of measures already implemented, should:

(a) Finalize the national programme on air protection covering all sectors with air pollution impacts by identifying priorities, designing prevention and abatement measures with time frames, and estimating the related budget;
(b) When ready, submit the programme to the Government for approval and promote its adoption by the parliament.

The 2003 Law No. 13-03 on Combating Air Pollution contains all the necessary provisions to set up a system for the efficient management of air quality. However, most of the implementing regulations are long overdue and those that have been adopted provide an insufficient basis for taking action. Furthermore, the 2009 Decree No. 2-09-286 setting standards for air quality and the procedures for air monitoring is not complemented by regulations for using the information gathered in decision-making, for instance to warn the population about and protect it from pollution peaks and to regulate road traffic.

Similarly, the 2010 Decree No. 2-09-631 setting limit values for clearance, emission or discharge of pollutants into the air from stationary sources of pollution and the procedures for air monitoring, has to be applied to industrial plants. There are currently two voluntary initiatives to limit air emissions, based on international recommendations. No specific order for sectoral values has been adopted so far, although these have largely already been developed by the relevant public authorities. There are also no obligations on industry to self-monitor their emissions or to report them.

While the current voluntary approach through partnership with industry and the handicrafts sector may have shown some initial success, its limitations will be felt when partners taking voluntary actions and incurring additional expense begin to feel the inequity of their situation as others continue to pollute. A stricter command-and-control approach must inevitably be introduced, at least gradually. Therefore, it will be necessary that the Department of Environment be prepared to progressively implement control actions (chapters 2 and 10). In any case, when ELVs for various branches of industry are adopted, the Department of Environment has to ensure that proper monitoring and reporting of pollutants is done by industry. Furthermore, establishing technology-based emission limits should be considered for new or renovated sources. Industrial pollution hotspots identified through the emission inventories would be a priority for self-monitoring and self-reporting.

Recommendation 6.2:
The Ministry of Energy, Mines, Water and Environment, in cooperation with the relevant ministries and departments, should:

(a) Speed up the elaboration of the implementing regulations called for in the Law on Combating Air Pollution and its implementing decrees, and promote their adoption, in order to make the Law operational;
(b) Finalize decrees on sectoral air emission limit values and ensure that self-monitoring and self-reporting are mandatory for the most polluting industrial facilities.

The traditional pottery sector is an area of major concern, given the heavy emission of harmful pollutants into the air from pottery kilns in heavily populated areas. The Ministry of Handicrafts and the Department of Environment have combined their efforts to offer acceptable technical and financial solutions to the craftsmen to shift pottery kilns from wood to gas. For financial, technical and social reasons, local solutions, with equipment designed in Morocco, would be an interesting option to work on.

Recommendation 6.3:
The Ministry of Handicrafts and the Ministry of Energy, Mines, Water and Environment, with the support of the Mohammed VI Foundation for Environmental Protection and relevant stakeholders, should continue to work out technical solutions and incentives to shift traditional pottery kilns from wood to gas fuel.

Chapter 7

WATER MANAGEMENT

7.1 The water challenge: an overview

Morocco has limited potential with respect to water resources and faces substantial challenges in that regard. An uneven distribution of water in space and time is the main feature of the hydrological regime. Yearly precipitation may diverge significantly (almost on a 1:10 ratio) and the same asymmetry may be observed among water basins in the course of the hydrological year. Furthermore, similarly to most Mediterranean countries, Morocco has experienced severe droughts in recent decades with occasional extreme precipitation episodes and disastrous flash floods. The water quality is also questionable.

As early as 2004, a World Bank report estimated the cost of water resources pollution and its health-related effects to be 1.23 per cent of GNP. Since then, the population growth and agriculture demands are increasing the pressures on water resources and non-treated wastewater discharges, threatening many aquatic ecosystems. The population of Morocco is estimated to grow by more than 10 million by 2050 and the demand for food and water will increase accordingly.

Moreover, the continuous urbanization and building in the littoral zone will induce localized peak water demands. This increasing exposure and sensitivity to water issues and limited adaptive capacity will worsen Morocco's vulnerability regarding water. A reinforced multilevel governance approach in terms of legislation, institutions and community empowerment would ensure that sustainable planning and management of water resources and water services will be reached.

7.2 Water resources quantity

Water balance

The country's weather and climate are influenced mostly by large-scale atmospheric circulation dominated by the influence of the North Atlantic (Azores) storm track and the orographic effects induced by the Atlas Massif. The climate is characterized by strong seasonality and high inter-annual variability. The average rainfall over the territory is 140 billion m^3/year, but can vary from 50 billion m^3/year to 400 billion m^3/year. Evapotranspiration is high: evaporation and transpiration losses are, on average, 118 billion m^3/year. The freshwater recharge is estimated at 22 billion m^3/year, of which 18 billion m^3/year is from surface water and 4 billion m^3/year from groundwater.

The water volume that may be technically and economically exploitable reaches 80 per cent of current available resources. This reveals the current national constraints on water issues and the challenges that are ahead regarding the urgency of an integrated water management approach. From the supply side, the internal market of virtual water trade embedded in food and other goods behaves as an indirect intraregional water deficit compensation mechanism, but no statistical information exists that would allow assessment of these exchanges.

Surface water resources

The distribution of water resources is consistent with the precipitation pattern in Morocco. Higher annual precipitation is reached in the mountainous areas of the north-west, in the water basin of Loukkos, Tangier and the Mediterranean coast, at more than 1,000 mm/year. Conversely, annual precipitation is less than 300 mm/year in the Moulouya, Tensift, Souss-Massa and South-Atlas basins. In the sub-Saharan region it is even lower, below 100 mm/year. Consequently, the pattern of water availability and intrinsic characteristics in each water basin is heterogeneous and very relevant to all water supply-side decisions. For instance, the Sebou water basin holds 30 per cent of surface water resources and groundwater and, although it represents only 6 per cent of the total area of Morocco, 18 per cent of the country's population lives within it. The northern (Loukkos, Tangier and Mediterranean Coastal) and Sebou basins cover nearly 7 per cent of the area of the country and more than half of the surface water resources. Conversely, the Tensift, Bouregreg and other southern water basins exhibit water security insufficiencies. Internal water transfers are already used to somehow compensate for shortages in each water basin. About 0.3 million m^3 may be transferred from Oum Er-Rbia basin to Tensift dry areas, essentially to sustain irrigated areas. Similarly, another 0.16 million m^3 may be transferred from the

Sebou and Oum Er-Rbia water basins to support Bouregreg's domestic water needs.[16]

The inter-annual water balance suffers extreme oscillations. For instance, the annual inflow was 47 billion m^3 in 1962–1963, but was less than 5 billion m^3 in 1992–1993. An additional characteristic of the Moroccan river system is the irregular flow during the hydrological year – a pronounced low flow during the summer and occasional floods under intense but brief rainfall. Therefore, *average values* should be always regarded with caution.

Another related feature is temporary rivers and oases. Many small rivers ("wadis") may be dry during a part of the year or even several years but are very important at local level. Oases are hotspot ecosystems in regions where precipitation is lower than 200 mm/year. Unfortunately, several oases are suffering from the abandonment of traditional agricultural practices because of the soil salinization and water quality degradation, allowing desertification to proceed. In the southern Ouarzazate region, 80 per cent of soils are affected by salinization.

The mobilized potential yet available from conventional surface water sources is rather limited. Certainly, between 80 per cent and 90 per cent of economically accessible surface water resources have already been regulated through dams and inter-annual storage reservoirs in Morocco. The number of dams increased from 16 in 1960 to 115 by 2006 and stood at 133 in 2012, representing a significant increase in the water storage capacity. A nominal volume of 17.5 billion m^3 is now available, even if combined problems of leakage, soil erosion and dam silting is causing significant storage losses. About 75 million m^3 per year is lost from dams' capacity.

Groundwater resources

Groundwater represents approximately 20 per cent of Morocco's water resources potential. Groundwater has been consumed at a high rate, around 4.2 billion $m^{3/}$year, a value 10 per cent higher than the average yearly replenishment, leading to water destocking estimated at 0.9 billion $m^{3/}$year. This extraction led to a rapid drop in the water table, at a rate of 2 m/year on average. Unsustainable abstraction rates were used in several aquifers. The current water level in the Saïss aquifer is 60 m lower than that in the 1980s, and similar problems are also identified in the Souss, Témara, Haouz and South Atlas aquifers, among others. This situation is prone to occur on territories where precipitation is less than 400 mm/year and groundwater is used for agriculture irrigation by local farmers – an extensive use given pressure from a rain-fed deficit and the recent droughts.[17] Aquifer overexploitation is endangering the socioeconomic development of rural areas, promoting a dysfunctional ecological situation and increasing desertification.

Water scarcity

The average water availability in Morocco is approximately 700 m^3/cap./year, based on a global water resources value of nearly 22 billion m^3/year. This is below the UNDP's criterion, 1,000 m^3/cap./year. Amongst the water basins, the Loukkos, Tangier and Mediterranean coast basins present the highest value, 1,350 m^3/cap./year; the Bouregreg and Saharan regions reveal the lack of regional homogeneity, having only 130 m^3/cap./year to 140 m^3/cap./year. An important water balance deficit is also noted for Oum Er-Rbia.

According to a 2012 study on the vulnerability of Morocco and other Southern Mediterranean countries to climate change, the Hydrological Water Stress Index of Morocco is 11, a worse indicator than the Social Water Scarcity Index, with a value of 8. The Water Poorest Index demonstrates a high value (46) and reveals the effort that would be required to support the low-income population in Morocco.[18] This framework confirms that water is a vulnerable commodity in Morocco, but the future will be even worse if a business-as-usual perspective is pursued. The anticipation of this negative and continuous trend may be well perceived, considering the per capita water availability that has been experienced in Moroccan water basins since 1971 and regarding the forecast for 2020 (table 7.1).

[16] Transfers among sub-basins/basins are provided by 13 infrastructures with a design capacity of 210 m^3/s.

[17] Farmers have a reasonable knowledge of the local water balance and try to develop strategies to manage water stress during scarcity, and they also recognize the State's legitimacy in controlling groundwater exploitation.

[18] The Hydrological Water Stress Index (HWSI) is the number of hundreds of people per 1 million m^3 of available renewable water. The Social Water Scarcity Index (SWSI) equals the HWSI divided by UNDP's Human Development Index (HDI) and by a correction factor of 2. An SWSI or HWSI value of 0 to 5 indicates sufficient water supply, a value above 5 and below 10 indicates water stress, and above 10 indicates water scarcity. The Water Poverty Index (WPI) measures the impact of water provision on human populations and the maximum value is 100 (higher values indicate higher water provision in the country).

Photo 7.1: Wastewater treatment plant in Marrakech

Table 7.1. Water resources availability in Morocco water basins

Availability	1971		1994		2000		2020	
	Water basin	Population	Water basin	Population	Water basin	Population	Water basin	Population
m^3/cap./year	No.	Million	No.	Million	No.	Million	No.	Million
<500	2	3.3	2	5.1	2	5.9	3	12.0
1,000-500	1	2.4	2	4.0	2	4.5	3	17.0
1,700-1,000	1	0.9	4	14.4	4	15.6	3	8.6
> 1,700	5	8.4	1	2.1	1	2.4	..	..

Source: Direction de la Recherche et de la Planification de l'Eau, cited in Bzioui (2004).

Forecasts shown in table 7.1 may be somewhat uncertain regarding population and water availability. However, the focal point to retain remains unquestionable: population growth will exacerbate the water deficit in all water basins of Morocco. Today, probably 30 per cent of the population already lives in a water-stress region (below 1,000 m^3/cap./year). By 2020, the same population percentage would live under the water scarcity threshold of 500 m^3/cap./year and more that 80 per cent will live at a dangerous limit of water stress.

Climate vulnerability and risk management

The Mediterranean region is vulnerable to changes in temperature and precipitation that are likely to severely affect river runoff. Depending on the model and assumptions, precipitation might be reduced in Morocco in the period 2011–2050 from 5 per cent (mountainous areas) to 20 to 30 per cent in the southern regions, and extreme hydrological phenomena (droughts and floods) will be more frequent and intense. The general forecast seems to be supported by past hydrological events. Drought cycles are now occurring more frequently in the country: four severe episodes lasting 3 to 4 years were recorded over the last 30 years. During these episodes, the water deficits have reached up to 50 to 60 per cent for precipitation, almost 70 per cent for flows, and an extreme precipitation deficit was found in the Souss-Massa basin (a 79 per cent reduction). A clear example of the drought consequences is the sharp fall in cereal production that was experienced in 2007 (down 76 per cent on 2006) and the related social outbreak in 2008. Furthermore, the expected reduction of snow formation in the Atlas Mountains during the winter season because of the North Atlantic oscillation also threatens the water recharge.

At the other extreme, flash floods occurred in several cities and agricultural plains in recent decades. Significant cases were reported in Ourika in 1995, Tétouan in 2000 and Mohammedia in 2002. Other flooding episodes occurred in the Gharb Valley, Oum Er-Rbia, Agadir, Essaouira, Tangier, Al Hoceïma, Ziz Guir and Figuig, many of them during the 2008–2009 hydrological year.

The first negative impact as a consequence of climate change will concern the water supply sector and coastal zone management. For instance, the progressive salinization of littoral aquifers may be anticipated.[19] In addition, several shoreline points that are already under intense anthropogenic pressure will be more exposed to a sea level rise and to marine hydrodynamics. In terms of coastal flooding and erosion risks, the sensitive urban areas of Tangier and Saidia-Ras El Ma should be named. The paralic ecosystems of Oualidia-Sidi Moussa, Nador and the estuary of the Sebou River are examples of equilibrium in danger, but other ecological changes regarding nature conservation and ecosystem preservation would occur. Any increase in the intensity and frequency of hydrological extreme phenomena would impact negatively on agriculture production, because rain-fed cultures are the most important outcome of agriculture in Morocco.

Climate change is increasingly posing a significant challenge affecting and interacting with the environmental and anthropogenic systems in Morocco, revealing the importance of adaptation in order to efficiently reduce vulnerability. The first step of the adaptation measures is taking win-win actions from both the supply and demand side, aiming at covering Morocco's water uses and needs. However, adaptation cannot be achieved by one sector alone and consequences are transversal to most sectors. Table 7.2 summarizes the climatic impacts mediated by water in several sectors – water services, agriculture, biodiversity, energy and coastal zones – that would be more significant to the implementation of an adaptation strategy in Morocco.

7.3 Water resources quality

Surface waters

Environmental pollutants released from domestic and industrial sources threaten the ecological state of water bodies and compromise downstream human uses. The current water monitoring network clearly reveals the current non-satisfactory diagnosis. In 2007–2008, based on 200 monitoring points, 6 per cent of the samples were considered excellent, 37 per cent good and 18 per cent medium. Around 39 per cent of the monitoring stations displayed a not satisfactory water quality. Most of the problems are located in water basins affected by wastewater discharges, namely downstream of urban and industrial settlements and in the coastal areas. Some contaminated areas are the downstream parts of Wali Sebou, Wali Fès, Walis R'dom and Beht, Wali Oum Er-Rbia (Khénifra and Kasbat Tadla), Wali Tensift, Walis Tangier and Martil, and Wali Isly.

Dissolved organic compounds and suspended solids are the most typical municipal water pollutants. Organic matter is rather high in urban wastewaters in Morocco and the concentration decreases with the population increase due to the dilution effects (850-1,000 mg/L as COD, 300-400 mg/L as BOD, 300-500 mg/L as TSS). Nutrients, heavy metals and other xenobiotics are chemicals present in Moroccan industrial wastewaters. Municipal wastewaters are also a source of biological contamination. The concentrations of faecal coliform and fecal streptococci bacteria also exceed WHO quality standards for surface waters.

The average world fertilizer consumption rate is about 92 kg/ha of arable land, but in the North Africa/Near East region it is 71 kg/ha of arable land and in sub-Saharan Africa only 5 kg/ha of arable land. Despite this low rate of fertilizer dosing, eutrophication processes are causing water quality problems in lakes and constructed reservoirs across the entire African region.

In Morocco, the water quality of dam reservoirs was excellent to good in the year 2011/2012 according to the physico-chemical analyses performed by the WBA under Order No. 1275-02 defining the grid quality of surface water (lake water). Levels slightly elevated in chlorophyll were observed occasionally in the reservoirs of Takerkoust Mohammed V, Sidi Mohamed Ben Abdellah (SMBA).

Moreover, ONEE regularly and carefully tracks water quality, among other factors the algal population and toxins in all reservoirs used for the production of drinking water and supports all measures to secure the quality of drinking water. ONEE has conducted since 1987 at the reservoir level (SMBA) the introduction of fish eating microalgae and in 1992 the installation of an artificial ventilation system in order to inhibit algal production which is causing any

[19] An assessment of climate change impacts in the Saïdia aquifer (Mediterranean coast) indicates that in a worst-case scenario the effect would be a decrease of 50-60 per cent in water resources. This effect is due to a recharge decline and an inflow reduction from an adjacent aquifer.

harmful problems for water quality reservoirs. Regarding toxins (although they may exist in small quantities in the superficial layers of the dam), tests show that these toxins are eliminated by the type of treatment recommended at purification stations with a sizeable drawdown .

In addition, ONEE established a monitoring programme at all water supply treatment plants. This programme is based on the optimization procedures of the level of water abstraction, and the choice of the nature and doses of treatment products according to the quality of raw water, which has improved the performance stations and produce water that meets drinking water standards.

Good bathing water quality is an important asset for recreational activities and tourism, but is also an excellent indicator of the effectiveness of upstream contamination control, in the watershed. Most bathing waters have a good bacteriological quality in Morocco, considering reference to the national standards and WHO guidelines. In 2010, across 141 sampled beaches, 71 per cent of the bathing waters were classified as of good quality, an improvement over 66 per cent in 2006. However, it should be noted that bacteriological quality at 58 monitoring points was worse in 2011–2012 than in 2010–2011. The reverse was less impressive: only 39 monitoring points improved their quality status in 2011–2012. Domestic and industrial wastewaters or contaminated rainfall discharges are the reason for these low-grade results. Therefore, measures to achieve a secondary level of wastewater treatment have been identified but most will require an additional disinfection barrier to achieve pathogen control. A reduction in the diffuse pollution will be also required, but that is a second level of action.

The uncontrolled disposal of solid wastes in water basins or nearby river territories is an additional non-point source of potential contamination. The public health impact is local and is easily reversible in surface waters but aesthetic value is compromised. Another main concern in Morocco is water erosion and sediment transport in water basins due to deforestation and hydrological extreme phenomena – droughts or intense rainfalls. Indeed, the movement of sediment and associated agricultural pollutants is a major off-site impact leading not only to sedimentation in watercourses and dams but also to disruption of lakes and reservoir ecosystems[20]. In that regard, it is reported that 10 million ha are currently threatened by water erosion in Morocco.

The transport of chemicals is an additional anthropogenic hazard to freshwater and coastal water quality. The littoral is exposed to anthropogenic risks caused by chemical and other industrial plants and by maritime traffic.[21] In addition, around 30 harbour infrastructures (including an oil shipping port) exist along the shoreline. Because of their negative impact on tourism, but also on aquatic biodiversity, these hazards are a primary concern of marine, coastal and transitional water protection policies. Morocco is ecologically rich in coastal and inland aquatic ecosystems. The biodiversity inventories for natural lakes of the Middle Atlas and other ecological zones that have been granted international Ramsar designation are well known. However, other wetlands and water courses deserve a similar approach in terms of nature conservancy and biological values protection. Ecological services are reported to use 0.7 billion m^3/year of water, which is only around 5 per cent of the available surface water resources.

Groundwater

Aquifer contamination is mostly related to anthropogenic activities. A groundwater quality assessment carried out in 2007 indicates a chemical water status of good in 28 per cent of stations, medium in 28 per cent and degraded on 44 per cent of the network points. The main factor behind this situation is water contamination with nitrates – over 10 per cent of the main aquifers have a concentration above 50 mg/L. High levels were recorded in zones where the pressure from agriculture and irrigation is very intense, as is the case in Tadla (Oum Er-Rbia) and Rmel (Loukkos). Other known cases are Chaouia, Témara, Meskala-Kourimate and Berrechid. In the case of coastal aquifers, additional problems result from the risk of seawater intrusion and salinization because of water overexploitation.

Highly mineralized waters are notorious in the coastal zones of Chaouia, Berrechid, Kert Gareb Bouregreg, Beni Amir and Tafilalet. An interesting example is Essaouira aquifer, since its recharge is entirely dependent on rainwater. There, precipitation does not exceed 300 mm/year on average, temperature hovers around 20°C and potential evapotranspiration is very high, about 920 mm/year.

[20] The highest water erosion rate is in the Rif and pre-Rif mountain zones. For instance, erosion is estimated to be 265 m^3/km^2 upstream of Sidi Mohamed Ben Abdellah dam, representing a loss of 2.5 million m^3 storage.

[21] Daily passage of approximately 240 ships through Gibraltar and 360 along the Atlantic coast carrying oil, chemicals and liquefied natural gas are reported.

Table 7.2: Risks and consequences of climatic impacts in Morocco's water-related sectors

Sector	Risks	Consequences
Water services - drinking water and wastewater	Reduction in water availability Changes in precipitation pattern Water temperature increase Salinization of coastal aquifers	Increasing water shortages Increasing water installation flooding Increasing contamination of raw water Advanced treatment systems would be required
Agriculture	Reduction in water availability Increase in extreme short precipitations Water temperature increase	Increasing water requirements for irrigation Reduction in agricultural productivity Conflicts in water allocation processes
Nature conservation and biodiversity	Reduction in water availability Water temperature increase	Changes in the territorial distribution of species Losses of biodiversity and ecosystem services
Energy	Changes in surface flows Temperature rise in reservoirs (and eutrophication)	Reduction of electricity production and hydroelectric potential Malfunctions of stations Conflicts in water allocation processes
Coastal zones	Sea level rise Saline intrusion	Increasing coastal erosion Changes in coastal morphology Change in marine and estuarine ecosystems

Another pollution pressure on groundwater resources is the emission of leachates from uncontrolled landfills, which are known to have an array of different types of recalcitrant organic compounds and heavy metals. This is a typical urban problem only solved by making available MSW processing sites and closer inspection of illegal dumping.

Another environmental problem is the abandoned mines in Morocco, which are numerous and identified as being responsible for sulphate, iron and heavy metals leaching into water surfaces (Zaida lead and Kettara ore mines, for instance). Agricultural activity downstream of these emission points requires careful consideration and the remediation of surface water and soil in the vicinity is advisable.

7.4 Water services

Drinking water

Drinking water production in Morocco is around 1.02 billion m^3/year. In 2011, ONEP produced 932 million m^3 of drinking water, 70 per cent from surface water and the remainder from groundwater; 88 million m^3 is provided by authorities and dealers. The urban population served currently exceeds 18 million. Nearly 94 per cent is supplied by individual connections and 6 per cent by standpipes. Despite the progress made in improving drinking water distribution, Morocco is facing the low efficiency of its drinking water systems. Overall performance of its drinking water systems at the national level increased from 69.45 per cent in 2003 to 71.67 per cent in 2009. The rate of safe access to drinking water for the rural population was 92 per cent in 2012 (up from 14 per cent in 1994 and 61 per cent in 2004). Forty per cent of the rural population has an individual water supply connection.

Industries

Water use in industry and tourism is estimated to be 0.2 billion m^3/year (1.5 per cent of total abstractions). Although this rate is rather low and does not seem very significant when compared with agricultural and household water volumes, it is of the utmost strategic importance to Morocco in a sector that will not withstand water supply shortages.

Agriculture

Currently, around 1.5 million ha of irrigated cultures exist in Morocco. The irrigation process consumes a water volume estimated at about 12 billion m^3/year, which is 80 to 90 per cent of total water consumption in Morocco in a normal hydrological year, a value above the average rule of 70 per cent of water use in agriculture at the global scale. The water availability in reservoirs is largely affected by annual rain and snow inflows.

Large irrigation systems occupy an area around 0.7 million ha and water is provided mostly by dedicated

reservoirs. Total reservoir capacity is about 11 million m^3, with Al Whada and Al Massira dams accounting for more than 50 per cent. In contrast, private irrigation systems (500,000 ha) are mostly dependent on local aquifers. Water losses are estimated at a rate of 25 per cent of water abstracted, which compares very well with higher loss rates in Northern Mediterranean countries (40 to 60 per cent).

Hydropower and artificial reservoirs

The hydropower developed in Morocco up until 2008 reached an installed annual capacity of 1,700 MW, ensuring electricity production of up to 10 per cent in a normal hydrological year. The water–energy nexus may be viewed as a contribution to the aim of national security of energy supply in Morocco, a goal more important than the renewable energy perspective. Another source of renewable energy may result from the geothermal gradients that are present in some areas of Morocco. Geothermal energy could be delivered by high temperature aquifers, such as those identified in the Berkane and Oujda areas, but no full-scale plants are in operation yet.

The environmental impacts of the construction of artificial reservoirs are not known and are to be assessed and likely minimized. The ecological fragmentation due to hydraulic barriers (dams), the absence of environmental flows in most hydropower plants and the extended non-flowing rivers regimen because of intense upstream water abstractions are among the most significant impacts. Sensitive planning at water basin level is required in order to conciliate natural values with human requirements, mitigating local and cumulative impacts.

Municipal wastewater treatment and reuse

The current level of sanitation systems is inadequate in many parts of Morocco, with impacts on public health and ecosystems. Due to urban growth, urban wastewater production is estimated to reach about 0.7 billion m^3/year, a sharp increase on the previously estimated value of 0.5 billion m^3/year. The coastal waters receive most of the discharges, 0.3 billion m^3/year (amounting to 61 per cent of the total wastewater production), reflecting the urban (and industrial) occupation of the littoral zone. In urban areas, the total length of the sanitation network is around 13,000 km, giving a ratio of 0.72 m/cap. and 1.03 m/cap. connected. The current wastewater treatment rate is still low and reflects the shortage of municipal wastewater treatment plants (WWTPs). In late 2012, the wastewater treatment level was around 37 per cent (it was 8 per cent in 2005). There were 81 WWTPs in operation (21 in 2005), 29 per cent equipped with primary treatment, 45 per cent with secondary treatment and 26 per cent with tertiary treatment. Table 7.3 characterizes treated wastewater and reuse in Morocco in 2011.

Around 71 per cent of the wastewater treatment systems are of the extensive secondary type, predominantly of the lagoon type; such low-energy WWTPs, the best suited to Morocco, are installed whenever possible. Mechanical systems are being designed in Morocco where area availability is restricted, in the coastal zone (e.g. Al-Hoceïma, Nador) and inland (e.g. Marrakech, Fès). In the coastal zone, a different option may be used for the disposal of wastewater based on marine outfalls. This is the method chosen for Tangier and part of Casablanca (582,000 m^3/day). Additional nominal capacity of 166,000 m^3/day is under construction in El Jadida, Tétouan and Rabat. The wastewater discharge is subject to a pre-treatment, but dissolved organic pollution will impact upon sea resources. Because of known outfall limitations, beyond costly ruptures, the marine self-depuration capacity should be monitored in order to guarantee safe operation that does not threaten fisheries and bathing water quality.

Allegedly, part of the raw wastewater is illegally used in agriculture for the irrigation of around 7,000 ha in market gardening areas, forage crops, fruit and grain farming. Although reuse is an excellent strategy to face water scarcity in a context of regional food security, proper wastewater treatment to comply with current water irrigation norms and sanitary control should be in place to prevent abnormal health risks. However, the existence of non-controlled wastewater abstraction clearly points to the fact that reuse should be at the top of Morocco's water policy priorities for irrigation of food crops and touristic facilities (golf and recreational areas).

In rural areas, in "douars" (those that already have a drinking water service) the access rate to sanitation is 40 per cent, comprising water sealed latrines (34 per cent), septic tanks (3 per cent) and collective networks (3 per cent). Therefore, in many areas, sanitary systems of collection, evacuation and transport of black and grey water are not available. If this demand is to be satisfied by conventional sanitation systems, an enormous investment in sewer networks will be required. In order to address this drawback and avoid the disadvantages of conventional WWTPs, off-grid systems should be used and the possibility of resource recovery could be sought.

Table 7.3: Treated and reused wastewater in Morocco, 2011

Treatment levels	Treated		Reused		Used for
	(mm^3/year)	%	(mm^3/year)	%	
Primary	37	5.3	0	0	Agriculture, green spaces, groundwater recharging and industry
Secondary	84	12.0	47	56	
Tertiary	56	8.0	33	59	
Total	177	25.3	80	45	

Source: Bourziza and Makhokh (2011). *Country report for the Expert Consultation on Wastewater Management: Morocco*. Dubai, UAE, May 22-24.
Note: Raw sewage: 700 mm^3/year

Industrial wastewater

The industrial sector generates significant pollution. Industrial wastewater production in Morocco is about 0.08 million m^3/year and is evaluated as representing over 3.3 million inhabitant-equivalents. The coastal waters suffer the most negative impact because urban settlements and more than 80 per cent of the industries are concentrated on the littoral. The chemical industry (refinery and related activities) is the main one responsible for wastewater discharges, with an annual volume of 0.931 billion m^3. Other relevant sources of wastewater are the agro-food, textile and leather sectors, and, to a lesser extent, the mechanical and metallurgic industries, responsible overall for 0.058 billion m^3/year.

Industrial pollution has attracted particular interest in the national policy for the protection of the environment. This has resulted in the adoption of an incentive instrument, the Fund for Industrial Depollution (FODEP), which encourages environmental upgrading and has already supported 93 industrial and handicraft enterprises with total investment of 558 million dirhams. This interest in industrial pollution also appears in the objectives of the National Water Strategy, particularly in its axis relative to the preservation of water resources. In fact, the success of this ambitious programme remains dependent on a structural approach to industrial pollution. Further, consumptives industries should be encouraged to recycle water towards the implementation of clean technologies and a zero-discharge approach.

7.5 Legal, policy and institutional framework

Legal framework

The water policy of Morocco is ruled at the highest level by the 1995 Law No. 10-95 on Water. In 1995, this Law was a major breakthrough in water governance and aimed at providing Morocco with modern technical, financial and institutional tools in order to face modern water challenges.

The Law marked a first tentative paradigm shift from the supply side to demand-side management, aiming at integrating these two perspectives. A strong emphasis was directed to water use efficiency, resource allocation and protection of water quality, recognizing water as an economic and social good. The Law on Water encompasses the regulation of drinking water, improvement of agricultural water uses, wastewater treatment and reuse, and water security against illegal pollution.

The environmental principles of user pays and polluter pays are established in the Law on Water, as is administrative reform based on water basin agencies (WBAs) for integrated water resources management. Unfortunately, the implementation of the user-pays and polluter-pays principles is taking longer than expected and should be strengthened. The Law on Water led to the formulation and establishment of strategies and planning actions by the administration. Among the legislation that was approved subsequently regarding water resources protection, mention should be made of the 1998 Decree No. 2-97-787 on water quality standards and the inventory of the degree of water pollution, 2005 Decree No. 2-04-553 on spills, discharges, and direct or indirect deposits into surface water or groundwaters, and 2006 Decree No. 2-05-1533 on on-site sanitation.

Despite the steps forward they represent, the absence of a legal framework regarding allowable emission values for industrial and municipal wastewater discharges into all types of water bodies hinders practical application of the user-pays and polluter-pays principles. This issue is the most important weakness in the current water pollution legislation in Morocco.

Policy framework

The National Water Strategy is the cornerstone of water policy in Morocco. In 2009, it triggered and demonstrated new impetus for the reinforcement of

water policy. The Strategy was elaborated based on three levers:

- Much more ambitious objectives to consistently meet the country's water needs, but also to continually and sustainably protect water resources against the effects of climate change;
- A dramatic shift in the pattern of resource use and management through the coordinated management of supply and demand. This covered the perpetuation of protection measures and reconstitution of the underground stocks and lake areas, rationalization of water demand, generalization of the treatment and reuse of wastewater in cities, an innovative portfolio of mobilization solutions and of access to the resource, combining all the relevant local solutions with better connection between regions, and proactive measures for environmental protection and against floods;
- The long-term management of water through regularly updated, readily available data at the national level, of long-term needs and availabilities, political commitment and effort from all stakeholders, supported by an adequate regulatory framework and governance, and ambitious public and private funding.

In 2010, the implementation of the National Water Strategy was initiated through the establishment of a Project Management Office, including 10 working groups to conduct and monitor the implementation of Strategy-related programmes year by year in close collaboration with all relevant stakeholders. Currently, the Department of Water is finalizing the National Water Plan. This document was developed taking into account findings and conclusions of the master plans for integrated management of water resources in the different river/water basins, studies of the Strategy and its implementation, and documentation of plans and sectoral strategies such as the Green Morocco Plan (PMV), the National Programme of Sanitation and Wastewater Management, the National Pact for the Development of Industry, and the Vision 2020 strategy of the tourism sector.

The National Water Strategy proposes to increase the reuse of treated wastewater on a large scale. The Department of Water's target for reused treated wastewater is about 300 million m^3/year by 2030. In terms of implementing the part of the Strategy related to Reuse of Treated Wastewater the Department has conducted several studies on the reuse of treated wastewater and set up a National Committee on Reuse and Recovery of Subproducts from Sanitation, to promote projects on reuse and recovery of treated wastewater and sludge.

Up until 2012, 17 projects mobilized about 88 million m^3/year of reused treated wastewater (46 per cent of all treated wastewater and 17 per cent of all raw sewage).

The transversal scope of the 2009 National Plan on Climate Change targets the encouragement of intersectoral contributions in terms of mitigation and adaptation measures that are encompassed in other plans. This horizontal integration seems appropriate, but a strong monitoring process is mandatory in order to guarantee coordination. Since the Plan's disclosure, knowledge gaps regarding climate change phenomena and impacts have been thoroughly addressed by national research institutions in Morocco, mostly in an international cooperation framework. This trend was supported by the Government, which also promoted some studies financed by the World Bank (e.g. resilience of coastal urban zones, emissions inventory).

Even before the adoption of the National Plan on Climate Change, a National Plan on Flood Protection was launched in 2002, aiming at the implementation of mitigation and adaptation measures for the reduction of flooding risks and damage. That Plan included the typology of floods, the list of vulnerable sites and the mapping of zones vulnerable to drought and flooding, as well as a set of preventive measures to be adopted for each site. About 400 sites exposed to flooding risks were identified and a network of almost 200 transmitters for flooding alert is already integrated into a warning system managed by the WBAs. The Department of Water recently launched an update of the Plan.

The 2006 National Programme for Sanitation and Wastewater Treatment (PNA) is the operational guideline for the implementation of municipal WWTPs in Morocco. The PNA considers the installation of WWTPs for the treatment of 122×10^6 m^3/year and will comprise a set of different actions in 330 urban settlements. The goal, if met, will mean the reduction of pollution by 80 per cent by 2020 and 100 per cent by 2030. It is foreseeable that the volume of treated wastewater will increase from 186 million m^3 in 2010 to over 1 billion m^3 in 2030. The PNA will require connections to the urban sewer network to increase by 80 per cent by 2020 and 90 per cent by 2030. The PNA aims for the treatment and reuse of 100 per cent of the wastewater collected

by 2030.[22] The PNA also takes into consideration the sustainability of wastewater treatment systems design and operation. With the production of about 400,000 tons of dry matter/year foreseen for 2030, the 2010 National Strategy on Wastewater Sludge Management addresses the sludge production from WWTPs, aiming at the protection of public health and at incineration. This issue is significant because sludge treatment is the counterpart of wastewater treatment and both lines should be in operation at the same time.

Industrial wastewater treatment has been partly addressed by the FODEP. In order to financially support industrial investment, this fund has been created as an economic tool to help industry adhere to the process of cleaning up pollution and protecting water resources (chapter 4).

The 2008 Green Morocco Plan (PMV) aims at raising the efficiency of agricultural water use through upgraded irrigation infrastructure and best practices, but also by increasing low-water-demand crops. Furthermore, water losses in irrigated areas, cropping of marginal lands and non-resilient crops (e.g. growing wheat instead of the traditional barley) would be avoided. These are strong points that are in accordance with addressing Morocco's current (and future) climate vulnerability. To support the Plan, the Ministry of Agriculture and Maritime Fisheries launched the National Programme for Saving Irrigation Water (PNEEI) aimed at upgrading public irrigation networks and their adaptation for localized irrigation and on-farm drip irrigation (on 550,000 ha during a 10-year period), as well as introducing the appropriate equipment in reservoirs located in agricultural areas (namely in the Sebou watershed). Irrigation projects at Gharb (Kenitra), Haouz (Marrakech) and Souss-Massa (Agadir) were initiated in 2012 with the support of the European Investment Bank.

In addition, the revision of water pricing has been a recurrent intent of all water policies in order to improve water use efficiency. However, the specific characteristics among the irrigation perimeters are very different in terms of water availability and social context. Therefore, the practical translation of such intent in the context of large-scale irrigation perimeters has remained one of the most difficult issues to solve in Morocco.

[22] This integrated *resource recovery* policy could be enlarged to cover the wastewater discharges into coastal waters. These discharges represent a potential source of pollution but also mean a loss of freshwater that could be reused after proper treatment.

Rural Drinking Water Supply Programme

The 1995 Rural Drinking Water Supply Programme (PAGER) has significantly improved the rate of access to drinking water for the rural population, which increased from 14 per cent in 1994 to 92 per cent by 2012. The PAGER was a very innovative management programme because it involved the population who benefited from the service. It was designed in such a manner that the population in the different rural settlements has been responsible for covering part of the initially subsidized expenses for pumping and metering, as well as for equipment maintenance. Indeed, the central authorities contributed 80 per cent of the funds while local governments and populations contributed 15 per cent and 5 per cent respectively. The current challenge is to establish the effective operation and maintenance of such decentralized water supply systems, but institutional support and village associations should provide the required organizational capabilities.

Institutional framework

Ministry of Energy, Mines, Water and Environment

The Ministry of Energy, Mines, Water and Environment has the responsibility to initiate, promote and coordinate the protection of water resources, pollution abatement and legislation enforcement. In addition, it is responsible for environmental control, auditing and reporting, including public awareness and participation regarding water resources and environment. The executive role regarding water issues inside the Ministry is assigned to the Department of Water. Its responsibilities are to evaluate the water resources and plan their development and valorization, protect water resources and water infrastructures, contribute to the protection of property and persons through the prediction and monitoring of the development of weather-related risks, and promote information and research in the climate and water fields.

The Ministry of Energy, Mines, Water and Environment is responsible for the current surface water quality norms and groundwater surveillance; the national monitoring system is managed by the WBAs. Although the system complies with the minimum requirements for supporting decision-making, network extension is advisable. The current water quality norms encompass chemical and bacteriological parameters (with chlorophyll analysis in reservoirs). Additional ecological quality and hydromorphological assessments would be useful in order to comply with the most recent trends in water

resources monitoring. Furthermore, expansion of the monitoring network and the geographic information system (SIG-Qualité-Eaux) would consolidate the national water information system.

High Council for Water and Climate and other consulting bodies

The High Council for Water and Climate (HCWC) is an interministerial consultation forum established in 1980 (then named the High Council for Water) to reinforce horizontal and vertical coordination among the different actors in the water sector, involving State members, public agencies (of drinking water production, irrigation, hydroelectricity) and water users, as well as non-government stakeholders. The Council is in charge of assessing the national strategy on climate change and its impact on water resources, the National Water Plan and integrated water resources planning, among other consulting powers. The last meeting of the HCWC (the 9th session) was held in 2001. The Interministerial Commission on Water was established in July 2001 as part of the revival of Government action; it is in charge of the follow-up of HCWC recommendations. However, these two bodies have not met since 2001. At the regional level, consulting bodies provide assistance to the WBAs on the preparation of management plans and contribute to public awareness regarding water, among other consulting duties. They are composed of representatives of the State and public institutions placed under their supervision (responsible for the production of drinking water, energy and irrigation) and other representatives from the local communities and commercial or industrial chambers.

All these consulting bodies seem to have fragile performance in the water governance architecture of Morocco, hindering real public participation and non-governmental empowerment. Besides, on the implementation level, the linkages between the Ministry of Energy, Mines, Water and Environment and different departments in the other ministries involved could be stronger. Finally, no independent agency is fulfilling a comprehensive regulatory role in the water services sector on issues such as contract control and a sanctions and tariff regime.

Water basin agencies

Following the promulgation of the Law on Water, water administration went through significant changes. The WBAs are defined by hydrology but water areas are also considered, leading to adjustments in some cases. The WBA jurisdiction concerns only freshwaters (surface and groundwater), which means that transitional and coastal waters are excluded. WBA duties include preparation of river/water basin management plans; authorization of water abstractions and discharges, and maintenance of a public register; collection of charges for abstraction and effluent discharges; financing and technical assistance for water pollution prevention; efficient use of water; water resources quality monitoring; enforcement of laws related to water resources protection; setting up an emergency response system; and promotion of public awareness about water resource management.

Nine WBAs have been established as nodal agencies for administration at the regional level since 2000.[23] According to the Law on Water, WBAs are legally and financially independent as they should be financed through users' fees. However, the reality is different and the responsibilities that have been entrusted to the WBA administrations are too large in relation to their financial and human resources. In that regard, a common decision support system would overcome some of the current staff limitations, increase transparency and speed up licensing procedures. The administration boards of the WBAs encompass governmental and non-governmental water stakeholders and are responsible for several key tasks regarding administration, planning and financing. Their composition aims to empower all relevant users but the fact that they seldom meet (a maximum two times a year) hinders their stronger involvement in an integrated water management process.

Water services bodies

Drinking water and sewerage services across Morocco are currently operated by the National Office of Electricity and Drinking Water (ONEE – Branche eau), four private companies and 13 independent public companies (régies autonomes). ONEE and the independent public companies each service some 30 per cent of the total number of subscribers to water services in urban areas, and private companies the remaining 40 per cent.

ONEE is a public autonomous company that is the major national water producer and, when including rural water supply, the dominant national water distributor also. It delivers water to 416 urban settlements and 198 small rural settlements, but also to more than 3,500 camps and nomadic villages. Besides the public entities, private water operators have been engaged in the four major agglomerations (Casablanca, Rabat, Tangier and Tétouan). The

[23] The first, pilot WBA (Oum Er-Rbia) was created in 1997, six others in 2002 and the remaining two in 2009.

independent public companies are in charge of sanitation and wastewater treatment in 10 urban areas across the country. ONEE and the other institutions bulk water from surface or groundwater sources controlled by WBA.

