State of the Environment - Iran

(2005/06)

State of the Environment Iran 2005/06

UNEP promotes environmentally sound practices globally and in its own activities. This magazine is printed on 100% recycled paper, using vegetable -based inks and other eco-friendly practices. Our distribution policy aims to reduce UNEP's carbon footprint.

Foreword

Department of the Environment

Education and Planning is the division within Iran's DoE responsible for the State of Environment reporting and has recently published its first report on this subject. We are pleased that the second SoE report for Iran is prepared within the framework of a valuable joint venture between the Department of Environment and the United Nations Environment Programme (UNEP) in collaboration with Shahid Beheshti University. This is a reflection of the excellent and ever-expanding cooperation between the Islamic Republic of Iran and UNEP.

Towards the fulfillment of its duties and obligations, the Department of the Environment is determined to promote its underlying philosophy, which requires accurate scientific information for any decision made on the protection of the environment. To this purpose, it has initiated an integrated statistical system for the environment, which some of its components have already been put into practice.

This report is the result of efforts by the DoE in collaboration with several government ministries and other organizations whose activities lie in various fields such as energy, petroleum, roads and transportation, ports and shipping, agriculture and industry. Such cross-sectoral collaboration in itself reflects an important procedural aspect of sustainable development and the obligation of governments to operate in a more collaborative manner. The activities of the above-mentioned ministries and organizations have considerable impacts on the environment through their utilization of both renewable and non-renewable resources. We would like to thank these institutions for extending their support and providing the necessary data for this endeavor.

This report aims to assist the decision-makers involved in economic planning and development programming as well as the researchers and interested students in the field of environmental studies, through the accurate depiction of the national enviEnvironment and its current status and trend. Moreover, the subsequent adverse consequences, impacts and the required mitigation measures are identified.

This study could have not been prepared without the continuous support and encouragement of UNEP.
Our sincere thanks also goes to the chair and editor-in-chief of this report, Dr. Mohammad Zokaei, Dean of Faculty of Mathematical Sciences of Shahid Beheshti University and his research team who have prepared this report.

Division of Education and Planning
DoE

Foreword

Chair and Editor-in-Chief

The first official SoE-report for the Islamic Republic of Iran was prepared and published in Persian in August 2004, using experiences from other countries the recommendations of international agencies (UNEP and UNDP) and was welcomed by both the executive and scientific authorities of Iran.

In order to enable it to prepare this report on a continuous basis, Iran's DoE decided to build improved national capacity in association with UNEP. To fulfill this purpose, a 3-day workshop was organized in Tehran from 5-7 March 2005 by the Division of Education and Planning, Department of the Environment (DoE) and UNEP's Regional Office in Asia and Pacific Office in cooperation with Shahid Beheshti University (SBU).

Participants of this workshop were experts from DoE, UNEP and universities as well as the representatives of the ministries in charge and a tentative outline for a national Integrated environment assessment report of I. R. Iran was prepared by them. The report identifies key environmental issues for I.R. Iran, including Air, Land, Inland Waters, Coastal Waters, Biodiversity, Natural Disasters and Human Settlement. It reviews their status and recommends measures to prevent or minimize their negative impacts. These issues were analyzed by various experts, including national officials, scientists, academics, and DoE experts. The Persian version of this was published as the Second SoE-report in September 2005. This English report is a brief version of the Persian one which was prepared, taking into consideration UNEP's recommendations and collaboration.

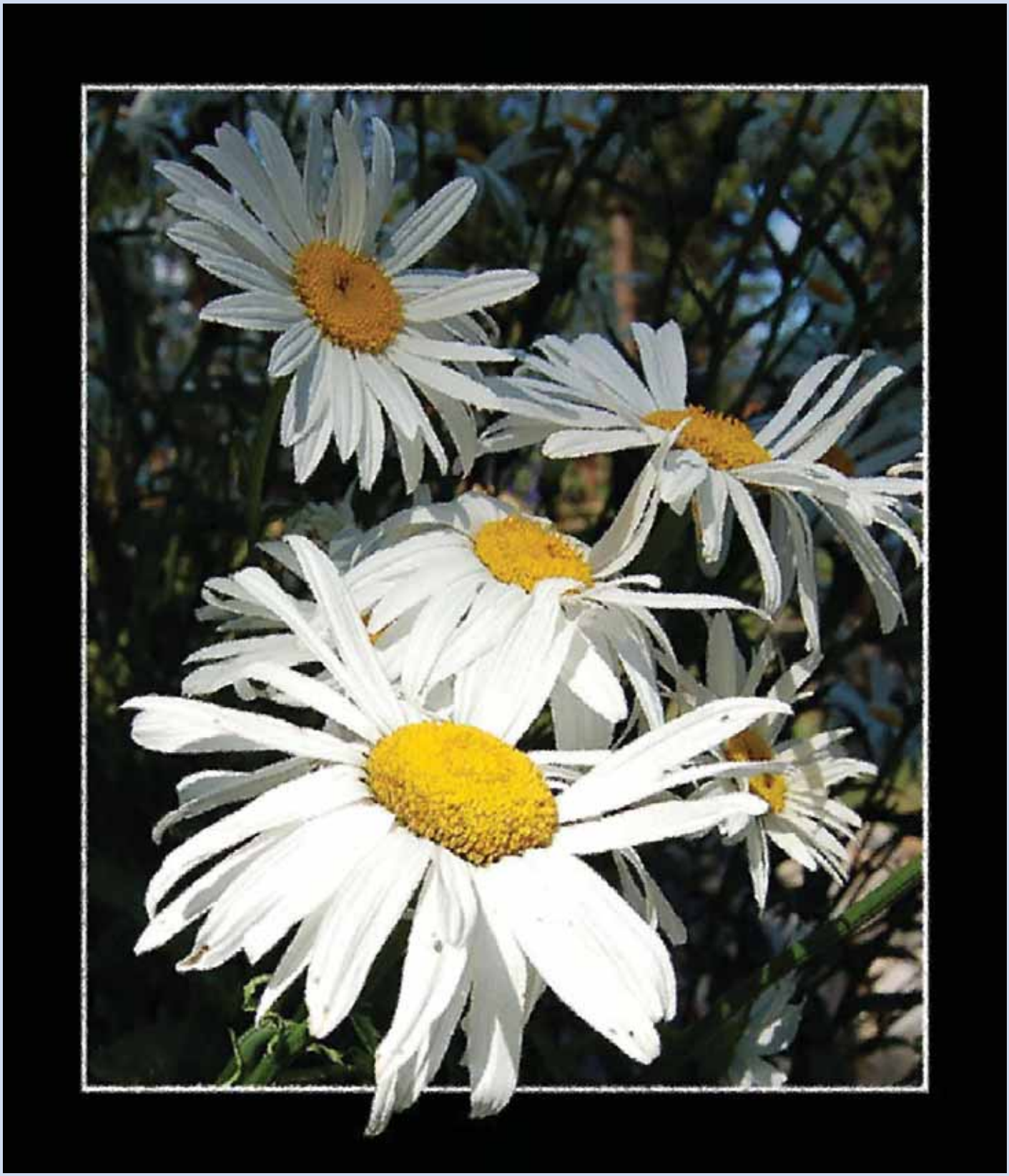