Other ministries and institutions

Several other ministries are involved in water and wastewater planning, monitoring and pollution control besides the Ministry of Energy, Mines, Water and Environment. Among them, the role of the Ministry of Agriculture and Maritime Fisheries on water issues should be highlighted. Agriculture irrigation management is supervised by the Ministry at the central level and by nine regional departments concerned with the public irrigation of large areas (regional offices for agricultural development (ORMVAs)). Provincial directorates of agriculture hold this responsibility outside ORMVA areas, and there are around 1,200 associations of agricultural water users that directly manage irrigation water in rural zones. In that regard, it is interesting to note that several projects are aimed at improving the performance of community-based irrigation schemes in Morocco and to reinforce their management by local water user associations. Conjugating human pressures and agricultural development to the drought impacts observed during the last 15 years, the Moroccan administration is increasingly interested in designing policies to tackle irrigation and groundwater overuse. This process resulted from collective action around a local project and, when is successful, it can revitalize the way the community manages water. The created associations usually play a role as intermediary between farmers using irrigation and external institutions. Aquifer management contracts for the main overused aquifers are expected to bring about coordinated supply and demand policies.[24]

The Ministry of the Interior plays a substantive role in water and sanitation at the municipal level. The Ministry is responsible for water supply and wastewater collection in local communities, supporting the operations of basic water and sewerage infrastructure and monitoring the performance of the régies autonomes and municipal concessions. The Ministry also provides coordination and technical assistance on water and sanitation to the local communities. The Ministry of Health is mainly responsible for drinking water quality control, but also has an important role in the development of water-related standards and laws. The Ministry of Finance oversees the fiscal aspects of public utilities and the contracting of concessions, as well as tariff adjustment proposals. The Ministry of Equipment and Transport plays a key role in planning and managing projects and implementing resources allocation in order to optimize water infrastructures. The Ministry of Housing, Town Planning and Urban Policy has responsibilities in territorial management, namely in the human occupation of littoral and other water-sensitive zones.

Coordination

Since their establishment over the last decade, WBAs demonstrate continuous and steady progress. Because of their youth, they are more focused on coordination and regulation than on service delivery, but decentralization should be encouraged, reinforcing their technical and financial resources in the framework of an integrated water resources management policy. Vertical coordination of WBA management is assured by the president of the administration board being the minister responsible for the Ministry of Energy, Mines, Water and Environment. The WBA director is in charge of strategic implementation and daily management, representing the horizontal coordination provided by the Department of Water.

The question of coordination seems to be much more complex in the littoral. This issue tends to be a classic one in maritime countries, with several institutions having responsibilities and duties, often superimposed and conflicting. Morocco follows the rule – coastal zone administration is rather fragmented in terms of licensing, monitoring and inspection regarding water pollution, the public maritime domain, coastal ecosystems and biodiversity. Integrated coastal zone planning and management is sought, considering the importance of this area for Morocco's development and the need to manage the complex array of territorial interactions which are likely to be further impacted upon by climate change risks.

7.6 Conclusions and recommendations

A range of legal, political and institutional processes exist through which stakeholders articulate their interests and decision-makers are held accountable in water resources management in Morocco. However, the effectiveness of all consulting bodies and the role of the High Council for Water and Climate has been doubtful since no meetings have been reported in recent years. Coordination, between different

[24] For instance, various stakeholders have been involved in the design of an aquifer management contract in the Souss, where water basin agencies and the Ministry of the Interior collaborate to control the drilling of boreholes.

ministries and between subnational authorities, is therefore not accomplished. In addition, the same weak role of public participation occurs at WBA level, hindering stakeholders' involvement in supporting and auditing WBA.

The Department of Water is the national water authority responsible for the coordination of integrated water management. However, "water" needs to be viewed in the light of the definition of "water basin", which encompasses groundwater and surface waters – inland, estuarine and coastal waters, not just "freshwaters". Therefore, the consolidation of WBAs will contribute to reducing institutional fragmentation and better performance concerning resources regulation in the management of all water bodies, namely in water allocation permits, inspection and enforcement. Besides, the contribution of the WBAs to vertical coordination of the multiple scales at which water is used and managed will be reinforced. In water services, a regulator with strengthened capacity is needed for performance assessment and increased transparency and accountability, which would ultimately lead to increased sector efficiency.

Recommendation 7.1:
The Government should reinforce integrated water resources management at the institutional level, by:

- *(a) Stimulating action by the High Council for Water and Climate to fulfil its strategic advisory role, with the involvement of water stakeholders;*
- *(b) Extending the jurisdiction of water basin agencies to transitional and coastal waters in order to improve integrated water management;*
- *(c) Creating an independent body for water services regulation, covering both drinking water and wastewater, with jurisdiction over public and private companies;*
- *(d) Improving cooperation among the responsible actors.*

Because water policy increasingly relies on shared responsibilities, a clear vision is required to achieve momentum towards sustainable water management. The Ministry of Energy, Mines, Water and Environment has adopted the National Water Strategy, which aims at providing this vision of water resources management and achieving the National Water Plan, the legal document reporting the water policy.

River basin integrated management master plans (RBMPs) are important tools for planning and necessary in order to better manage the development of water resources.

The development of the master plans for a period of 20 years was entrusted, according to the Law on Water, to the WBAs, with coordination and cooperation with different stakeholders in the water sector. The consistency of the master plan documents focuses on the general framework and climate characteristics, natural and socioeconomic characteristics of the study area, the assessment of water resources both quantitatively and qualitatively and the water demand, the state of development and utilization of water resources, water demand by sector, and the definition of the different actions of integrating water resources in the river basin management plan and how to implement the plan.

An ecosystem-based approach and the establishment of climate change adaptation measures are additional features that should be included in the integrated river basin management master plans. Although current integrated river basin management master plans are a very good step, they are not always as comprehensive as they should be and require updating and revision. Further on, in order to address communication and information gaps, a common information resource centre should exist among WBAs and the central administration. Such a system will favour public participation, capacity-building and shared assessment of the situation. It could also be used as a decision-making support system that would deliver homogenous and transparent rules for licensing.

An excellent level of science and technology on water-related issues is available at Morocco universities and research centres (as international data banks confirm). If involved in planning and management activities, this capacity would support solutions to complex water problems, where knowledge is decisive.

Recommendation 7.2:
The Ministry of Energy, Mines, Water and Environment should reinforce integrated water resource management at the policy and legal levels by:

- *(a) Revising the Law on Water accordingly;*
- *(b) Submitting the National Water Plan and the river basin integrated management master plans (RBMPs) to the High Council for Water and Climate for consultation prior to their submission to the Government for adoption;*

(c) Promoting a national water information system, as a part of the national environmental information system, which could be interoperable among all water basin agencies, would contain the geo-referenced inland water and maritime domains and a database of all water uses, and could produce an annual monitoring report on the implementation of the National Water Strategy and RBMPs.

Climate change is an ultimate challenge for water resources management in Morocco but also a driver for resilient water supply systems. The water, food and energy nexus is increasing under scenarios of climate variability and urgently requires the adoption of *no-regret* measures. The most rational measures belong to a demand management approach that would comprise the residential, industrial, agriculture and energy sectors. Among the demand-side actions, it is possible to highlight the minimization of water losses in urban settlements and irrigation networks, as well as wastewater reuse. Wastewater reuse is expected to attain the goal of 100 per cent in 2030 according to the current National Programme of Sanitation and Wastewater Treatment and a wider application of such technologies could promote Morocco's leadership in this field, encouraging the creation of skilled jobs. From the supply side, aquifer recharge and rain harvesting in sustainable building practices should be mentioned as easy-to-implement measures. A policy of water transfers requires heavy investment and should include a transparent assessment of socioeconomic and resource costs within a transaction cost framework.

Recommendation 7.3:
The Ministry of Energy, Mines, Water and Environment should guarantee the security of water supply under scenarios of climate variability, by:

(a) Preparing a national programme for more efficient water use, encompassing all sectors in cooperation with the National Office of Electricity and Drinking Water, existing private enterprises and municipal systems;
(b) Taking effective measures for artificial recharge of aquifers;
(c) Supporting efforts to reach the 2030 goal of 100 per cent of treatment of wastewater;
(d) Ensuring that climate adaptation and flooding risk concerns are properly reflected in the design of water supply systems in inland and coastal urban settlements, with the cooperation of the Ministry of Housing, Town Planning and Urban Policy;
(e) Implementing measures to mitigate erosion in the watersheds, with the cooperation of the governmental authority responsible for forests, and other relevant stakeholders.

Close cooperation of the Ministry of Energy, Mines, Water and Environment with ONEE, private water companies, municipalities and the industrial sector is encouraged in order to reduce wastewater impacts. Appropriate technologies and sustainability concepts, in both WWTP design and sludge processing facilities that would recover resources and minimize operation costs are appropriate perspectives.

Integrated resource management would protect freshwater quality but also estuarine and coastal ecosystems and related marine economic activities (e.g. fisheries, tourism and recreation). Besides, the value of ecosystems services is being recognized at the intersectoral level, along with the need to protect the integrity of aquatic fauna and riparian ecosystems. Therefore, hydromorphological impacts require minimization in all water reservoirs disregarding this purpose (energy, irrigation or drinking water).

Recommendation 7.4:
The Ministry of Energy, Mines, Water and Environment should protect human health, aquatic ecosystems and biodiversity by:

(a) Supporting sustainable and resource-recovery wastewater treatment strategies that discourage wastewater discharge into transitional and coastal waters;
(b) Implementing discharge standards for industrial and municipal wastewater into the environment, with values aligned with ecosystem resilience, and collect the corresponding pollution load charges;
(c) Implementing the National Strategy on Wastewater Sludge Management;
(d) Setting up a regime of ecological water flow and increasing the ecological connectivity of existing and new dams;
(e) Preparing, in cooperation with the Ministry of Agriculture and Maritime Fisheries, an action plan to reduce nitrate concentration in contaminated aquifers.

Chapter 8

WASTE MANAGEMENT

8.1 Introduction

In recent decades, Morocco has experienced strong growth in its urban population and a proliferation of peripheral areas, with a significant increase in access to basic services (of 10 per cent from 2003 to 2011). With population growth, rapid urbanization and changing consumption patterns, production of household waste in Morocco is increasing. This has made more difficult the collection, removal and disposal of household and similar waste. These wastes are often disposed of by wild or spontaneous discharges and dumping without any treatment or control, resulting in serious consequences for public health and the environment.

This situation contributes to the contamination of surface and ground water, spread of disease and degradation of the landscape. It impacts indirectly on the economic development of the country, particularly in the tourism sector. A World Bank study conducted in 2003 estimated the economic costs of environmental degradation in Morocco related to the poor performance of the system for managing solid waste at 0.5 per cent of GDP (about 1.7 billion dirhams), one of the highest rates in the MENA region.

The 2006 Law No. 28-00 on Waste Management and Disposal, together with other related legislation, provides a framework for improving waste management. This legislation is implemented with the support of various national programmes – especially the National Municipal Solid Waste Management Programme (PNDM), which promotes the collection of household waste, creation of controlled landfills and rehabilitation of illegal dumpsites – designed to reach ambitious objectives over the next few years.

Nevertheless, the lack of appropriate institutional structures, particularly at the regional level, and limited funding, are preventing these programmes from being optimally implemented. In addition, skills and expertise, especially at the local level, as well as clear responsibilities and monitoring and control systems, are still lacking. As a result, there is a risk that the programmes will not be implemented adequately, or that they will be only partially implemented.

8.2 Trends in waste management

Generation

Municipal solid waste

An estimated 6.8 million tons of household and similar waste is generated annually, with 5.3 million tons per year (t/year) from urban areas alone. Urban areas have an average waste generation of 0.76 kg/cap./day. The recycling rate is estimated at 8 to 10 per cent. Household waste composition breaks down as follows:

- Organic matter: 50 to 70 per cent;
- Paper and cardboard: 8 to 10 per cent;
- Plastic: 6 to 10 per cent;
- Glass: 1 to 3 per cent;
- Metals: 1 to 4 per cent;
- Other: 4 to 8 per cent.

Organic matter

Starting in the 1960s, Morocco set up a dozen or so composting facilities. However, since 2000, all of these have been shut down due to technical and economic constraints, such as poor management, insufficient funding and a lack of marketing and markets. The latter can be partially explained by the inadequate quality of the compost. Green waste composting is, nevertheless, being encouraged in rural regions, and tests are being carried out on the Oum Azza landfill.

Glass, paper and paperboard, aluminium, PET, metals

There is no segregation structure for recyclable household waste. There are also no precise data (only estimations) on the quantities collected and recycled by unofficial waste pickers. Collected waste is sold to wholesalers and is then generally sent on to Casablanca to be transformed into energy or reusable materials, or to be exported.

Plastic

There are several programmes for collecting and incinerating plastic and plastic bags at cement plants. The quantities of collected plastic are hard to

estimate since they have not been systematically weighed, but they probably amount to several hundred tons. These programmes have also made it possible to clean up several thousand plastic waste hotspots (box 8.1).

Cells and batteries

There is no official collection and recycling system for cells and batteries at this time.

Tyres

There are no data on the quantities of used tyres that have been discarded in Morocco. Many of them are used in ceramic kilns or bathhouses as fuel, which causes a great deal of air pollution. Tyres are also incinerated in cement plants, and a certain quantity is imported for this purpose (100,000 tons in 2009).

Electrical and electronic equipment waste

Generation of electrical and electronic equipment waste is estimated at 30,000 to 50,000 tons per year. At present, there is no centralized or even organized waste collection for this type of waste. The quantity generated annually is insufficient to ensure the economic performance of a dismantling and recycling centre; the sale value of the recovered metals would not support the operating cost. For that reason, this waste is mainly disposed of with household waste; waste pickers collect and disassemble some discarded electrical and electronic equipment and recover the materials of value.

Various pilot projects have been set up, such as a social integration project in Casablanca, in which computers are disassembled and repaired so that they can be reused and given to public schools. An electronic waste recycling project at the Guemassa site involves separating and recovering the precious and non-ferrous metals in electronic boards in order to produce blister copper and gold and silver alloys.

Industrial non-hazardous waste

Industrial non-hazardous waste production is estimated at 1.35 million t/year. The breakdown by region shows that Grand Casablanca produces approximately 37 per cent of manufacturing waste. The chemical and parachemical and leather and textile industries produce 40 per cent and 33 per cent of the manufacturing waste respectively. Very few data are available on manufacturing waste and its treatment. It is often still stored in public landfills. Identical deficiencies exist in the area of handicraft activities, for which there is no dedicated collection and treatment system.

The most problematic handicraft activities for the environment (potteries, tanneries and brassware manufacturers) are the subject of detailed expert assessments and concrete proposals. Nowadays, ceramic kilns burn wood but also a lot of waste as fuel (e.g. treated wood, tyres and used oil collected by waste pickers from landfills and sold to potters), which causes a great deal of air pollution and contaminates the soil. The unburned refuse is discharged into landfills or nature. The same situation occurs in bathhouses (of which there are approximately 5,000 across the country), which have ovens that use some waste as fuel.

Hazardous waste

Studies conducted to determine the quantities of hazardous waste generated in 2008 estimated the total amount at around 256,045 tons. These studies show that most hazardous waste is stored in situ, at the production sites (235,561 tons in 2008 alone). The risk of pollution is highest at the storage sites. Hazardous waste not stored in situ is disposed of with household and similar waste. Large international private chemical and pharmaceutical groups manage the problem of their hazardous waste internally. Companies such as ECOVAL and ECO-CIM (subsidiaries of the cement manufacturing groups Holcim and Ciment du Maroc-Lafarge-Asment Témara) have invested in waste treatment units for recycling and final treatment. Apart from these cases, however, there is no specific treatment for hazardous industrial waste at this time.

Construction waste

It is estimated that 30 million tons of construction waste (wood, stones, cement, steel, isolation products) are produced yearly. They are mostly not segregated and are dumped along roads, rivers or on unused plots of land. A part of this waste is landfilled.

Mining and quarrying waste

Morocco has a large mining industry with its own solid waste treatment system. Sands or flotation tailings are pushed into a disposal area. Approximately 88 per cent of the treated tonnage is stored. The method for storing flotation tailings still consists in moving the largest particles so that they build and thicken the retaining wall, thereby creating a large enough decantation zone so that the wastewater can be clarified before it is recycled.

Photo 8.1 : Intermunicipal landfill Oum Azza

Box 8.1: Plastic as a priority material for recycling

The Moroccan Government has developed an integrated strategy to combat the excessive use of plastic bags and their spread in the environment. The strategy's objectives are to sensitize and raise awareness among school children of the negative impact that using plastic bags has on the environment, to encourage schoolchildren to replace plastic bags with other less-polluting alternatives and to teach them how to properly dispose of plastic bags after use. A key event was organized for Earth Day 2010 in all the schools, and a guide to waste management was widely distributed at the event. The children not only participated in collecting plastic bags at nature sites and clean-up projects, but were also asked to pass on what they learned to friends and neighbours.

Ground infiltration is limited because the ground on which the dike is built is watertight, while the finer particles are dragged to the bottom of the dike, which blocks water seepage by decantation. Antiquated dikes are covered with arable land and cultivated.

Agricultural waste

A project supported by FAO has made it possible to establish an inventory of obsolete pesticide containers. The inventory training was undertaken in 2007. The participants included 32 technicians, engineers and medical doctors from the various authorities responsible for agriculture, environment, the interior and public health. The training session covered the aspects of personal protective equipment, inventory forms for data collection and inventory implementation. Of 335 illegal dump sites, 275 were inventoried under the project. In addition, training on the pesticide stock management system for inventory data entry was organized in 2008.

Medical waste

Information describing the situation with medical waste is lacking. It is estimated that 142 public and 443 private hospitals generate 21,000 tons of medical waste per year, of which 6,000 tons is infectious waste. Several methods are currently being used to dispose of hazardous medical and pharmaceutical waste:

- Shredding – disinfection;
- Autoclave units;
- Incineration.

However, it should be noted that, even though many hospitals are equipped with an incinerator, most of these do not work or are obsolete. It is estimated that most of this waste is stored in public landfills, which is a serious problem, since it is not only a source of environmental pollution, but also a potential source for the spread of infectious diseases. Management of

medical waste improved after the hospital reform, which was implemented as part of the economic and social development plan (2000–2004). More specifically, 21 autoclaves/shredders were purchased and a budget line was created in hospitals for medical waste management. On the other hand, the majority of the waste generated by private laboratories and the 2,644 health centres is not treated.

Radioactive waste

No data are available on radioactive waste in the country.

Sludge

The sludge produced at the WWTPs is generally disposed of in landfills. There is currently no disposal system for the sludge resulting from industrial wastewater treatment, which is also disposed of in landfills as a result. In the case of some WWTPs, dried sludge is used by farmers as compost fertilizer for agricultural land.

Used oil

Some used oil is incinerated at cement plants, where contracts exist with large companies, but it is also incinerated in kilns and bathhouses, which causes a great deal of air pollution.

Collection and treatment

Collection

It is estimated that the average rate of waste collection in 2012 was approximately 76 per cent. The waste collection rate in rural areas is even lower and often unorganized. Most collected waste (68 per cent) is sent untreated to illegal dumpsites.

Recycling

Waste segregation has not yet been organized. There is an informal recycling sector, in which valuable waste items are recovered by waste pickers at the landfill sites. Informal recycling is practised in precarious conditions by approximately 15,000 waste pickers. The most recycled types of waste are paper, metals, plastics and glass. The estimated quantity of recycled waste is given in table 8.2.

Some pilot systems have been set up, such as the one in which recycling companies collect recoverable waste (plastic, paperboard, glass and steel) directly from hotels and businesses. At the Oum Azza controlled landfill, a simple system has been established in which waste is sorted before it is disposed of in landfills and this provides an occupation for waste pickers who previously worked at the landfills (box 8.2).

Land disposal

Until recently, all waste was disposed of in illegal dumpsites. It is estimated that there are 300 illegal dumpsites that have to be closed and rehabilitated. As at 2012, 14 landfills are in use and five are being developed. That means that about 1.7 million t/year of waste are disposed of in controlled landfills. Twenty-one illegal dumpsites have been closed and rehabilitated and 64 more are in the process of being rehabilitated. It is expected that, by 2021, all illegal dumpsites will be rehabilitated. During landfill rehabilitation, an emphasis is placed on confining waste and controlling leachate flows. Generally, a sealing cover and leachate collection system are installed. In some cases, leachate is sent to the leachate treatment facilities of controlled landfills.

The objective of the rehabilitation is to ensure that the landfill fits into the landscape. In some rare cases, waste is moved in order to allow land to be recovered. Pumping tests are sometimes carried out to assess the biogas potential. No monitoring or supervision is planned after rehabilitation. Expertise in rehabilitating former landfills is still minimal, both at design offices and the companies that are active at the sites. Furthermore, regulations are lacking, as is an implementing decree. The construction of new controlled landfills is subject to environmental impact studies. There are guidelines on carrying out environmental impact studies for controlled landfill projects. They apply to the three landfill categories set out in section 48 of Law No. 28-00 on Waste Management and Disposal, which are:

- Category 1: household and similar waste landfills;
- Category 2: industrial, non-hazardous medical and pharmaceutical, agricultural, residual and inert waste landfills;
- Category 3: hazardous waste landfills.

A natural or geotextile seal is applied at the base of landfills and the leachates are collected and treated. Since up to 80 per cent of waste is made up of organic matter, very large compactions are carried out, despite the compaction during the application phase. Large quantities of leachates are produced and they contain large quantities of salt, which requires specific treatment. Biogas is not systematically collected and recovered. Some landfills collect and process biogas by thermal destruction (flaring).

Table 8.1: Industrial waste generation by sector, tons

Sector	2000	2008	2010
Food processing	531,830	380,000	394,002
Textile and leather	49,700	..	86,052
Chemical and parachemical	187,210	844,628	947,802
Electrical and electronic products	73,910	..	3,083
Engineering and metallurgic	..	94,268	..
Others	131,424	..	15,110
Total	**974,074**	**1,318,896**	**1,446,049**

Source: High Commission for Planning, 2011.

Table 8.2: Treatment and disposal of municipal waste, tons

Process	1992	2000	2010 (4)
Mechanical sorting	..	..	..
Total operations of processing and recovery	148,051	130,000	500,000
Recycling	90,301 (1)	130,000 (2)	500,000
Composting	57,750	0 (3)	..
Incineration	..	..	..
Disposal	4,366,999	6,370,000	4,500,000
Controlled landfill	..	20,000	1,533,250
Uncontrolled landfill	4,366,999	6,350,000	2,966,750
Total	**4,515,050**	**6,500,000**	**5,000,000**

Source: High Commission for Planning, 2011.
Notes:
(1) This is an estimated amount, representing 2 per cent of municipal waste in 1992.
(2) In the absence of data on the amounts recovered and recycled in 2000, data are based on the same percentage as in 1992 to estimate the amount recycled.
(3) The only composting unit in Morocco is no longer in service (since 2000).
(4) Municipal waste generated in urban areas only.

Box 8.2: Oum Azza landfill

The controlled landfill of Oum Azza, in the region of Rabat, has been operational since December 2007. It has a surface area of 100 ha and can store up to 13 million tons of waste. The waste of 13 communes is collected and transferred to three transfer centres before being transported to and stored at Oum Azza. About 1,400 tons of waste, 80 per cent of it organic material, arrives each day.

The bottom of the landfill is sealed with clay and geotextile so that it is watertight. The leachate is collected and treaded (by sedimentation, oxygenation and reverse osmosis). The treated leachate is discharged into a river and the concentrated leachate from the reverse osmosis is treated by lagooning, as there is no other more specific treatment possibility in the country. There is no gas collection at the moment. It is planned to compost a part of the organic matter.

Since 2011, 160 waste pickers, organized in a cooperative, work in Oum Azza. Approximately half of the waste passes first through a drum to segregate the fine fractions and then is conveyed on two treadmills. This permits the waste pickers to collect recyclable waste (plastics, glass, metals). The waste contains no paper or carton, which has already been picked up before the waste is collected and sold to a wholesaler.

Incineration in cement plants

A partnership has been developed with cement plants in order to develop industrial waste treatment systems. Industry is increasingly interested in the possibility of co-incinerating its waste in cement plants. The combustion systems at many cement plants have been readapted to allow the co-incineration of several types of waste. In 2005, the Moroccan cement industry signed a voluntary agreement to comply with international co-incineration standards.

Exports

Some hazardous waste is exported to Europe for treatment in accordance with the rules of the Convention on the Control of Transboundary

Movements of Hazardous Wastes and their Disposal (Basel Convention). This involves mainly waste containing polychlorinated biphenyls (PCBs) (600 tons in 2009).

8.3 Pressure from waste

Past and current deficiencies in waste management are having negative effects on the environment, such as the pollution of surface water and groundwater, the proliferation of rodents, the release of nauseating odours and toxic fumes, the deterioration of landscapes and urban and peri-urban spaces, soil contamination and the risk of fires and explosions.

Illegal dumpsites are sources of methane and other gas pollutants. Waste incineration (tyres, used oil and treated wood) in kilns and bathhouses is a major source of air pollution. A large portion of the waste is still disposed of in illegal dumpsites, often in or along stream or river beds and areas where water resources are vulnerable, which causes water pollution. However, no studies have been undertaken to identify possible impacts from the leaks of uncontrolled landfills to groundwater and surface water, and there is no basic frame of reference for setting the objectives that need to be achieved, the thresholds that should not be exceeded and the corrective measures that must be applied. Liquid waste from handicraft activities and most industrial activities are discharged directly into surface water. Groundwater is also affected by the pollutants present in the soil.

Soil is polluted by waste in landfill areas, but also around the pottery kilns and bathhouses that use waste as fuel. The pollutants emitted in the smoke settle in a small area, which causes a great deal of persistent soil pollution. Open dumps cause major damage to the landscape. Plastic is particularly problematic because it spreads widely. Shutting down open dumps and hotspots would help improve the situation significantly.

The lack of a general collection system and the household waste stored in illegal dumpsites, not to mention the land disposal of medical and specific industrial waste, all have negative repercussions on human health through soil, water and air pollution. In addition, informal recyclers who search the landfills in order to collect recyclable waste jeopardize their own health. Animals that graze on the landfills also absorb pollutants, which are then passed to humans through their milk or meat.

There are currently no studies on the impact of waste in Morocco.

8.4 Waste reduction, reuse and recycling, and energy recovery

Legal framework

Law No. 28-00 on Waste Management and Disposal calls for:

- The establishment of the polluter-pays principle;
- The creation of controlled landfills based on type of waste;
- Methods for planning regional and national waste management;
- The creation of a national hazardous waste management structure;
- The implementation of a system for controlling and reporting offences.

Law No. 28-00 on Waste Management and Disposal integrates the provisions of the Basel Convention. All waste exports and imports are controlled in compliance with the Basel Convention system (notification, contract, consent of the State to import). Hazardous waste cannot be imported, while imports of non-hazardous waste are subject to authorization.

To date, a series of implementing decrees has been promulgated for the purposes of applying and implementing Law No. 28-00. The 2008 Decree No. 2-07-253 on waste classification and determining the list of hazardous waste ranks waste by type and source and describes the hazardous properties of waste. This list also includes the waste listed by the Basel Convention and the European Waste Catalogue (EWC: a catalogue of all waste types generated in the EU based on Decision 2000/532/EC of 3 May 2000 establishing a list of wastes). The 2009 Decree No. 2-09-139 on medical and pharmaceutical waste management sets out methods for sorting, packaging, collecting, storing, transporting, treating and disposing of medical and pharmaceutical waste, as well as the procedure for authorizing the collection and transport of these types of waste.

The 2009 Decree No. 2-09-284 setting the administrative procedures and technical requirements for landfills establishes the procedures for opening, transferring, making substantial changes to and shutting down controlled landfills, as well as technical guidelines for setting up controlled landfills in terms of site choice and development and conditions for operating the landfill.

The 2010 Decree No. 2-09-285 establishing the methods for developing the prefectural or provincial master plan for managing household and similar

waste and the procedure for organizing the public inquiry related to this plan establishes the composition of the advisory board in charge of reviewing and making recommendations on such master plans. It also designates the governmental authorities in charge of defining the content of the draft plan and sets out the procedure for organizing and conducting the public inquiry to which the draft plan is subject. In addition to the Decree, terms of reference for studies on the provincial/prefectural master plans for managing household and similar waste have been elaborated to provide consultants with the terms of reference that require a technical review. Consultants will have to review these terms of reference and make comments and recommendations on how to improve them.

The 2010 Decree No. 2-09-538 establishing the procedures for developing the national master plan for managing hazardous waste sets out the procedures and the authorities concerned with the development of the national master plan, as well as its review committee, which is known as the National Hazardous Waste Committee. The 2010 Decree No. 2-08-243 instituting the Commission on Polychlorinated Biphenyls aims at ensuring compliance with and the implementation of the provisions of the Stockholm Convention on Persistent Organic Pollutants by setting up a PCB commission, which will be in charge of assisting in the completion and update of the PCB inventory and supporting the Department of Environment in development and implemention of the National PCB Disposal Plan.

The 2010 Decree No. 2-09-683 establishes the methods for developing the regional master plan for managing non-hazardous industrial, medical and pharmaceutical, residual, agricultural and inert waste and the procedure for organizing the public inquiry related to this plan. In order to complete it, terms of reference for developing the regional master plan for managing non-hazardous industrial, medical and pharmaceutical, residual, agricultural and inert waste are currently being drafted.

The 2011 Decree No. 2-09-85 on the collection, transport and treatment of certain used oils specifies the technical conditions for the used oil management chain. The 2008 Decree No. 2-07-253 on the classification of hazardous waste includes classification of medical and pharmaceutical waste.

Other legal texts concerning waste disposal, treatment and storage that are being finalized or at the draft stage include:

- A draft decree on hazardous waste management;
- A draft decree on the technical guidelines for storing, recovering, treating and disposing of hazardous waste;
- A decree on the control of the transboundary movement of waste;
- A draft decree on establishing technical guidelines applicable to incineration facilities and thermal waste recovery.

The 2007 Law No. 47-06 on Local Government Finances introduces a reform of the tax regime. The reform provides for local communities to establish local taxes better designed and easier to recover.

The current legal framework regarding plastic bags consists of the 2010 Law No. 22-10 on the Use of Degradable or Biodegradable Plastic Bags and Sacks and the 2011 Decree No. 2-11-98 adopted for the application of Law No. 22-10. Two joint orders were issued under the 2011 Decree.

Assessment

The legislation in place lays a foundation for consistent and sustainable waste management. However, implementation is lagging. References, objectives and specific technical requirements are still lacking in a number of areas. Regardless of whether they concern developing regional master plans for managing non-hazardous industrial, medical and pharmaceutical, residual, agricultural and inert waste or provincial/prefectural master plans for managing household and similar waste – or even the development of controlled landfills – the national guidelines primarily address methods of organizing and implementing these tools, but hardly touch on technical and environmental requirements.

For instance, the 2009 Decree No. 2-09-284 prescribes a list of equipment needed to open a landfill; however, there are no minimum requirements for any of this equipment. Legislation requires annual control of watercourses that could have been affected by any landfill leachate, but does not mention which parameters need to be analysed or their limit values. The same applies for water pollution, as no parameters or limit values are mentioned. Furthermore, no measures are mentioned in the event of pollution.

In the area of controlled landfills, a national standard for sealing quality, as well as criteria for protecting groundwater or preventing leachates after treatment is lacking. Threshold values that may not be exceeded and corrective measures are also lacking.

Likewise, the period of time that landfills are to be supervised after they have been shut down is not explicitly mentioned.

Although a general recycling and recovery target of 20 per cent by 2020 is set at the national level, recycling and recovery targets are not set in the provincial/prefectural master plans and the regional plans. The draft terms of reference for these plans state, however, that among the objectives to be determined by the developer in close cooperation with an advisory committee are: the scaling-up and improvement of non-hazardous waste management; the rates and stages of correcting regulatory breaches; the reduction of waste production at the source by category; the recycling rates; the energy recovery rates; the waste recovery rates by category; and the management cost recovery rates by category. The advisory committee is composed of representatives of regional and provincial councils, administrative and professional bodies involved in the production and disposal of such waste and environmental protection associations in the region concerned. It would, nevertheless, be more effective to define all these objectives in detail at the national level, while still allowing for some flexibility.

Environmental surveillance and monitoring plans for landfills do not exist. National requirements on environmental surveillance and monitoring plans for landfills are also lacking.

The methods for recovering the costs of managing various types of waste are not defined at the national level and have to be proposed in the plans by developers. A clear national vision would not only be helpful but, above all, would ensure that permanent funding is secured.

Strategies, policies, programmes and main projects

National Charter for Environment and Sustainable Development

The two main components of the 2011 National Charter for Environment and Sustainable Development related to waste management are: the consolidation of environmentally sound management of municipal solid and similar waste, and medical, pharmaceutical and industrial waste management.

Improving the methods of collecting and transporting municipal waste and supporting cleaner cities through the increased use of professional systems are the best ways to accomplish the objectives in this area. It is recommended that integrated programmes for solid waste management be prepared, particularly also for agricultural waste and especially in rural areas, and that the public be incited and encouraged to use the household and similar waste segregation system and recover and recycle these raw materials. Pilot projects on energy production from this waste should also be encouraged. The spread of plastic bags in natural areas should be limited by producing alternative, biodegradable bags and encouraging the creation of control mechanisms for the waste generated by the operations of fishing vessels.

As for the second component, and parallel to the creation of specialized units to treat industrial, chemical and hazardous waste, it is recommended that regional programmes dealing with the management of non-hazardous medical, pharmaceutical and industrial waste be institutionalized and that special units be created to treat such waste. In addition, a national management policy for all radioactive waste should be devised and a national centre for special waste management should be created by 2017.

National Solid Waste Management Programme

In 2007, the Department of Environment initiated the National Solid Waste Management Programme (PNDM) in collaboration with the Ministry of the Interior. It is intended to:

- Ensure that the collection and clean-up of household waste achieves a collection rate of 85 per cent in 2016, by 90 per cent in 2020 and 100 per cent in 2030;
- Increase the volume collected from 3.4 million tons in 2007 to 6.6 million tons in 2020;
- Create controlled landfills for household and similar waste that will serve all (100 per cent) urban centres in 2020; leachates and biogas must be treated;
- Rehabilitate or shut down all (100 per cent) existing illegal dumpsites by 2020;
- Develop the "sorting-recycling-recovery" system through pilot waste segregation projects in an effort to achieve a 20 per cent recycling rate by 2020;
- Apply the master management plans for household and similar waste for all prefectures and provinces;
- Train and raise awareness of all actors involved in waste management.

The PNDM prioritizes collection and controlled landfill disposal services, whereas the development

of "sorting-recycling-recovery" systems is accorded less than 2 per cent of the total Programme budget. Investment projects eligible to receive funds from the Clean Development Mechanism (CDM) have been developed for collection, transport, recycling (paper and paperboard, plastic and glass, materials and metals, used oil, etc.) and biomass energy recovery.

A strategic environmental assessment (SEA) of the PNDM has been conducted. The SEA made it possible to determine the strategic choices that will enable the Programme to achieve its objectives by reconciling socioeconomic development and environmental conservation.

The overall cost of the PNDM is estimated at 37 billion dirhams, spread over 15 years (tables 8.3 and 8.4). Since 2007, the main results achieved are:

- The collection rate has increased to 80 per cent, compared with 44 per cent before 2008;
- The rate of household waste disposal in controlled landfills has grown to 32 per cent of the waste generated, i.e. 1,690,000 t/year, compared with 10 per cent before 2008. This rate will be 61 per cent once the controlled landfills under development are completed, which represents an additional 1,554,250 t/year;
- 14 new controlled landfills have been completed;
- Six controlled landfills are being developed;
- 24 illegal dumpsites have been rehabilitated;
- 84 illegal dumpsites are in the process of being rehabilitated;
- National studies on solid waste management, solid waste recycling, private sector participation, national solid waste strategy and fiscal impacts, and sustainability have been conducted;
- Two projects were certified for funding under the CDM;
- Master plans for household waste for Boujdour, Beni Mellal, Dakhla, Es-Smara, Tétouan and Tiznit were finalized;
- 63 master plans for household waste are under consideration.

However, the implementation of the PNDM faces the following constraints:

- The underdevelopment and lack of visibility of certain projects (feasibility studies are required);
- Project planning and management difficulties, especially with regard to local authorities (lack of knowledge, signature of contracts with private actors) that result in delays in project execution;
- Reluctance and trouble in setting up intercommunity structures, which makes it impossible to effectively carry out the activities;
- Insufficient monitoring and control of activities;
- Absence of a system to secure sustained funding, which makes it impossible to secure the budgets allocated to activities and causes delays in payment.

National Programme for the Collection and Disposal of Plastic Bags

The National Programme for the Collection and Disposal of Plastic Bags (2011–2012), initiated as part of the partnership between the Department of Environment and Ministry of the Interior, had the following objectives:

- To dispose of used plastic bags and eliminate hotspots in all provinces and prefectures by the end of 2012;
- To sensitize the public on the sound use of plastic bags and promote the use of more ecological alternatives.

The Programme, with a cost of 80 million dirhams, consisted of organizing campaigns to collect plastic bags for incineration at cement plants and carrying out awareness-raising campaigns.

Among its achievements, the Programme led to the establishment of regional committees to coordinate the collection, storage, transportation and disposal of plastic bags in cement kilns across 83 provinces and prefectures; the collection and disposal of 1,000 tons of used plastic bags; and the eradication of over 2,200 plastic bag hotspots. The Programme mobilized more than 11,800 workers for more than 300,000 working days.

National Programme for the Safe Management and Disposal of Equipment Containing Polychlorinated Biphenyls

As a party to the Stockholm Convention on Persistent Organic Pollutants (Stockholm Convention), Morocco identifies the environmentally sound management and disposal of PCBs as a priority action. For that purpose, Morocco requested financial assistance from the GEF to implement a PCB management and disposal programme, in cooperation with UNIDO and UNDP.

Table 8.3: PNDM funding contributions, millions of dirhams

Source	Phase 1 (years 1 to 5)	Phase 2 (years 6 to 10)	Phase 3 (years 11 to 15)	Total
Local governments	6,711	8,583	11,597	**26,891**
Fees	195	1,100	3,000	**4,295**
CDM	260	480	260	**1,000**
Government	800	1,200	1,250	**3,250**
Donations (cooperation)	500	500	500	**1,500**
Total	**8,466**	**11,863**	**16,607**	**36,936**

Source: Environmental Strategy, Department of Environment, 2009.

Table 8.4: Costs of the PNDM by component

Component	billion of dirhams	%
Improve collection services	26.50	72.0
Create and operate controlled landfills	5.40	15.0
Rehabilitate existing landfills	2.30	6.0
Control and monitor project development studies	1.30	3.4
Develop sorting-recycling-recovery	0.70	1.8
Communicate, inform and train	0.70	1.8

Source: Environmental Strategy, Department of Environment, 2009.

This programme has been subdivided into two parts, which have been implemented simultaneously:

- Part 1:
  - Reinforcing the regulatory framework for PCB management;
  - Boosting national PCB management capacities and identifying new PCB sources;
  - Exporting equipment containing pure PCBs for environmentally sound disposal in specialized centres;

- Part 2:
  - Establishing a process for identifying mineral oil transformers contaminated by PCBs;
  - Setting up a local infrastructure for dismantling the transformers and decontaminating the oil and metals;
  - Increasing the administration's PCB pollution supervision and monitoring capacities.

Since this Programme was launched in 2010, the following activities have been carried out:

- The Commission on Polychlorinated Biphenyls was established by Decree No. 2-08-243;
- A draft regulatory framework on safe PCB management has been prepared;
- New PCB sources have been identified and the inventories have been updated;
- The various stakeholders concerned have been sensitized, informed and trained on safe PCB management at every stage of their life cycle;
- Fourty tons of DDT and related waste were eliminated in July 2013 (chapter 5).

Scheduled activities include:

- Exporting all stored PCB-containing equipment inventoried (approximately 470 items) for ecologically sound disposal at specialized centres;
- Conducting sampling campaigns and analyses to identify new PCB sources;
- Preparing techno-economic feasibility studies and methods for managing dismantling and decontamination units;
- Working with the private sector to set up units for dismantling transformers and decontaminating oil and metals;
- Starting to dismantle and decontaminate the transformers and decontaminate the oil contaminated by PCBs;
- Approving and promulgating the regulatory framework on safe PCB management.

Draft National Master Plan for Managing Hazardous Waste

The draft National Master Plan for Managing Hazardous Waste (PNGDD) was developed in the framework of German–Moroccan financial cooperation. Given that it is the first draft of the master plan for managing hazardous waste after the publication of Law No. 28-00, it will also serve as guide for developing the other master plans called for in that legislation. The PNGDD requires the following infrastructure to be put in place:

- A physico-chemical treatment unit (with a capacity of approximately 140,000 t/year);
- Transfer and/or sorting centres;
- A Category 3 controlled landfill (approximately 60,000 t/year).

These facilities are to be operational by the end of 2017. For medical and pharmaceutical waste, the PNGDD recommends providing health institutions that produce a large quantity of waste, preferably 500 t/year or more, with a treatment unit. In order to lower treatment and transport costs, these facilities are to be designed to treat medical and pharmaceutical waste from hospitals in the neighbouring zone.

The PNGDD also includes a solution for managing small quantities of hazardous waste, such as used batteries for electronic devices, small capacitors, fluorescent lights and lamps, expired medication, lacquers and paint products. For the purposes of sound environmental management of municipal waste, a separate collection system is to be set up for small quantities of hazardous household waste. That way, household waste will not contain hazardous fractions and can be treated and sustainably disposed of without the threat of hazardous materials.

Clean Development Mechanism

The CDM funds projects to reduce GHG emissions, such as a project to collect and flare biogas (captured methane) at various landfill sites. For the El Oulja landfill, it is estimated that the project currently under way will reduce emissions by 455,000 tons CO_2-e equivalent over a period of 21 years. At the new landfill in Fès, where a similar project is under consideration, 102,647 tons of CO_2-e equivalent could be saved during the same time period.

Industrial Waste Stock Exchange

The Industrial Waste Stock Exchange, an initiative of the Sustainable Development Commission of the General Confederation of Moroccan Enterprises (CGEM) and implemented by the Moroccan Clean Production Centre (CMPP), is the first online platform for trading waste in Morocco dedicated to promoting the recovery of reusable waste as a secondary raw material. This exchange encourages the trading of various types of industrial waste by putting manufacturers who have industrial waste to dispose of in contact with manufacturers who accept secondary raw materials.

Regulatory, economic, fiscal and information instruments

Eco-tax on plastic

The 2013 Finance Act 2013 introduced an environmental tax on sales, factory output and imports applicable on plastics and articles thereof falling within Chapter 39 of the Harmonized System which came into force is planned from the beginning of 2014 and whose proceeds will be allocated to the National Fund for Environment and redistribute to the restructuring of the recycling of these plastics.

Green jobs

To find out the percentage of green jobs in the national job market, a study was conducted in an attempt to quantify the jobs that have been or will be created by implementing various national environmental conservation programmes. The preliminary results of this investigation indicate that 12,000 to 18,000 jobs will be created by the PNDM by 2020.

Institutional framework

Ministry of Energy, Mines, Water and Environment

The Department of Environment of the Ministry of Energy, Mines, Water and Environment is responsible for the development of the national waste management policy. It develops the legal framework and the tools for its application. It applies the PNDM.

Ministry of the Interior

The Ministry of the Interior is responsible for ensuring that the local authorities apply the national waste management policy.

Commission on Polychlorinated Biphenyls

The Commission on Polychlorinated Biphenyls was established to ensure that the provisions of the

Stockholm Convention in general, and regarding PCBs in particular, are enforced.

Local governements

The municipalities have to apply waste management policy. They are responsible for organizing the collection of municipal waste.

One of the objectives of the PNDM is to professionalize municipal waste collection. The municipalities sign collection and clean-up contracts (5- to 7-year contracts) and land disposal contracts (15-year contracts) with private companies. When a collection contract is signed, it is generally agreed that the company will hire a large proportion of its personnel from the municipality – which does not simplify the contractual system. The companies often have to deal with delayed payments, especially when cuts are made to the national subsidies allocated to the municipality. Even though waste treatment is a mandatory expenditure, communities often face financial difficulties in ensuring appropriate treatment, because of tight budgets. Local governments also lack the expertise to control the activities of the contracted enterprises.

8.5 Conclusions and recommendations

Since 2003, various legal acts have been adopted to improve the waste management situation in Morocco. Further efforts are now needed to implement the current legislation and to create the skills and expertise needed at all levels. It is also necessary to assess how sustainable waste management can actually be planned in the long term and adapted to the country's needs.

Recommendation 8.1:
The Ministry of the Interior, in collaboration with the Ministry of Energy, Mines, Water and Environment, should continue strengthening capacity, especially in terms of human and financial resources, and developing expertise, especially by staff training, in waste management at the national and territorial levels.

Although the waste legislation provides for the collection of data on waste generation and disposal, no reliable data on waste management are available in the country. Data on MSW and industrial waste are based on estimations, a situation which does not support decision-making in waste management.

Recommendation 8.2:
The High Commission for Planning and the Ministry of the Interior, in cooperation with the Ministry of Energy, Mines, Water and Environment, should set up a system to collect data on generation and disposal of municipal and industrial waste according to international waste classification.

Currently, there is no separation of waste by type, which makes disposal of waste by incineration impracticable, as waste is currently 80 per cent organic matter. The establishment of composting facilities would decrease quantities of waste disposed of in landfills, and permit the incineration of other wastes, resulting in a substantial reduction of liquid and gas discharges. It would also result in the production of compost and biogas, which would lead to the creation of new jobs.

Recommendation 8.3:
The Government should promote mechanical-biological treatment of waste, in particular to stimulate recycling and the effective use of existing composting facilities.

In 2012, 14 controled landfills are in use and five are being developed in Morocco. It is estimated that there are 300 illegal dumpsites that have to be closed and rehabilitated. It is expected that, by 2021, all illegal dumpsites will be rehabilitated. No environmental monitoring is performed around landfills and dumpsites.

Recommendation 8.4:
The Ministry of Energy, Mines, Water and Environment should ensure that environmental monitoring is performed around landfills and dumpsites.

The service life of a landfill lasts well beyond its operation and can be extended for decades. The costs of post-operational monitoring and landfill rehabilitation or clean-up can be considerable. There is no legislation in place in Morocco to assess these costs and to ensure funds are available to pay them.

Recommendation 8.5:
The Government should:

(a) Conduct a study on the costs of the landfills under operation and development for the duration of their expected life cycles;
(b) Based on the results, ensure that the landfill tax is sufficient to cover the post-operational monitoring and rehabilitation of the landfills.

Electrical and electronic equipment waste and used batteries are disposed of in Morocco with household waste, and cause harm to the environment. Since they contain precious metals, disassembling them at

dumpsites is often an attractive option. However, this disassembly is not carried out appropriately, and creates a hazard for humans and the environment.

Recommendation 8.6:
The Government should:

(a) Study the possibility of implementing collection and recycling systems for waste with a high pollution risk, such as electrical and electronic equipment waste, in order to prevent informal collection and disassembly, which are extremely harmful to human health and the environment;
(b) Consider, on the basis of the experience gained so far (e.g. with packaging wastes) promoting the principle of extended producer/importer responsibility, especially for electric and electronic equipment waste.

Information describing the situation pertaining to medical waste is lacking. Several methods, such as shredding, autoclave units and incineration are currently being used to dispose of hazardous medical and pharmaceutical waste. However, even though many hospitals are equipped with an incinerator, most of these do not work or are obsolete. It is estimated that most of this waste is stored in public landfills, which is a serious problem, since it is not only a source of environmental pollution but also a potential source for the spread of infectious diseases.

Recommendation 8.7:
The Ministry of Health, in cooperation with the Ministry of Energy, Mines, Water and Environment, relevant territorial authorities and other stakeholders, should develop a national strategy for the safe disposal of medical and pharmaceutical waste. Such a strategy should aim to:

(a) Strengthen capacity to handle the sanitary risks posed by this waste;
(b) Establish and ensure implementation of a master plan to manage hazardous medical and pharmaceutical waste;
(c) Establish and ensure implementation of regional master plans to manage non-hazardous medical and pharmaceutical waste;
(d) Strengthen the institutional, legal and regulatory frameworks regarding the management of medical and pharmaceutical waste;
(e) Build capacity of medical staff to manage medical and pharmaceutical waste.

Chapter 9

BIODIVERSITY AND PROTECTED AREAS

9.1 Status and trends in species and ecosystems

Morocco has a great diversity of ecosystems because it incorporates a range of climatic and physiographic regions. Five main categories of ecosystems are identified in the country's 2004 Strategy for the Conservation and Sustainable Use of Biodiversity (Biodiversity Strategy), namely, forest and steppic ecosystems, Saharian ecosystems (e.g. regs and ergs), marine and coastal ecosystems, ecosystems of the continental humid zones, and cave ecosystems. These act as a repository for several species of conservation importance. Morocco is indeed important for biodiversity conservation within the broader area of the Mediterranean Basin, which region is considered to be a biodiversity hotspot.

However, based on the IUCN Red List (status as of December 2012), which includes 1,189 species from Morocco, it would appear that the trend for several species of conservation importance is generally negative. The worst-affected species appear to be those which are already known to have a very poor conservation status. Of 32 species listed as being Critically Endangered (CR), 63 per cent are considered to have a decreasing population (table 9.1). The corresponding proportion of Endangered species (EN) is 56 per cent (31 of 55 species), that of Vulnerable species (VU) 64 per cent (54 of 84 species) and that of Near Threatened species (NT) 56 per cent (59 of 105 species).

Within these four conservation status categories, only three species have been recorded as having an increasing population,[25] while the population of 12 species appears to be stable. Amongst species with a decreasing population trend are a number of charismatic mammal species often associated with the country, such as the Barbary macaque (*Macaca sylvanus*), the Mediterranean monk seal (*Monachus monachus*), and the Barbary leopard (*Panthera pardus panther*). Prospects for lesser-threatened species appear to be more promising, with 10 per cent of Red List species of Least Concern (LC) registering an increasing population and 39 per cent recorded as having a stable population. Nevertheless, there is a high degree of uncertainty concerning the status of several species, with 83 Data Deficient (DD) species; additionally, the population status of 38 per cent of CR species, 36 per cent of EN species, 23 per cent of VU species, 30 per cent of NT species and 26 per cent of LC species is presently unknown. This represents a total of 299 species of unknown population status.

Morocco has a substantial number of endemic species across animal and plant groups, in part because of the isolation resulting from its biogeographic location, bounded by the Mediterranean Sea (to the north), the Atlantic Ocean (to the west), the Sahara (to the south) and the Atlas mountain chains (to the east). The Biodiversity Strategy observes that, of some 7,000 floral species, 930 are endemic. In comparison with other Mediterranean countries, Morocco has the highest percentage of endemic reptile species and the highest number of European relict reptile species, as well as harbouring centres of diversity of certain reptile genera (the Biodiversity Strategy puts the figure of endemic reptiles at 21, out of a total of 92 species). However, in a recent regional review of the state of herpetofauna, 30.8 per cent of the 13 amphibian species and 13.9 per cent of the 101 reptile species of Morocco were reported to be Threatened, while two species were reported to be Regionally Extinct.

The 2004 data indicate that there were between 30 and 39 Invasive Alien Species (IAS) in Morocco. As of December 2012, the Global Invasive Species Database (GISD) lists 34 alien species (table 9.2) and an additional four species of unspecified biostatus. Other literature sources indicate other IASs not listed in the GISD source, e.g. the silver-leaved nightshade (*Solanum elaeagnifolium)* which competes with various crops, resulting in losses within Morocco of up to 64 per cent in maize without treatment and 78 per cent in cotton, and in a 25 per cent loss of value in infested fields. The silver-leaved nightshade is one of nine IASs identified by the European and Mediterranean Plant Protection Organization (OEPP) as pests recommended for regulation as quarantine pests (none of the other eight species within the list are indicated as occurring in Morocco).

[25] Species noted to have a growing population are the blue whale (*Balaenoptera musculus)*, the Cape Verde petrel (*Pterodroma feae*) and Adalbert's eagle (*Aquila adalberti*).

Photo 9.1: Addax

Table 9.1: Status of IUCN Red List floral and faunal species occurring in Morocco

Status	Decreasing		Increasing		Stable		Unknown		No indication given in IUCN Red List		Total
	Nb	%	Nb	%	Nb	%	Nb	%	Nb	%	
Extinct (EX)	..	..	..	..	..	..	..	..	..	..	2
Extinct in the Wild (EW)	..	..	..	..	..	..	..	..	..	..	1
Critically Endangered (CR)	20	63	0	0	0	0	12	38	0	0	32
Endangered (EN)	31	56	1	2	0	0	20	36	3	5	55
Vulnerable (VU)	54	64	1	1	1	1	19	23	9	11	84
Near Threatened (NT or LR/nt)	59	56	1	1	11	10	31	30	3	3	105
Least Concern (LC or LR/lc)	192	23	83	10	326	39	217	26	9	1	827
Data Deficient (DD)	5	6	0	0	1	1	74	89	3	4	83

Source: Compiled from data available from the IUCN Red List of Threatened Species (as of December 2012).

Similarly, the brine shrimp (*Artemia franciscana)* is proliferating in Morocco. This species is not listed within the GISD list. There thus appears to be some lack of coordination and synthesized information concerning the occurrence and status of IASs in Morocco, at least in terms of what is publicly available. In the absence of such data, any assessment of trends over the review period is somewhat limited.

A key concern relating to the status and trends of species and ecosystems appears to be inadequate knowledge, particularly for certain species groups/biodiversity aspects. Morocco's Biodiversity Strategy makes reference to the need for further research on invertebrates; that was also highlighted by some national experts. However, while knowledge of certain groups (e.g. mammals, birds) is substantial, other groups are far less well known – several groups of invertebrates were highlighted as falling within the latter category. There is currently no existing compendium of comprehensive information relating to the flora of Morocco, although it is understood that this work is in progress.

Another major gap was the lack of knowledge of genetic resources in Morocco. It would appear that the concept of genetic conservation is very much in its infancy, with a corresponding urgent need for more expertise relating to genetic studies, and more knowledge of Morocco's genetic resources.

Table 9.2: Number of invasive alien species in Morocco

Biotic components	No. (as per GISD database)
Trees	4
Herbs/shrubs	5
Sedges	1
Aquatic plants	1
Grasses	2
Algae	1
Birds	2
Molluscs	1
Fish	16
Insects	1

Source: Compiled from data available from the GISD database, December 2012.

To date, there are some studies relating to crop genetic diversity, but practically no studies concerning wild biodiversity. Such studies are strongly advocated, particularly in the case of endemic/rare/endangered species, and particularly given the current situation, where populations of several such species of conservation interest are rapidly declining. In the case of crop diversity, genetic knowledge could be a very useful tool in the development of varieties that are capable of adapting to conditions of drought and decreased rainfall, which conditions are predicted to become more common in the country in the light of climate change (chapter 7).

A second, related concern is the absence of clear and standard criteria for the classification of species and habitats within Morocco. While it would appear that, on a national level, the characterization of species within a conservation hierarchy (e.g. rare, threatened, endangered, etc.) has taken place to some degree, albeit in piecemeal fashion, there is no national Red Data Book; there is also a problem in streamlining existing data, because criteria used nationally do not necessarily correspond across assessments, or with criteria used on an international scale. These concerns appear to apply in at least several such assessments.

A similar issue was noted in the case of habitat classification systems; while EU member States utilize the system of habitat classification outlined in annex I of the EU's Habitats Directive[26] (together with the accompanying *Interpretation Manual of European Union Habitats*), there is no equivalent nomenclature in Morocco, and no official or standard classification methodologies for habitats; this again limits the exchange and comparability of data, both within the country and on an international scale.

Some of these gaps may be related, at least in part, to lack of expertise and/or supporting infrastructure. It was noted during the EPR review mission that there is a need for more taxonomists within the country, not only because of the gaps in knowledge on biodiversity issues but also because some existing data may need to be reexamined. The dearth of taxonomists is not only a national phenomenon but has been noted as a worldwide shortage, with significant negative implications for conservation efforts; according to 2006 data from the Global Taxonomy Initiative of the Convention on Biological Diversity (CBD), it would appear that some systematic evaluation of taxonomic needs within Morocco has been conducted, but that this is not comprehensive and that, generally, taxonomy is not well addressed. At the same time, there is a need for adequate support structures; in the case of flora, for example, there is presently only one well-equipped and comprehensive herbarium, housed within the Scientific Institute at University Mohammed V in Rabat-Agdal, and this also needs to be updated and further enriched. The CBD data from 2006 likewise note that it is unclear whether major collections are adequately safeguarded, curated and staffed. Similar initiatives elsewhere in Morocco are, to date, small scale and limited, because of this complexity of factors including funding limitations, running costs and lack of staff. Having a secure and up-to-date knowledge database is, however, crucial to any effective conservation strategy.

9.2 Development and management of protected areas and ecological networks

The Critical Ecosystem Partnership Fund's profile of the Mediterranean Basin Biodiversity Hotspot identifies 68 key biodiversity areas in Morocco, which form part of the wider Mediterranean Basin Biodiversity Hotspot – this number is exceeded only by four other countries within the Basin.[27] Of the 68 Moroccan biodiversity areas, two have been identified as being Irreplaceable Key Biodiversity Areas, because they contain the entire known range of a globally threatened species; these two sites are the Essaouira dunes and the area of Fès and surroundings.

[26] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

[27] Spain has 221 key biodiversity areas, Italy has 156, Turkey has 140 and Greece has 103.

Additionally, the Critical Ecosystem Partnership Fund's profile makes specific mention of the importance of Toubkal National Park, the Eastern High Atlas Mountains National Park, the Ifrane National Park and the Eastern Middle Atlas, which are noted to hold significant numbers of threatened mammal, bird and reptile species. The profile also identified 17 important corridors within the Mediterranean Basin Biodiversity Hotspot, five of which traverse areas in Morocco (table 9.3).

Morocco currently has 10 national parks. Of these, six have been created since 2003: the Al Hoceïma National Park (established in 2004), Talassemtane National Park (2004), Ifrane National Park (2004), High Atlas Oriental National Park (2004), Khénifiss National Park (2006) and Khenifra National Park (2008).

With respect to biosphere reserves, to add to the two biosphere reserves designated in Morocco prior to 2003, a third biosphere reserve was designated in 2006: the Intercontinental Biosphere Reserve of the Mediterranean, spanning territories in both Spain and Morocco.Data for Morocco provided through the Clearing House Mechanism on Biodiversity of Morocco (CHMBM) also indicate that a fourth biosphere reserve (Biosphere Reserve of the Cédraie) is planned, incorporating an area of around 500,000 ha across the Ifrane, High Atlas Oriental and Khenifra National Parks, with a view to listing the Cédraie de l'Atlas as World Heritage (table 9.4). In 2005, Morocco also designated 20 new Ramsar wetlands, bringing its total Ramsar sites to 24, covering a total area of over 272,010 ha. There is also a network of 160 Sites of Biological and Ecological Interest (SIBEs).

Since 2003, Morocco has made substantial progress in extending its network of conservation areas to afford protection to species and habitats. Nevertheless, gaps within the protected area network remain, with some ecosystem types being underrepresented at present. These include wetland areas, coastal areas and Saharian ecosystems; in the latter case, it was noted that the south of the country remains poorly represented in proportional terms, within the national network of protected areas.

The revisions of the protected area system have only recently been undertaken; monitoring of effectiveness and progress has not yet been widely undertaken. However, Morocco has been involved in initiatives to better its protected area system in recent years. One example is a project jointly undertaken by the IUCN Centre for Mediterranean Cooperation and the High Commission for Water, Forestry and Desertification Control, with the aim of enhancing the governance and management of Al Hoceïma National Park. On a general scale, however, there appears to be scope for more efforts relating to management evaluation, particularly for those parks that have long been established (Toubkal, Tazekka, Souss-Massa and Iriki), but also for those established since 2004 (Al Hoceïma, Ifrane, Talassemtane, High Atlas Oriental, Khénifiss and Khenifra); in these cases, the time span for which the territory has been designated/managed as a national park ranges from four to eight years, which is certainly well within the typical management planning review period recommended for such protected areas.

There appears, however, to be limited publicly available data concerning evaluations of management effectiveness, with only few examples, such as the 2008 Rapid Assessment and Prioritization of Protected Area Management study conducted in Morocco by the High Commission.

A 2007 report by the World Wide Fund for Nature (WWF) also makes reference to Management Effectiveness Tracking Tool studies, which included sites in Morocco in 2004 and 2006. A number of recommendations of these studies are worth pointing out, notably (i) more coordinated management of the protected area system, (ii) improved governance at various levels, (iii) providing more resources for park management, and (iv) enhanced autonomy for protected areas. The first two appear to be addressed, at least in part, by the new legal framework for such areas, but future monitoring of conservation progress in such areas is undoubtedly crucial, particularly in the light of evident threats within these areas.

Notwithstanding the recent listing of additional Ramsar sites, this has not precluded development activities from being carried out within these sites, even following designation; similarly, hunting/poaching is still carried out within several protected sites, as are polluting/illegal activities. It also appears that, in many cases, human resources within protected areas are simply too limited to be able to adequately manage such resources on the ground while, with respect to some protected areas, assignment of protection has been little more than a paper exercise. As in the case of species/ecosystems, there are information gaps relating to aspects of the protected area network. Apart from gaps relating to management effectiveness, there is also inadequate understanding of ecosystem services derived from these protected areas; this aspect is of particular importance given that one of the stated goals of the protected area network is valorization of biodiversity.

Table 9.3: Key biodiversity corridors within the Mediterranean Basin Biodiversity Hotspot: Moroccan corridors

Corridor name	Countries	Corridor surface area (ha)
Coastal Atlantic Plains	Morocco	1,265,656
Mountains of Ksour and Djebel Krouz	Morocco, Algeria	1,762,216
Oranie and Moulouya	Morocco, Algeria	1,656,081
Atlas Mountains Corridor	Morocco	12,812,888
Rif Mountains	Morocco	1,490,912

Source: Compiled from data in Critical Ecosystem Partnership Fund, 2012.

Table 9.4: Protected sites by type

	Area (ha)	Date of establishment
National parks		
Toubkal	36,000	1942
Tazeka	13,737	1950
Souss-Massa	33,800	1991
Iriqui	123,000	1994
Al Hoceïma	48,460	2004
Talassemtane	58,950	2004
High Atlas Oriental	55,252	2004
Ifrane	124,150	2004
Khénifiss	185,000	2006
Khenifra	93,500	2008
TOTAL National parks	**771,849**	
Biosphere reserves		
Arganeraie	2,500,000	1998
South Moroccan Oasis	7,200,000	2000
Intercontinental Biosphere Reserve of the Mediterranean	1,000,000	2006
TOTAL Biosphere reserves	**10,700,000**	
GRAND TOTAL National parks and Biosphere reserves	**11,471,849**	

Source: High Commission for Water, Forestry and Desertification Control, 2012.

Apart from gaps relating to management effectiveness, there is also inadequate understanding of ecosystem services derived from these protected areas; this aspect is of particular importance given that one of the stated goals of the protected area network is valorization of biodiversity. It is also of relevance given the close links between conservation and socioeconomic concerns in the country, as discussed further below. It was noted, however, that authorities face challenges in assimilating and keeping up with the rapid stream of management concepts that constantly emerge in this field (e.g. ecosystem services, adaptation, and resilience-building), particularly given limited (and in many cases, overstretched) human resources – this points to several opportunities for improved, mutually supportive policy–academic partnerships. There are also information/assessment needs relating to conservation designations that fall outside the national park system. For example, the most recent assessment data concerning Important Bird Areas (IBAs) dates back to 2001. Birdlife International data indicate that national monitoring of IBAs is not yet under way in Morocco, making an assessment of trends impossible.[28] Similarly, the conservation status of several SIBE sites is far from certain, as is the status of a number of Ramsar sites.

9.3 Pressures on species and ecosystems

Morocco's ecological footprint as of 2008 was calculated by the Global Footprint Network to be 1.32, indicating an ecological deficit, which had increased by 41 per cent since 1961. Human population in Morocco is presently calculated at approximately 32 million, and this figure is projected to increase to around 41 million by 2050. While this increase is limited and reflects a stabilizing population, the human population has increased since 1950 by 260 per cent, and this increase has

[28] For further details, see Birdlife International's IBA Monitoring Reports http://www.birdlife.org/datazone/info/ibamonreports.

necessarily brought with it an increased human impact on terrain and natural resources. Tourism pressures must also be factored in, particularly as this is a priority sector for investment in the country. Morocco's Tourism Strategy has set a target of 20 million visitors per year, with a projected corresponding increase in tourism infrastructure, to upgrade capacity by 200,000 new beds.

The negative impact of such tourism development was highlighted by several respondents, who referred, amongst other aspects, to (i) the competition for land on the coastal littoral which, while very attractive to tourism investors, also harbours many habitats of conservation importance, (ii) the lack of adequate and rigorous consideration of the impact of tourism development on biodiversity in planning processes, prior to the construction of such infrastructure, and (iii) the misuse of the concept of "ecotourism", with several developments marketed under this label falling far short of sustainability ideals, with damaging repercussions for sites of natural importance and rural areas.

Key threats

In order to obtain an understanding of the most significant threats to species of conservation priority, a review of threats to IUCN Red List species was conducted by the authors, focusing on species present in Morocco and which are presently considered to be Critically Endangered or Endangered. For the 87 species identified as meeting these criteria, key threats (as listed and described on the IUCN Red List of Threatened Species) are indicated in table 9.5.

While table 9.5 focuses only on species of unfavourable conservation status (CR/EN status), it is likely that several of the key threats identified would affect other, more widespread/less threatened species. For example, in the case of Moroccan amphibians, the most pervasive threats have been found to be habitat loss (related mainly to changing agricultural practices and groundwater extraction) and degradation, affecting 100 per cent of threatened species and 69 per cent of all species. Two groups of threats to biodiversity appear to be particularly significant in Morocco at the present time, these being (i) changes in the quality and quantity of water resources, and (ii) habitat loss, change and degradation. Species exploitation of various forms is also a relevant factor of concern for particular species and/or groups.

With regard to water resources management, Morocco will likely face serious challenges over future years, particularly within parts of the country already characterized by high levels of aridity and precipitation variability. Drought is becoming a matter of fact, particularly in light of climate change, although this does not necessarily imply a constant trend of lesser rainfall but, rather, more variability. This variability is evident in recent data from 2008–2009, 2009–2010 and 2010–2011, although no consistent trend can be identified based on data from the 1960s to the present.

Table 9.5: Selected major threats affecting Moroccan Critically Endangered and Endangered species listed on the IUCN Red List of Threatened Species

Threat	No. of species
Water pollution	31
Declining water levels	28
Habitat loss and degradation	25
Grazing pressure	16
Fishing	15
Drought	10
Urbanization	9
Land drainage and reclamation	6
Shell collection	6
Tourism pressure	5
Hunting	4
Predation by carnivores	3
Species harassment and persecution	3
Fire	2
Invasive/competing species	2
Exploitation (flora)	2
Road infrastructure	1
Illegal live trade	1
Soil contamination and alteration	1
Hybridization	1
Acidification	1

Source: Compiled from data available from the IUCN Red List of Threatened Species, December 2012.

However, precipitation is expected to decrease in the region in future years, with median change scenarios from a selection of predictive models of -15 to -29 per cent. In parallel, mean annual temperature increases of 1.1˚C to 3.5˚C are envisaged, with implications in terms of evapotranspiration rates. Increased incidences of drought are likely to result in forced socioeconomic changes in the country, with consequent indirect effects on biodiversity. A possible 33 per cent decrease in precipitation within the province d'Ouarzazate, could reduce profits from pastoralism by up to 57 per cent. Declining water resources affect both groundwater and surface waters, with consequent impacts on a wide range of species. At present, agriculture is the main user of water; while the share consumed by industry and domestic supplies is projected to increase to 20 per cent by 2020 (from 13 per cent in 2000), agriculture is still

envisaged to remain the main water user. Indeed, the question is raised whether Morocco, as a country with limited water resources, should be striving for large-scale agricultural development at all. The issue straddles different fields of concern, with agriculture being a mainstay of the livelihood of many Moroccans and a key contributor to decreases in poverty, but with the likelihood that water resource management issues will becoming increasingly more challenging within the country, and with biodiversity negatively impacted upon by several water management measures and/or related infrastructure.

Agriculture is also relevant to two of the main sources of impact on water quality, these being (i) pollution from domestic and industrial wastewater discharges, (ii) leakage of fertilizers and phytosanitary products and (iii) soil erosion and transport of sediments. In one example, an analysis of nitrate levels conducted in the Souss-Massa basin found that 20.3 per cent of samples exceeded the maximum permissible limit (50 mg/L) established by WHO, while 47.1 per cent of samples exceeded the recommended limit (25 mg/L). While research specifically linking such water quantity/quality issues to biodiversity does not appear to be widespread, it would appear that water resources management will be a key element of biodiversity conservation strategies for the country in years to come.

Habitat loss and change, including habitat degradation, is the third main threat factor of relevance (table 9.5). IUCN Red List Data distinguishes between various causes of habitat loss, with clearance for agriculture and deforestation being the most notable, together with urbanization. In the former case, a number of species were noted to be impacted upon by land clearance for cannabis (*Cannabis sativa*) cultivation (specifically for hashish), with this being particularly relevant in the Rif. The 2012 World Drug Report gives a statistic of 47,400 ha being used for cannabis cultivation in Morocco (based on 2010 data); this represents a decrease from previous years: 64,377 ha in 2006, 72,500 ha in 2005 and 120,500 ha in 2004. The Government is reported to be continuing with its efforts to reduce illegal cannabis cultivation, and this thus represents a significant change over the period of this review (2003–2012).

Data concerning more general deforestation/clearance rates (i.e. not only related to cannabis cultivation) appears to be subject to some ambiguity; a figure of 30,000 ha of forest lost per year reported by the Association Marocaine des Droits de l'Homme (AMDH), for example, was argued to be incorrect by the High Commission (case reported in *Au Fait*, 2012), partly due to the balance between forest loss and reforestation. The High Commission is quoted as saying that planting and reforestation result in a net positive balance of 272,000 ha over the period 2005–2011, contradicting the AMDH figure. A figure of 31,000 ha loss (similar to the AMDH figure) is given in the country's fourth national report on biodiversity to the CBD.

Another quantitative estimate of forest loss based on satellite data analysis gives a 10-year rate of forest loss of 0.21 per cent. Fire is reported to be one of the causes of forest loss, with data from 2006–2010 indicating that this issue remains significant (table 9.6), with an increase in both the number of fires and the extent of area affected. For purposes of biodiversity, however, the quantitative extent of forest is not a sufficient indicator, albeit an important one, as the composition of forests and the extent to which they support a diverse and functional ecosystem are arguably equally important. For this reason, statistics concerning forest extent may misrepresent the significance of the issue for conservation purposes, particularly where plantations are included with natural forest cover in statistics. The 2003 National Environmental Action Plan (PANE) estimates a total forest cover of 9 million ha, with 5.8 million ha of these being natural forests.

Underlying reasons for loss/degradation of forests also need to be considered. Poverty was highlighted as a key cause of forest degradation, with indications that substantial illegal harvesting/collection of wood (e.g. for firewood, timber, etc.) constitute a major problem, and with suggestions that official statistics addressing only *legal* forest uses may significantly under- or misrepresent the real situation. The illegal exploitation of the *Argania* forests exists for the derivation of products including timber and oils. However, illegal forest exploitation is not primarily a consequence of lack of awareness, but is more fundamentally driven by poverty, and by a lack of adequate socioeconomic alternatives.

Furthermore, it would appear that while (legal) forest earnings do benefit local communities to some degree, there is little to no reinvestment to support sustainable development goals, notwithstanding a 1976 dahir specifying that 20 per cent of receipts from forest products auction sales should be reinvested by local communes into forest capital – indeed, it was suggested that such reinvestment rarely occurs.

Data concerning land use change in Morocco appears to be somewhat sparse.

Table 9.6: Number of forest fires and the extent of area burned, 2006–2010

	2006	2007	2008	2009	2010
Number of forest fires	378	337	257	480	632
Extent of area burned (ha)	73,870.7	65,331.9	52,410.0	134,720.4	136,528.2

Source: Mounir and Charki (2012).

The majority of land in Morocco is sparsely vegetated or bare, with a slight decrease in the latter category over the study period (from 35 per cent to 29 per cent) and a slight increase in the former (from 41 per cent to 44 per cent), possibly due to increased irrigation and drought recovery. Broadly, vegetation increases are indicated for 79 per cent of the country, while 21 per cent of the country has experienced decreases. The latter occurred primarily in the north-west of the country, which is densely populated and where dominant land uses are agricultural and urban. The study also revealed the expansion of population distribution into mountain and valley areas over the period of analysis.

Apart from the impact resulting from the extent of agriculture, changes in agricultural practice also appear to be of relevance, in particular, increased intensification and increased irrigation. Cropland makes a significant contribution to the ecological footprint of Morocco. Future developments in this sector, e.g. those resulting from the Morocco Green Plan, are likely to be significant, especially given a push in this Plan for high- productivity agriculture. Certain aspects of this Plan may also have significant environmental impact, for example the experimental use of semi-desert zones to increase the usable agricultural surface area. In terms of land use change in urban areas and urban fringes, urbanization is a significant consideration, with the share of the population living in towns and cities increasing from 25.44 per cent in 1950 to 51.4 per cent in 2000 and 55.74 per cent in 2010. Projected figures for 2020 and 2030 are 58.69 per cent and 61.23 per cent respectively. As in the case of forest cover, the implications for conservation emerge not only from the spatial extent of urban cover but also from the nature of such change, particularly where it results in habitat fragmentation and/or habitat degradation, both directly and indirectly.

Illegal hunting was indicated as an issue, with observations that, notwithstanding the existence of laws enacted to limit hunting in specific sites/during specific seasons, there is little effective enforcement. This was highlighted as an issue even within protected areas, raising concerns as to the extent of this activity *beyond* such conservation areas. It was also noted that hunters presently do not receive any training prior to receiving their hunting licence; this contrasts with an approach adopted in other countries where hunters are required to demonstrate that they can correctly identify species for which hunting is permitted, enabling differentiation between protected and unprotected species. With regard to species other than avifaunal ones, exploitation appears to affect different species to varying extents. The Barbary macaque (*Macaca sylvanus*), for example, is considered to be a pest because it strips the bark of *Cedrus atlantica*, and is exploited for the pet trade, with recent estimates corroborating indications that the population is in decline.

It is estimated that some 300 macaques are being captured from the wild for trade to Europe on an annual basis. Studies on the Mediterranean monk seal (*Monachus monachus*) indicate that deliberate killing of individuals by fishermen has contributed greatly to the species' decline, leading to its present day critically endangered status. The Cabo Blanco population is the largest of the three/four remaining subpopulations of the species, with a second subpopulation located on the Mediterranean coast of Morocco; the latter, however, is believed to number only some 10 individuals.[29] Entanglement in fishing nets has also been a factor contributing to the decline of the Mediterranean monk seal. Collection of specimens is a threat to a number of other species, affecting a number of endangered molluscs (*Melanopsis* sp.), as well as snakes, which are collected for traditional medicine and entertainment, while fishing (both deliberate commercial fishing and incidental by-catch) has had a substantial impact on several species of fish, as well as seabirds.

An underlying "threat" factor is the lack of a conservation conscience among the population at large. Fostering conservation conscience in children would appear to be a productive strategy for future conservation efforts. Indeed, there appears to have been useful investment in environmental education in recent years within Morocco, both Government and NGO led, as well as an internationally recognized push by the country to reduce illiteracy rates (from 43 per cent in 2004 to 30 per cent in 2011). The Clearing

[29] The remaining two Mediterranean monk seal subpopulations lie outside Morocco.

House Mechanism on Biodiversity of Morocco (CHMBM) gives various examples of public outreach and awareness-raising initiatives relating to biodiversity, particularly of initiatives conducted during the International Year of Biodiversity (2010), with various media features and other outreach activities. However, teachers lack training and, as a result, actual environmental education in schools is falling short of established goals. This educational aspect is particularly important, in order for children to develop an attachment to nature but also for overcoming unfounded fears that may negatively impact on particular species, or groups of species (e.g. snakes).

Fragile ecosystems

Oases

The oasis area covers about 15 per cent of the area of Morocco, and about 5.3 per cent of the population lives there. Moroccan oases experience degradation due, in particular, to climate change, compounded by population and urban pressures. A tenth of oases located in southern Morocco have already lost more than 40 per cent of their crop area: 208 ha of agricultural land were silted in Errachidia area. Extreme weather conditions (irregular rainfall, floods and flooding, droughts) are more intense and unpredictable. The extent of desertification can also be assessed based on the rate of decline of forest cover vegetation, water erosion, silt level, water salinity and rising water.

Recurrent droughts exacerbate the problem: on average, water bodies experienced a drop in water level of 20 m. One third of water sources in these areas are totally dried or running at an insignificant rate. Over the past decade, the Moroccan oases area saw a 34 per cent decline in its date production, mainly due to the spread of diseases such as Fusarium wilt, and a 20 per cent reduction in the land used for grain growing. The problems of soil salinity, water erosion and silting are increasingly serious for agricultural land, and impoverish the oasis populations.

Water erosion is considered intense, with specific damage exceeding 2,000 t/km^2/year in the slopes of the Rif in northern Morocco, between 1,000 and 2,000 t/km^2/year in the pre-Rif, between 500 and 1,000 t/km^2/year in the Middle and High Atlas, and less than 500 t/km^2/year in other regions.

In parts of the south and east of the country, siltation due to wind erosion is one of the main manifestations of desertification. Indeed, dozens of small reservoirs and hundreds of open irrigation channels are unusable after only a short period of operation, due to silting. In these areas, rural areas, palm groves and lines of communication also suffer from this phenomenon.

The problem of salinization and rising water affects almost all large irrigated areas. In the provinces of Zagora and Errachidia, it is estimated that 22,000 ha of irrigated land and 5 million ha of rangelands are affected by salinization that combines its effects with those of silting.

The mountains of Morocco

In Morocco, mountain areas cover over 19 million ha, or 28 per cent of the national territory. Mountain areas are of particular interest in national policy, given their key role in socioeconomic development, to the extent that:

- About 30 per cent of the population (over 8 million) lives in mountain areas;
- These areas include the majority of the forest area and constitute the Moroccan water tower (70 per cent of the water surface);
- They support a large part of endemic biodiversity and represent important potential for tourism.

However, these mountain areas are under threat due to the overexploitation of natural resources potential that has led to a fragile environmental ecosystem and will have to be managed.

Policy framework on fragile ecosystems

Aware of the socioeconomic and environmental role played by the oases, Morocco pays special attention to these favourable but fragile areas. Similarly, mountain areas are important due to their richness in biodiversity and water reserve and their surface covering almost one third of the national territory.

The National Charter for Planning and Sustainable Development and the National Physical Land Management Master Plan acknowledge threats and challenges that these sensitive areas are facing and recommend that the protection of these areas should be of national emergency priority.

To this end, the Strategy on Planning and Saving Oases in Morocco and the Strategy on Planning and Sustainable Development of the Middle Atlas Mountains have been developed and implemented in the context of territorial development programmes initiated in collaboration with national and territorial

partners and with the support of international organizations. However, there is a gap in legislation on their environmental protection (chapter 1).

9.4 Policy, legal, regulatory, management and other measures

Since 2003, Morocco appears to have made some progress in establishing and enhancing policy and legal frameworks and regulatory and management measures, in particular on protected area management, as well as in general strategic environmental management areas.

Policy framework

The 2004 Strategy for the Conservation and Sustainable Use of Biodiversity represents the country's first report in connection with the CBD. The Strategy was formulated in four stages, comprising (i) an inventory and evaluation of existing information, (ii) identification and analysis of management scenarios/options, (iii) development of a strategy and plan of action, and (iv) development of a national report concerning biodiversity. Information provided through the CHMBM indicates that the project was conducted in a participatory manner, although no further details are provided.

The 1996 National Strategy for Protected Areas forms the basis for changes in the protected area network. In the same year, the Strategy for Conservation and Valorization of Genetic Resources of Moroccan Flora was also released. Also of relevance is the 2008 Report on Sustainable Tourism in Morocco's Protected Areas (*Atelier International sur le Tourisme Durable dans les Aires Protégées du Maroc*). In addition, Morocco has ratified the African-Eurasian Waterbirds Agreement, with this entering into force in December 2012.

In 2010, the country launched the National Charter for Environment and Sustainable Development (chapter 1). The Charter is intended to serve as a blueprint for the development of environmental policy, and will be implemented through 16 regional observatories (OREDDs). Of particular relevance is the commitment made in the Charter to increase wastewater recycling to 96 per cent.

In the same year, the country also issued the National Strategy for Education and Sensitization Related to the Environment and to Sustainable Development. The 2006 National Action Plan to Combat Desertification was intended to serve as an ongoing planning framework. The objectives of the 2006 Strategy for Forest Development and the 2007 National Forest Programme include the protection of soils and the regulation of water resources, contributing to the socioeconomic development of rural populations, and protection of biodiversity and the environment.

Although these strategic documents undoubtedly provide a valuable framework for biodiversity conservation, actual implementation/enforcement supporting these strategic documents and coordination across sectoral interests are lacking. Targets and regulations established on paper are often not accompanied by effective implementation on the ground, including hunting regulations, pollution control regulations, the regulation of forest exploitation and the regulation of grazing, amongst others.

The plans and programmes of different governmental authorities are issued without any view towards holistic and coordinated management of environmental resources and, indeed, often contain conflicting objectives, which, in several cases, are not realistic and/or advisable. An element of conflict between different sectoral interests was indeed evident in this analysis, notable amongst which are those of the biodiversity conservation, forestry, tourism, water management, infrastructure development and agricultural sectors.

Legal framework

Laws of relevance to biodiversity include the 2003 Law No. 11-03 on the Protection and Conservation of the Environment, which includes general provisions for environmental protection and spatial planning within the country. Chapter 3, section 2 of the Law deals specifically with fauna, flora and biodiversity, and incorporates general provisions for the conservation of biodiversity, as well as specific provisions, including the listing of species which require specific protection, the banning of activities posing a threat to endangered, threatened or rare species, and the regulation of exploitation, utilization and trade of such species. The Law also notes that forests are to be considered a public good, and highlights the necessity of their protection.

A significant development over the review period has been the promulgation of the 2010 Law No. 22-07 on Protected Areas. This has addressed two key problematic issues with the previous system of designating "national parks": (i) the significantly different situation and context of areas classified under the same heading of "parc national", and consequent need for different management strategies within these areas, and (ii) discrepancies between the

Moroccan use of the "parc national" title and the use of the same term ("national park") by the International Union for Conservation of Nature (IUCN).

In the latter case, the term is used to refer to areas falling within Category II of the six-category classification system, comprising "large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities".

This definition does not apply to all of the national parks designated as such in Morocco. For this reason, the 2010 Law establishes an alternative classification system, incorporating five categories, namely (i) parc national, (ii) parc naturel, (iii) réserve biologique, (iv) réserve naturelle and (v) site naturel. This classification system is designed to address the two key goals of the protected area network in Morocco, i.e. (i) conservation and (ii) valorization of biodiversity, and is also custom-designed for the Moroccan context; at the same time, it allows comparability with other protected areas at international scale, through definition of how these national categories correspond with IUCN designations. The Law also establishes procedures for the designation, planning and management of these sites.

Law No. 29-05 on the Protection of Wild Fauna and Flora and Control of their Trade was adopted in July 2011. This Law builds on the provisions established in Law No. 11-03. It also implements requirements under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Regulatory measures

Limitations need to be highlighted with respect to the process of environmental impact assessment (EIA) and, specifically, the assessment of impacts on biodiversity. Such assessments are often conducted in a very superficial manner, with impacts considered being mostly of a general nature and with inadequate consideration of the specific context of different sites. Examples may be cited of assessment studies that omitted certain fundamental aspects (e.g. the location of a project site within an Important Bird Area).

This concern is linked to the lack of baseline information for many sites in Morocco, and to limited attempts in such EIA studies to build on existing databases. It was noted, furthermore, that submissions by NGOs relating to EIA documents have, at least in certain cases, resulted in no feedback. While it is understood that Morocco's experience with the EIA process is somewhat limited, it is crucial that the process be conducted in a manner that conforms to established norms of good practice and to high standards. As in the case of protected areas, fostering an "evaluation culture" is crucial in this regard.

There appears to be little information available pertaining to the involvement of the public and of key stakeholders in processes of decision-making; while several plans and programmes make mention of having been formulated in a participatory manner, few provide specific details of who was involved, for what purpose and in what manner. Academics are often not involved in the development of policies and plans. While these considerations extend beyond the topical scope of biodiversity to wider issues of governance, they are certainly of relevance to the success of conservation initiatives.

Institutional framework

Ministry of Energy, Mines, Water and Environment

The Ministry of Energy, Mines, Water and Environment has responsibility for strategic management of energy, mines and geology, as well as other sectors. While the general remit of the Ministry does not appear to be extensively directed towards biodiversity, there is some direct relevance in the work of the Department of Environment. In particular, the Department is responsible for overseeing the implementation of the CBD within Morocco, as well as for the development, monitoring and implementation of relevant national strategies and action plans.

High Commission for Water, Forestry and Desertification Control

Created in 2003 and reporting directly to the Chief of the Government, the High Commission plays a key role in preserving and managing biodiversity in Morocco. Of particular relevance is the Directorate for the Fight against Desertification and the Protection of Nature, and the Directorate of Forestry Development, as well as the Forest Research Centre. The former Directorate, responsible for nature protection, is further subdivided into different priority areas, with these incorporating (i) hunting and aquaculture, (ii) parks and reserves (protected

areas) and (iii) soil and water conservation, and forest protection.

National Committee on Biodiversity

The National Committee on Biodiversity incorporates representatives from several agencies and institutions in Morocco, including the above-mentioned Ministry and High Commission, as well as representatives of ministries with responsibility for (i) foreign affairs and cooperation, (ii) agriculture, rural development and fisheries, (iii) tourism, (iv) the interior, (v) cultural affairs and (vi) national education, higher education and professional training and other specific departments.

It also includes representatives of scientific institutes and NGOs. The Committee was established to contribute towards the implementation of the CBD in Morocco, has been central to the development of national studies/action plans relating to biodiversity, and is intended to provide a framework for information and coordination of actions related to the CBD. The diversity of representation on the Committee has, however, presented some constraints.

Academia

There is a variety of academic institutions with remits relevant to biodiversity conservation in Morocco, including departments/units focused on biology, botany and zoology, amongst others. These contribute to the management of biodiversity in various ways: through general consultative services, the generation of original data relating to Morocco's biodiversity as a result of research endeavours, knowledge/skills development and international exchanges.

Other measures

The Clearing House Mechanism on Biodiversity of Morocco (CHMBM) identifies a suite of mechanisms and initiatives for implementation of the CBD. Several of these relate to the documents and strategies discussed elsewhere in this chapter. The state of implementation varies across measures; e.g. while the CHMBM lists measures being implemented to preserve genetic diversity, these are evidently not yet yielding adequate results, as emerges elsewhere in this review.

Similarly, there appear to be some shortcomings relating to sustainable use of biodiversity, and the involvement of local communities and stakeholders. In other areas, however, progress made has been quite substantial, e.g. in the establishment of new protected areas, including parks and Ramsar sites.

9.5 Conclusions and recommendations

Notwithstanding progress made, there are still substantial uncertainties concerning various aspects of the biodiversity of Morocco. As demonstrated in table 9.1, there are at least 382 species for which there is insufficient data and the status of which is unknown. Furthermore, knowledge gaps were highlighted by several respondents, including gaps relating to specific species/groups, genetic resources and ecosystems/sites.

While the Clearing House Mechanism of Biodiversity of Morocco established in connection with the Convention on Biological Diversity is contributing to a more synthesized knowledge base for Morocco, this is not yet sufficient and further investment in knowledge-building (for infrastructure, research and human capacity-building) is crucial.

Recommendation 9.1:
The Ministry of Energy, Mines, Water and Environment, together with the Ministry of Agriculture and Maritime Fisheries and the High Commission for Water, Forestry and Desertification Control, in cooperation with other relevant governmental bodies, the scientific community and international donors, should conduct a systematic analysis of knowledge gaps relating to Moroccan biodiversity, which would provide the basis for a research plan to address the gaps identified, and which should be accompanied by a comprehensive needs assessment and an action plan.

While Morocco has made substantial progress in extending its network of protected areas and in building a suite of management and regulatory plans, policies and laws, there is substantial evidence to suggest that practice falls short of set targets and objectives, with problems of enforcement and implementation. In this regard, it is crucial that evaluations of management effectiveness be institutionalized, in order to allow for "real" adaptive management and to ensure that conservation resources are being put to the most efficient use possible. In parallel, technical and human capacities for better implementation and enforcement need to be built.

Recommendation 9.2:
The Ministry of Energy, Mines, Water and Environment and the High Commission for Water, Forestry and Desertification Control, in cooperation

with the managers of protected areas, conservation bodies and NGOs, should:

(a) Conduct evaluations of management effectiveness across protected areas and for other conservation plans/measures on a regular basis, with such evaluations institutionalized as part of the management process and considered to form a key part of adaptive management strategies, in order to ensure the conservation and sustainable use of natural resources;
(b) Build capacities for implementation and enforcement of conservation measures through financing, investment and training.

Several key threats to biodiversity in Morocco appear to be intrinsically tied to socioeconomic development challenges; indeed, conservation initiatives that fail to consider the short- and long-term socioeconomic dimension appear to be of limited feasibility. It is difficult to persuade people of the necessity of biodiversity conservation when their basic livelihood needs are not being met and where the use of natural resources (legally or illegally) goes some way towards alleviating hardship.

While there have already been efforts to integrate the two goals of conservation and socioeconomic development, further investment in this area is crucial, particularly for conservation of specific ecosystem types (e.g. forest ecosystems). The recategorization of national parks, as a result of the 2010 Law No. 22-07 on Protected Areas, may provide a useful opportunity for undertaking such an exercise to better integrate conservation and development agendas, within protected areas.

Recommendation 9.3:
The High Commission for Water, Forestry and Desertification Control, in cooperation with the Ministry of Energy, Mines, Water and Environment, should:

(a) Integrate conservation planning needs with socioeconomic concerns when preparing management plans for protected areas in order to reduce the pressure on biodiversity while also catering to socioeconomic needs;
(b) Raise public awareness of biodiversity conservation matters.

There is a lack of integrated management across different sectoral areas as a major limiting factor for effective biodiversity conservation, with disjointed initiatives and, in some cases, the setting of conflicting objectives by different authorities, with evidence also of competing agendas. This results in resources being put to ineffective use, and casts doubt on the utility of a number of the plans/policies established. A key priority for more effective biodiversity conservation, therefore, needs to be the establishment of theme-based cross-sectoral initiatives that seek to develop coordinated, and mutually agreed-upon, strategic instruments for subject areas/sites which are of interest to different sectors.

Recommendation 9.4:
The Government, in collaboration with the scientific community and other relevant stakeholders, should review the main activities on biodiversity conservation in the country and develop proposals to promote cross-sectoral and interdisciplinary initiatives, especially in the areas of wetlands, water resources, agricultural land management, mining and tourism.

Morocco possesses many natural habitats of high ecological value. While some of these environments, such as nature reserves and national parks, enjoy legal protection, there are many that do not. In particular, oases and mountain areas are subject to various threats, such as overexploitation of natural resources, loss of crop area, siltation, flooding, droughts, water and wind erosion, and soil salinity. Strategic documents recognize the magnitude of the phenomenon, but also recognize the legal vacuum regarding the protection of these ecosystems.

Recommendation 9.5:
The Ministry of Energy, Mines, Water and Environment, the High Commission for Water, Forestry and Desertification Control, the Ministry of Housing, Town Planning and Urban Policy and the Ministry of Agriculture and Maritime Fisheries, in cooperation with other relevant stakeholders, should prepare legislation to protect sensitive oasis and mountain areas and promote its adoption by the parliament.

PART III: INTEGRATION OF THE ENVIRONMENT IN HEALTH AND OTHER SECTORAL POLICIES

Chapter 10

HEALTH AND ENVIRONMENT

10.1 Status of human health

In its most recent study of the health status of the population, the Ministry of Health of Morocco notes an epidemiologic transition between infectious and chronic diseases. The prevalence of contagious diseases and malnutrition is progressively declining, while non-communicable diseases, such as cardiovascular diseases, diabetes, cancer and chronic respiratory diseases are on the rise. These changes have resulted in significant increases in national health expenditure and high social costs.

This new epidemiologic profile is explained by an increase in life expectancy (currently, 73.9 years for men and 75.6 years for women) and rapid socioeconomic development associated with behavioural changes such as tobacco addiction, a sedentary lifestyle and unhealthy diets. The evolution of the lifestyles of the population and the migration of a significant part of the rural population into urban or suburban areas also constitutes a major factor. The Ministry of Health estimates that one third of the Moroccan adult population suffers from hypertension, and that the number of Moroccans affected by diabetes could shortly reach 2 million. Based on the Cancer Registry of Grand Casablanca, the number of new cases each year is estimated to be 30,500.

Since the 1990s, efforts to combat chronic diseases have been carried out within the framework of programmes focused on specific diseases or health areas, in the absence of a comprehensive and integrated strategy. Today, the Ministry of Health has concluded that non-communicable disease control has to be based on multisector actions and, in particular, on raising public awareness by collecting and spreading information about the link between these diseases and development, and the necessity of protecting the environment.

The Ministry of Health therefore recommends a comprehensive approach, based on the integration of the policies and programmes to control non-communicable diseases in all planning processes with regard to health, as well as the national development programme.

10.2 Health risks associated with environmental factors and causes of morbidity

Air pollution

After the Casa Airpol assessment study, which confirmed the impact of air pollution on the health of populations in Casablanca, an assessment of the impact of air pollution on asthmatic children was carried out in Mohammedia in 2003 by the Department of Environment and the Ministry of Health. The study comprised 76 children between 12 and 15 years old over the course of an average of 82 days. The health indicators were based on the daily number of asthma attacks, whistling in the chest, nocturnal cough, difficulty breathing, respiratory infections and use of anti-asthma drugs by the children in the study. The environmental indicators were based on the three main pollutants measured – NO_x, O_2 and SO_2. The measurements were carried out by a mobile monitoring station. Daily concentrations for SO_2 20.9 $\mu g/m^3$ were in the range of 0-110, for NO_x 8.5 $\mu g/m^3$ in the range of 2-54 and for O_3 43.6 $\mu g/m^3$ in the range of 12-70. The study showed links between SO_2 and asthma attacks and nocturnal cough. NO_x was also associated with asthma attacks and nocturnal cough, but, additionally, also with respiratory infections with fever.

Water

Drinking water

Drinking water supply in Morocco is provided mainly by treated surface water (72 per cent in 2010). Groundwater contributes a much smaller share (28 per cent in 2010), but supplies an important area of the territory. A still marginal share of water production consists of treated seawater. About 7,000 m^3/day of seawater are treated in Laâyoune and 2,600 m^3/day in Boujdour.

There is a 100 per cent rate of access to drinking water in urban areas, including 92 per cent by individual connections and 8 per cent by public standpipes. In the countryside, the access rate in 2010 was 91 per cent, of which approximately one third was by individual connection and two-thirds via public standpipes.

In 1990, the Ministry of Health set up the Basic Sanitation Programme, the main goal of which is to ensure sanitary control of water for human consumption. Within the Basic Sanitation Programme, in 2008, the Ministry of Health services undertook 16,798 samplings, including 11,122 on the distribution networks (95.5 per cent rate of conformity with bacteriological standards) and 5,676 on collective water supply spots, which include public stand pots, dug wells and boreholes (57 per cent rate of conformity). This evaluation of microbiological quality is completed by tests of chlorine concentration carried out on the distribution networks (111,870 tests; 95.1 per cent conformity rate) or on collective water supply spots (85,820 tests; 66.2 per cent conformity rate).

Sanitary inspections of drinking water facilities are conducted by the Ministry of Health: in 2008, 17,545 inspections were carried out on urban water supply networks and 42,645 on water supply spots in rural areas, leading to 5,575 recommendations to correct the irregularities found.

The incidence of waterborne diseases in Morocco has decreased considerably over the past 25 years. Since 1995, cholera has disappeared and the number of cases of typhoid fever and viral hepatitis decreased by 90 per cent (figure 10.1).

With regard to safe drinking water supply, so crucial for public health protection, the issue of access for rural populations is a priority concern for Morocco. Despite the fact that 61 per cent of the rural population now have improved access to drinking water, according to the criteria adopted by the World Bank, 5.4 million people in the countryside are still not adequately supplied.

Bathing waters

The Moroccan coastline is divided into two sectors: the Mediterranean coast and the Atlantic coast. The increasing urbanization and progressive privatization of the coastal area, as well as the erosion and fragility of the coastal zones, are a major concern.

The number of beaches covered by the National Monitoring Programme on bathing water quality has been increasing for several years, growing from 86 in 2005 to 141 in 2012. These beaches are subject to water quality controls, and sometimes to sand quality controls. The beaches generally stretch from 0.5 to 10 kilometres, with an average daily rate of 1,500 bathers per day per beach and 1 million bathers daily for all of the beaches during the summer period.

Monitoring of bathing seawater quality is organized jointly by the Ministry of Equipment and Transport and the Ministry of Energy, Mines, Water and Environment, and implemented by the Public Laboratory of Studies and Tests and the National Laboratory of Studies and Pollution Monitoring. The Ministry of Health has not yet set up any monitoring for freshwater bathing in wadis and lakes.

From May 2011 to February 2012, 3,890 samples were collected in 354 sampling stations distributed on the 141 beaches which constitute the National Surveillance Network. Only samples from 349 sampling stations were analysed, of which 315 sampling stations (90.3 per cent) were found to be in conformity with the Moroccan standard and 34 stations (9.7 per cent) were not. These situations of non-conformity correspond to areas impacted upon by wastewater discharges, potentially at risk from tributary run-off, and this is sometimes combined with insufficient infrastructure to handle the number of bathers.

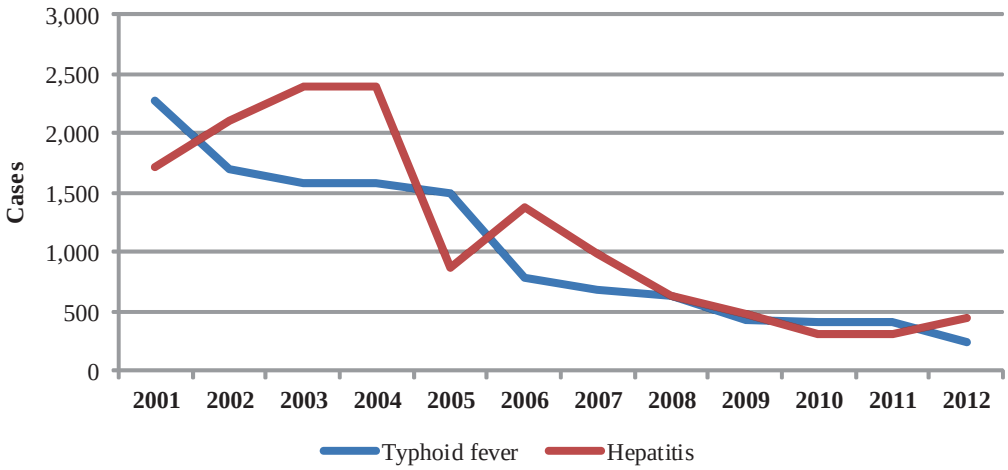
Quality controls are carried out by the Ministry of Equipment and Transport and the results are published annually. A specific characteristic of this quality control is that it also includes sand quality checks on some beaches. This mode of administrative organization differs from that usually met with in other countries, where the body in charge of this type of health control is generally the Ministry of Health.

In collaboration with the Ministry of Equipment and Transport, the Mohammed VI Foundation for Environmental Protection has built up a database that now allows necessary data to be available to track the evolution of bathing water quality along the whole of the coastline. By Moroccan standards, the percentage of bathing water of good quality at beaches within the monitoring programme rose from 25 per cent in 1999–2000 to 79.5 per cent in 2011–2012. However, calculations based on European standards, as set out in Directive 2006/7/EC of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC concerning the quality of bathing water, produce a less favourable ranking (figure 10.2).

By highlighting defects of coastal water quality in some areas, bathing water quality controls have demonstrated the need to prioritize wastewater management. With a view to adopting the standards set out in Directive 2006/7/EC, although no proposed legislation imposing such standards has yet been drafted, the Moroccan Government has already committed to developing bathing water profiles, in particular in Agadir.

Photo 10.1 : Medicinal herbs produced in Ifrane Region

Figure 10.1: Waterborne diseases



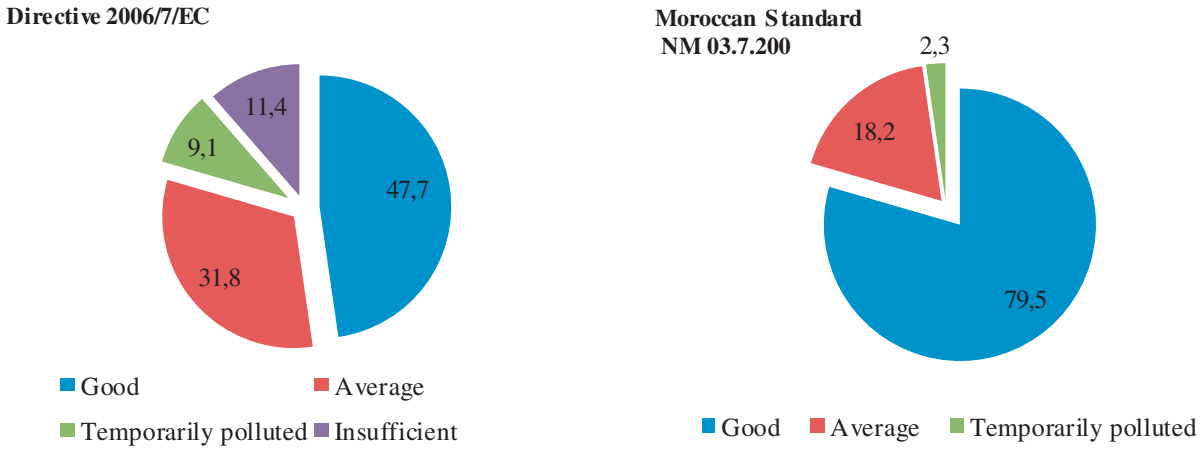
Source: Ministry of Health, Department of Epidemiology and Disease Control, 2012.

It is planned to carry out nine bathing water profiles in 2013 and 2014. These profiles are intended to specify active management measures to limit the exposure of bathers and to regulate water infrastructure with a view to decreasing the level of water contamination. The latter, in particular, relate to wastewater collection and treatment equipment, but also to rainwater collecting networks, especially in areas exposed to rapid water level rise.

Within the next few years, the upgrade of the Moroccan standard of 1998 to the European Directive 2006/7/EC will reinforce quality requirements. The drafting of bathing water profiles for each beach will make it possible to identify the main contamination sources of coastal waters which, in turn, will assist in defining strategic priorities for sanitation efforts and the calculation of the financial resources needed to implement them.

The studies developed within the framework of these bathing-water profiles would, furthermore, contribute to the development of urban management plans in coastal areas.

Figure 10.2: Ranking of water quality of monitored beaches according to European Directive 2006/7/EC and Moroccan Standard NM 03.7.200



Source: Surveillance de la qualité des eaux de baignade, Rapport National 2011–2012, Ministry of Equipment and Transport and Ministry of Energy, Mines, Water and Environment, 2013.

Lastly, the increasing interest taken in coastal water quality and in the dependent economic sectors will most probably result in the development of collaboration between the Ministry of Health and the Ministry of Equipment and Transport.

Municipal solid waste and medical waste

Urban sprawl in Morocco has led to a direct increase in the risk of contamination by uncontrolled dumping of waste for the populations living on the periphery of the major cities. Among other consequences, the accumulation of uncollected waste creates conditions for the development of disease vectors, such as rodents or insects. Pending the needed improvements in the waste collection system in these areas, rat extermination and insect control would make it possible to reduce the associated health risks. In Morocco, while the standard of cleanliness in private spaces is high, the practice of dumping waste in public places is still very frequent. At present, the population does not make the link between illegal dumping and the risk of water contamination.

The elimination of sewage material and sewage sludge produced by treatment plants is not yet organized according to any specific plan. However, risks to human health and the environment can be important, in particular in the summer period when some water uses – such as for watering of vegetable gardens or bathing – accentuate these risks. As regards professional exposure, there is currently no plan or programme to raise awareness among informal recyclers (i.e. waste pickers) to the immediate risks to which they are exposed, while these are likely to be high.

Vector-borne diseases

Leishmaniasis cases are kept under increasing surveillance by the health authorities and the number of registered cases has also clearly increased. Nevertheless, the impact of this disease is appreciably lower in Morocco than in many other African countries.

Vector eradication programmes still make up a significant part of public health protection activities, in particular with regard to rural populations, which are the most exposed to parasitic diseases. Three vector-borne diseases are subject to monitoring in Morocco (figure 10.3):

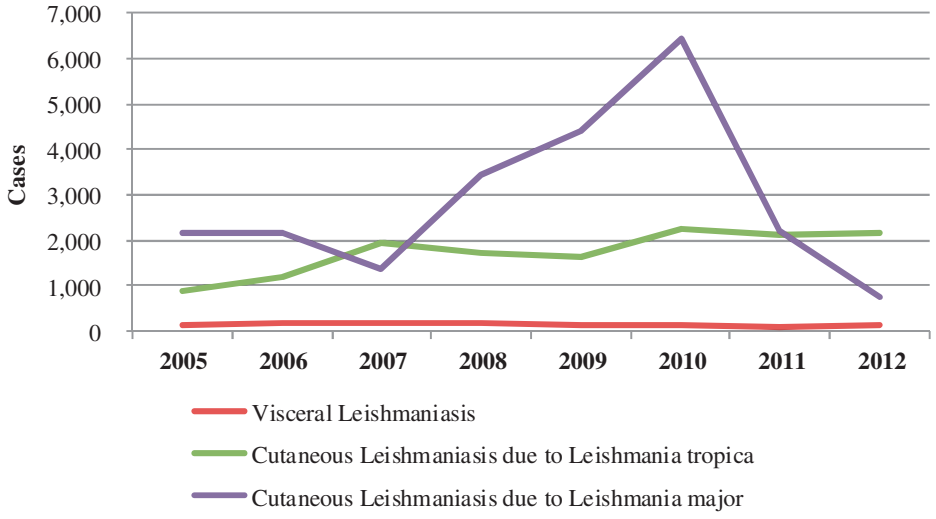
- Bilharziasis (or schistosomiasis), a water-borne disease transmitted by parasitic worms;
- Malaria, transmitted by female *Anopheles* mosquitoes;
- Leishmaniasis, transmitted by female sandflies (*Phlebotominae*).

In 2010, WHO declared the eradication of malaria in Morocco – i.e. the disappearance of indigenous cases. With regard to schistosomiasis, the last indigenous cases were recorded in 2003.

Food safety

Diseases spread by food-borne pathogens are still frequent in Morocco. Quality control of food products at the last stage before consumption is therefore of great importance (figure 10.4).

Figure 10.3: Identified cases of Leishmaniasis in Morocco



Source: Ministry of Health, Department of Epidemiology and Disease Control, 2012.

Food quality control is operated at two levels in the country:

- Control of food production and food sales, which is the responsibility of the National Office of Food Safety (ONSSA);
- Control at the stage of food marketing is done by the Ministry of Health with the support by the National Institut of Hygiene and regional laboratories of epidemiology and environmental health.

The inspection system for food hygiene and animal health set up by ONSSA comprises a national laboratory and six regional laboratories of veterinary research and analysis located in Agadir, Casablanca, Fès, Marrakech, Oujda and Tangier. Some of these laboratories have been undertaking food quality testing for almost 20 years, and aim at being accredited according to standard ISO 17025.

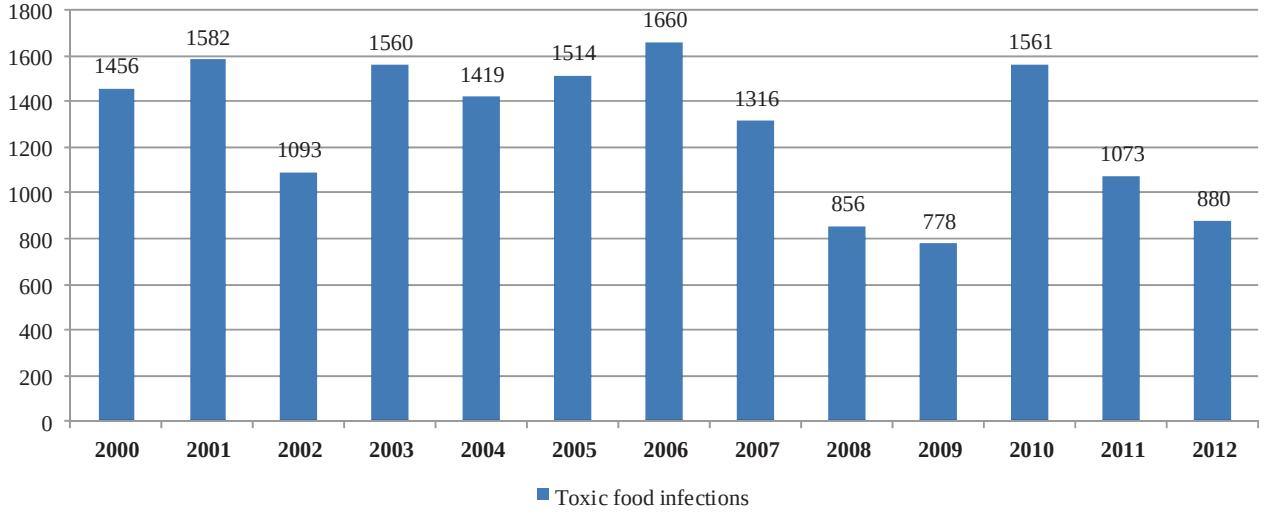
These laboratories carry out quality controls on the physico-chemical quality and toxicological risks of foodstuffs, as well as their microbiological quality (table 10.1).

The inspection process, which is under the responsibility of the Ministry of Health, is carried out with the support of the National Institut of Hygiene and the National Research Laboratory, and a network of 40 regional and provincial laboratories of epidemiology and environmental health that are involved, in particular, in testing and monitoring drinking water and food quality. A few of these laboratories are also involved in other fields of activity, such as screening for parasitic diseases, screening for carriers of germs, wastewater control or bathing-water analysis. These laboratories are organized as a network managed by the Department of Epidemiology and Disease Control. Sixteen laboratories of epidemiology and environmental health started a quality control process five years ago and aim at being accredited according to Standard ISO 17025. The regional laboratory of Fès obtained its accreditation ISO 17025 in 2012.

The analyses that the Department of Epidemiology and Disease Control laboratories perform on food relate only to microbiological quality. The most frequently analysed types of food are dairy products and cooked dishes. In 2011, of 23,769 samples, about 24 per cent or 5,696 did not comply with the microbiological standards. The standards are set for various categories of food by decrees, sometimes joint orders, from the Ministry of Agriculture and Maritime Fisheries and the Ministry of Health.

There has been an improvement in the coordination of the activities conducted by the veterinary services, which undertake priority controls of food of animal origin, and those carried out by the health services. Information exchange between these two services on the activities they undertake remains insufficient, however. Strengthening the means and capacities of the laboratories involved is another important challenge in improving food safety control in Morocco.

Figure 10.4: Toxic food infections



Source: Ministry of Health, Department of Epidemiology and Disease Control, 2012.

Table 10.1: Number of analyses of regional laboratories of veterinary research and analysis, 2011

Analysis type	Agadir	Casablanca	Fès	Marrakech	Oujda	Tangier	Total
Physico-chemical/toxicology	44,104	9,634	1,740	13,408	2,342	4,039	**75,267**
Microbiology	38,448	36,549	7,161	21,383	13,265	29,569	**146,375**

Source: National Office of Food Safety, 2012.

Housing

Urban development is worrisome in terms of public health because of the precarious housing – often qualified as informal housing, or sometimes as illegal housing – that has developed around the large urban areas.

In 2005, within the framework of the National Initiative for Human Development, the Government launched a programme to fight against social exclusion, including the demolition of derelict buildings, rehousing of inhabitants and provision of construction assistance for the concerned population, as well as assistance to repair dilapidated or unsafe housing.

Sanitary services appear to be almost wholly absent from this process, even though public health issues are at stake. Unhealthy housing, deficiency in drinking water supply or wastewater evacuation and/or bad conditions for solid waste collection pose risks to human health. In addition, the social exclusion that results from bad housing conditions also constitutes an important risk factor for the exposed populations.

10.3 Legal, policy and institutional framework

Legal framework

The current environment-related legal framework has provisions on human health protection. The 2003 Law No. 13-03 on Combating Air Pollution is the main law to protect human health from air pollution. Secondary legislation stipulates general ELVs to be applied where there are still no sectoral limit values (chapter 6). The legal framework on water includes the following legal texts:

- 1995 Law No. 10-95 on Water;
- 2006 Decree No. 2-05-1326 on water for use in food;
- Moroccan Standard NM 03.7.001 on the quality of water for human consumption (updated in 2006);
- Moroccan Standard NM 03.7.002 on the control and the monitoring of water in public water supply networks (updated in 2011).

The bacteriological quality control of bathing waters is based on the 1998 Moroccan Standard NM 03.7.200, inspired by EU Directive 76/160/EEC.

Collection and treatment of various types of waste (household, industrial, hazardous, medical waste) are garnering increasing attention since the promulgation of the 2006 Law No. 28-00 on Waste Management and Disposal and the decrees to enforce it (chapter 8). The Law clearly sets as a first objective the protection of human health, then the protection of the environment. Several decrees adopted to enforce this law aim at preventing or limiting direct impacts on health through microbiological contamination, deterioration of air quality resulting from bad conditions of incineration and contamination of water resulting from illegal dumping. The mains texts setting the legislative framework relating to medical waste collection and treatment are:

- 2006 Law No. 28-00 on Waste Management and Disposal;
- 2008 Decree No. 2-07-253 on waste classification and determination of the list of hazardous waste;
- 2009 Decree No. 2-09-139 on medical and pharmaceutical waste management;
- 2012 Decree No. 2-12-172 setting technical specifications relating to waste elimination and methods of waste recovery by incineration.

A draft decree on the internal management of medical and pharmaceutical waste in hospitals has also been elaborated recently (as at the end of 2012).

Health impact assessment

The 2003 Law No. 12-03 on Environmental Impact Assessment and the 2008 Decrees Nos. 2-04-563 and 2-04-564 make it compulsory to undertake EIA studies for a set of projects listed in the aforementioned Law. These legislative measures foresee the decentralization of the assessment process and the consultation of the concerned local populations. Although the 2003 Law stipulates that EIA studies should methodically assess possible direct and indirect, temporary or permanent effects on the environment and on people, a review of EIAs undertaken before 2006 demonstrated that many were carried out without sufficiently integrating a health component in the assessments.

To remedy this situation, in 2006, the Department of Epidemiology and Disease Control distributed a guide on health aspects in EIA for the attention of all representatives of the Ministry of Health in prefectures and provinces, providing a methodology for integrating health considerations in EIAs for all the relevant actors.

Strengthening the consideration of health concerns in projects and programmes is identified in the National Programme for Health and Environment as a priority, and an action on the integration of impacts in health impact studies on the environment has been proposed in the priority action plan of the programme.

Policy framework

There are various environmental programmes and strategies in place to reduce the impact of pollution on the environment, which likely also reduce the impact of pollution on human health. These include the 2005 National Programme of Sanitation and Wastewater Treatment, the 2010 National Strategy on Wastewater Sludge Management, the 2007 National Solid Waste Management Programme, the 2007 National Industrial Waste Programme and the 2010 National Programme for the Safe Management and Disposal of Equipment Containing PCBs. However, no study has yet been undertaken to determine the health impact of these programmes and strategies. The Department of Environment reports that a study should be launched in 2014, still under the National Programme for Health and Environment, to assess the environmental and health-related benefits of the National Programme of Sanitation and Wastewater Treatment and the National Solid Waste Management Programme.

National Initiative for Human Development

The massive movement of impoverished rural populations to cities and the subsequent expansion of urban areas, as well as the resulting pressures on the coastal fringe, make it imperative to consider an integrated approach to environmental protection, one that aims also to protect the health of populations exposed to these new living conditions.Launched in 2005, the National Initiative for Human Development includes an environment and health dimension. Action programmes linked to the National Initiative – a programme to combat rural poverty, a programme to fight social exclusion in the urban environment and a programme to protect vulnerable populations – are combined with an environmental protection approach that seeks to improve the social and psychological conditions associated with human health.

The National Initiative for Human Development aims to reduce poverty, social precariousness and social exclusion by undertaking efforts in numerous areas, including the improvement of basic services such as drinking water supply, wastewater collection and solid waste disposal.

National Environmental Action Plan

In 2003, the Government adopted the National Environmental Action Plan (PANE). Three of its priorities are directly related to the environment and health: the protection of water resources, the reduction of waste and improvement of solid waste management, and the improvement of air quality and reduction of atmospheric pollution. The Action Plan has not been implemented, however, owing to a lack of funding (chapter 1).

National Charter for Environment and Sustainable Development

The National Charter for Environment and Sustainable Development states that human development and environmental protection are inseparable, and that protection of health is one of the priorities for the country's development.

The Charter reiterates to all citizens the right to an environment that guarantees good health conditions for the population. It also supports the principle that social progress is an essential factor of public health, and considers that it is inseparable from environmental protection. It recommends a precautionary approach in relation to insufficiently known ecological and social risks. However, the Charter looks only to protect populations through reducing the actual dangers posed, and makes no mention of possibilities to reduce exposure levels as a way of managing environmental threats.

National Programme for Health and Environment and regional plans for health and environment

In September 2010, the Ministry of Health and the Department of Environment launched the National Programme for Health and Environment, which was elaborated according to the WHO methodology already used by most European countries.

The National Programme is built upon three thematic axes – prevention, precaution and social equity – and three organizational axes – pooling of resources, access to information and accountability. Although one of the top priorities is the pooling of the means of the two governmental institutions, the charter of collaboration between the two principal partners has not yet been signed. In spite of that, six regions already started to implement the national programme in the form of regional plans for health and environment: Souss-Massa-Drâa, Tadla-Azilal, Marrakech Tensift, Chrarda Béni H'ssen, Fès Boulmane and Oriental.

The implementation of the regional plans, given the current trend to decentralize State services, has led to a bottom-up approach, with local services adapting the national working scheme and developing organizational objectives at the regional level that are essential at the national level, i.e. the setting up of a partnership framework between environment and health agencies of ministries to develop a health and environment information system, disseminate information, raise awareness and perform research on these issues. This regional implementation has mobilized various local actors, in particular, regional services of health, regional laboratories of epidemiology and environmental health, municipal health offices of the Ministry of the Interior, and regional observatories of the environment and sustainable development (OREDDs).

The regional plans for health and environment focus strongly on health-related topics, such as the development of a food strategy or the implementation of the decree relating to drinking water. They also provide a framework for addressing social issues related to environment and health, such as protection of the population from the effects of cold weather. The conditions of this implementation are very dependent on the real level of activity of the particular local actors: established structures such as the laboratories of epidemiology and environmental health or the Ministry of Health are more easily incorporated into the process of implementing the plans.

The regional plans for health and environment constitute a basis to improve cooperation and the organization of health services and offices of environment at the regional level. The involvement of the regional laboratories of epidemiology and environmental health, in close cooperation with the OREDDs and the local services of the Ministry of the Interior, represents one of the key challenges for the implementation of regional plans. This cooperation should lead, in particular, to setting up regional health and environment databases.

Other results are expected from this decentralization of the National Programme for Health and Environment at the regional level, such as the creation of regional committees for integrated vector control management (IVCM) or the development of regional plans for medical waste management. Sometimes these can be pilot activities already included in regional plans to facilitate their implementation, such as the development of a health and environment information system in the region of Chrarda Béni H'ssen.

The Department of Environment conducts currently studies to improve knowledge on the assessment of health risks associated with pollution, through the various links between the state of ecosystems, health and sustainable development: impacts of mining on the environment and health; exposures due to pollution by lead, mercury and cadmium; and environmental and health impacts of pesticide use in the region of Gharb-Chrarda-Béni H'ssen.

Vector-borne policy

In recent years, environmental concerns have increasingly been taken into account in Morocco. For example, the use of pesticides has now come under scrutiny and new restrictions on their use have been put in place. At the same time, non-chemical alternatives are being promoted. Several action plans in this area have been prepared and implemented:

- 2006 National Plan to Implement the Stockholm Convention;
- 2007 Action Plan for the Development of Integrated Vector Control Management;
- 2008 Strategy and National Action Plan for the Ecologically Sound Management of Chemical Products;
- 2009 Action Plan for the Period 2009–2012 for the Rational Management of Pesticides Used to Protect Public Health.

A technical committee for IVCM was established and includes members from the Ministry of Health; Ministry of the Interior; Ministry of Agriculture; Ministry of Energy, Mines, Water and Environment and Ministry of Higher Education, Scientific Research and Executive Training.

Activities are mainly carried out in rural areas. Among the most involved local actors are those from the Ministry of Health and Ministry of the Interior (Division of Hygiene and Public Health), as well as the provincial- and prefectural-level institutions and outpatient services/health centres.

Eradication of bilharziasis, considered effective on the ground by the Moroccan health authorities, will be confirmed by WHO in the coming years. At this point, the main function of the system set up to control this parasitic disease will be to monitor – as is done for malaria – that there are only non-indigenous cases in the country and that the number of such cases is decreasing.

It is planned to gradually implement IVCM throughout the whole national territory. The control of the use of pesticides needs to become more rigorous and mobilize new actors mainly concerned with the protection of fauna and flora. A first challenge consists in working out a legal basis to regulate the use of pesticides, taking into account their whole life cycle. A second challenge is the reinforcement of the human, technical and financial means for implementation.

The Moroccan experience in this field will most probably continue, as has been the case for many years, to benefit other African countries as well. The pioneering role of Morocco in IVCM in Africa should be underscored.

Medical waste management

There is no information at present regarding the quantities of all types of medical waste actually collected and treated in the country. The annual production of medical waste from the 142 public hospitals is estimated at 21,000 t/year, including 6,000 tons of infectious medical waste.

In 2011, the Ministry of Health completed a programme to install 21 sterilizing medical waste crushers in hospitals. This equipment treats roughly 70 per cent of the medical waste produced by the hospitals. At the start, the equipment was operated by the hospital staff; today, this task is progressively outsourced to private services. Three accredited private companies located in Meknès, Témara and Tétouan collect and treat waste produced by hospitals. As a result of this outsourcing, the crushers that are no longer being used in some hospitals are transferred to others that still do not have adequate equipment. Templates for standard contracts of services have also been made available to hospitals wishing to outsource their waste disposal.

A detailed assessment of the results and impacts of the installation of the 21 crushers has not been yet undertaken. The Ministry of Health could, however, perform such an assessment, as well as specific studies on medical waste treatment, using the Ministry staff already seconded to hospitals to improve hygiene conditions and monitor cases of nosocomial (hospital-acquired) infection. Identifiable anatomical waste, as recently classified under legislation, must be buried. Compliance with this regulation has not yet been assessed, however.

Even though some hospitals take responsibility for managing the waste generated by the health centres within their areas, a significant part of the waste produced by the 2,650 health centres throughout the country – more than 1,900 of them in rural areas – is not processed at all. This situation confirms that, in

Morocco, medical waste processing still requires improvement. On the other hand, waste management, including medical waste, is now on the university curriculum (Faculty of Science of the University of Tétouan), and the number of professionals specialized in this field should therefore increase shortly.

The rules applicable to medical waste sorting are still insufficiently respected in some hospitals. The Ministry of Health therefore foresees integrating medical waste management into the Systemic Quality Improvement System for healthcare institutions. In addition, taking this criterion into consideration in the ranking system for health institutions would likely improve waste sorting. Sensitizing health professionals from the private sector to recycling is a further objective of the Ministry of Health.

In addition, even if the regional laboratories of epidemiology and environmental health are still not very involved in this field, for which they do not have an explicit mandate, some of them have, nevertheless, developed initiatives at the regional level. Thus, although the National Programme for Health and Environment does not plan any specific action for medical waste processing, a few actions are already included in some regional plans for health and environment, as in Fès. Moreover, WHO recommends the development of specific regional master plans for medical waste. The process carried out in the Fès region is on a voluntary basis and is a very good example of the positive impact the regional plans can have in coordinating the activities of the local services and building synergies for the protection of the environment and human health.

Improvement of waste sorting, services outsourcing and coordination of the various actors at the regional level (in particular, the regional departments of health, regional laboratories of epidemiology and environmental health, municipal health offices of the Ministry of Health and the OREDDs) thus appear to be the main lines along which it is hoped to progress in the years to come to improve the current situation. The setting up of a monitoring and assessment process, or an inspection process, would be a final step to complete this process.

Institutional framework

The Ministry of Health is responsible for water quality control throughout the whole country. Health officials are mandated to check that producers and distributors properly ensure that installations and water quality conform to the regulations.

The Ministry of Health's services do not yet include routine physico-chemical analyses, which remain the responsibility of the suppliers. On the other hand, the National Public Health Laboratory carries out analyses of heavy metals and pesticides in drinking water.

Enforcement of the water laws is ensured by the health services under the Ministry of Health and the Ministry of the Interior, which prohibit or restrict water use, as necessary. A procedure has been set up to examine complaints from users in a few regions. It aims to speed up the reaction and decision-making time of the relevant public authorities when water quality issues are reported, in particular regarding the aspect, flavour or smell of water supplies.

The National Office of Drinking Water (ONE), now part of ONEE exploits 1,065 water catchments and operates 57 water treatment plants. A factory run by a private company (Société des Eaux de l'Oum Er-Rbia) in the province of Settat, ensures an additional production of 56 million m^3/year, of which 95 per cent is distributed by the company Lydec (Lyonnaise des Eaux de Casablanca) (30 per cent of the production of Grand Casablanca) and 5 per cent by the publicly owned companies RADEEJ and RADEEC.

The National Office of Drinking Water (ONEP) is a major supplier of drinking water throughout the country, with 1,400 water tanks offering a full storage capacity of 955,000 m^3 and 26,280 km of water pipes. The Office is responsible for monitoring the quality of the water produced and distributed by all the production units and water supply networks that it operates. It has a central laboratory, which leads a network of 57 decentralized laboratories. In 2008, the Office's laboratories carried out 4,181 samplings: 849 at the production level, 1,077 at the storage level and 2,555 on the distribution network. In addition to basic water testing on the spot, the samples are subject to microbiological and physico-chemical analyses.

Laboratories

Several categories of laboratories currently contribute to public action in the environment and health field. Since the early 2000s, the qualifications and networking capacity of these laboratories has increased appreciably, but more needs to be done. To ensure environmental and health protection in Morocco, there must be further improvement in these areas.

These laboratories can be divided into those at the national level (ONEP, Public Laboratory of Studies and Tests, ONSSA, National Institut of Hygiene, Poison Prevention and Drug Control Centre, and National Laboratory of Studies and Pollution Monitoring), and networks of regional or provincial laboratories (the laboratories of epidemiology and environmental health, and the decentralized laboratories of ONEP, Public Laboratory of Studies and Tests, and ONSSA).

The majority of the laboratories at the national level have attained a very high level of performance. All of them have been working to increase the quality of their services for several years; some of them have already obtained their ISO standard accreditation and the others are still seeking to obtain it. Several of the laboratories have developed partnerships with foreign countries, in particular Canada and Germany. Most of the national laboratories are heading networks and at the same time carry out research activity.

The regional or provincial laboratories, some of which have also reached a very good level of performance and organization, including accreditation under international standards, are responsible for monitoring in the field in close partnership with the various actors in the environmental and health domains.

The network of ONEP, in addition to its central Rabat laboratory, accredited in August 2008 according to ISO standard 17025, includes nine regional laboratories, 23 provincial laboratories and 25 treatment plant laboratories. It takes action in the drinking water sector and the wastewater management sector. Its activity is not only analytical; the Office's network, in close partnership with the various public actors in the water domain, contributes to water resources protection and pollution control, and takes part in environmental and health investigations and even in pumping tests. The levels of qualification are very different depending on the type of laboratory.

The network of the laboratories of epidemiology and environmental health has also been very well organized for many years: it is made up of 16 regional laboratories and 24 provincial laboratories which intervene specifically in the field of drinking water, food quality, epidemiology and waterborne disease control. This network covers the whole territory very efficiently. In accordance with 2006 Decree No. 2-05-1326, requiring approval of the laboratories in charge of drinking water quality control, in 2009 the Ministry of Health started a very proactive upgrading programme (with 5.6 million dirhams for 2009 alone). The levels of qualification are very different from one laboratory to another. The regional laboratory of epidemiology and environmental health of Fès, accredited in 2012, plays a leading role in the network.

This network under the Ministry of Health is reinforced at the central level by the laboratories of the National Institut of Hygiene and National Poison Prevention and Drug Control Centre, both located in Rabat. The laboratories of the National Institut of Hygiene provide technical assistance and support government public health policy in order to monitor health and ensure health safety at the national level. The National Institut of Hygiene provides technical expertise with regard to food safety, environmental toxicology and in the medico-legal field; it also ensures the coordination of the management and use of the public health laboratories with the aim of improving their performance.

The Laboratory of Toxicology and Pharmacology under the National Poison Prevention and Drug Control Centre, which was originally under the supervision of the National Institut of Hygiene, has gradually increased its independence. Since 2001, it has made very strong technological strides. Its expertise on brief and high-level exposure, as well as in the field of long and low-level exposure, have conferred on this institution the role of environmental expert. The Public Laboratory of Studies and Tests intervenes in four spheres of quality control activity. On the environment, the Laboratory is well known for its bathing waters quality control activities. The central services of the Laboratory are based in Casablanca; 12 regional laboratories are located throughout the country.

The National Office of Food Safety (ONSSA) was created in 2009 (Dahir No. 1-09-20 promulgating Law No. 25-08). ONSSA's laboratory network consists of a central laboratory in Rabat and six regional laboratories located throughout the country. Their principal field of activity includes food quality control, animal health and plant health. The central laboratory monitors the quality of veterinary medicinal products and has a lead role in animal disease control. ONSSA's laboratories are specialized in controlling the use of pesticides for agricultural purposes.

Some laboratory networks are currently trying to improve their organization at the regional level without consulting the ministries concerned. Joint agreements among ministries using the same laboratory could yield progress in this area and might lead to significant savings. To carry out these efforts

to enhance performance and provide better coverage throughout the territory will require, in addition to the necessary structural investments, the recruitment of senior managers, professional training and audits by international experts.

The planned improvements in all the laboratory networks should have a major impact on the organization of public action in the environment and health field. These institutions not only have a testing function, but also take action in surveillance and monitoring in the field of public health and environmental protection. This area certainly deserves the utmost attention from the decision-makers concerned. Collaborations between different networks could significantly help to improve the laboratories' performance. Unproductive competition and inefficient public financing are both to be avoided.

10.4 Conclusions and recommendations

Morocco is confronted with an epidemiologic transition characterized by a progressive decline in infectious diseases and an increase in chronic and non-communicable diseases. The health authorities are thus examining with growing interest the link between protection of the environment and the protection of public health.

The significant efforts undertaken since the early 2000s by the Government to protect the environment need to be enhanced and oriented as well as possible to better protect public health. It is advisable to minimize the exposure of the population to environmental factors likely to cause, either directly or in the long term, harmful effects on human health.

The organizational context created by the National Initiative for Human Development, the National Charter for Environment and Sustainable Development and the cooperation methods established between the relevant ministries and some particularly active institutional partners, such as the Mohammed VI Foundation for Environmental Protection, appears very favourable for the implementation of the cross-cutting actions needed to efficiently handle the environment and health interface. Nonetheless, the current legislation does not contain requirements on environment and health.

Recommendation 10.1:
The Ministry of Health, in cooperation with the Ministry of Energy, Mines, Water and Environment, should draft a coherent legal framework on health and environment and promote its adoption by the parliament.

The National Programme for Health and Environment and related regional plans are an excellent means to ensure efficient collaboration among key stakeholders, such as the Ministries of the Interior, Health, and Energy, Mines, Water and Environment, and all their external services whether at the regional, provincial or municipal level. These plans are a great tool for collaboration and synergy among public actors.

Recommendation 10.2:
The Ministry of Health, the Ministry of Energy, Mines, Water and Environment, the Ministry of the Interior and the Ministry of Agriculture and Maritime Fisheries, with other relevant stakeholders, should ensure that regional plans for health and environment are implemented by enhancing the existing cooperation.

Coastal tourism is a sector of great economic importance for Morocco and therefore special attention should be paid to the quality of bathing waters to provide sanitary conditions along the coastline. The process of developing bathing water profiles is an essential tool for progress in this area.

Recommendation 10.3:
The Ministry of Health, in cooperation with the Ministry of Equipment and Transport and the Ministry of Energy, Mines, Water and Environment, the Mohammed VI Foundation for Environmental Protection and other relevant stakeholders, should work out a legal framework relating to bathing water profiles in order to accelerate the improvement of human health and environmental quality in the coastal areas.

An environmental health information system is needed to identify indicators that contribute to the analysis of the links between environmental degradation and health problems. The implementation of such a system will require several years and the development of consistent approaches by contributors. The regional level appears to be where such initiatives can best be developed, as part of the regional organization in progress.

Recommendation 10.4:
The Ministry of Health, in collaboration with the regional health departments, the regional observatories of the environment and sustainable development, and the Ministry of Energy, Mines, Water and Environment, should elaborate a health and environment information system compatible with the integrated information system for environmental data and WHO standards and guidelines for information, to be run during the first stage at the

regional and national levels, with access to data at the provincial and communal levels.

Demographic and social trends, including the inversion of the rural–urban balance, recent modifications in the lifestyles of the population and ongoing economic development in the country have brought with them very significant changes and have led to the population being exposed to various new environmental factors. The phenomenon of intense suburbanization and urban sprawl that the country is facing is of major concern for governmental institutions responsible for health and planning, particularly the urban development authorities. Public health issues are appearing, such as unhealthy housing, poor drinking water supply, the absence of wastewater connection and poor solid waste management.

Recommendation 10.5:
The Ministry of Housing, Town Planning and Urban Policy, in collaboration with the Ministry of Health and the Ministry of Energy, Mines, Water and Environment, should develop a strategy on how to effectively address the health and environmental implications of suburbanization and urban sprawl.

Environmental health impact studies are lacking in EIAs, in some cases. The development of these health impact studies requires the ability to rely on players with a very good knowledge of the potential health effects resulting from either low-dose exposure, or long or short exposure to high doses.

Recommendation 10.6:
The Ministry of Health, in collaboration with the Ministry of Energy, Mines, Water and Environment, should promote eco-epidemiological studies to specifically assess the impact of air pollution on human health and develop health impact assessment methodologies for inclusion in the study records ofimpact on the environment, since there may be a risk to human health.

Significant pollution of the air or water can quickly and seriously threaten the population. However, there is a lack of an events warning system that would allow the authorities to deal effectively in the event of extreme pollution events.

Recommendation 10.7:
The Ministry of Energy, Mines, Water and Environment, in cooperation with the Ministry of Health and other relevant stakeholders, should implement an early warning system in the event of extreme air and water pollution episodes.

The food analyses performed by the Ministry of Health focus on microbiological parameters. The need to better assess health risks associated with chemical contamination has significantly increased and it is now necessary to strengthen controls of physico-chemical quality.

Recommendation 10.8:
The Ministry of Health should:

(a) Reinforce the national system for assessing risks to human health from the chemical contamination of food, based on relevant international guidelines;
(b) Actively participate in international programmes on the exchange of information on risks to human health from the chemical contamination of food.

Health risks associated with contamination of drinking water is a major concern because of the risks to the population. WHO guidelines on security plans for the supply of drinking water have not yet been implemented in Morocco.

Recommendation 10.9:
The Ministry of Health should develop and implement water safety plans for drinking water in accordance with WHO guidelines.

The action plan for the integrated management of vector control was initiated in Morocco in 2007. Its implementation is foreseen on the territory but has not been achieved.

Recommendation 10.10:
The Ministry of Health should ensure that integrated vector control management (IVCM) is implemented throughout the country by, inter alia, establishing IVCM committees at the territorial level.

Chapter 11

INDUSTRY AND ENVIRONMENT

11.1 Trends in industry development

Developments in main industrial branches

The industrial sector in Morocco can be subdivided into five main subsectors: (i) food processing industry, (ii) textile and leather industry, (iii) chemical and parachemical industry, (iv) engineering and metallurgic industry and (v) electrical and electronics industry. According to 2011 statistical data, of the total number of enterprises, nearly one third were in the chemical and parachemical branch, just over one quarter in the food processing branch, around one fifth in each of the textile and leather and engineering and metallurgic branches, and only three per cent in the electrical and electronics branch (figure 11.1).

The total number of registered enterprises across the industrial sector had not been changing much since 2003. In the period 2003–2006 a slight increase was followed by a slight decrease. Since 2008 one can see a slight increasing trend, followed by a decrease until 2011. The median in the period 2003–2011 was nearly 8,356 industrial enterprises. The number of enterprises has further decreased in 2011 according to the data of the Ministry of Industry, Trade and New Technologies, to some 7,970 enterprises.

Total industrial investments and value added were increasing in the period 2003–2011, whereas production and exports were increasing until 2008 and then dropped in 2009 to the level of 2007 or below, followed by an increase until 2011. Data for 2011 from the Ministry of Industry, Trade and New Technologies show that both production and exports grew in 2010 to levels above 2008 peaks. Employment increased from 2003 to 2004, decreased in 2005 then increased until 2011.

Comparing the indicators of employment and value added in the period 2003–2011, work productivity in the industrial sector has been improving in Morocco. Looking at the subsectors, it has been improving in the food processing, chemical and parachemical, engineering and metallurgic industries and remained rather stable in the textile and leather and electrical and electronics industries.

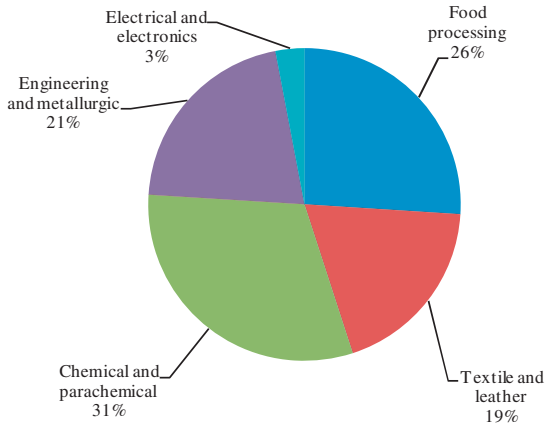
The industrial sector is dominated by small enterprises in Morocco; together with medium-sized enterprises, they constitute 97 per cent of all the sector's enterprises. At the same time, it is the largest enterprises that are responsible for the highest investments (accounting for more than 50 per cent since 2005 and reaching 63 per cent in 2011), volume of exports (more than 50 per cent since 2004 and reaching 79 per cent in 2011) and production (over 43 per cent since 2004 and more than 77 per cent in 2011). The medium-sized enterprises generate the greatest employment. Details on the number of enterprises, employees, level of production, export and investment vis-à-vis the size of enterprise is shown in table 11.1, based on 2011 data.

In terms of the localization of industry across the country, and based on 2011 data, the region of Grand Casablanca concentrates around one third of all industry and is far ahead of the second region, Tangier-Tétouan, with a concentration of some 10 per cent. Furthermore, the six most industrialized regions concentrate nearly 70 per cent of industry, compared with 12 per cent concentration in the six least industrialized regions. The ranking of the regions changes when comparing production levels. After the region of Grand Casablanca, which accounts for almost 45 per cent of total production, the second-ranked (15 per cent) is the region of Doukala Abda, which hosts large phosphate processing industries. The six regions with the lowest number of industrial establishments also have the lowest production levels.

The region of Grand Casablanca also leads industrial concentration in every subsector. Taking into account the average number of establishments and percentage of sectoral production, the Tangier-Tétouan region ranks second in the textile and leather and electrical and electronics subsectors, Doukala Abda is second in the chemical and parachemical subsector, the Oriental region is second in the engineering and metallurgic subsector, and Souss-Massa-Drâa is second in the food processing subsector. The subsector of food processing is most equally distributed across the country. In terms of number of establishments, the five regions with the highest concentration account for 50 per cent of the subsector's establishments, and the next five regions for 31 per cent.

Photo 11.1: Textile Industry

Figure 11.1: Percentage of enterprises in industrial subsectors, 2011



Source: Ministry of Industry, Trade and New Technologies, 2013.

Table 11.1: Indicators by size of enterprises, 2011

	Size of enterprise (No. of employees)			
	< 50	**50-500**	**> 500**	**Total**
Number of enterprises	6,140	1,622	206	7,968
Number of employees	79,984	248,031	250,834	578,849
Production in million dirhams	37,946	145,938	203,906	387,790
Export in million dirhams	4,922	35,014	68,716	108,652
Investments in million dirhams	6,408	8,763	11,003	26,174

Source: Ministry of Industry, Trade and New Technologies, 2013.

At the other end of the scale are the textile and leather and electrical and electronics industries with ratios, respectively, of 91 per cent to 8 per cent, and 82 per cent to 13 per cent. The distribution is less equal in terms of production level. The five regions with the highest production levels in the food processing industry account for 73 per cent of the subsector's production, whereas the next five regions

account for 20 per cent. For the other subsectors, the five regions with the highest production levels are responsible for more than 85 per cent of production in the subsector.

Industry is mainly hosted by the regions' leading cities. Of those cities with at least 100 enterprises, six accommodate more than 75 per cent of the industrial establishments of their region. Based on 2009 data, these are: Fès (92 per cent of its region's industrial establishments), Béni Mellal (87 per cent), Laâyoune (85 per cent), Kenitra (84 per cent), Marrakech (80 per cent) and Casablanca (79 per cent). Calculated on the basis of number of establishments and production and investment levels, the leading cities are Casablanca, Mohammedia, El Jadida, Nouaceur, Tangier-Assilah, Fès and Settat.

Modernization and technological development

In the period 2003–2011, the industrial sector received nearly 172 billion dirhams of investment, of which about half went to chemical and parachemical, one fifth to food processing, 17.5 per cent to engineering and metallurgic, 7.5 per cent to textile and leather and about 5 per cent to electrical and electronics industries. The total investment more than doubled between 2003 and 2011. However, this was mainly triggered by the chemical and parachemical subsector in which investments increased more than threefold in this period. In other subsectors there has not been such a considerable rise in investment. Investment in food processing industries has been growing since 2006, while the textile and leather industries had a stable level of investment until 2009, when it dropped more than 50 per cent compared with the average level in the period 2003–2008 then increased slightly in 2011. The engineering and metallurgic and electrical and electronics industries have seen increases interwoven with decreases in investment levels. Overall, all industrial subsectors except textile and leather have experienced growth trends (figure 11.2).

Comparing the investment level with the production or value added by the industries in the period 2003–2009, the overall ratio of investment to production level was 7 per cent, on average, and the ratio of investment to value added was 25 per cent, on average. The subsectoral average ratios are provided in table 11.2. The chemical and parachemical subsector has been investing most, not only in real numbers but also compared with production or value-added levels. The engineering and metallurgic and electrical and electronics subsectors followed. There are no data available to assess what percentage of investment is related to purchasing modern technologies or knowledge and licences, or to spending on research and development.

Table 11.2: Subsectoral average ratios, 2003–2011

Subsector	Ratio I-P	Ratio I-VA
	%	
Food processing	5.0	16.9
Textile and leather	5.3	14.4
Chemical and parachemical	8.6	32.0
Engineering and metallurgic	7.8	33.4
Electrical and electronics	5.4	21.2

Source: Ministry of Industry, Trade and New Technologies, 2013.
Note: I = investment; P = production; VA = value added

There are also no data on energy or water consumption by the industrial subsectors to assess whether decoupling trends between resources consumption and production level could be noted. Due to lack of data, it is also not clear how much has been invested into better protection of the environment, e.g. through purchase and installation of filters or WWTPs. It is only known that some 650 million dirhams has been invested, mainly into WWTPs within the programme for industrial clean-up.

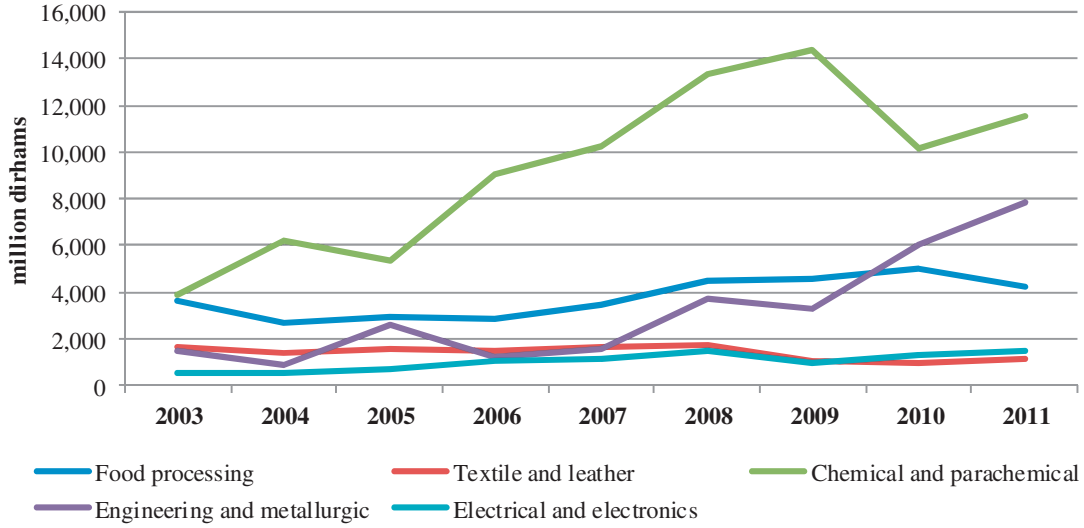
11.2 Environmental pressures and trends

It is very difficult to provide a data-based assessment of the pressure of industry on the environment due to the fact that there is no systematic data series available. Data on industry provided by the statistics books of Morocco are relatively scattered (table 11.3). Data for waste generation by industry exist, but only for 2008 and 2010 among recent years and for the earlier years of 1992, 1995 and 2000. Data on CO_2 emissions generated by industry are available, but only for 2004 and the earlier years of 1994 and 2000. Data on SO_2, NO_x and PM are also available for the industrial sector, but only for 2005 and 1996.

There are no data related to industry on wastewater discharges. It is clear, therefore, that any attempt to use these scattered data for identifying any trends would be highly questionable.

It is only possible to say that there was more industrial waste generated in 2010 as compared with 2008. There had also been more SO_2, NO_x and PM emissions by industry in 2005 than in 1996, as well as more CO_2 emissions in 2004 than in 2000.

Figure 11.2: Investment in the industrial subsectors, 2003–2011



Source: Ministry of Industry, Trade and New Technologies, 2013

A 2002 study under the programme for industrial clean-up, to quantify industrial pollution, estimated pollution by organic waste expressed as COD load and toxic contamination expressed in heavy metals load to waters. Organic waste expressed as COD load was estimated at nearly 288,000 t/year (of which 69 per cent was in the food processing subsector, 20 per cent in the chemical and parachemical subsector, 10 per cent in the textile and leather subsector and 1 per cent in the engineering and metallurgic and electrical and electronics subsectors together).

Toxic contamination expressed in heavy metals load to waters was estimated at 257 t/year (of which 41 per cent was in the engineering and metallurgic and electrical and electronics subsectors together, 38 per cent in the textile and leather subsector, 19 per cent in the chemical and parachemical subsector and 2 per cent in food processing). This study was not repeated at any later stage and thus there is no possibility to make any data comparison and draw any conclusion on trends or any positive or negative developments.
Some of the large enterprises operating in Morocco produce reports on their impact on the environment or on sustainable development in which they present the pressures on the environment. These reports usually show, at the level of an enterprise or its installations, that the emission level is stable or decreasing over time and that it does not exceed the required threshold quantities referred to by the enterprises themselves. It is not evident whether these data are collected, validated, aggregated and evaluated by the authorities.

For example, Morocco Holcim Group – an enterprise in the cement sector – in its report on sustainable development for 2007–2009, publicized environmental pressure data, both consolidated as well as separate for its cement facilities in Oujda, Fès, Settat and Nador (table 11.4). Data are shown vis-à-vis the limits agreed in the convention between the Department of Environment and the Moroccan Association of Cement Industries. Another example comes from SAMIR, in the refinery sector. The enterprise reports that its facilities pollution level (BOD_5, COD or SO_2) is below the limits contained in a partnership agreement signed with the Department of Environment (chapter 12).

Lack of, or only scattered, data on industrial pollution validated by the authorities suggests that not enough attention has been given to this in recent years. This situation can send a wrong message to industry and may be read that industrial development can happen at the cost of the environment. If so, it would undermine the efforts to promote environmental protection and run counter to the concept of the sustainable development of Morocco.

11.3 Integration of environmental considerations into industry policies

Legal and regulatory framework including technological standards

The 2003 Law No. 11-03 on the Protection and Conservation of the Environment is the main law in Morocco to govern environmental performance by industry. It requires that construction of categorized installations is subject to authorization or declaration. Further, it introduces the requirement for carrying out environmental impact assessment (EIA).

Table 11.3 Available environmental pressure data on industry, thousand tons

	1994	1996	2000	2004	2005	2008	2010
Emissions of							
CO_2	3,158	..	3,772	4,992	..	..	..
SO_2	..	210	..	..	301	..	..
NO_X	..	8	..	..	20	..	..
PM	..	12	..	..	17	..	..
Generation of industrial waste	..	..	974	..	..	1,318	1,446

Source: Statistical Yearbook of Morocco, 2005–2011.

Table 11.4: Consolidated data on environmental pressure by the Morocco Holcim Group

	Unit	2007	2008	2009	Limits*	EU limits
Water consumption	Litre/t cement	81	80	65		
Emission (main chimney)						
PM	mg/Nm3 - 10 per cent O_2	30	19	14	50	30
NO_x	mg/Nm3 - 10 per cent O_2	719	642	599	1,200	500
SO_2	mg/Nm3 - 10 per cent O_2	11	12	11	100	50

Source: Morocco Holcim Group, Report on sustainable development 2007–2009.
Note: Nm^3 = Normal cubic meter; Temperature: 0°C; Pressure: 1.01325 barA
* Limits specified in the convention entered into with the Department of Environment.

It obliges the operators of the categorized installations to take necessary measures for prevention of pollution to and degradation of the environment in accordance with the regulations, norms and standards in force. It also introduces the user-pays and polluter-pays principles and obliges the elaboration of contingency plans.

The Law seems to be quite comprehensive in introducing industry to its responsibilities with regard to its environmental performance. Nevertheless, to be effective, this law requires secondary legislation, which is described below.

Dahir regulating industrial activities as unhealthy, inconvenient or dangerous

The 1914 Dahir on the Regulation of Unsanitary, Inconvenient or Dangerous Industrial Plants has regulated the classification of establishments, and sources of pollution or risk, since the rise of manufacturing at the beginning of the twentieth century. It distinguishes three classes into which industrial activities can be categorized depending on the degree to which they can cause damage to health, or be inconvenient or dangerous. Activities within classes 1 and 2 cannot be open without an authorization, while operators of class 3 activities are only required to submit a declaration of operation.

The Dahir was supplemented in 1933 with an Order of the Prime Minister containing a list of named industrial activities and their categories. The categorization is mainly motivated by the possible inconveniences that certain industrial activities can cause and not by the environmental pressure they exert, e.g. production of chemicals was categorized in class 3, whereas slaughterhouses causing inconveniences such as smell, noise and the hazard of flies are listed in class 1.

Furthermore, there is no link between the category and inspection frequency. The consideration of environmental pressures – although only for new installations – was introduced in 2003 with the adoption of Law No. 12-03 on Environmental Impact Assessment. The Law requires that EIA be carried out and approved before an authorization for construction can be given. All class 1 activities and, more importantly, all specified extractive industries, industries in the energy sector, chemical industries, treatment of metals, food or textile industries are subject to the EIA procedure (chapter 2).

Air protection law

The 2003 Law No. 13-03 on Combating Air Pollution requires that industry complies with the specified ambient air quality standards and the sectoral ELVs. The ambient air quality standards are defined in the 2009 Decree No. 2-09-286. As for the ELVs, the 2010 Decree No. 2-09-631 specifies only general ELVs for stationary sources. It further specifies that the general ELVs are not applicable to sectoral activities, to which specific sectoral ELVs should apply. At the same time, neither the sectoral

activities nor their ELVs have been defined in any existing legislation in force. As a result, it is not clear how the legislation can obligate industry to prevent and/or limit air pollution (chapter 6).

Law on Water

The 1995 Law No. 10-95 on Water sets requirements for industry regarding the use of and discharges into inland waters. Further requirements on discharges had been specified in the 2005 Decree No. 2-04-553. For industry, the use of water and discharges of wastewater according to the legislation in force are subject to authorization.

The authorization for water use is to be in line with the integrated water resources master plan – valid for 20 years and subject to review every five years – of the continental basin from which water is abstracted. The authorization for discharges of wastewater is given for a maximum 20 years. It should specify the place of wastewater discharge, modality of sample taking, discharge limit values (DLVs), pollution coefficient of the industrial activity and modality of payment. It is not clear, however, how the pollution coefficient and the DLVs can be specified in the authorization in the absence of secondary legislation in force that would introduce them. As a result, it is not clear how the legislation can obligate industry to prevent and/or limit water pollution.

The DLVs have been available only for the following industries: pulp, paper and cardboard (2006 Joint Order No. 1606-06), sugar (2006 Joint Order No. 1608-06), cement (2009 Joint Order No. 1447-08) and hot-dip galvanizing (2010 Joint Order No. 862-10). All these orders have been in force since 17 April 2011. DLVs for the following sectors are in development or negotiation: oil refining, textile, ceramic, building materials, pharmaceuticals, paintings, varnishes, lacquers, inks, pigments and dye, yeast production, milk and cheese, chlorine and soda, canning fruits and canning vegetables and olives, margarine, edible oil, fish meal and surface treatment (cold galvanizing).

Payments for water use and discharges are based on the application of the user-pays and polluter-pays principles. The 2005 Joint Order No. 2565-05 sets down the charges for the use of water for industrial purposes, whereas the 2006 Joint Order No. 1180-06 contains the formula for calculation of the pollution unit on the basis of which payment for industrial wastewater discharges should be made (chapter 4).

Despite the availability of the formula, however, it is not clear how industry can be made to pay for discharging wastewater, given that there is no regulation specifying industry pollution coefficients. Without the coefficient, there is no basis for estimating the pollution level for industries that are not taking samples. At the same time, charging only those industries taking samples would put them at a competitive disadvantage vis-à-vis those not doing so. However, the order for the coefficients has been developed and its publication is expected by the end of 2013.

Waste law

The 2006 Law No. 28-00 on Waste Management and Disposal sets requirements for industry to manage waste in accordance with the waste management plans, which are not yet available. The 2008 Decree No. 2-07-253 introduced the list of hazardous waste (chapter 8).

Law on management of chemical substances

The regulations in the area of management of chemical substances are spread through a multitude of legal acts, which often refer to chemical substances using terms such as “noxious substances”, “hazardous substances” or “toxic substances”. There is, however, no framework legislation that would allow for the introduction of a coherent government policy with regard to the management of risk linked with chemical substances, or ensure the management of the full life cycle of a chemical substance. At the same time, there is a national strategy and an action plan, the implementation of which should lead to availability of coherent government policy on the management of chemical substances (chapter 1).

Effectiveness of laws

Due to a relatively high level of incompleteness of the legislation on air and water, in particular when it comes to the sectoral ELVs and DLVs, the regulations do not precisely obligate industry to prevent or abate air or water pollution. It is also questionable how effectively the impact on water and air can be limited through the procedures of EIA, with which the ELVs and/or DLVs should be inserted into the operation’s terms and conditions for new installations. In their absence, ELVs and DLVs can only be introduced into the terms and conditions by a conventional agreement between the authorities and industries, which is voluntary. Otherwise, the operators of new installations are put at a competitive disadvantage vis-à-vis similar installations put into operation before 2003.

It is also not clear why the introduction of sectoral ELV and DLVs is a process without an end. The availability of a system of ELVs and DLVs based on Best Available Techniques (BATs) is generally considered as economically viable for industrial enterprises. Thus, such a system allows for benefit in terms of environmental protection and, at the same time, industrial enterprises maintain their competitiveness. For other cases, a flexible approach can be introduced in the legislation. Such an approach usually allows for the exemption of industries from BATs in cases where it can be proven that adopting them cannot be done in an economically feasible way.

In addition, while legislation on water and air requires industry self-monitoring, there are no regulations specifying the procedure to be followed. Only Decree No. 2-09-631 specifies self-monitoring on air emissions on a voluntary basis. There are no regulations on self-monitoring on water discharges. The Law on Environmental Impact Assessment requires that a self-monitoring programme be part of the project. Again, there are no details on what such a programme should comprise (chapter 2).

Industry observance of any limit values not in force, or performance of self-monitoring, is more of a voluntary action. Industries may, however, observe certain limit values or perform self-monitoring if this is required under international certificates which they have obtained or are attempting to obtain, or if the observance of the emission limits had been a condition of a project for which they had received financial grants.

In addition, in the absence of the waste management plans it is not clear how the Law on Waste Management and Disposal could obligate industry to manage waste accordingly (chapter 8).

There is no modern legislation in force on major accident prevention by industry. The 2003 Law No. 11-03 on the Protection and Conservation of the Environment cannot be considered as such. It only gives the authorities the basis for obliging operators of categorized installations to prepare contingency plans and to ensure that incidents are contained at industrial sites, for which protection barriers must be introduced; there are no requirements detailing hazard and risk identification, assessment and management during the whole life cycle of industrial installations. The latter are the core of modern law on major accident prevention.

In addition, the 1995 Law on Water pertains only to inland waters and thus, even if DLVs were available, they would not be applicable to discharges into coastal waters. At the same time, the majority of enterprises are located in proximity to the coast and discharge wastewaters directly into the sea; no regulations have yet been adopted for the protection of those waters.

Finally, there is no specific legislation in force on combating pollution of soil or on dealing with noise, which normally would also pertain to industry.

The legal environmental requirements pertaining to industry either do not respond to the existing state of development (Dahir of 25 August 1914), or are incomplete (laws on air, water and waste) or non existent. At the same time, a law on the environment and sustainable development is under preparation (in 2012) to replace the 2003 Law No. 11-03 on the Protection and Conservation of the Environment. This, once adopted, should ensure not only reform of the law on authorizations with regard to the categorization of installations but also elaboration of the law on management of chemical substances as well as on noise, radiation and odour. It should, further, ensure the adoption of the regulations for prevention and management of man-made – industrial – risks as well as actualization of waste legislation with the objective to reduce waste at source and manage hazardous waste. Nevertheless, it needs to be underlined that real change can only occur when the secondary legislation stipulating all the necessary norms and standards is complete and in force.

Institutional framework

Competent authorities in line with the environmental legislation

Law No. 11-03 on the Protection and Conservation of the Environment as well as the Law on Combating Air Pollution and Law on Waste Management and Disposal list the criminal police, the competent authority and local authorities as being in charge of identifying an offence against these regulations. The Law on Water designates the WBAs in cooperation with a governmental authority responsible for the environment as competent to control industry compliance with water regulations.

Apart from the Law on Water, the legislation is ambiguous when it comes to naming the competent authorities. In addition, the legislation does not define the procedures for performing inspections, including procedures for inspection notification and in cases of non-compliance. Neither is the frequency of inspections specified. These legal shortcomings

can, therefore, cause challenges for the different authorities listed in the legislation, in planning and ensuring the necessary capacities for carrying out inspections.

The case of the Inspection and Control Unit of the Department of Environment within the Ministry of Energy, Mines, Water and Environment illustrates well such a challenge. The 25 inspectors (12 at national and 13 at local level), who worked at the Unit in 2012, may be considered as highly insufficient in number to carry out the environmental inspections. At the same time, their tasks on environmental inspection had not been clearly defined and thus they mainly work in the regional commissions responding to complaints filed by parliamentarians, NGOs or citizens regarding industrial pollution. It is evident, therefore, that improvements in the environmental legal framework are necessary both in the matter of norms and standards for industry to follow, and with regard to the designation of competent authorities and the control regime. The expected adoption of the new law on the environment and sustainable development, which is to introduce the environmental police as the competent authority for ensuring compliance with the environmental laws, may bring the necessary improvement with regard to the institutional framework.

At the same time, it should be mentioned that competent authorities have been clearly designated for granting authorizations and for the decision with regard to EIAs. The relevant WBAs, in accordance with the Law on Water, are in charge of providing industries with the authorizations for water use and wastewater discharge. The general director of public works for class 1 installations and the inspection authority or the chief of municipal services for class 2 installations are the relevant administrative organs for granting the authorization for construction and operation in accordance with the Dahir of 25 August 1914.

The decision on accepting an EIA, in accordance with the Law on EIA, is given either by the Minister in charge of Environment (for investment projects: (i) over 200 million dirhams, (ii) interregional project or (iii) transboundary project) or the wali of the region (for investment projects below 200 million dirhams), on behalf of, respectively, the national or regional committees on EIA.

Other bodies

There are also other governmental authorities involved in the work on environmental protection vis-à-vis industry. Their roles can refer to the elaboration and/or acceptance of environmental regulations or to assurance of compliance with norms and standards pertaining indirectly to environmental protection.

The Ministry of Industry, Trade and New Technologies is involved in elaboration of legislation pertaining to industry, including environmental legislation, in order to ensure that it would not impede the development of the industrial sector in accordance with the government strategy adopted for it. The Ministry is also responsible for promoting and controlling safety in the industrial sector, which can have clear links with environmental protection. The Ministry has been also elaborating norms on management of chemical substances (norms NM 03.02.100-102 respectively on classification, packaging and labelling of hazardous chemical substances; on classification, packaging and labelling of preparation of hazardous chemical substances; and on determining the flashpoint of liquid inflammables) and the 2010 Law No. 22-10 on the Use of Degradable or Biodegradable Plastic Bags and Sacks.

The Ministry of Equipment and Transport is responsible for inspection of equipment and its compliance with technical norms and standards, so that incidents related to equipment are avoided as are possible effects on the environment.

The Ministry of Health is involved in elaboration of laws in the fields in which there are clear links to the protection of the health of the population. One such field, in particular, is the management of hazardous substances.

The Ministry of the Interior and institutions coming under its regional bodies in the field of response to emergencies and civil protection are responsible for investigation and control pertaining to safety measures applied by industrial operators against technological risks and industrial accidents, which, in turn, can have effects on the population and/or the environment.

Environmental objectives of strategies, programmes and plans

Programme for industrial clean-up

Within its environmental strategy, the Department of Environment elaborated a number of programmes aimed at improving the country's environmental performance. One of the programmes – for industrial clean-up – is devoted to industry. Its objective is to encourage industrial enterprises to invest in treatment

or elimination of solid waste, liquid discharges and gaseous emissions or in more efficient use of natural resources, and to use clean technologies.

To accompany the programme, the FODEP was created with the support of Germany. Industrial enterprises can apply to the FODEP for financial subsidy to a maximum 40 per cent of the total costs of their clean-up projects. The remaining costs need to be covered from their own resources and loans (chapters 4 and 11).

The FODEP provided support to some 115 projects between 1997 and 2012, during which the 240 million dirhams given by Germany were utilized, leveraging total project investments of nearly 650 million dirhams. In most cases, the funds subsidized investment in industrial wastewater treatment plants. Thus, enterprises operating in those industrial subsectors had to be interested in taking the necessary steps to meet the DLVs within the funding deadline. In addition, there had been a study prepared under the FODEP in 2002 to quantify industrial pollution, which showed that priority should be given to clean-up actions in seven water basins.

The FODEP has a stake in progress on the industrial clean-up. Following the 2002 study, which gave a preliminary estimate of the costs of clean-up at 1.5 billion dirhams for the seven priority water basins, and taking into account that the FODEP leveraged 566 million dirhams of investment into water projects, the Fund has helped reduce water pollution. According to another study carried out in 2007 evaluating the impact of the FODEP, by that date, the subsidized water projects had contributed to reducing the volume of organic pollution by one third and of industrial wastewater by 5 per cent. Furthermore, it had helped 15 projects to limit air pollution by decreasing the concentration of SPM (suspended particulate matter) emissions to 50 mg/Nm^3.

The change to the FODEP made in 2008 – to support only SMEs with the clean-up funds – can be assessed as a positive development. The clean-up funding is now available only to enterprises that, without support, may not be able to bear the cost of environmental protection, whereas, prior to 2008, it was also open to application from large and wealthy enterprises. Thus, it can be expected that more recent mechanisms than the FODEP that start offering clean-up subsidies for SMEs, such as the Mechanism for depollution of industrial water, with funding provided since 2011 by the European Commission, will be more appropriately allocated. The availability of the subsidizing mechanisms for projects is the core of the clean-up programme. In the event that funding ceases, it can be expected that industrial clean-up at the level of SMEs would also stop, or at least slow down considerably. The programme is therefore vulnerable, since it depends heavily on international donor financing.

National Strategy and Action Plan for Environmentally Rational Management of Chemical Substances

The National Strategy and Action Plan were prepared in November 2008 to identify and eliminate gaps in the field of management of chemical substances in relation to international practice. They were prepared with the financial support of WHO. The Action Plan specified actions up until 2020, with 19 prioritized actions, most for implementation during 2009–2011 and some up until 2014.

The objective of the Strategy is to implement an adequate framework for the management of chemical substances that would allow support for the country's economic interests while ensuring effective protection of the population and workers against the risks associated with hazardous substances.

The Strategy is based on a number of principles. The first is that Morocco should take advantage of the knowledge available in other countries, which are more advanced in the management of hazardous substances. Second, this knowledge should be integrated into the national policies on management of chemical substances. Third, risk should be prevented and reduced at source, when possible by replacing hazardous substances by less hazardous ones. Fourth, all who are exposed to such substances should have the right to be informed on their dangerous properties. Fifth, there should be a participatory approach in elaboration and implementation of actions proposed on the management of chemicals.

The Action Plan proposed measures in the fields of collection and compilation of data, illegal traffic of chemical substances, reinforcement of the legal framework and administrative capacities, elimination and reduction of risks associated with certain chemical substances and the strengthening of technical capacities.

The implementation of the Action Plan requires the mobilization of all national actors concerned with the proper management of chemical substances. Furthermore, it requires the mobilization of the technical and financial support that can be offered within programmes of assistance for developing

countries. In addition, there are several priority actions in progress, such as:

- Creating a national inventory of heavy metals and environmental and health assessment for their use;
- Conducting an inventory of hazardous chemicals;
- Developing a pilot project on a pollutant release and transfer register (PRTR) in a pilot region;
- Strengthening the implementation of the Globally Harmonized System of classification and labelling of chemicals;
- Developing guidelines on best practices for sound management of chemicals in industry;
- Assessing the impact of pesticides on the environment and health in the Gharb region.
- Establishing a programme on secure management of PCBs.

The following actions have already been carried out:

- Publishing databases on chemicals used in Morocco;
- Preparing an inventory of heavy metals;
- Establishing a PRTR.

However, the national legal system must be harmonized with the international legal system.

Draft national programme for prevention of industrial pollution

A new programme for prevention of industrial pollution is being set up, which should address all the actions that the Government administration as well as the private sector should undertake to reduce industrial pollution. The realization of the programme is to be based on the analysis of the existing technical, institutional and legal frameworks. In addition to focusing on processing industries (chemical and parachemical, food, textile and leather, engineering and metallurgic, electrical and electronics), it is also to focus on mining, handicrafts, energy industries, slaughterhouse industries and the informal sector.

The implementation of the programme began with the development of a framework document that:

- Established a diagnosis of the current status of, and technical, institutional and regulatory framework for the prevention of and fight against various forms of industrial pollution at the national level;
- Identified priority actions to be taken;
- Developed the terms of reference for studies to be conducted at the regional level.

Following the development of the framework document, the choice has been made to focus on the Grand Casablanca area to develop a plan to prevent industrial pollution. The development of this action plan was preceded by the identification of pollution sources in the region and the assessment of pollution load.

Some actions have been identified and presented in the form of project files. These actions are first aimed at the most polluting sector, in particular, the chemical and parachemical industries; thereafter, preventive actions will involve other sources of pollution. Actions are planned in the short term (5 years) and medium term (10 years for reducing pollution in the event of a major emergency). As for other, less-polluting industrial units, preventive measures are planned in the long term (15 years).

National Pact for the Development of Industry

Morocco has a strategy for industrial development with precise objectives allowing economic and social progress in making the most of the strengths and assets of the country. The 2009 National Pact for the Development of Industry specifies the implementation programme and commitments of the State and the private sector. Industrial revitalization efforts have focused on the sectors in which Morocco has strong competitive and operational advantages, such as the automotive, aerospace, electronics, offshoring, textile and food industries.

Following the National Pact, two new sectors with high growth potential have been integrated, namely, the chemical and parachemical industries and the pharmaceutical industry, through the development of two strategies. The programme and roadmap for these strategies, engaging both the public and private aspects of the contract, were signed in February 2013.

In this context, the programme on the chemical and parachemical sector includes measures relating to environmental protection and safety through the implementation of specific regulations for the chemical and parachemical industries, including the rational use of energy (energy efficiency and use of renewable energy sources) and raw materials (by recycling and recovery of waste).

All stakeholders will implement a proactive action plan for the development of regulations by 2023 through:

- Strengthening environmental regulations;
- Supporting the implementation of logistics regulations;
- Modernization of the rules on the classification of industrial land;
- Enhancing the safety of people at work.

Measures towards greening the industry

Cleaner production methods

The Ministry of Industry, Trade and New Technologies promotes the concept of sustainable industrial development. Cleaner production is encouraged in Morocco by the Moroccan Clean Production Centre (CMPP). It was created in 2000 as a project of the Ministry of Industry, Trade and New Technologies on environmentally sustainable industrial development in partnership with the General Confederation of Moroccan Enterprises (CGEM). The CMPP is the national reference clean production centre and is a member of the international clean production centres network managed by UNIDO and UNEP. The CMPP is funded in the framework of cooperation with Switzerland and its mission is to assist the industrial sector in its efforts in environmental upgrading, by, inter alia, using clean technologies and strengthening the competitiveness of business by optimizing the consumption of resources, such as energy, water and raw materials.

Following the mission of clean production centres, the CMPP helps Moroccan industrial enterprises, in particular SMEs, to apply integrated preventive environmental strategies to processes, products and services, to increase efficiency through improved productive use of natural resources, and to advance human development through reduction of risks to people and the environment.

The CMPP puts emphasis on awareness-building, dissemination of information on cleaner production methods, training on environmental engineering and management, and promotion of environmental management systems, corporate social responsibility and investments in environmentally sound technologies. It also assists Moroccan SMEs to increase their competitiveness by improving environmental performance and being able to access the global market with their products and services.

This awareness and capacity-building is offered through numerous training programmes, workshops and round tables organized by the Centre within the projects it manages or co-manages, often in partnership with UNIDO.

The CMPP work leads to the implementation of solutions such as the Industrial Waste Exchange (la Bourse de Déchets Industriels) and to the growing availability of experts on environment, resource efficiency and cleaner production in Morocco.

Environmental management and pollution prevention and reduction

Environmental management is promoted in the industrial sector by the CGEM. In its code on good governance of enterprises, the CGEM draws the attention of Moroccan enterprises to good environmental practices. The code suggests that enterprises should adopt best available practices in terms of social, societal and environmental responsibility, even if these are not required by existing law. This should allow enterprises to improve their reputation and image as well as their relationships with stakeholders.

The CGEM recommends that Moroccan enterprises adopt its Corporate Social Responsibility (CSR) Chart and obtain the CSR label (see box 2.1). As of May 2012, there were 38 enterprises, including some 20 industrial enterprises, which had obtained this label. A few more industrial enterprises possess the ISO 14001 certificate (the standard related to environmental management). The 2007 FODEP study on environmental impact referred to some 20 enterprises in Morocco which were ISO 14001 certified.

The CGEM also provides enterprises with material on why and how to improve environmental management. Enterprises can take advantage of the CGEM guide on the first steps towards environmental management, published in 2009. With its guide, the CGEM promotes environmental management as a tool by which enterprises would be able to achieve competitive advantage over other companies by getting a higher dividend on their products and services. The CMPP has carried out several projects, including environmental audits, general and specialized environmental education, environmental management, and assisting companies with compliance (with the Law on Water, 1933 Order listing classified establishments, Law on Environmental Impact Assessment), the implementation of clean production measures and international environmental partnerships.

In addition, sectoral associations promote good environmental management among their members. For example, the Moroccan Association of Textile and Clothing Industries (Association Marocaine des Industries du Textile et de l'Habillement) (AMITH) developed a process to promote conformity with environmental and social norms and with ethics in trading. The Association introduced a Citizen Fibre Label (fibre citoyenne) with which, as of October 2012, some 66 enterprises were certified. The holders of the label, among others, have to protect the environment.

Since September 2012, environmental management is also promoted in a German–Moroccan cooperation project on industrial environmental management. The project aims to motivate industrial enterprises to introduce systems of environmental management to improve resource efficiency as well as to better control pollution. It is further aimed at working closely with industry to develop and facilitate the adoption of economic instruments from which industries implementing environment management systems could benefit.

Waste management

Within a project launched by CGEM, the CMPP has introduced and manages an Internet platform for industrial waste exchange to promote waste management within industry. The platform is to help industries to reinforce synergies by reutilizing and upcycling each other's waste. The platform offers the possibility to registered users from industrial enterprises to post an offer or demand for a particular kind of industrial waste. The platform clearly contributes to more sustainable industrial waste management and supports the greening of the industrial sector in Morocco. It also reinforces expertise on the upcycling and management of waste and contributes to reducing the impact of waste on the environment and human health.

Since September 2012, waste management has also been promoted under German–Moroccan cooperation. A project on the integrated management of industrial and dangerous waste aims, inter alia, at building industry awareness about the organizational and technical measures for waste management and about applying the 3R (reduce, reuse, recycle) approach.

Chemical management and reduction of major accident risks

Proper chemical management is promoted by the Federation of Chemical and Parachemical Industries (Fédération de la Chimie et Parachimie) with the Responsible Care approach among its members. There were 26 enterprises in December 2012 that had signed the Responsible Care Charter.

Every year, the Federation prepares a report on the responsible care performance of those enterprises that are signatories to the Responsible Care Charter. The report is based on indicators such as the frequency of work accidents, energy and water consumption, and total production of waste. It cannot, however, be considered representative of the whole chemical and parachemical subsector in Morocco. This is due to the fact that only 26 enterprises are Charter signatories; they are, in the main, big internationals operating in Morocco, in a sector with more than 2,000 enterprises. To assist with the management of chemical substances, Morocco established, with the support of UNEP and the United States Environmental Protection Agency, a network for the exchange of information on chemical substances. Registered users can receive or share scientific, technical and legal information through the web network regarding chemical substances. The network is hosted by the Department of Environment.

Regarding risk management, the CGEM promotes and builds awareness of Moroccan industry in this field. It offers guidelines to enterprises to help them better understand the risks and their management and prevention, as well as the main difficulties in risk management. Using the guidelines, the enterprises can learn identification and evaluation of risks, risk mitigation measures, methods for risk communication and risk coverage, and how to deal with risk perception and human uncertainty.

Innovations, green investments and jobs, including training

Moroccan industry is also making efforts to improve energy efficiency. The Mechanism for Clean-up (Mécanisme de Dévéloppement Propre) offers industry the possibility of applying for funding to projects aimed at decreasing energy consumption of industrial processes. There is also a project to build the awareness of industrial enterprises, in particular SMEs, about potential cost savings and increased profits when investing in energy efficiency (chapter 12).

Voluntary agreements

No legal requirements oblige industry to apply ELVs and DLVs (except for five sectoral DLVs). Therefore, any agreement by industry to comply with the limit values not in force can be considered

voluntary. In this context, the Department of Environment encourages sectoral associations to sign conventional agreements on the application of ELVs and DLVs, as have been signed, e.g. by the association of cement industries.

11.4 Conclusions and recommendations

The Moroccan industrial sector increased its production levels between 2003 and 2009 by some 7 per cent on average. This result would have been some 10 per cent if there were not the decline in 2009 that was linked to the slowdown in the global economy. Nevertheless, the decline was reversed in 2010 and the added value generated by industry grew continuously until 2011, even during the 2009 production decline. This allows the conclusion that, based on the economic indicators, the industrial sector is developing well in Morocco.

To evaluate whether this industrial development was also sustainable would require data on the environmental pressures caused by industry. Unfortunately, such data are not available and thus it is not possible to assess whether the development has been neutral for, or at the cost of, the environment. The lack of data may suggest, however, that the environment and its protection have not been taken fully into account in the economic development of Moroccan industry in recent years.

Recommendation 11.1:
Following the proposal by the Ministry of Energy, Mines, Water and Environment, the Government should approve a decree establishing an effective mechanism for collection and validation of data on pressures by industry on the environment inspired by international pollutant release and transfer register (PRTR) experience and specifying:

(a) The type of data, their format and the frequency of collection;
(b) The authorities, by responsible departments, that would collect data from industry, and validate and assess them.

Different industrial activities can cause different pressures on the environment due, for example, to the type of activity, its size or substances used. The activities are therefore categorized into groups within which a similar kind of pressure is exerted, where groups of activities exerting higher pressure have more stringent requirements imposed upon them in repect of authorization to operate, including with regard to the type and frequency of data collection. The existing categorization of Moroccan industry is not based on the environmental pressure principle. As a consequence, industries gain operational authorization without adhering to pollution limits. In addition, there is no link between the category of industrial activity and inspection frequency; thus, industries in higher pressure categories are not even subjected to more frequent inspection.

At the same time, pollution limit values can be introduced, to some extent, in the terms and conditions for operation that are agreed during the EIA process for new installations. Nevertheless, it is not clear how these limits can be imposed on industry when there are no relevant regulations by which the limits would have been brought into force, apart from the orders on DLVs for five particular sectoral industrial activities.

Recommendation 11.2:
The Government should revise the Dahir of 1914 relating to the authorization of industrial activities to include the categorization of activities based on the environmental pressure principle, with activities exerting higher environmental pressures categorized into classes to which more stringent requirements apply, and promote the adoption of the revised law by the parliament.

Recommendation 11.3:
The Ministry of Energy, Mines, Water and Environment, in cooperation with other relevant stakeholders, should:

(a) Speed up defining emission limit values and discharge limit values for sectoral industrial activities based on best available technology, and link them with the categorization/authorization system;
(b) Introduce a flexible approach, which would permit industries, where this is not economically feasible, to be exempt from implementing best available technology.

Another weakness of the legal framework of Morocco pertaining to industry is the lack of legislation on prevention of and preparedness for industrial accidents. Such legislation obligates industries processing or storing hazardous substances to operate only upon receipt of a safety licence. It also defines the scope of safety documentation linked with a degree of hazard as well as methodologies and methods used for hazard and risk identification and assessment. It sets the inspection frequency linked to the degree of hazard and also links hazard and risk identification and assessment with the preparation of contingency plans. The UNECE Convention on the Transboundary Effects of Industrial Accidents (http://www.unece.org/env/teia.html) or guidelines

prepared by UNEP – Flexible Framework for Chemical Accident Prevention: Guidance for Governments (http://www.unep.fr/scp/sp/saferprod/initiatives.htm) provide a good basis for elaboration of a national legal system on prevention of and preparedness for industrial accidents.

Recommendation 11.4:
The Ministry of Energy, Mines, Water and Environment, in cooperation with other government institutions such as the Ministry of the Interior, should elaborate a comprehensive legal basis for the prevention of and preparedness for industrial accidents.

The programme for industrial clean-up helping industrial enterprises, in particular SMEs, to invest in technologies protective of the environment in Morocco proved to be useful in accelerating the transition to sustainable industrial development. The source of funding within the programme, however, cannot rely only on international donors but must also be based on domestic financing. A possible source of financing could be fines paid for non-compliance with environmental norms and standards, or fees for the use of environmental resources. Thus, the source of funding could be linked to bringing into force the user-pays and polluter-pays principles. Nevertheless, there are gaps in the legal environmental framework which do not allow this, yet.

Apart from the clean-up programme, the efforts and initiatives undertaken by Moroccan industrial associations as well as the Moroccan Clean Production Centre (CMPP) are also crucial for accelerating the transition to sustainable industrial development. What would further benefit industry as well as the country is for the Government to continue to work with the associations in promoting good environmental practices through the preparation of useful guidelines (e.g. on the first steps in environmental management) or working out concrete, businesslike solutions (e.g. the waste exchange) for industry.

Recommendation 11.5:
The Government should:

(a) Identify and implement solutions to ensure funding for the industrial clean-up programme when the international donor support ends;
(b) Continue to improve cooperation with industrial associations to further accelerate the transition to sustainable industry.

Chapter 12

ENERGY AND ENVIRONMENT

12.1 Trends in energy balance

As a developing country, Morocco has a growing demand for energy. Throughout the period 2003–2011, the total final energy consumption of Morocco steadily increased from 8.2 million tons of oil equivalent (Mtoe) in 2003 to 13.1 Mtoe in 2011 (table 12.1). The total final consumption per capita was also marked by an increase from 0.28 tons of oil equivalent (toe) in 2003 to 0.41 toe in 2011. Even though it has been steadily rising, the level of consumption per capita remains relatively low in comparison with the global average rate of 1.7 toe. However, further consumption growth can be expected as the Moroccan population becomes wealthier.

The consumption of energy increased in every sector of the economy during the period 2003–2011. Consumption grew most in the commerce and public services sector, jumping 146.72 per cent from 2003 to 2011, while, during the same period, agricultural consumption increased by 31.26 per cent, industrial by 77.79 per cent, residential by 34.14 per cent and transport by 68.79 per cent. At the same time, the share of energy consumption in every sector remained relatively stable: for industry it was between 21 and 24 per cent with a slightly increasing trend; for transport, between 34 and 36 per cent; for residential, between 23 and 19 per cent; for commerce and public services, between 2 and 4 per cent with an increasing trend; and for agriculture, between 16 and 13 per cent.

Nearly all fossil fuels have to be imported. Domestic production of fossil fuels was less than 0.3 per cent of Morocco's total primary energy supply in 2011 (table 12.2). The situation was different in the past when coal was extracted from national reserves. However, as the coal in Moroccan reserves is of a low quality and is costly to extract in comparison with the costs abroad, the last Moroccan coal mine, in Jerada, was closed in 2001.

The demand for energy is supplied mostly by fossil fuels (table 12.3). Over the period 2003–2011, fossil fuels represented a 93.5 to 95 per cent share of all primary energy supply products. The remaining share was provided by renewable sources of primary energy and electricity imported from neighbouring countries.

Crude and refined oil products form the greatest share of imported fossil fuels. They accounted for more than 75 per cent of the energy product mix imported in 2009–2011. In particular, imports of refined oil products have increased over the period 2003–2011. Imports of coal decreased from 27.7 per cent to 14.9 per cent in the mix in those years and are in a decreasing trend for the period (table 12.4).

Table 12.1: Total final consumption, ktoe

Sector	2003	2004	2005	2006	2007	2008	2009	2010	2011
Industry	1,742.4	2,062.1	2,622.2	2,609.8	2,779.7	2,777.4	2,707.8	2,874.4	3,097.8
Transport	2,791.7	2,861.8	2,981.5	3,071.0	3,262.1	3,648.6	3,858.2	3,501.4	4,712.0
Residential	1,857.0	1,985.4	2,109.7	2,235.9	2,412.2	2,538.8	2,575.6	2,672.2	2,490.9
Commerce and public services	196.6	205.8	221.6	241.1	254.6	336.1	346.6	448.7	485.0
Agriculture/forestry	1,279.9	1,357.5	1,453.2	1,505.9	1,623.0	1,640.2	1,721.6	2,242.8	1,680.0
Non-specified (other)	14.7	15.8	39.0	36.1	41.1	19.2	20.3	191.5	44.2
Non-energy use	323.7	408.2	403.1	437.9	520.5	503.4	651.1	544.5	556.8
Total	**8,205.9**	**8,896.5**	**9,830.5**	**10,137.8**	**10,893.3**	**11,463.8**	**11,881.2**	**12,475.6**	**13,066.8**

Source: International Energy Agency (IEA), 2012

Table 12.2: Energy balance of Morocco, 2011 (ktoe on a net calorific value basis)

Supply and consumption	Coal	Crude, natural gas liquid and feedstocks	Oil products	Natural gas	Hydropower	Solar, tide and wind	Biofuels and waste	Electricity	Total *	Total renewables
Production	0.0	9.3	0.0	49.9	161.0	59.5	489.8	0.0	769.5	710.3
Imports	2,728.5	7,151.6	7,333.6	661.8	0.0	0.0	0.0	441.3	18,316.7	0.0
Exports	0.0	0.0	-883.1	0.0	0.0	0.0	0.0	-45.1	-928.1	0.0
International marine bunkers	0.0	0.0	-126.0	0.0	0.0	0.0	0.0	0.0	-126.0	0.0
International aviation bunkers	0.0	0.0	-599.7	0.0	0.0	0.0	0.0	0.0	-599.7	0.0
Stock changes	248.8	-26.4	-372.1	0.0	0.0	0.0	0.0	0.0	-149.7	0.0
Total primary energy supply	**2,977.3**	**7,134.6**	**5,352.7**	**711.7**	**161.0**	**59.5**	**489.8**	**396.2**	**17,282.7**	**710.3**
Transfers	0.0	520.0	-464.9	0.0	0.0	0.0	0.0	0.0	55.1	0.0
Statistical differences	0.0	136.9	-65.5	-0.2	0.0	0.0	0.0	28.1	99.3	0.0
Main activity producer electricity plants	-2,957.5	0.0	-1,297.1	-661.6	-161.0	-59.5	0.0	2,053.7	-3,083.0	-220.5
Autoproducer electricity plants	0.0	0.0	-297.8	0.0	0.0	0.0	0.0	85.3	-212.5	0.0
Oil refineries	0.0	-7,791.4	7,537.9	0.0	0.0	0.0	0.0	0.0	-253.5	0.0
Energy industry own use	-5.3	0.0	-457.1	0.0	0.0	0.0	0.0	-90.6	-553.1	0.0
Losses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-268.1	-268.1	0.0
Total final consumption	**14.5**	**0.0**	**10,308.1**	**49.9**	**0.0**	**0.0**	**489.8**	**2,204.5**	**13,066.8**	**489.8**
Industry	14.5	0.0	2,121.5	49.9	0.0	0.0	74.1	837.7	3,097.8	74.1
of which:										0.0
Chemical and petrochemical	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.2	93.2	0.0
Non-metallic minerals	0.0	0.0	951.6	0.0	0.0	0.0	0.0	262.1	1,213.7	0.0
Machinery	0.0	0.0	0.0	0.0	0.0	0.0	0.0	145.3	145.3	0.0
Mining and quarrying	0.0	0.0	0.0	29.6	0.0	0.0	0.0	158.2	187.8	0.0
Food and tobacco	6.6	0.0	0.0	0.0	0.0	0.0	0.0	76.5	83.1	0.0
Paper, pulp and print	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.9	14.9	0.0
Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.6	28.6	0.0
Textile and leather	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.6	36.6	0.0
Non-specified (industry)	7.9	0.0	1,169.9	20.3	0.0	0.0	74.1	22.2	1,294.5	74.1
Transport	0.0	0.0	4,686.0	0.0	0.0	0.0	0.0	26.0	4,712.0	0.0
of which:										0.0
Road	0.0	0.0	4,686.0	0.0	0.0	0.0	0.0	0.0	4,686.0	0.0
Rail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.0	26.0	0.0
Residential	0.0	0.0	1,351.7	0.0	0.0	0.0	415.7	723.5	2,490.9	415.7
Commerce and public services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	485.0	485.0	0.0
Agriculture/forestry	0.0	0.0	1,547.8	0.0	0.0	0.0	0.0	132.3	1,680.0	0.0
Non-specified (other)	0.0	0.0	44.2	0.0	0.0	0.0	0.0	0.0	44.2	0.0
Non-energy use	0.0	0.0	556.8	0.0	0.0	0.0	0.0	0.0	556.8	0.0

Source: International Energy Agency, 2012.
Note: * Totals may not add up due to rounding of the numbers.
International marine and aviation bunkers are included in Transport for world totals.

Photo 12.1: Dam on River Baht

Table 12.3: Total primary energy supply, ktoe

Source	2003	2004	2005	2006	2007	2008	2009	2010	2011
Coal	3,227.4	3,070.6	3,257.9	3,250.8	3,312.6	2,944.9	2,705.4	2,787.2	2,977.3
Crude, natural gas liquid and feedstocks	4,481.7	6,294.9	7,118.7	6,357.8	6,474.2	5,783.9	4,708.0	6,389.3	7,134.6
Oil products	2,557.1	1,987.7	1,686.0	2,495.4	3,145.5	4,839.0	6,021.0	5,583.4	5,352.7
Natural gas	35.1	44.8	374.6	473.1	547.7	473.9	527.4	569.7	711.7
Renewables	594.6	611.9	563.0	567.4	573.2	580.8	734.5	839.8	710.3
of which:									
Hydropower	125.2	138.3	84.2	85.8	78.7	79.9	220.8	298.2	161.0
Solar, tide, wind	17.5	17.1	17.7	15.7	24.0	25.6	33.6	56.7	59.5
Biofuels and waste	452.0	456.5	461.1	465.8	470.5	475.3	480.1	484.9	489.8
Electricity	121.9	130.0	69.0	171.8	297.1	366.4	397.6	338.8	396.2
Total	**11,017.8**	**12,139.9**	**13,069.2**	**13,316.3**	**14,350.2**	**14,988.9**	**15,093.9**	**16,508.2**	**17,282.7**

Source: International Energy Agency, 2012.

Table 12.4: Energy imports, ktoe

	2003	2004	2005	2006	2007	2008	2009	2010	2011
Coal	3,227.4	3,073.0	3,251.2	3,234.7	3,312.6	2,944.9	2,705.4	2,787.2	2,728.5
Crude, natural gas liquid and feedstocks	4,530.2	6,221.7	7,007.7	6,492.5	6,356.6	5,613.3	4,853.7	6,176.1	7,151.6
Oil products	3,775.9	3,590.5	3,480.5	3,896.0	4,877.2	5,640.8	7,231.1	7,230.2	7,333.6
Natural gas	0.0	0.0	340.6	423.0	494.1	429.8	490.4	524.8	661.8
Electricity	121.9	130.0	69.0	171.8	297.1	366.4	397.6	338.8	441.3
Total	**11,655.3**	**13,015.2**	**14,148.9**	**14,218.0**	**15,337.6**	**14,995.3**	**15,678.1**	**17,057.1**	**18,316.7**

Source: International Energy Agency, 2012.

At the same time, coal remained the main source for electricity production in the period 2003–2011, although with a decreasing trend (table 12.5). It accounted for a 70 per cent share in the product mix in 2003, which fell to some 47 per cent in 2011. In the same period, electricity production grew by 42 per cent with an increasing use of oil products (increase of 87.7 per cent), renewables (increase of 54.6 per cent) and natural gas (increased from a 0 per cent share in 2003–2004 to a nearly 16.2 per cent share in 2011).

Further developments regarding the import of energy products will depend on government decisions on the kinds of power stations that should be built to supply the growing demand for energy – and, in particular, for electricity – which is expected to double by 2020 and quadruple by 2030, as well as the implementation of those decisions. As of the end of 2011, Morocco has an installed power capacity of 6,407 megawatts (MW), based on the following energy sources:

- 1,785 MW from coal;
- 1,306 MW from hydropower;
- 915 MW from natural gas;
- 803 MW from fuel oil;
- 470 MW from the combined solar and natural gas cycle (20 MW solar);
- 464 MW from a pumped storage hydroelectric scheme;
- 384 MW from the natural gas combined cycle;
- 280 MW from wind power.

This capacity has increased by 1,100 MW since 2009, of which 300 MW comes from gas turbines, 470 MW from a combined solar and natural gas cycle and 140 MW from a new wind farm. At the same time, 1,266 MW of hydropower, 615 MW of gas turbines and 465 MW of coal-fired plants have undergone rehabilitation works.

Noting the growing thirst for energy, Morocco plans to install an additional capacity of some 8,200 MW in the period 2012–2020, of which:

- 3,720 MW is to come from the development of wind and solar programmes;
- 520 MW is to be generated from hydropower plants to be built in Mdez El Menzel and Abdelmoumen;
- 2,500 MW is to come from the ongoing development of thermal power (2 x 660 MW in Safi, 700 MW in Jorf Lasfar, 300 MW in Jerada, 80 MW in Agadir and 100 MW in Tarfaya);
- 1,000 to 1,500 MW is to be generated from the development of stations powered with natural gas, clean coal or nuclear energy to be built in the period 2017–2020 (for nuclear until 2025).

Should the plans for the period 2012–2020 be realized, slightly over 50 per cent of the new capacity will be established from green energy sources, and thus the growth in fossil fuels import, at least for electricity purposes, should slow down.

12.2 Environmental pressures

It is very difficult to provide a data-based assessment of the pressure of the energy sector on the environment due to the fact that there is no systematic data series available in the statistics books of Morocco.

Based on targeted modelling provided in the 2010–2011 Energy Study of Morocco, GHG emissions resulting from energy consumption were in a growing trend between 2003 and 2007 in terms of both total emission levels and per capita emissions, and a stable trend for the period 2008–2010 (table 12.6).

At the same time, comparing the GHG emissions with GDP (production-based CO_2 productivity), the yearly ratio is relatively stable in the period 2003–2010 (table 12.7). Since 2004, the production-based CO_2 productivity showed a downward trend.

In addition, based on the available CO_2 emissions and GDP data for the period 2004–2010, the emissions level increased by 27 per cent while GDP grew by 31 per cent during the same period. This shows that there was a slight but positive trend in decoupling CO_2 pollution from GDP growth.

Concerning air pollutants (chapter 6), generation of electricity from burning fossil fuels in thermal power plants (TPPs) is among the main sources of air pollution in Morocco. According to a 2008 study by the Ministry of Equipment and Transport, which was based on 2005 data, in urban areas TPPs were responsible for 60 per cent of overall SO_2 emissions, 40 per cent of overall NO_x emissions and 79 per cent of overall PM_{10} emissions. The second national communication to UNFCCC (2010), based on 2004 data, records that, at the national level, TPPs were responsible for 19 per cent of total SO_2 emissions and 21 per cent of total NO_x emissions, and that the sector is a major contributor of heavy metals pollution (lead and cadmium) and of suspended solids.

Table 12.5: Electricity production by energy sources, GWh

Energy sources	2003	2004	2005	2006	2007	2008	2009	2010	2011
Coal	12,247	13,002	13,162	13,478	12,863	11,699	11,248	11,089	11,679
Oil products	3,543	3,706	3,561	3,259	3,626	5,031	4,320	4,939	6,578
Natural gas	0	0	2,003	2,512	2,823	2,867	2,844	2,153	4,051
Renewables	1,659	1,807	1,185	1,181	1,194	1,227	2,959	4,127	2,564
of which:									
Hydropower	1,456	1,608	979	998	915	929	2,568	3,468	1,872.0
Solar, tide, wind	203	199	206	183	279	298	391	659	692.0
Total	**17,449**	**18,515**	**19,911**	**20,430**	**20,506**	**20,824**	**21,371**	**22,308**	**24,872**

Source: International Energy Agency, 2012.

Table 12.6: GHG emissions, total and per capita, 2003–2010

	2003	2004	2005	2006	2007	2008	2009	2010
CO_2 emissions (Kt)	37,561	43,311	45,771	47,425	50,267	49,934	49,541	50,608
CO_2 emissions (t per capita)	1.26	1.44	1.52	1.56	1.64	1.61	1.58	1.60

Source: World Bank DataBank, 2013.

Table 12.7: GHG emissions versus GDP, 2003–2010

	2003	2004	2005	2006	2007	2008	2009	2010
CO_2 emissions (Kt)	37,561	43,311	45,760	46,985	49,372	51,254	49,541	50,608
GDP (current prices and PPPs, US$ million)	94,357	101,668	108,171	120,325	127,164	137,238	145,032	152,326
CO_2 emissions (kg per 1,000 PPP US$ of GDP)	398.1	426.0	423.0	390.5	388.3	373.5	341.6	332.2

Source: World Bank DataBank, 2013.

There have been no indications that the impact of TPPs on air pollution has decreased. Positive developments, such as burning better quality fuels, are most probably counterbalanced by increased energy production from fossil fuels. At the same time, according to 2012 data (chapter 6), emission levels in big cities often exceed the emission limits established by WHO, which would seem to indicate that the air quality is not sufficiently protected, including from energy generation. In addition, wood-burning ceramic kilns – for which a lot of material waste, such as treated wood, tyres or used oil collected by waste pickers from landfills, is also used as fuel – have a considerable impact on air quality. The unburned refuse is then usually discharged into dumpsites or the natural environment, polluting soils. Similar impacts occur from using such waste material as fuel in public bathhouses (approximately 5,000 across the country).

12.3 Energy intensity and efficiency by end use

The primary energy intensity for Morocco, according to IEA, was 0.26 toe/US$1,000 GDP in constant 2000 prices for the year 2009, in comparison with 0.52 and 0.31 for Algeria and Tunisia respectively. This relatively low value is explained by the structure of the Moroccan economy, with a relatively high share of total GDP coming from the agricultural sector and the dominance of the services sector, both not very energy-intensive sectors. At the same time, taking into account the growing demand for energy in every sector of the economy, including the agricultural and services sectors, it can be expected that the energy intensity share of total primary energy supply in GDP will be increasing.

As far as energy efficiency is concerned, energy audits conducted to date at Moroccan companies by the National Agency for the Development of Renewable Energy and Energy Efficiency (ADEREE) show that the overall potential for energy efficiency enhancement is more than 15 per cent. In some sectors this potential is even greater: in the building sector the potential for energy savings is estimated at over 29 per cent, and in the agricultural sector at 20 per cent.

12.4 Alternative sources of energy

Morocco has great potential for generating energy from alternative, "green" sources of energy, in

particular solar and wind energy. As for solar energy, the country has irradiation of 5 kWh/m^2/day on average and 3,000 hours of sunshine per year (over 8 hours per day). The wind power potential is estimated at 25,000 MW for onshore wind energy, of which 6,000 MW can be implemented at sites identified in regions characterized with wind speeds between 9.5 and 11 metres per second (m/sec) at 40 metres height (Essaouira, Tangier and Tétouan) or with wind speeds between 7.5 and 9.5 m/sec (Tarfaya, Dakhla, Laâyoune and Taza).

The development of renewable energy began as early as 2000 and accelerated in 2009, when the National Energy Strategy was launched. The Strategy's goal is for 42 to 44 per cent of installed capacity for electricity generation (around 6,200 MW) to be from renewable sources by 2020 (figure 12.1).

Figure 12.1a: Installed capacity in 2010

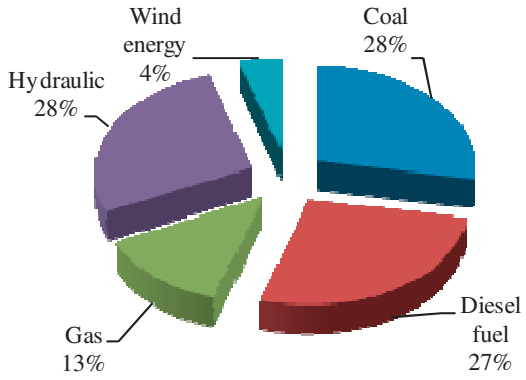
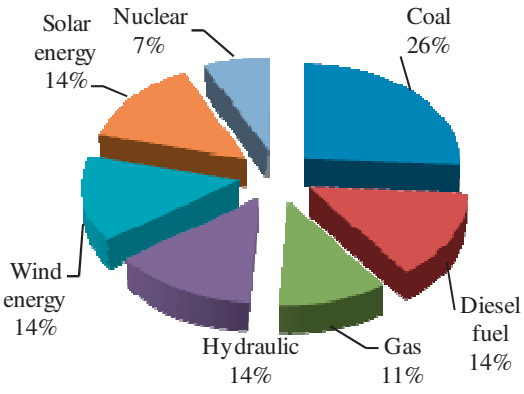


Figure 12.1b: Planned capacity in 2020



Source: Ministry of Energy, Mines, Water and Environment, 2012.

In order to meet this goal, a capacity of 2,000 MW has to be generated in wind farms by 2020. To date, 14 per cent of that capacity, i.e. 280 MW, is produced at the three wind farms in the region of Tangier-Tétouan (220 MW) and one in Essaouira (60 MW). Another 36 per cent, i.e. 720 MW, will be generated by sites currently under construction: three in the Laâyoune region (550 MW) and two in the Tangier-Tétouan region (170 MW). Construction is yet to begin on an additional five sites, which together are expected to ensure a further 1,000 MW: in Tangier (150 MW), Tétouan (300 MW), Taza (150 MW), Laâyoune (300 MW) and Boujdour (100 MW). The electricity production of all the wind farms is expected to reach, on average, some 6,000 GWh.

Another 2000 MW has to be generated from solar energy, with the first of five plants to be commissioned in 2015 and the whole project to be finished by the end of 2019. The sites will be located at:

- Ouarzazate, with a capacity of 500 MW; the solar panels will cover 2,500 ha and the plant is expected to generate 1,150 GWh annually;
- Ain Beni Mathar, with a capacity of 400 MW; the solar panels will cover 2,000 ha and the plant is expected to generate 835 GWh annually;
- Foum al Ouad, with a capacity of 500 MW; the solar panels will cover 2,500 ha and the plant is expected to generate 1,150 GWh annually;
- Boujdour, with a capacity of 100 MW; the solar panels will cover 500 ha and the plant is expected to generate 230 GWh annually;
- Sebkhate Tah, with a capacity of 500 MW; the solar panels will cover 2,500 ha and the plant is expected to generate 1,040 GWh annually.

For hydropower, it is planned to increase energy generation by an additional 520 MW through two projects: the Abdelmoumen Pumped Power Transfer Station Project (STEP) and the Mdez El Menzel Hydropower Complex. The Abdelmoumen STEP Project will reinforce the national electricity grid in the south, with a capacity of 350 MW. The key objectives of the Mdez El Menzel complex are to match peak-hour electricity supply with demand and contribute to the Haut Sebou Development Programme (2010–2014). The project consists of a hydropower complex comprising two waterfalls, namely, Mdez and El Menzel in Haut Sebou, with a capacity of 45 MW and 125 MW respectively. With this increase, Moroccan hydropower capacity will reach 2,290 MW, with an expected average electricity generation of 4,650 GWh.

In addition to green energy production in the existing hydropower and wind plants, clean energy is also produced in a decentralized system via photovoltaic kits, with which over 50,000 households were

equipped between 1996 and 2011 within the National Programme on Rural Electrification. The decentralized system offers a capacity of 30 MW, which is supposed to increase to 40 MW in 2020 and 80 MW in 2030.

Green energy is also generated for non-electric use. Thermal solar panels for water heating have been installed on administrative buildings, schools and collective and individual houses, covering a surface of over 400,000 m^2 in 2012. It is planned for solar panels to cover a surface of 1.7 million m^2 in 2020 and 3 million m^2 in 2030.

Possibilities for nuclear energy and shale gas exploitation are also being investigated. With regard to nuclear energy, the Government has decided to continue to follow and consider international experience before embarking on the construction of a nuclear power plant. With regard to large scale exploitation of shale gas, there is currently a broad public debate on this issue, especially as estimates on the reserves differ widely. According to the Petroleum and Renewable Energy Company Limited (Petrenel), Morocco would have 150 years of reserves and the IEA talks about 50 years, whereas the most recent explorations by Spanish and American companies indicate that these reserves are not significant.

12.5 Integration of environmental considerations into energy policies

Morocco took steps in the past decade to integrate environmental considerations in the energy sector. Environmental protection is explicitly mentioned in all policy documents of institutions dealing with energy, as well as in legislation.

Environmental objectives of energy policy, strategies, programmes and plans

The 2009 National Energy Strategy explicitly includes the protection of the environment as one of its four main objectives. Its target is to reach a total share of installed electrical capacity of 42 per cent from green energy sources (hydropower, solar and wind) by 2020.

The implementation of the Strategy has led to the launch of two integrated renewable energy programmes, as well as energy efficiency programmes. The Integrated Moroccan Solar Energy Programme, launched in 2009, aims to build a capacity of 2,000 MW at five sites and to reduce CO_2 emission by 3.7 million tons a year. The Integrated Wind Energy Programme, launched in 2010, aims to reach a 2,000 MW capacity in 2020 and to reduce CO_2 emission by 5.6 million tons a year.

The main aim of the National Programme for Energy Efficiency is to achieve 12 per cent of energy savings by 2020 and 15 per cent by 2030. This will be achieved through the implementation of energy efficiency in the building, industry and transport sectors. The Programme specifies a number of concrete measures to be applied in each of the three targeted sectors.

In the building sector, the Programme aims to implement an energy efficiency code and to promote use or installation of: (a) low-consumption light bulbs; (b) insulation materials and double glazing; and (c) installation of solar photovoltaic kits and pumps. In 2010, due to the fact that the building sector represents about one third of national energy consumption, the Ministry of Housing, Town Planning and Urban Policy took the initiative to develop a best practices guide for energy efficiency and renewable energy in housing and urban development.

In the industrial sector, the Programme recommends mandatory energy audits. It also promotes installation of solar photovoltaic kits and pumps, use of low-consumption light bulbs and optimization of cold and heat storage.

In the transport sector, the Programme aims at: (a) rejuvenation of the vehicle fleet (for cars and taxis older than five years); (b) reorganization of urban transport with the development of tramways in the cities of Casablanca and Rabat; and (c) enforcement of energy efficiency requirements for vehicles. The National Programme for Energy Efficiency, contrary to the renewable energy programmes, is considered to be in its infancy and is only implementing pilot projects at present. Implementation of this Programme should be further enhanced.

There is also a territorial strategy for renewable energy and energy efficiency, which was launched in March 2012 by ADEREE. This strategy aims at integrating initiatives on renewable energy generation and energy efficiency in local development plans. As a start, an innovative methodological framework for sustainable energy planning and implementation will be demonstrated in a number of cities across the country (three to six cities). The project includes measures to build institutional and individual capacities, to provide support to local decision-makers and to facilitate access to information and the education of the population.

It is expected that a national strategy for energy efficiency will be developed and adopted by the end of 2013. Its aim will be to save between 10 and 15 billion dirhams each year out of the annual energy bill, estimated at 103 billion dirhams in 2012. All stakeholders – in the building, transport, agriculture and industrial sectors – will be involved in discussions. The following actions will take place: (i) an inventory of the results of actions already taken, international benchmarks, consumption status and a quantification of the potential savings will be carried out; (ii) guidelines on energy efficiency will be developed and submited for adoption; and (iii) prioritization and means for the implementation and monitoring of the strategy will be identified.

In 2012, a study was carried out by the Ministry of Energy, Mines, Water and Environment to assess the needs for jobs in the renewable energy sector. By 2020, it is expected that about 36,800 jobs will be created in energy efficiency and 13,300 in renewable energies. To achieve this goal, since 2011, programmes covering these topics have been developed at the university level or through vocational training.

Legal framework and environmental standards related to the energy sector

Over the past few years, Morocco has adopted an arsenal of environmental protection laws pertaining also to the energy sector. There have also been a number of laws developed in conjunction with the implementation of the National Energy Strategy. The environmental laws that are relevant for the energy sector are the:

- 1995 Law No. 10-95 on Water, with its sub-laws relevant for hydropower plants, but also water use and discharges by TPPs and oil refineries;
- 2003 Law No. 13-03 on Combating Air Pollution, with its sub-laws relevant for combustion plants (TPPs) and for oil refineries;
- 2003 Law No. 12-03 on Environmental Impact Assessment.

The laws that have been developed for the implementation of the National Energy Strategy (adopted in 2009) are the:

- 2010 Law No. 13-09 on Renewable Energy;
- 2010 Law No. 16-09 on the National Agency for the Development of Renewable Energy and Energy Efficiency (ADEREE);
- 2011 Law No. 47-09 on Energy Efficiency;
- 2010 Law No. 57-09 creating the Moroccan Agency for Solar Energy.

The environmental laws cited above, however, are lacking implementing secondary legislation. With regard to air protection, the ELVs are not specified for combustion plants (chapter 6). A draft regulation on the specific limit values for air pollutants for refineries and TPPs is currently under discussion. Also the 2012 Decree No. 2-12-172 is laying down technical requirements for the disposal and recycling processes of waste by incineration. Its aim is to define administrative procedures and technical requirements for incineration, as well as to set emission and release limit values for energy production facilities. The Law on Environmental Impact Assessment includes a fixed list of activities that should undergo an EIA, although not all energy-related activities are covered, e.g. wind and solar projects.

Of the four laws for the implementation of the National Energy Strategy, Laws No. 13-09 on Renewable Energy and No. 47-09 on Energy Efficiency are the operational ones. Law No. 13-09 introduces the authorization or declaration regime for projects for generation of energy from renewable sources, namely, solar, wind, geothermal, wave and tidal, biomass, landfill gas, gas from sewage treatment plants and biogas. It obliges the project developers interested in using these renewable sources of energy to undertake an EIA and the implementation of measures to reduce environmental impacts before authorization can be granted.

Law No. 47-09 introduces mandatory energy audits for big energy consumers (beyond thresholds specified in ministerial orders) as well as for enterprises and facilities related to energy production, transmission and distribution. Further, it introduces energy impact assessments for all new construction and urban projects that are specified in the lists of consumers of energy beyond thresholds defined by ministerial orders. It also requires that domestic appliances and other electrical equipment sold on the market meet minimum energy performance standards. Effective application of this Law requires availability of the threshold values. So far, however, no secondary legislation has been adopted on threshold values.

The legislation in place is mainly implemented through a partnership and negotiation approach (box 12.1). The relevant authorities, either through partnership agreements or negotiation, try to encourage self-monitoring (by enterprises themselves or by a third company) and self-control measures by

industry, including in the energy sector. Currently, even the enterprises that have signed partnership agreements are under no obligation to report their emissions, although they are requested to do so.

Economic, fiscal and financial instruments

The Government implements fiscal measures to encourage lower or more energy-efficient consumption. For example, a super-peak pricing tariff has been introduced for very high and high voltage users to discourage electricity use during peak demand periods. A socially sensitive and user-friendly incentive pricing system, called "-20-20", has been put in place, by which final consumers who are clients of municipal utilities or of the National Office of Electricity (ONE) can benefit from a 20 per cent bonus when reducing their monthly electricity consumption by 20 per cent as compared with the same month of the preceding year (chapter 4). Since the launch of the model, some 260 million dirhams have made their way back into the pockets of electricity consumers, representing a total reduction of 1,769 GWh in electricity consumption.

The Government also subsidizes the purchase of low-energy light bulbs. It is hoped that some 15 million low-energy bulbs will be installed thanks to the subsidy. The subsidy functions by offering electricity customers the ability to purchase low-energy light bulbs at a price close to cost, in this case 22.65 dirhams. This cost of the bulbs is then included in the client's electricity bill and paid for at the rate of 1 dirham per month over the course of 24 months. At the end of 2010, 4.6 million low-energy bulbs were installed under this programme. The estimated impact is an economy of about 173 MW during peak hours, and energy savings of 591 GWh.

At the same time, the Government regulates the electricity tariffs, which are the lowest in the MENA region, despite some increases in 2006 (for all users) and 2009 (for all users except households and small businesses). This approach keeps inflation low and allows Moroccan enterprises to be competitive in the region. On the other hand, the low tariffs may not encourage users to use electricity efficiently. In addition, because the tariffs do not cover the production and distribution costs of electricity, there is a growing operational deficit at the National Office of Electricity.

The Government also operates a subsidy system for petroleum products to protect industry and households from price surges for a number of primary energy products in international markets. A compensation fund was established to cover the gap between the international market prices at which the products are purchased and the sell prices established in special government regulations. During the years 2006–2011, the cumulative subsidy level reached 117.7 billion dirhams and is becoming a heavy, almost unbearable, burden on the State budget.

This subsidy scheme, which should benefit the poor, is available to everyone, and it is, rather, rich households and enterprises that benefit most. Furthermore, the scheme encourages overconsumption by keeping prices of petroleum products significantly below the cost recovery level (chapter 4.)

To support the implementation of the National Energy Strategy, a dedicated US$1 billion fund has been created – the Energy Development Fund. This Fund is financed by the Hassan II Fund for Economic and Social Development (US$200 million), Saudi Arabia (US$500 million) and the United Arab Emirates (US$300 million). The Fund, managed by the State, aims to preserve and enhance production capacity from local energy sources, including renewable energies, to provide financial support to energy efficiency projects and to support energy service enterprises. In 2009, the Fund received US$150 million in financial support from the World Bank's Clean Technology Fund to support wind power and energy conservation measures, particularly in industry and urban transport. However, the estimated costs of the investments are as follows:

- Solar farms with 2,000 MW capacity: 70 billion dirhams (approximately US$9 billion);
- Wind farms with 1,720 MW capacity: 31.5 billion dirhams (approximately US$4 billion);
- Hydropower with 520 MW capacity: 4.5 billion dirhams (approximately US$0.6 billion).

The Fund thus offers less than 10 per cent of the investment needs for these projects. It is foreseen, therefore, that public–private partnerships will need to be developed, combining public and private national and foreign funding, to realize the projects. At the same time, due to the fact that the incentives for private investors to invest in renewable energy projects are relatively limited – there are neither quotas nor feed-in tariffs foreseen for supporting such projects – there is a considerable risk that private investors may show limited interest in entering into such partnerships.

Box 12.1: Environmental management at the Mohammedia refinery

In 2006, SAMIR installed a modern wastewater treatment plant at the Mohammedia refinery, which meets Moroccan standards for wastewater discharges from oil refineries. Tests now show that the oil content in the wastewater is at very low levels, at less than 1 mg/L, and the levels of other pollutants (such as organic pollutants revealed by chemical oxygen demand and five-day biological oxygen demand (BOD5) tests, as well as lead and phenol) are also low. SAMIR has a directorate for environmental issues.

The Mohammedia refinery has established an integrated management system for work quality, safety and protection of the environment. It is also certified according to ISO 14001 (since 2004) and ISO 9001 (since 2008). The refinery has 36 piezometric wells, distributed all over the site, that ensure the continuous monitoring of groundwater. Priority is given to recycling and recovery of solid and liquid waste. Contaminated or hazardous waste is recovered, incinerated locally or disposed of in specialized centres.

The environmental action plan implemented by the refinery between 2006 and 2009 allowed for a reduction of SO_2 emissions by 53 per cent in its older installations. These facilities used to emit 92.7 tons of SO_2 per day.

A project to modernize installations for the production of more environmentally friendly fuels was also implemented, resulting in a considerable improvement in the quality of diesel, the sulphur content of which was reduced two-hundredfold (50 ppm instead of 10,000 ppm).

Institutional framework and capacities

The Department for Energy and Mines within the Ministry of Energy, Mines, Water and Environment is the main authority in Morocco for the implementation and enforcement of the legal provisions related to the environmental management of, and environmental standards to be met by, energy providers. This includes, in particular: (a) preparation and revision of the necessary regulations and preparation of guidelines; (b) control and monitoring of discharges; (c) participation in commissions reviewing EIAs for energy facilities; and (d) proposing research projects related to environmental protection. In reality, and in particular due to limited human resources at the disposal of the Department, its activities so far are limited to providing support for interministerial technical commissions and preparing orders on limit values for different types of pollutants in the energy sector.

There are several other national entities mandated to fulfil particular roles in the fields of energy and environment or to implement the National Energy Strategy. These are the National Office of Electricity and Drinking Water (ONEE), the National Agency for the Development of Renewable Energy and Energy Efficiency (ADEREE), the Moroccan Agency for Solar Energy (MASEN), the Research Institute for Solar Energy and New Energies (IRESEN) and the Energy Investments Company (SIE).

ONEE is the result of the merger of ONE (the National Office of Electricity) and ONEP (the National Office of Drinking Water) following the adoption of the 2011 Law No. 40-09. This institutional change was the response to a search for synergies between and the harmonization of the two entities representing complementary specialized areas. However, to date, the staff of these two former entities are physically separated: one part (electricity) is located in Casablanca and the other (water) in Rabat, and they do not appear to enter into much collaboration. The electricity branch of ONEE is responsible for the production, transport and distribution of electricity. Its main environmental actions include promotion of renewable energy, integration of EIAs for all energy projects under development and improvement of environmental performance of its existing energy production facilities. The Office is in charge of implementing the Integrated Wind Energy Programme.

ADEREE, created by Law No. 16-09 and replacing the former Centre for Development of Renewable Energy established in 1982, supports the implementation of the national policy on renewable energy and energy efficiency. In particular, the Agency is mandated to coordinate, implement and monitor renewable energy and energy efficiency programmes, identify renewable energy and energy efficiency potentials and development zones, develop standards and labels, provide research and development support, and support the implementation of recommendations. It is also responsible for conducting energy audits. MASEN and SIE were both created in 2010 to facilitate the implementation of the National Energy Strategy. MASEN is in charge of implementing the Integrated Moroccan Solar Energy Programme by means of which 2,000 MW of solar capacity is to be created by 2020. The Agency has recently launched a tender for the first solar plant with a 125 MW capacity in Ouarzazate.

created by 2020. The Agency has recently launched a tender for the first solar plant with a 125 MW capacity in Ouarzazate.
SIE, funded by the Energy Development Fund (1 billion dirhams), invests in projects that increase energy production capacity, giving priority to those that promote renewable energy resources and improve energy efficiency, or that rely on the use of clean technologies. It provides financial support for the Integrated Wind Energy Programme undertaken by ONEE and the Integrated Moroccan Solar Energy Programme implemented by MASEN.

IRESEN was created in 2011 to translate the National Energy Strategy into research and development projects, and, in particular, to develop, coordinate and reinforce the efficiency of research on solar and new energies, as well as to implement and participate in the financing of the research projects. The Institute is also mandated to transfer the research and development results to industry.

12.6 Conclusions and recommendations

As required by Law No. 13-09 on Renewable Energy and Law No. 12-03 on Environmental Impact Assessment, EIAs are carried out on energy development projects at the planning phase. At the same time, self-monitoring and self-reporting by operators on the impacts on the environment once projects become operational are lacking in this sector. The 2010 Decree No. 2-09-631 setting limit values for clearance, emission or discharge of pollutants into the air from stationary sources of pollution and the procedures for air monitoring recommends voluntary self-monitoring and annual self-reporting.

Recommendation 12.1:
The Ministry of Energy, Mines, Water and Environment should propose to the Government that it revise the 2010 Decree No. 2-09-631 to ensure environmental self-monitoring and self-reporting by energy operators, among other operators that cause significant adverse environmental impacts.

No specific secondary legislation for sectoral ELVs for the energy sector – TPPs and refineries – has been adopted so far, which means that the 2010 Decree No. 2-09-631 setting limit values for clearance, emission or discharge of pollutants into the air from stationary sources of pollution and the procedures for air monitoring should be applied to the energy sector. At the same time, application of this Decree is only an intermediate solution, as the general limits cannot properly address emissions in sectoral activities.

The Government strategy related to energy efficiency aims at reducing Morocco's vulnerability to fossil fuel markets and increasing national economic competitiveness, and thus decoupling economic growth from increased carbon emissions and moving towards a low carbon economy. Energy audits for big energy consumers and for enterprises and facilities related to energy production, transmission and distribution are mandatory according to Law No. 47-09 on Energy Efficiency. Energy impact assessments for new big construction and urban projects are also required by the same Law. However, effective application of the Law requires the adoption of threshold values for economic actors for which the audits and energy impact assessments will have to be applied.

Recommendation 12.2:
The Ministry of Energy, Mines, Water and Environment, in cooperation with the relevant ministries and departments, should finalize secondary legislation on:

(a) Sectoral air emission limit values related to energy sources, especially for combustion plants;
(b) Threshold values for energy audits and energy impact assessments, as called for in Law No. 47-09 on Energy Efficiency.

The funding available in the Energy Development Fund can cover less than 10 per cent of the estimated investment needs for the planned projects on energy from renewable sources. The realization of the country's renewable energy programmes requires that incentives be offered to private investors in order to attract them to participate in the financing of these development projects. However, such incentives are not offered at the moment in Morocco.

Electricity prices for end-users are regulated and are below the recovery cost of electricity generation and transmission. Such a situation discourages rather than attracts private investors to join renewable energy development projects. In turn, this may mean that the plans to achieve an installed capacity of some 42 per cent for electricity generation from renewables may not be realized by 2020.

Recommendation 12.3:
The Government, supported by the National Agency for the Development of Renewable Energy and Energy Efficiency, should:

(a) Create incentives for private investors to attract them to co-finance renewable energy projects;

(b) Reconsider its electricity pricing policies to allow electricity companies to recover the costs of electricity generation and transmission from renewable sources.

Chapter 13

AGRICULTURE AND ENVIRONMENT

13.1 Introduction

The agricultural sector's importance in Morocco is reflected in its share of the country's GDP and its contribution to employment, especially in rural areas where agriculture remains the leading provider of jobs (74 per cent in 2010) and the main source of income. Over the past 10 years, the average annual agricultural GDP growth rate has been 3.98 per cent. Food exports account for 19 per cent of the country's total exports. Produce from irrigated areas contributes significantly to agricultural value added.

13.2 Conditions and activities in agriculture

Main agricultural activities

Moroccan agricultural activities consist of two major groups: production of cereals and production of high-value-added, export-oriented products. The main constraints to the growth of agricultural sector activities are:

- Land tenure factors (the small size of farms, the fragmentation of land, joint ownership, the precarious nature of tenure and the shortcomings of land registration), which curb investment initiatives;
- Frequent climatic fluctuations;
- Degradation of natural resources through erosion, inappropriate use of soil and overgrazing;
- Very poor access to investment credit;
- Farmers' lack of professional organization;
- Farmers' illiteracy;
- The low level of technical training.

Irrigated areas

Irrigated areas only represent 15.7 per cent of the country's cultivated lands. They account for 45 per cent of agricultural value added (and even 75 per cent in the event of a bad crop year) and 75 per cent of total agricultural exports. Irrigated areas cover a total surface area of 1.46 million ha, 70 per cent (1.02 million ha) of which are developed with public (State) funds and 30 per cent (0.44 million ha) with private (farmers, private companies, etc.) funds.

Morocco has pursued a proactive irrigation strategy, mainly through dam construction. Today, the country has more than 113 dams, with an annual holding capacity of 16 billion m^3. This contribution is higher during drought years.

The irrigated sector accounts for up to 99 per cent of the production of sugar, 82 per cent of vegetables, 100 per cent of citrus and 75 per cent of milk. During the past two decades, between 51 and 75 per cent of the investment budgets for agriculture have been devoted to irrigated areas. Today, the objectives are largely achieved and irrigated areas are "poles" of local and regional development. However, while the surface of the irrigated perimeters fitted out by the State progresses by 2.3 per cent a year, the supplies of water fall by 2 per cent, on average, a year.

At the same time, modern agriculture is more and more water intensive. Indeed, Morocco leads efforts to ensure the more efficient and economical use of water in agriculture, in order to face recurring drought cycles (it does this through the activities of the National Observatory for Drought). The development of irrigated agriculture in Morocco is confronted with a twofold challenge:

- Improving the performance of irrigated agriculture to ensure the conservation and enhanced development of water and the sustainability of irrigation systems;
- Extending irrigation as part of a countrywide harmonious water policy, and within a context of scarce water resources compounded by climate change and competition with other sectors.

Significant efforts have been made to rehabilitate and modernize irrigation networks. A water conservation programme was initiated to equip producers in irrigated areas with modern techniques for water-saving irrigation. Morocco has, in this respect, established three structured programmes. The National Water Conservation Programme aims, over the next 10 years, to increase the irrigated area using more efficient and more water-saving techniques.

The second irrigation extension programme aims to increase the capacity of hydro-agricultural dams by nearly 110,000 additional ha, with an additional

annual holding capacity of 1 billion m^3/year, which will result in a significant improvement in income for the beneficiaries. The third programme focuses on the institutional reform of large-scale irrigation, and aims to promote delegated management of irrigation water through the encouragement of private investment in public–private partnerships.

There is continued growth in localized (i.e. drip and/or micro-sprinkling systems) irrigation areas. The objective in the PMV is the conversion of 550,000 ha currently irrigated by gravity (e.g. flooding, use of furrows) to localized irrigation by 2020.

Climate change has impacted in numerous ways on Moroccan agriculture. It is responsible for:

- A drop in agricultural productivity, especially for rain-fed crops and those for which technological progress is low or zero, such as barley, durum wheat, olive trees and pulses;
- Displacement of the area of cultivation of certain crops, such as those demanding water (corn, sunflowers, beans, olive trees) or those that will be affected by higher temperatures (fruit trees that need cooling);
- Loss of soil fertility due to the decline in soil organic matter, and water and wind erosion;
- Water scarcity, and a decreasing availability of water for irrigation.

Organizational types of agricultural production units, including ownership

The 8.5 million ha of useful agricultural land in Morocco are characterized by diverse legal statutes and numerous supervisory authorities:

- Privately owned lands managed by the National Agency for Land Conservation, Land Registry and Mapping (75 per cent of agricultural land);
- Collective lands managed by the Ministry of the Interior (18 per cent of agricultural land), probably one of the oldest forms of land ownership. Initially, these were essentially lands belonging to tribes with no legal ownership of the land itself, but in de facto occupation of the land. Organization of these lands dates to 1919, when the French Protectorate attempted to organize this form of ownership, giving tribes the legal right to use the land (droit de jouissance) without an ownership right;
- Guich lands managed by the Ministry of the Interior (less than 3 per cent of agricultural land), which were originally collective lands granted by kings to tribes in exchange for services, mainly of a military nature;
- Domanial lands – State-owned lands managed by the Ministry of Equipment and Transport (3 per cent of agricultural land);
- Habous lands managed by the Ministry of Habous and Islamic Affairs (less than 1 per cent of agricultural land), generally offered by an individual in favour of charitable or social activities. These properties are inalienable and governed by the rules of Islamic law. Their sale is only possible with the permission of the King (Dahir of 7 July 1914 on the regulation of civil justice and the transfer of real estate).

The current fragmentation of agricultural property appears to be an obstacle to the optimization of crop yields and agricultural profit. Land structure is dominated by small farms and the average farm size is 6 ha. Close to 70 per cent of farms have areas of less than 5 ha and make up 25 per cent of all agricultural land. There has been a slow upward trend in average farm size. In an effort to increase productivity and rationalize the use of inputs, the PMV aims at increasing the average farm size and encouraging the switch to privately owned lands.

The reform of land structure has been delayed because of the lack of coordination between relevant ministries, as well as between the national government and local authorities. Mobilization of agricultural land is an essential lever for the implementation of investment projects planned as part of the Green Morocco Plan and, in particular, its projects to develop modern agriculture with high value added and high productivity.

13.3 Pressures from agriculture

Water

Water resources in Morocco are mainly influenced by the annual and inter-annual variability in rainfall and by a very marked heterogeneity in spatial distribution. The alternating sequence of high run-off and drought intensity and duration is dominant, particularly in recent years because of climate change.

Agriculture's pressures on water compound this severe hydrological context. The sector uses 85 per cent of the available water in the country.

Photo 13.1: Oasis

Agricultural pollution from phosphates and nitrates is estimated at 10,000 tons annually in irrigated areas. Manure is widely used, originating from sheep and cattle. Few official statistics are available on manure use, as both production and distribution remain dominated by the informal sector. Although data on nitrogen fertilization are lacking, there is a concern that nitrogen fertilization, especially in irrigated areas, contributes significantly to nitrate pollution. Analyses and studies in this field have shown that the phenomenon is beginning to affect several soil layers in Morocco, especially in Souss-Massa and Chtouka Ait Baha.

The use of fertilizers is closely linked to Morocco's position as a world leader in production of phosphates and its derivatives, particularly phosphoric acid and phosphate fertilizers. The government phosphates authority, OCP, encourages farmers to use fertilizer to improve agricultural productivity and crop yields. However, the use of fertilizers is still limited. The majority of farmers are reluctant to invest in fertilizers given the climatic uncertainties and poor cash flows in most situations. Only 52 per cent of farmers use fertilizer, which corresponds to an annual consumption of 750,000 tons, compared with an estimated need of 2.5 million tons.

Annual pesticide consumption is around 10,000 tons, increasing by 10 per cent each year. Around 33 per cent of farmers use phytosanitary products. Between 0.5 per cent and 1 per cent of phytosanitary products are found in water streams. Pressures from agriculture on water are due to the inefficient use of fertilizers and pesticides and the overexploitation of groundwaters.

Approximately 32 per cent of fertilizers are used for production of citrus fruits, sugar and truck farming (vegetable crops for export), representing only 5 per cent of the cultivated lands (generally, irrigated agricultural lands), and account for 58 per cent of agricultural tonnage. Approximately 43 per cent of fertilizers are used for cereal crops, which take up 63 per cent of the cultivated lands. The remaining 25 per cent of total fertilizers are used for other types of agricultural products. In several groundwater aquifers the nitrate content has already reached the limit thresholds of 50 mg/L fixed by WHO for drinking water quality.

Approximately 1 million ha are cultivated using pesticides, 60 per cent in irrigated zones. The quantities of pesticides used by the farmers are considered low. However, the levels and types of pollution of the water and the soil by pesticides are not known.

The Water Satisfaction Index (WSI) (real evapotranspiration/maximum evapotranspiration), which expresses the percentage of a crop's water

requirements that were actually met, is a rather reliable indicator of the performance of cultivated land. With climate change, all cultivated lands in oasis zones will suffer from a reduction in WSI. The changes in rainfall and temperature anticipated for the period 2020–2050 will lead to additional demands for water. The hydric balance sheet for alfalfa, palm and fruit trees and summer crops shows that these will be highly penalized by climate change. Climate change will also lead to reductions in yields on the order of 10 to 15 per cent in all oasis zones.

Soil

The rates of degradation of soils are excessive in Morocco, especially in the regions of the north and north-west where they exceed 2,000 t/km^2/year. Water stress amplifies pressures on soils and aridity is a major cause of soil erosion. Some 93 per cent of soils are subject to significant aridity, of which 15 per cent are semi-arid, and only 7 per cent are humid or sub-humid.

More than 23 million ha are affected by erosion. The silting-up of dams aggravates the situation. An estimated 75 million m^3 of capacity is lost each year due to silting for an average annual volume of 11 billion m^3, which corresponds each year to a decrease of 0.5 per cent of the dams' capacity and a loss of irrigation potential for 5,000 ha. The World Bank estimates the annual cost of silting at 122 million dirhams, or the equivalent of 0.03 per cent of GDP. With the persistence of soil erosion, the silting of dams and climate change pressures, one third of agricultural lands could become unsuitable for farming by 2050.

These issues are compounded by desertification. Some 30,000 ha are invaded by the desert each year and hundreds of oases disappear, threatening biodiversity and the lives of 2 million inhabitants. Pressures on soils are further impacted upon by deforestation.

Hydric erosion is the most important form of degradation of soils and threatens almost all the territory of the country, and approximately 75 per cent of the useful agricultural area.

Wind erosion is the second most important form of pressure on soils. The provinces of the south and east of Morocco are strongly affected. Approximately 300,000 ha are threatened by sand deposits in the regions of Ouarzazate, Zagora and Errachidia, while, at the same time, wind erosion carries off approximately 500 ha/year of topsoil in these regions. In addition, wind erosion threatens 25 per cent (65 km) of irrigation channels in the Drâa Valley.

The limited access of rural populations to conventional energy is a major cause of the heavy consumption of firewood. Since the production of fuel wood is limited, this consumption comes mainly from the exploitation of forests, estimated to be between 3 million and 4 million m^3 of forestland annually. More than 31,000 ha of forests are lost each year, 4,500 ha due to land clearing, 22,000 ha due to firewood consumption and 4,500 ha due to fires.

Providing food for 17 per cent of the livestock supply, forest grazing is considered a major cause of the degradation of forest ecosystems. In addition, Morocco has 65 million ha of rangeland, which constitutes the primary source of animal feed. These lands are also subject to continuous degradation due to a combination of climatic factors (erosion and drought) and anthropogenic ones (land clearing, overgrazing and uprooting of woody plants).

There are, furthermore, serious issues with the eutrophication of surface waters and dam reservoirs. Some dam reservoirs are already experiencing water quality degradation, especially after the intake of nutrients in run-off, particularly from soils cultivated on slopes, such as for olive trees.

Sanitation, health and pollution from food chains

The uncontrolled use of phytosanitary products and the uncontrolled organization of many food chains are a major concern for sanitation and health.

According to the Poison Control Centre, pesticides are the second leading cause of poisoning in the country. The environment has not escaped the disasters caused by the misuse of these products. Several regions of Morocco are still suffering from anti-sparrow campaigns, which result in the extermination of the local wildlife. In particular, the lack of supervision in carrying out such campaigns is to be deplored. Handling of pesticides that are easily degradable, active, water-soluble and volatile requires expertise, and precautions are not always observed. In addition, no regular inventories of obsolete pesticides are performed. Old stocks are often used, or at best, are disposed of by processes that do not meet standards.

A 2007 national inventory identified 304 storage sites with 33 to 39 per cent of obsolete pesticides, especially in the regions of Meknès, Haouz and Souss-Massa-Taza.

The red meat sector is a typical example of poor food chain management in the country. Large numbers of animals are slaughtered and transported by an uncontrolled, informal sector, while discharges of slaughterhouse waste are classified as the food industry's most environmentally damaging activity. Slaughterhouses in Morocco are not yet equipped with system recovery of by-products. Blood, stomach contents, urine and excrement of animals and pieces of fat, wool and other organic matter are drained with water to sewage collectors. Solid waste from slaughterhouses is transported to landfills and left in public dumps. It is estimated that more than 50 per cent of the country's slaughterhouses do not meet the technical standards and sanitary requirements in several areas: in their siting, the availability of water and sewerage, their design, their equipment, and in the management and operation of the sites. The total amount of slaughterhouse waste produced nationally is estimated at 500 t/day.

The coastal zones are subject to the greatest pressure of pollution from slaughterhouses. The major watersheds are heavily impacted upon, especially those of the Souss, Oum Er-Rbia, Tensift, Bouregreg, Loukkous and Sebou Rivers.

According to Morocco's Consumer Protection and Orientation Association, Casablanca's slaughterhouses supply only 50 per cent of the market. The rest comes from illegal slaughtering or meat from other regions that is transported haphazardly. As a result, tuberculosis is coming back to Morocco mainly because of bovine tuberculosis.

On the other hand, the poultry sector is considered to be a good practice example in the environmental context. The sector has grown considerably in recent decades and significant investments have been made (8 billion dirhams in 2008 alone). The industry is well organized under the Inter-Professional Federation of the Poultry Sector. Starting in 2000, the Federation has worked closely with the Government on the elaboration and implementation of a modern regulatory framework and an upgrade of the whole production chain in order to meet health standards.

The process culminated in 2006 with the publication of a legal and regulatory regime stemming from Law No. 49-99 on Health Protection relating to Poultry Farms and Control of the Production and Marketing of Poultry Products, in force from April 2007. This framework allows authorities to monitor the sector and to undertake efficient inspections for the prevention of pollution and avian diseases.

Although no data are available on the environmental impact of these improvements, there has been a significant reduction in and/or the total elimination of cases of poultry disease owing to colibacillosis, salmonellosis (*Salmonella gallinarum* and *S enteritidis*) and pseudo-fowl pest (Newcastle disease).

Airborne pollutants and greenhouse gas emissions

Agricultural machinery and processes, as well as the use of manure and pesticides, contribute to airborne pollutants and GHG emissions. Air quality in rural areas is also strongly affected by the excessive use of firewood. Biomass consumption in rural areas is estimated at around 4 million toe (30 per cent of the total energy consumed in the country as compared with 3 per cent in Egypt and 12 per cent in Tunisia).

The annual amount of airborne pollutants and GHG emissions from agriculture is thus estimated at 406,045 tons. If all agricultural activities are considered, the annual amount is 2.3 million tons and that figure is supposed to increase by at least 50 per cent by 2020. In addition to the consequences on water pollution and the risks of intoxication for animals, air quality is severely affected because of the odours emanating from anaerobic fermentation, which emits atmospheric methane and ammonia.

Impact on biodiversity

The use of modern agricultural methods has increased productivity, but has also impoverished biodiversity, particularly by:

- The appearance of resistant parasites resulting from the uncontrolled use of phytosanitary products;
- Adverse effects from the application of stronger and stronger doses of fertilizers and pesticides;
- The overexploitation of pasture land, leading to the degradation of silvopastoral ecosystems and their biodiversity, especially in regions where there are strong concentrations of livestock.

There are some regions where agricultural activities have no negative impact on biodiversity: along the north coast, the Rif Mountains, the mountainous areas of the western border of the High Atlas, the high valleys of the High Atlas and the oases of the Saharan fringe. In these regions, the use of fertilizers and pesticides is not so important, due to traditional agricultural methods.

13.4 Greening the agricultural sector

Over the past five decades, the agricultural sector in Morocco has been the object of several government reform plans and programmes aimed at modernizing agriculture in order to be better prepared to face global socioeconomic, commercial and environmental challenges.

Reforms have actively begun (the adoption of laws, institutional reforms and development of strategies), but at this stage there are not enough data to be able to accurately assess the situation, especially with regard to the implementation of laws or regulations, results and constraints. The same applies to the numerous national strategies covering the sector, and there is a lack of information concerning cooperation and interactions between the different actors implementing these strategies.

Legal framework

The legal framework for environmental protection and related subsectors has been adopted, apart from a few lacunae such as waste management. Implementing regulations are still lacking, however, in a number of areas, such as the control of atmospheric pollution, the protection of coastal areas and wetlands, and the clean-up of highly polluted areas. Morocco seems to have difficulty implementing and applying legislation and needs to conduct strategic planning with more adequate administrative infrastructure and with sufficient human and financial resources.

There is no overarching agricultural law, but only some specific laws with impacts on agriculture. Some of them take environmental measures into consideration.

The Dahir No. 1-69-170 of 25 July 1969 on the protection and restoration of soil repeals those of 20 March 1951 and 4 December 1954, and supports the creation of "perimeter defence zones and restoration of soil of national interest".

The 1995 Law No. 34-94 on the Fragmentation of Agricultural Holdings within Irrigation Perimeters and on Bour (non-irrigated) Lands Targeted for Development aims to conserve a minimum surface viable to support a family. The Law establishes the prohibition of any land transaction that has the effect of generating plots of land less than a minimum threshold set at 5 ha for irrigation and in function of the agricultural potential of each zone.

The 1997 Law No. 42-95 relating to the Control and Organization of Trade in Agricultural Pesticides specifies that no pesticide product can be marketed without being approved for use by the competent authority for a period of 10 years. The product packaging must comply with safety rules and follow the rules for labelling to identify the nature of the substances. Containers must be destroyed in conditions that respect the environment. The premises used for the storage and sale of agricultural pesticides may not be be used for the storage or sale of food products or their components. The manufacture, importation, sale and distribution (even for free) of pesticide products are subject to authorization by the administration.

The legal framework governing environmental considerations for agriculture is built upon:

- The 1995 Law No. 10-95 on Water;
- The 2003 Law No. 12-03 on Environmental Impact Assessment;
- Laws and regulations related to the 2009 Dahir governing the National Office of Food Safety.

Pursuant to the provisions of Law No. 10-95 on Water and its implementing regulations, including the 1998 Decree No. 2-97-787 on water quality standards and the inventory of the degree of water pollution, water quality standards have been prepared setting out requirements for various water uses. For matters relating to agriculture, the 2002 Joint Order No. 1276-01 establishing the quality standards for water destined for irrigation defines the quality of irrigation water, and especially treated wastewater, to ensure citizens are protected against various waterborne diseases carried by these waters and for optimum agricultural production.

Law No. 10-95 on Water specifies that no agricultural project can be approved if its implementation may damage water resources or cultivated soils.

The 2003 Law No. 12-03 on Environmental Impact Assessment lists the types of projects subject to the procedure and sets out the procedure for undertaking an EIA and ensuring it is properly carried out. In the agricultural sector, projects that must undergo an EIA include:

- Rural land consolidation;
- Reforestation of a surface of more than 100 ha;
- Conversion of uncultivated land or of semi-natural lands for intensive farming purposes.

A number of agricultural industry projects are also subject to Law No. 12-03. Recent agricultural projects, carried out in 2012, include an environmental and social impact assessment, with the environmental assessment following the requirements of Law No. 12-03. These include:

- A development project for the almond industry in Azilal;
- Extension and enhancement of production in the fig industry in the Doukkala-Abda region;
- Intensification of cereals (wheat) production in the region of Rabat-Salé-Zemmour-Zaër;
- Intensification of cereal crops production centred on direct seeding in the Chaouia-Ouardigha region;
- Expansion and intensification of oil production in the region of Doukkala-Abda;
- Development of dairy cattle breeding in Ben Slimane.

There is no law on organic farming. The Ministry of Agriculture and Maritime Fisheries is currently preparing legislation to define the basic principles of organic production. Moroccan organic farming mainly concerns products of medicinal and aromatic plants and cultivated plants. At present, total organic farmland is estimated at 622,500 ha.

Action plans and programmes

Green Morocco Plan

Morocco has adopted an agricultural strategy up to 2020 called the Green Morocco Plan (Plan Maroc Vert (PMV)). Launched in 2008, it not only aims to optimize and increase the productivity of all agricultural inputs, and in particular water, but also has a specific sustainable development component with the goal of ensuring that all natural resources are protected in the course of modernization of the country's agriculture.

The PMV has adopted a pragmatic approach to mobilize all stakeholders in agricultural development based on two pillars. Pillar I concerns the development of modern, efficient and high-value-added agriculture in line with marketplace rules and based on private investments (financing 700 to 900 projects using an export-oriented productivity model). Pillar II concerns support for smallholder agriculture of a social nature in areas with fragile ecosystems (oases, mountainous areas, etc.) by improving the incomes of the most vulnerable farmers (300 to 400 social projects under a regional plan aimed at converting vulnerable farms to viable activities backed by training and supervision). All the regional agricultural plans that are already developed are based on the PMV objectives.

The environmental components of the PMV cover, in particular:

- Conversion of nearly 1 million ha from cereal crops to fruit tree plantations, which will help protect agricultural land;
- Mainstreaming climate change issues through a number of local projects funded by international donors;
- Supporting the use of renewable energy in the agricultural sector (solar, wind and biogas);
- Water conservation.

In 2012, the Government completed the strategic environmental and social assessment of the PMV. The assessment report contains no specific recommendations, but revealed the non-rational and dangerous uses of phytosanitary products and fertilizers, overgrazing and poor management of animal waste. It stressed that the PMV would lead to:

- A significant increase in cereals production, while at the same time effecting a 30 per cent reduction in cultivated areas and thus removing environmental pressures on water and soils;
- A number of local initiatives aimed at developing environmentally friendly activities built upon the production of cactus, capers, honey and sunflowers.

All programmes, plans and projects under the PMV umbrella must undergo an environmental and social assessment and have a management plan that includes indicators for monitoring and assessment, training and a participatory approach, and have a sufficient budget allocated to implement the management plan.

Saving water in agricultural use, especially in irrigation systems, will contribute to the successful integration of adaptation to climate change in the implementation of the PMV.

Specific programmes and actions

The National Programme for Saving Irrigation Water seeks to convert conventional irrigation to localized irrigation, as well as to improve the irrigation water service and promote conservation techniques and farming systems that ensure the better use of water on an overall surface area of 555,000 ha. The

Programme is supposed to raise water-crop productivity and save 1.4 billion m^3 of water each year. From the start of the Programme in 2008 until the end of 2011, 288,000 ha were equipped with drip irrigation systems.

The Irrigation Extension Programme for the period 2009–2018 seeks the installation of hydro-agricultural infrastructure on an area of 155,500 ha over 10 years, for an estimated cost of 19.5 billion dirhams. It is also planned to implement an ambitious programme to desalinate seawater with a capacity of 165,000 m^3 in order to irrigate 14,000 ha in Souss-Massa.

Within the PMV, various action plans have been developed: on strengthening reforestation, recovery of methane and dried manure (dung) as fuel alternatives for 10 per cent of livestock within five years' time, the environmental certification of farms, improving the energy performance of agricultural equipment and processing residues from olive pressings.

The Government has also implemented a number of actions and measures to support farmers in the optimization of fertilization and the choice of fertilizers. These actions consist mainly in subsidies for soil analyses and access to certified laboratories. The Government certifies laboratories authorized to perform analyses of soil, water and plants according to technical standards. And in order to encourage farmers to do soil testing, the State pays 50 per cent of the cost of laboratory analyses, which are carried out by certified laboratories.

Economic and fiscal instruments

The Fund for Agricultural Development provides farmers with subsidies intended to encourage water conservation and soil protection:

- 4,000 dirhams per KW installed for the supply and installation of pumping equipment for water, including accessories for the pumping, engineering and construction of shelters for pumping stations;
- 35 dirhams per m3 for pond construction of water storage for irrigation, including coating;
- 9,600 to 13,600 dirhams/ha equipped by drip irrigation (50 to 90 per cent of the total cost);
- 50 per cent of the investment needed for rainwater harvesting;
- 50 per cent of the cost of laboratory tests for soils and seeds;
- 100 per cent of the acquisition cost of palm trees for densification and rehabilitation of certified palm groves.

Over the period 2008–2010, a total of 5.3 billion dirhams was disbursed by the Fund. The total amount devoted to water conservation will be 37 billion dirhams for the period 2008–2018. In addition to these subsidies, it is important to note that:

- Agricultural activities are exempt from taxes in Morocco. There are tax exemptions for agricultural income and inputs, and minimal importation taxes for agricultural equipment, as well as exemptions from VAT for certain equipment. These exemptions do not stimulate the rational utilization of resources, particularly as far as pressures on water and soils are concerned;
- Soft wheat flour and sugar consumption are heavily subsidized in Morocco, with no targeting schemes for the poor, which has resulted in a shift in the diets of Moroccans with the heavy consumption of two products that are large users of water resources.

Extension services

Awareness-raising campaigns to improve agricultural productivity, water conservation and the rationalization of the use of fertilizers by farmers are held annually nationwide. A particular emphasis is put on the benefits of soil analysis, which allows the level of soil fertility to be determined along with the soil's physical, chemical and biological characteristics. In 2011, 100 new agricultural advisers were hired – 61 technicians, 21 engineers and 18 lawyers – as well as communications experts.

Despite these efforts, extension services cover only 5 per cent of farmers. The Ministry of Agriculture and Maritime Fisheries is trying to outsource extension services by designing the appropriate legal framework for the creation of private agricultural advisory services.

Institutional arrangements

There is no structure dedicated to environmental management in the Department of Agriculture of the Ministry of Agriculture and Maritime Fisheries. The Department of Environment of the Ministry of Energy, Mines, Water and Environment has no clear lines of contact with the Ministry of Agriculture and Maritime Fisheries, which complicates coordination efforts at the governmental level.

The launch of the PMV resulted in the restructuring of the Ministry of Agriculture and Maritime Fisheries in 2009 in order to better distribute its mandates and capacity-building efforts in terms of control and monitoring. In addition, three new structures were created to accompany the PMV:

- The Agency for Agricultural Development;
- The National Office of Food Safety (ONSSA);
- The National Agency for the Development of Oasis Zones and Argan Plantations.

The 2009 Decree No. 2-08-563 promulgated Law No. 42-08 establishing the Agency for Agricultural Development, with the aim of implementing the PMV. The Agency is responsible for proposing action plans to governmental authorities in two different areas in order to achieve this goal: (a) in support of high-value-added agricultural sectors to improve productivity; and (b) in support of solidarity-based agriculture through the promotion and implementation of economically viable projects, with a view to improving farmers' incomes with reference to the strategic priorities established in the PMV.

The Agency for Agricultural Development has also developed an implementation manual for a project on mainstreaming climate change concerns in PMV implementation. The development objective of the project is to strengthen the capacity of public and private institutions and farmers to integrate adaptation to climate change in projects targeting small farmers in five target regions. The manual will help farmers to seek funding in this context.

The 2009 Dahir No. 1-09-20 promulgated Law No. 25-08 establishing ONSSA. Its objectives are related to the protection of consumer health and the preservation of the health of animals and plants. It is organized around a central office (with sectoral offices) and territorial offices (sectoral territorial offices, laboratories and territorial services). It approves and monitors agricultural inputs (seeds, pesticides, fertilizers) and veterinary drugs, and applies the laws and regulations relating to sanitary, veterinary and phytosanitary policies. ONSSA has mobile brigades for inspections, controls and implementation of the various regulations. However, there is a notable lack of know-how and of human and financial resources in ONSSA.

More importantly perhaps, the laws and regulations related to the prerogatives of ONSSA, set up in 2009, do not explicitly eliminate administrative rules prevailing in the country since the beginning of the twentieth century. This results in conflicts between the mandates of ONSSA and other important administrations such as the Customs and Excise Administration, Ministry of the Interior and Ministry of Health, as well as with local elected bodies in cities and rural villages. Many farmers and agriculture-related professions (farmers using phytosanitary products, importers and sellers of phytosanitary products, slaughterhouses, transporters of meats) hide behind administrative authorizations given by these entities in order to escape the regulations that are supposed to be imposed by ONSSA.

The main mission of the National Agency for the Development of Oasis Zones and Argan Plantations is to promote the management and sustainable development of oasis ecosystems and the argan tree.

There are no departments specifically dedicated to environmental issues in the three above-mentioned agencies.

The regional offices of agricultural development are public institutions with legal personality and financial autonomy and placed under the Ministry of Agriculture and Maritime Fisheries. They are responsible for promoting and developing agriculture in their areas of expertise, installing and maintaining hydro-agricultural facilities and equipment, managing water resources for agricultural purposes, the training of farmers, assisting credit agencies and protecting the environment from agricultural impacts.

The National Observatory for Drought in the Ministry of Agriculture and Maritime Fisheries is mandated to collect reliable information that shows the effects of drought. Its work helps to support decision-makers in elaborating plans to combat drought.

Other agricultural institutions dealing with environmental issues include:

- The National Institute of Agronomic Research;
- The Veterinary and Agronomic Institute;
- The Official Laboratory for Analyses and Chemical Research;
- The Hassan II Agronomic and Veterinary Institute.

There is not enough information on or examples of coordination between these agencies.

13.5 Conclusions and recommendations

Over the past several years, Morocco has been engaged in a vast range of ambitious structural reforms in the agricultural sector.

The launch of the PMV in 2008 not only aims to optimize and increase the productivity of all agricultural inputs, and in particular water, but also has a specific sustainable development component aiming to ensure that all natural resources are protected in the course of modernization of the country's agriculture. The PMV implements agricultural reforms taking environmental considerations into account. A number of measures have already been taken under the auspices of the Plan, such as the adoption of relevant legal provisions and the initiation of EIAs.

The Agency for Agricultural Development is carrying out a 10-year water conservation programme, mainly built upon the implementation of drip irrigation techniques on an area of 550,000 ha, at a rate of 55,000 ha/year, with the objective to save 1.4 billion m^3 of water. The Agency is halfway into its 10-year programme.

Recommendation 13.1:
The Ministry of Agriculture and Maritime Fisheries, in cooperation with the relevant authorities, should perform an interim assessment of the plans and projects under the umbrella of the Green Morocco Plan and present the conclusions to the Government, focusing on the environmental benefits of increasing the consolidation and overall security of land tenure of agricultural producers and support for the use of sustainable agricultural techniques assisted by intensified extension services.

Agricultural soils are under tremendous pressures resulting from desertification, the intensification of agriculture, the negative impacts of the multiplication of dams all over the country and the inadequate control of phytosanitary products. While there is a clear strategy to combat desertification, none exists for the protection of agricultural lands that are not affected by desertification.

Recommendation 13.2:
The Ministry of Agriculture and Maritime Fisheries should define and implement a national agricultural soil protection strategy focusing on environmentally friendly farming methods protecting soil, saving water, promoting adaption to climate change and capable of co-producing food, fodder and energy biomass.

The creation of the National Office of Food Safety (ONSSA) is a notable achievement in the country's institutional framework. However, the safety of whole food chains (the safety of the red meat food chain, in particular, is a time bomb) and the uncontrolled use of phytosanitary products remain of concern. Responsibilities in these areas are spread among different public authorities. As a result, this agency ensures only partial control of the safety of food chains and lacks authority in many important areas of food chains and in the use of phytosanitary products. In addition, the financial and human resources of ONSSA, as well as its knowledge base, are not in line with its strategic role in securing the country's food-related health, safety and environmental protection.

Recommendation 13.3:
The Government should:

(a) Give the status of autonomous agency to the National Office of Food Safety;
(b) Place this agency under the authority of the Chief of the Government, since its mandate covers subject matters currently falling under many important ministries;
(c) Secure and sustain the Office's human and financial resources.

ANNEXES

Annex I: Participation of Morocco in multilateral environmental agreements

Annex II: Key data and indicators available for the review

Annex III: List of major environment-related legislation

Annex I

PARTICIPATION OF MOROCCO IN MULTILATERAL ENVIRONMENTAL AGREEMENTS

Worldwide agreements		Morocco	
Year		**Year**	**Status**
1921	(BARCELONA) Convention and Statute on the Regime of Navigable Waterways of International Concern	**1972**	**Ac**
1921	(GENEVA) Convention Concerning the Use of White Lead in Painting	**1956**	**Ra**
1924	(PARIS) International Agreement for the Creation of an Office International des Epizooties in Paris	**1956**	**Ad**
1925	(GENEVA) Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous, or Other Gasses, and of Bacteriological Methods of Warfare	**1970**	**Ad**
1946	(WASHINGTON) International Convention for the Regulation of Whaling	**2001**	**Ad**
1948	(GENEVA) Convention on the International Maritime Organization	**1962**	**At**
	1979 (LONDON) Amendments to Articles 17, 18, 20 and 51 of the Convention on the International Maritime Organization	**1980**	**At**
	1991 (LONDON) Amendments to the Convention (institutionalization of the Facilitation Committee); Resolution A.724 (17)	**1995**	**At**
	1993 (LONDON) Amendments to the Convention; Resolution A.735	**1995**	**At**
1951	(ROME) International Convention on Plant Protection	**1972**	**Ad**
	1979 (ROME) Amendments to the International Plant Protection Convention	**1980**	**Ac**
1952	(BRUSSELS) International Convention for the Unification of Certain Rules relating to Civil Jurisdiction in Matters of Collision	**1990**	**Ad**
1954	(LONDON) International Convention for the Prevention of Pollution of the Sea by Oil	**1968**	**Ad**
1956	(NEW YORK) Statute of the International Atomic Energy Agency	**1957**	**Ra**
1961	(BRUSSELS) International Convention for the Unification of Certain Rules relating to Carriage of Passengers by Sea	**1963**	**Ra**
1961	(GENEVA) International Convention for the Protection of New Varieties of Plants	**2006**	**Ad**
1963	(VIENNA) Convention on Civil Liability for Nuclear Damage	**1984**	**Si**
	1988 (VIENNA) Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention	**1988**	**Si**
	1997 (VIENNA) Amendment	**1999**	**Ra**
1963	(MOSCOW) Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water	**1966**	**Ra**
1966	(RIO DE JANEIRO) International Convention for the Conservation of Atlantic Tunas	**1969**	**Ad**
1967	(NEW YORK) Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies	**1967**	**Ac**
1968	(LONDON) Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space	**1970**	**Ra**
1968	(LONDON) Treaty on the Non-Proliferation of Nuclear Weapons	**1970**	**Ra**
1969	(BRUSSELS) International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties	**1974**	**Ac**
	1973 (LONDON) Protocol relating to Intervention on the High Seas in Cases of Pollution by Substances other than Oil	**2001**	**Ac**
1969	(BRUSSELS) International Convention on Civil Liability for Oil Pollution Damage	**2001**	**De**
	1992 (LONDON) Protocol to amend the International Convention on Civil Liability for Oil Pollution Damage	**2000**	**Ra**
1971	(RAMSAR) Convention on Wetlands of International Importance Especially as Waterfowl Habitat	**1980**	**Ra**
	1982 (PARIS) Amendment	**1985**	**Ad**
1971	(GENEVA) Convention Concerning Protection Against Hazards of Poisoning Arising from Benzene	**1974**	**Ra**
1971	(LONDON, MOSCOW, WASHINGTON) Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Seabed and Ocean Floor and in the Subsoil Thereof	**1971**	**Ra**

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Worldwide agreements		Morocco	
Year		**Year**	**Status**
1972	(LONDON) Convention on International Liability for Damage Caused by Space Objects	**1983**	**Ra**
1972	(LONDON, MOSCOW, WASHINGTON) Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction	**2002**	**Ad**
1972	(LONDON) Convention on the International Regulations for Preventing Collisions at Sea	**1977**	**Ad**
1972	(PARIS) Convention concerning the Protection of the World Cultural and Natural Heritage	**1975**	**Ra**
1972	(GENEVA) International Convention for Safe Containers	**1990**	**Ac**
1972	(LONDON) Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter	**1977**	**Ra**
	1996 (LONDON) Protocol	**1996**	**Si**
1973	(WASHINGTON) Convention on International Trade in Endangered Species of Wild Fauna and Flora	**1975**	**Ra**
	1979 (BONN) Amendment	**1987**	**At**
	1983 (GABORONE) Amendment	**1990**	**At**
1973	(LONDON) International Convention for the Prevention of Pollution from Ships (MARPOL, 73/78)	**1993**	**Ad**
	1978 (LONDON) Annex I on Prevention of Pollution by Oil	**1994**	**Ra**
	1978 (LONDON) Annex II on Control of Pollution by Noxious Liquid Substances in Bulk	**1994**	**Ra**
	1978 (LONDON) Annex III on Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form	**1994**	**Ra**
	1978 (LONDON) Annex IV on Prevention of Pollution by Sewage from Ships	**2003**	**Ra**
	1978 (LONDON) Annex V on Prevention of Pollution by Garbage from Ships	**1994**	**Ra**
	1978 (LONDON) Protocol Relating to the International Convention for the Prevention of Pollution from Ships	**1994**	**Ad**
1974	(LONDON) International Convention for the Safety of Life at Sea	**1990**	**Ac**
	1978 (LONDON) Protocol	**2001**	**Ad**
1976	(GENEVA) Convention concerning Minimum Standards in Merchant Ships	**1981**	**Ra**
1976	(GENEVA) Convention on the Prohibition of Military or any Hostile Use of Environmental Modification Techniques	**1977**	**Si**
1978	(HAMBURG) Convention on the Carriage of Goods by Sea	**1981**	**Ac**
1978	(LONDON) International Convention on Standards of Training, Certification and Watchkeeping for Seafarers	**1997**	**Ac**
1979	(BONN) Convention on the Conservation of Migratory Species of Wild Animals	**1993**	**Ra**
	1995 (THE HAGUE) African/Eurasian Migratory Waterbird Agreement (AEWA)	**2012**	**Ra**
	1996 (MONACO) Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS)	**1999**	**Ra**
1979	(BERN) Convention on the Conservation of European Wildlife and Natural Habitats	**2001**	**Ac**
1979	(VIENNA) Convention on the Physical Protection of Nuclear Material	**2002**	**Ra**
1979	(LONDON) International Convention on Maritime Search and Rescue	**1999**	**Ac**
1981	(NEW YORK) Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons which may be deemed to be Excessively Injurious or to have Indiscriminate Effects		
1982	(MONTEGO BAY) Convention on the Law of the Sea	**2007**	**Ra**
	1994 (NEW YORK) Agreement relating to the implementation of Part XI	**2007**	**Ra**
	1995 (NEW YORK) Agreement for the implementation of the provisions relating to the conservation and management of straddling fish stocks and highly migratory fish stocks	**2012**	**Ra**
1985	(VIENNA) Convention for the Protection of the Ozone Layer	**1995**	**Ra**
	1987 (MONTREAL) Protocol on Substances that Deplete the Ozone Layer	**1995**	**Ra**
	1990 (LONDON) Amendment to Protocol	**1995**	**Ac**
	1992 (COPENHAGEN) Amendment to Protocol	**1995**	**Ac**
1986	(VIENNA) Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	**1993**	**Ra**
1986	(VIENNA) Convention on Early Notification of a Nuclear Accident	**1993**	**Ra**
1989	(BASEL) Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	**1995**	**Ac**
1990	(LONDON) International Convention on Oil Pollution Preparedness, Response and Co-operation	**2003**	**Ra**
1992	(NEW YORK) Framework Convention on Climate Change	**1995**	**Ra**
	1997 (KYOTO) Protocol	**2002**	**Ac**

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Worldwide agreements		Morocco	
Year		**Year**	**Status**
1992	(RIO) Convention on Biological Diversity	**1995**	**Ra**
	2000 (CARTAGENA) Protocol on Biosafety	**2011**	**Ra**
	2010 (NAGOYA) Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity	**2011**	**Si**
1993	(PARIS) Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction	**1995**	**Ra**
1993	(ROME) Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas	**2001**	**Ra**
1994	(PARIS) Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa	**1996**	**Ra**
1995	(LONDON) International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea	**2003**	**Ac**
1997	(VIENNA) Convention on Supplementary Compensation for Nuclear Damage	**1999**	**Ra**
1997	(VIENNA) Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	**1999**	**Ra**
1998	(ROTTERDAM) Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	**2011**	**Ac**
2001	(STOCKHOLM) Convention on Persistent Organic Pollutants	**2004**	**Ra**
2001	(ROME) International Treaty on Plant Genetic Resources for Food and Agriculture	**2006**	**Ra**
2001	(LONDON) International Convention on Civil Liability for Bunker Oil Pollution Damage	**2010**	**Ra**
2001	(PARIS) Convention on the Protection of the Underwater Cultural Heritage	**2011**	**Ra**
2001	(LONDON) International Convention on the Control of Harmful Anti-fouling Systems on Ships	**2010**	**Ra**
2003	(PARIS) Convention for the Safeguarding of Intangible Cultural Heritage	**2006**	**Ra**

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	Regional and subregional agreements	Morocco	
		Date	Status
1949	(ROME) Agreement for the Establishment of the General Fisheries Commission for the Mediterranean	**1956**	**Ra**
1951	(ROME) Convention for the establishment of the European and Mediterranean Plant Protection Organization	**1972**	**Ac**
1967	(KINSHASA) Phytosanitary Convention for Africa	**1976**	**Ra**
1968	(ALGIERS) African Convention on the Conservation of Nature and Natural Resources	**1977**	**Ra**
1968	(CAIRO) Convention on Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD)	**1977**	**Ra**
1970	(ROME) Agreement for the Establishment of a Commission for Controlling the Desert Locust in Northwest Africa	**1971**	**Ac**
1976	(BARCELONA) Convention for the Protection of the Mediterranean Sea against Pollution	**1980**	**Ra**
	1995 (BARCELONA) Amendment	**2004**	**At**
	1976 (BARCELONA) Protocol Concerning Co-operation in Combating Pollution of the Mediterranean Sea by Oil and Other Harmful Substances in Cases of Emergency	**1980**	**Ra**
	1976 (BARCELONA) Protocol for the Prevention of Pollution in the Mediterranean Sea by Dumping from Ships and Aircraft	**1980**	**Ra**
	1995 (BARCELONA) Amendment to 1976 Protocol for the Prevention and Elimination of Pollution in the Mediterranean Sea by Dumping from Ships and Aircraft or Incineration at Sea	**1997**	**At**
	1980 (ATHENS) Protocol on the Protection of the Mediterranean Sea against Pollution from Land-Based Sources (LBS Protocol)	**1987**	**Ra**
	1996 (SYRACUSE) Amendment to 1980 Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities	**1996**	**At**
	1982 (GENEVA) Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean	**1990**	**Ra**
	1994 (MADRID) Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil (Offshore Protocol)	**1999**	**Ra**
	1995 (BARCELONA) Specially Protected Areas and Biodiversity Protocol (replacing the 1982 (GENEVA) Specially Protected Areas Protocol)	**2009**	**Ra**
	1996 (IZMIR) Protocol on the Prevention of Pollution of the Mediterranean Sea by Transboundary Movements of Hazardous Wastes and their Disposal	**1999**	**Ra**
	2002 (VALETTA) Protocol Concerning Cooperation in Preventing Pollution from Ships and, in Cases of Emergency, Combating Pollution of the Mediterranean Sea (Prevention and Emergency Protocol)	**2011**	**Ra**
	2008 (MADRID) Integrated Coastal Zone Management Protocol	**2012**	**Ra**
1977	(CAIRO) Protocol on cooperation between the North African Countries in the fight against desertification	**1993**	**Ra**
1987	(ADDIS-ABEBA) Statute of African Centre of Meteorological Applications for Development	**1993**	**Ra**
1991	(DAKAR) Regional Convention on Fisheries Cooperation among African States Bordering the Atlantic Ocean	**1999**	**Ra**
1990	(LISBON) Cooperation Agreement for the Protection of the Coasts and Waters of the North-East Atlantic against Pollution	**2008**	**Ra**
	2008 (LISBON) Additional Protocol to the Lisbon Agreement	**2012**	**Ra**
1992	(NOUAKCHOTT) Maghreb Charter for Environment Protection and Sustainable Development	**1992**	**Si**
1993	(RABAT) Convention establishing the Organization for Plant Protection in the Middle East	**1994**	**Ra**
1998	(CASABLANCA) African Regional Centre for Space Science and Technology — in French Language	**2000**	**Ra**

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Annex II

KEY DATA AND INDICATORS AVAILABLE FOR THE REVIEW

Air pollution	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Emissions of SO_2										
- Total (1,000 t)	..	..	..	..	..	..	..	..	..	..
- by sector (1,000 t)	..	..	..	..	..	..	..	..	..	..
Energy	..	..	..	..	..	..	..	..	..	..
Industry	..	..	..	..	..	..	..	..	..	..
Transport	..	..	..	..	..	..	..	..	..	..
Other	..	..	..	..	..	..	..	..	..	..
- per capita (kg/capita)	..	..	..	..	..	..	..	..	..	..
- per unit of GDP (kg/1,000 US$ (2005) PPP)	..	..	..	..	..	..	..	..	..	..
Emissions of NO_X (converted to NO_2)										
- Total (1,000 t)	..	..	..	..	..	..	..	..	..	..
- by sector (1,000 t)	..	..	..	..	..	..	..	..	..	..
Energy	..	..	..	..	..	..	..	..	..	..
Industry	..	..	..	..	..	..	..	..	..	..
Transport	..	..	..	..	..	..	..	..	..	..
Other	..	..	..	..	..	..	..	..	..	..
- per capita (kg/capita)	..	..	..	..	..	..	..	..	..	..
- per unit of GDP (kg/1,000 US$ (2005) PPP)	..	..	..	..	..	..	..	..	..	..
Emissions of ammonia ($NH_{3)}$										
- Total (1,000 t)	..	..	..	..	..	..	..	..	..	..
- by sector (1,000 t)	..	..	..	..	..	..	..	..	..	..
Energy	..	..	..	..	..	..	..	..	..	..
Industry	..	..	..	..	..	..	..	..	..	..
Transport	..	..	..	..	..	..	..	..	..	..
Other	..	..	..	..	..	..	..	..	..	..
- per capita (kg/capita)	..	..	..	..	..	..	..	..	..	..
- per unit of GDP (kg/1,000 US$ (2005) PPP)	..	..	..	..	..	..	..	..	..	..

Air pollution	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Emissions of total suspended particles (TSP)										
- Total (1,000 t)	..	..	..	..	..	..	..	..	..	..
- by sector (1,000 t)	..	..	..	..	..	..	..	..	..	..
Energy	..	..	..	..	..	..	..	..	..	..
Industry	..	..	..	..	..	..	..	..	..	..
Transport	..	..	..	..	..	..	..	..	..	..
Other	..	..	..	..	..	..	..	..	..	..
- per capita (kg/capita)	..	..	..	..	..	..	..	..	..	..
- per unit of GDP (kg/1,000 US$ (2005) PPP)	..	..	..	..	..	..	..	..	..	..
Emissions of non-methane volatile organic compounds (NMVOC)										
- Total (1,000 t)	..	..	..	..	..	..	..	..	..	..
- by sector (1,000 t)	..	..	..	..	..	..	..	..	..	..
Energy	..	..	..	..	..	..	..	..	..	..
Industry	..	..	..	..	..	..	..	..	..	..
Transport	..	..	..	..	..	..	..	..	..	..
Other	..	..	..	..	..	..	..	..	..	..
- per capita (kg/capita)	..	..	..	..	..	..	..	..	..	..
- per unit of GDP (kg/1,000 US$ (2005) PPP)	..		..	..	..	..	..	..	..	..
Emissions of persistent organic pollutants (PCBs, dioxin/furan and PAH)	..	..	..	..	..	..	..	..	..	..
- Total (1,000 t)	..	..	..	..	..	..	..	..	..	..
- by sector (1,000 t)	..	..	..	..	..	..	..	..	..	..
Energy	..	..	..	..	..	..	..	..	..	..
Industry	..	..	..	..	..	..	..	..	..	..
Transport	..	..	..	..	..	..	..	..	..	..
Other	..	..	..	..	..	..	..	..	..	..
- per capita (kg/capita)	..	..	..	..	..	..	..	..	..	..
- per unit of GDP (kg/1,000 US$ (2005) PPP)	..		..	..	..	..	..	..	..	..
Emissions of heavy metals	..	..	..	..	..	..	..	..	..	..
- Total cadmium (t)	..	..	..	..	..	..	..	..	..	..
- Total lead (t)	..	..	..	..	..	..	..	..	..	..
- Total mercury (t)	..	..	..	..	..	..	..	..	..	..
Emissions of CO	..	..	..	..	..	..	..	..	..	..
- Total (t)	..	..	..	..	..	..	..	..	..	..

Climate Change	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Greenhouse gas emissions (total of CO2, CH4, N2O, CFC, etc.) expressed in CO2 eq.										
- Total aggregated emissions (1,000 t) without LULUCF	37,561	43,311	45,760	46,985	49,372	51,254	48,815	..	..	..
- Total aggregated emissions (1,000 t) with LULUCF	..	..	..	..	..	..	..	..	..	..
- by sector (1,000 t)	..	..	..	..	..	..	..	..	..	..
Energy	..	..	..	..	..	..	..	..	..	..
Energy industries	14,300	15,970	16,850	16,990	16,700	16,820	15,300	16,780	..	..
Manuafacturing industries and construction	4,080	5,350	7,130	6,840	7,470	7,380	7,200	7,600	..	..
Transport	8,360	8,640	9,000	9,270	9,840	10,810	11,440	10,570	..	..
Other sectors	..	..	..	..	..	..	..	..	..	..
Other	..	..	..	..	..	..	..	..	..	..
Fugitive emissions	..	..	..	..	..	..	..	..	..	..
Industry	..	..	..	..	..	..	..	..	..	..
Solvent and other product use	..	..	..	..	..	..	..	..	..	..
Agriculture	..	..	..	..	..	..	..	..	..	..
Land use, land use change and forestry (LULUCF)	..	..	..	..	..	..	..	..	..	..
Waste										
Other	..	..	..	..	..	..	..	..	..	..
- per capita (t CO2 eq/capita)	1.262	1.440	1.506	1.530	1.592	1.636	1.543	..	..	..
- per unit of GDP (t CO2 eq/1,000 US$ (2005) PPP)	0.375	0.412	0.423	0.403	0.412	0.405	0.369	..	..	..
Total emissions (1,000 t) of										
Cardon dioxide (CO_2)	..	..	..	..	..	..	..	..	..	..
Nitrous Oxide (N_2O)	..	..	..	..	..	..	..	..	..	..
Methane (CH_4)	..	..	..	..	..	..	..	..	..	..
Perfluorocarbons (PFCs)	..	..	..	..	..	..	..	..	..	..
Hydrofluorocarbons (HFCs)	..	..	..	..	..	..	..	..	..	..
Sulfur hexafluoride (SF_6)	..	..	..	..	..	..	..	..	..	..

Ozone layer	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Consumption of ozone-depleting substances (ODS) (t of ODP)	1,178	1,061	595	474	321	213	176	132	..	..

Water	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Renewable freshwater resources (million m^3/year)					22,000	22,000	22,000	22,000	22,000	..
Gross freshwater abstracted (million m^3/year)					13,500	13,500	13,500	13,500	13,500	..
- Share of water losses in total water abstraction (%)	..	..	..	..	..	..	..	..	..	..
Water exploitation index (water abstraction/renewable freshwater resources x 100)	..	..	..	..	61.4	61.4	61.4	61.4	61.4	..
Total water use by sectors (million m^3)	..	..	..	..	..	..	..	..	..	..
- Agriculture (ISIC 01-33)	..	..	..	..	..	..	..	12,160	12,160	..
- Households	..	..	..	..	..	..	..	1,300	1,300	..
- Industry (ISIC 10-33)	..	..	..	..	..	..	..	130	130	..
of which water used for cooling	..	..	..	..	..	..	..	..	..	..
- Services (ISIC 45-96)	..	..	..	..	..	..	..	..	..	..
Household water use per capita (l/capita/day)	..	..	..	..	..	..	..	730.0	730.0	..

Ecosystems and biodiversity	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Protected areas										
- Total area (km^2)	1,818	4,686	4,686	6,536	6,536	7,471	7,471	7,471	7,471	..
- Protected areas by IUCN categories (% of national territory)	..	..	..	..	..	..		..	..	..
Ia Strict Nature Reserve	77	77	77	77	77	77	77	77	77	..
Ib Wilderness Area (zakasniks)	..	..	..	..	..	..		..	..	..
II National Park	1,741	4,609	4,609	6,459	6,459	7,394	7,394	7,394	7,394	..
III Natural Monument	..	..	..	..	..	..	..	..	..	..
IV Habitat / Species Management Area	..	..	..	..	..	..	..	..	..	..
V Protected Landscape / Seascape	..	..	..	..	..	..	..	..	..	..
VI Managed Resource Protected Area	..	..	..	..	..	..	..	..	..	..
Ecosystems and biodiversity	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Forests and other wooded land	..	..	..	..	..	..	..	..	..	..
- Total area (km^2)	..	..	50,810	..	..	..	..	51,310.0	..	..
- Total area (% of total land area)	..	..	11.4	..	..	..	..	11.5	..	..
- Undisturbed by humans (1,000 ha)	..	..	..	..	..	..	..	..	..	..
- Semi-natural (1,000 ha)	..	..	..	..	..	..	..	..	..	..
- Plantation (1,000 ha)	..	..	..	..	..	..	..	..	..	..
- Area of regeneration (1,000 ha)	..	..	..	..	..	..	..	..	..	..
Share of threateaned species (IUCN categories) in total number of species:	..	..	..	..	..	..	..	..	..	..
- mammals (%)	..	..	..	..	..	..	..	18	13	..
- birds (%)	..	..	..	..	..	..	..	10	10	..
- fish (%)	..	..	..	..	..	..	..	45	17	..
- reptiles (%)	..	..	..	..	..	..	..	..	14	..
- vascular plants (%)	..	..	..	..	..	..	..	31	28	..

Land resources and soil	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Land area (km^2)	446,300	446,300	446,300	446,300	446,300	446,300	446,300	446,300	..	..
Built-up and other related area (% of total land area)	..	..	..	..	..	..	..	..	..	..
Soil erosion	..	..	..	..	..	..	..	..	..	..
- % of total land	..	..	..	..	..	..	..	..	..	..
- % of agricultural land	..	..	..	..	..	..	..	..	..	..
Total consumption of mineral fertilizers per unit of agricultural land (kg/ha)	..	..	..	..	..	..	..	..	..	..
Total consumption of organic fertilizers per unit of agricultural land (kg/ha)	..	..	..	..	..	..	..	..	..	..
Total consumption of pesticides per unit of agricultural land (kg/ha)	..	..	..	..	..	..	..	..	..	..

Energy	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total final energy consumption (TFC) (Mtoe)	..	..	..	..	..	..	..	..	..	..
- by fuel	..	..	..	..	..	..	..	..	..	..
Coal	3.27	3.62	3.72	3.88	3.38	3.72	3.48	3.50	..	..
Petroleum	6.68	6.98	7.59	7.71	9.10	9.07	9.11	9.92	..	..
Gas	0.04	0.05	0.38	0.48	0.59	0.53	0.59	0.63	..	..
Nuclear	..	..	..	..	..	..	..	..	..	..
Renewables	..	..	..	..	..	..	..	..	..	..
Electricity (hydro, wind and imports)	0.80	0.87	0.63	0.99	2.07	1.54	2.07	2.14		
- by sector	..	..	..	..	..	..	..	..	..	..
Industry	..	..	..	..	..	..	..	..	..	..
Transport	..	..	..	..	..	..	..	..	..	..
Agriculture	..	..	..	..	..	..	..	..	..	..
Services	..	..	..	..	..	..	..	..	..	..
Households	..	..	..	..	..	..	..	..	..	..
Electricity consumption (million kWh)	15,214.0	16,289.0	17,628.0	19,260.0	20,540.0	24,003.9	25,016.3	26,530.6	..	..
Energy intensity TPES/GDP (PPP) (toe/1,000 US$ (2005) PPP)	0.11	0.12	0.12	0.11	0.12	0.12	0.11	..	..	..

Transportation	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Passenger transport demand (million passenger km)	..	..	..	..	..	..	..	..	..	..
by mode:	..	..	..	..	..	..	..	..	..	..
private cars	..	..	..	..	..	..	..	..	..	..
road public transport	..	..	..	..	..	..	..	..	..	..
train	2,374.0	2,645.0	2,987.0	3,333.0	3,659.0	3,836.0	4,190.0	4,398.0		
water transport	..	..	..	..	..	..	..	..	..	..
air transport	..	..	..	..	..	..	..	..	..	..

Transportation	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Freight transport demand (million ton km)	..	..	..	..	..	..	..	..	..	..
by mode:	..	..	..	..	..	..	..	..	..	..
road	1,211.0	1,251.0	1,256.0	1,212.0	697.0	794.0	800.0	..	..	..
rail	5,147.0	5,564.0	5,919.0	5,827.0	5,837.0	4,959.0	4,111.0	5,572.0	..	..
pipelines	..	..	..	..	..	..	..	..	..	..
inland waterways	..	..	..	..	..	..	..	..	..	..
air transport	52.6	61.9	60.8	50.6	44.8	55.5	62.8	11.3		
Number of passenger cars	..	..	..	..	..	..	..	..	..	..
Average age of passenger cars	..	..	..	..	..	..	..	..	..	..

Waste	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total waste generation (1,000 t)	..	..	..	..	..	1,574.9	..	6,446.0	..	..
of which:	..	..	..	..	..	..	..	..	..	..
- Hazardous waste (1,000 t)	..	..	..	..	..	256.0	..	..	..	..
- Non-hazardous industrial waste (1,000 t)	..	..	..	..	..	1,318.9	..	1,446.0	..	..
- Municipal waste (1,000 t)	..	..	..	..	..	..	..	5,000.0	..	..
of which from households (1,000 m^3)	..	..	..	..	..	..	..	..	..	..

Demography and Health	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total population (million inhabitants)	29.5	29.8	30.2	30.5	30.9	31.2	31.5	31.9	32.3	32.6
Birth rate (per 1,000)	21.5	20.2	20.0	19.8	19.5	19.2	18.9	18.6	18.3	17.9
Total fertility rate	2.6	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.6	..
Mortality rate (per 1,000)	..	5.8	5.8	5.8	5.8	5.7	5.7	5.6	5.6	5.5
Infant mortality rate (deaths/1,000 live births)	40.0	40.0	37.6	36.0	34.4	33.0	32.2	32.2	28.8	
Female life expectancy at birth (years)	72.6	73.0	73.2	73.5	73.7	73.9	74.2	74.4	74.7	74.9
Male life expectancy at birth (years)	70.2	70.6	70.8	71.0	71.2	71.4	71.6	71.8	72.0	72.2
Population aged 0-14 years (%)	32.8	31.0	30.4	29.7	29.1	28.5	27.9	27.4	27.0	26.6
Population ages 15-64 (% of total)	62.4	63.5	64.1	64.7	65.2	65.7	66.2	66.6	67.1	67.4
Population ages 65 and above (% of total)	4.8	5.5	5.5	5.6	5.7	5.8	5.9	5.9	5.9	6.0
Proportion of population using an improved drinking water source, total (%)	78.4	78.4	80.0	81.0	81.0	82.0	82.0	83.0	78.6	..
- Urban (%)	96.8	96.8	97.0	97.0	98.0	98.0	98.0	98.0	94.0	..
- Rural (%)	48.3	48.3	59.0	60.0	60.0	60.0	61.0	61.0	59.5	..
Population with access to improved sanitation, total (%)	64.0	66.0	58.0	69.0	69.0	70.0	70.0	70.0	70.0	..
- Urban (%)	82.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0	..
- Rural (%)	44.0	46.0	50.0	52.0	52.0	52.0	52.0	52.0	52.0	..

Macroeconomic context	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
GDP										
- change over previous year (%) in 2005 prices and PPPs)	6.3	4.8	3.0	7.8	2.7	5.6	4.8	3.7	4.5	..
- in prices and PPPs of 2005 (million US$)	100,229.6	105,042.5	108,171.2	116,565.1	119,719.1	126,407.9	132,422.8	137,293.2	143,538.4	..
Registered unemployment (% of labour force, end of period)	11.5	10.8	11.1	9.7	9.8	9.6	9.1	9.1	8.9	..
Net foreign direct investment (FDI) (million US$)	2,312.7	787.1	1,619.8	2,366.0	2,806.6	2,466.3	1,970.3	1,240.6	2,521.4	..
Net foreign direct investment (FDI) (as % of GDP)	2.5	0.8	1.5	2.0	2.2	1.8	1.4	0.8	1.5	..
Cumulative FDI (million US$)	..	..	..	..	..	..	..	..	..	..

Income distribution and poverty	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
GDP per capita in prices and PPPs of 2005 (US$/capita)	..	..	..	..	..	..	..	..	..	..
Consumer price index (CPI) (% change over the preceding year, annual average)	97.6	99.0	100.0	103.3	105.4	109.3	110.4	111.5	112.5	..
Population below national poverty line										
- Total (%)	..	..	..	..	9.0	..	..	..	..	..
- Urban (%)	..	..	..	..	4.8	..	..	..	..	..
- Rural (%)	..	..	..	..	14.5	..	..	..	..	..

Telecommunications	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Telephone lines per 100 population	4.1	4.4	4.4	4.1	7.7	9.6	11.1	11.7	..	..
Cellular subscribers per 100 population	24.7	31.0	40.8	52.1	64.6	72.8	80.0	100.1	..	..
Personal computer in use per 100 population	2.0	2.1	2.4	3.0	3.5	5.7	..	..	..	..
Internet users per 100 population	3.4	11.6	15.1	19.8	21.5	33.1	41.3	49.0	..	..

Education	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Literacy rate (%)	..	57.0	59.0	61.5	63.8	65.0	66.4	68.0	69.0	..
Literacy rates of 15-24 years old, both sexes, percentage	..	70.5	71.5	73.2	75.0	77.9	79.5	80.6	81.2	..

Gender Inequality	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Share of women employment in the non-agricutlural sector (%)	23.2	22.9	22.8	21.0	20.7	20.8	..	..	..	..
Gender Parity Index in										
- Primary education enrolment (ratio)	0.90	0.91	0.90	0.90	0.91	0.91	0.93	0.94	0.94	..
- Secondary education enrolment (ratio)	0.82	0.83	0.84	..	0.86	..	..	..	..	..
- Tertiary education enrolment (ratio)	0.80	0.82	0.80	0.81	0.89	0.88	0.87	..	..	..

Source:
MDG database 10.7.2012
World Bank World Development Indicators 10.7.2012
High Commission for Planning

Annex III

LIST OF MAJOR ENVIRONMENT-RELATED LEGISLATION

1914–1969

- Dahir of 7 July 1914 on the regulation of civil justice and the transfer of real estate;
- Dahir of 25 August 1914 on the regulation of unsanitary, inconvenient or dangerous industrial plants;
- Dahir of 21 July 1923 on hunting ;
- Order of the Prime Minister of 13 October 1933 classifying unsanitary, inconvenient or dangerous industrial plants;
- Decree No. 2-57-1647 of 17 December 1957 setting down certain rules to implement the provisions of the mining regulations relating to institutional charges or renewal of mining permits, the annual concessions fee, and obligations relating to works undertaken by mining concessionaries and permit-holders;
- Law No. 370-67 on Statistical Studies;
- Dahir No. 1-69-170 of 25 July 1969 on the protection and restoration of soil.

1994

- Joint Circular of the Ministers of the Interior, Public Works and Agriculture No. 87 of 8 June 1994 on quarries' opening, exploitation and inspection.

1995

- Law No. 10-95 on Water ;
- Law No. 34-94 on the Fragmentation of Agricultural Holdings within Irrigation Perimeters and on Bour (non-irrigated) Lands Targeted for Development.

1996

- Decree No. 2-95-717 on the preparation for and the fight against accidental marine pollution.

1997

- Law No. 42-95 relating to the Control and Organization of Trade in Agricultural Pesticides.

1998

- Decree No. 2-97-377 updating the 1953 Order on the Road Police;
- Decree No. 2-97-787 on water quality standards and the inventory of the degree of water pollution;
- Joint Order of the Minister of Finance, Trade, Industry and Handicrafts, the Minister of Agriculture, Equipment and Environment and the Minister of Transport and Merchant Marine, Tourism and Energy and Mines No. 520-98 on charges for the use of water from the public water domain for the production of hydropower;
- Joint Order of the Minister of Economy and Finance, the Minister of Equipment and the Minister of Agriculture, Rural Development and Maritime Fisheries No. 548-98 on charges for the use of water from the public water domain for irrigation.

2000

- Law No. 06-99 on the Freedom of Prices and Competition;
- Decree No. 2-99-922 on the organization and responsibilities of the Secretary of State to the Minister of Land Use Planning, Water, Environment and Housing in charge of Environment.

2002

- Law No. 08-01 on the Exploitation of Quarries;

- Law No. 78-00 containing the Communal Charter;
- Order of the Minister of Equipment No. 368-02 delegating powers to the walis of the regions;
- Joint Order of the Minister of Equipment and the Minister of Land Use Planning, Urban Development, Housing and Environment No. 1275-02 establishing the quality classification system for surface waters;
- Joint Order of the Minister of Equipment and the Minister of Land Use Planning, Environment, Urban Development and Housing No. 1276-01 establishing the quality standards for water destined for irrigation;
- Joint Order of the Minister of Equipment and the Minister of Land Use Planning, Urban Development, Housing and Environment No. 1277-01 establishing the quality standards for surface waters used for the production of drinking water.

2003

- Law No. 11-03 on the Protection and Conservation of the Environment;
- Law No. 12-03 on Environmental Impact Assessment;
- Law No. 13-03 on Combating Air Pollution;
- Order of the Prime Minister No. 3-3-00 implementing Decree No. 2-95-717 of 1996 on the preparation for and the fight against accidental marine pollution;
- Joint Order of the Minister of Land Use Planning, Water and Environment No. 2027-03 establishing the quality standards for fishing waters;
- Joint Order of the Minister of the Interior, the Minister of Finance and Privatization and the Minister of Land Use Planning, Water and Environment No. 2283-03 on charges for the use of water from the public water domain for public drinking water supply.

2004

- Finance Law No. 26-04 for the fiscal year 2005.

2005

- Decree No. 2-04-553 on spills, discharges, and direct or indirect deposits into surface water or groundwaters;
- Joint Order of the Minister of Land Use Planning, Water and Environment, the Minister of Finance and Privatization and the Minister of Industry, Trade and Upgrading of the Economy No. 2565-05 on charges for the use of water from the public water domain for industrial water supply.

2006

- Law No. 28-00 on Waste Management and Disposal;
- Law No. 54-05 on the Delegated Management of Public Services;
- Decree No. 2-05-1326 on water for use in food;
- Decree No. 2-05-1533 on on-site sanitation;
- Joint Order of the Minister of the Interior, the Minister for Land Use Planning, Water and the Environment, the Minister of Finance and Privatization, the Minister of Industry, Trade and the Upgrading of the Economy, the Minister of Energy and Mines and the Minister of Tourism, Crafts and the Social Economy No. 1180-06 determining the pollution charge rates applicable to wastewater discharges and defining the pollution unit;
- Joint Order of the Minister of the Interior, the Minister of Planning, Water and Environment and the Minister of Industry, Trade and Upgrading of the Economy No. 1606-06 establishing specific limit values for discharges from the pulp, paper and cardboard industries;
- Joint Order of the Minister of the Interior, the Minister of Land Use Planning, Water and Environment and the Minister of Industry, Trade and Upgrading of the Economy No. 1607-06 setting specific limit values on domestic discharges;
- Joint Order of the Minister of the Interior, the Minister of Land Use Planning, Water and Environment and the Minister of Industry, Trade and Upgrading of the Economy No. 1608-06 establishing specific limit values for discharges from the sugar industries.

2007

- Law No. 1-06 on the Sustainable Development of Palm Plantations and on the Protection of Date Palms;
- Law No. 47-06 on Local Government Finances;
- Law No. 49-99 on Health Protection relating to Poultry Farms and Control of the Production and Marketing of Poultry Products.

2008

- Decree No. 2-04-563 on the functions and operations of the national committee and regional committees of environmental impact assessment;
- Decree No. 2-04-564 setting down the procedures for the organization and conduct of public hearings into proposals subject to environmental impact assessment;
- Decree No. 2-07-253 on waste classification and determining the list of hazardous waste.

2009

- Dahir No. 1-09-20 promulgating Law No. 25-08 creating the National Office of Food Safety;
- Decree No. 2-08-563 promulgating Law No. 42-08 establishing the Agency for Agricultural Development;
- Decree No. 2-09-139 on medical and pharmaceutical waste management;
- Decree No. 2-09-284 setting the administrative procedures and technical requirements for landfills;
- Decree No. 2-09-286 setting standards for air quality and the procedures for air monitoring;
- Order of the Secretary of State to the Minister of Energy, Mines, Water and Environment in charge of Water and Environment No. 470-08 delegating to the walis of the regions sign-off of environmental acceptability;
- Joint Order of the Minister of the Interior, the Minister of Industry, Trade and New Technologies and the Secretary of State to the Minister of Energy, Mines, Water and Environment in charge of Water and Environment No. 1447-08 establishing specific limit values for discharges from the cement industries;
- Joint Circular of the Minister of the Interior and the Secretary of State to the Minister of Energy, Mines and Environment in charge of Water and Environment No. D-1998 activating the decrees adopted for the application of Law No. 12-03 on Environmental Impact Assessment.

2010

- Law No. 13-09 on Renewable Energy;
- Law No. 16-09 on the National Agency for Renewable Energy Development and Energy Efficiency;
- Law No. 22-07 on Protected Areas;
- Law No. 22-10 on the Use of Degradable or Biodegradable Plastic Bags and Sacks;
- Law No. 30-08 amending and supplementing Law No. 06-99 on the Freedom of Prices and Competition;
- Law No. 57-09 Creating the Moroccan Agency for Solar Energy;
- Decree No. 2-08-243 instituting the Commission on Polychlorinatedbiphenyls;
- Decree No. 2-09-285 establishing the methods for developing the prefectural or provincial master plan for managing household and similar waste and the procedure for organizing the public inquiry related to this plan;
- Decree No. 2-09-538 establishing the procedures for developing the national master plan for managing hazardous waste;
- Decree No. 2-09-631 setting limit values for clearance, emission or discharge of pollutants into the air from stationary sources of pollution and the procedures for air monitoring;
- Decree No. 2-09-683 establishing the methods for developing the regional master plan for managing non-hazardous industrial, medical and pharmaceutical, residual, agricultural and inert waste and the procedure for organizing the public inquiry related to this plan;
- Decree No. 2-10-321 establishing the road code for vehicles;
- Joint Order of the Secretary of State to the Minister of Energy, Mines, Water and Environment in charge of Water and Environment and the Minister of Economy and Finance No. 636-10 setting fees for

government services in relation to a public hearing on proposals subject to environmental impact assessment;
- Joint Order of the Minister of the Interior, the Minister of Industry, Trade and New Technologies and the Secretary of State to the Minister of Energy, Mines, Water and Environment in charge of Water and Environment No. 862-10 establishing specific limit values for discharges from the branch of the hot-dip galvanizing industry pertaining to surface treatment.

2011
- Law No. 29-05 on the Protection of Wild Fauna and Flora and Control of their Trade;
- Law No. 31-06 on the Development, Protection, Enhancement and Preservation of the Coastline;
- Law No. 40-09 on the National Office of Electricity and Drinking Water "ONEE";
- Law No. 47-09 on Energy Efficiency;
- Decree No. 2-09-85 on the collection, transport and treatment of certain used oils;
- Decree No. 2-11-98 adopted for the application of Law No. 22-10;
- Joint Order of the Minister of Industry, Trade and New Technologies, the Minister of Health and the Secretary of State to the Minister of Energy, Mines, Water and Environment in charge of Water and Environment No. 3166-11 applying article 1 of Decree No. 2-11-98 of 17 June 2011 adopted for the application of Law No. 22-10;
- Joint Order of the Minister of Industry, Trade and New Technologies, the Minister of Agriculture and Maritime Fisheries and the Secretary of State to the Minister of Energy, Mines, Water and Environment in charge of Water and Environment No. 3167-11 applying article 2 of Decree No. 2-11-98 of 17 June 2011 adopted for the application of Law No. 22-10.

2012
- Finance Law No. 115-12 for the fiscal year 2013;
- Decree No. 2-12-172 setting technical specifications relating to waste elimination and methods of waste recovery by incineration.

Strategies, programmes, and action plans

1995
- National Environmental Strategy.

2006
- National Plan to Implement the Stockholm Convention;
- National Action Plan for the Ecologically Sound Management of Chemical Products;
- National Strategy for Conservation and Sustainable Use of Biodiversity;
- National Strategy for Protected Areas.

2007
- Action Plan for the Development of Integrated Vector Control Management.

2008
- Mitigation Strategy;
- Strategy for the Transport Sector for the period 2008–2012;
- Strategy for the Ecologically Sound Management of Chemical Products.

2009
- Action Plan for the Period 2009–2012 for the Rational Management of Pesticides Used to Protect Public Health;
- National Water Strategy;
- National Rural Development Strategy;
- National Energy Strategy.

2010
- National Strategy for the Development of Logistical Competitiveness;
- National Strategy on Wastewater Sludge Management.

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Morocco
Environmental Performance Reviews

The United Nations Economic Commission for Europe (ECE) Environmental Performance Review Programme assesses progress made by individual countries in reconciling their economic and social development with environmental protection, as well as in meeting international commitments on environment and sustainable development.

The Environmental Performance Review Programme assists countries to improve their environmental policies by making concrete recommendations for better policy design and implementation. Environmental Performance Reviews help to integrate environmental policies into sector-specific policies such as those in agriculture, energy, transport and health. Through the peer review process, the reviews promote dialogue among Governments about the effectiveness of environmental policies as well as the exchange of practical experience in implementing sustainable development and green economy initiatives. They also promote greater Government accountability to the public.

This report provides detailed analyses of Morocco's legal and institutional frameworks in respect of the environment, and its financing of environmental policies, with specific focus on agriculture, energy, industry, health, biodiversity, water and waste management. The purpose of the recommendations of the Environmental Performance Review is to support policymakers, representatives of civil society, the business community and other actors in their efforts to improve environmental management. The review also aims to promote sustainable development in Morocco, as well as strengthen Morocco's cooperation with the international community.

Due to their proven usability and effectiveness, Environmental Performance Reviews have attracted the attention of countries outside the ECE region. This led to requests for a transfer of know-how from ECE to other UN regional commissions. Morocco is the first country outside the ECE region to be reviewed by ECE. This has been done in cooperation with the UN Economic Commission for Africa.

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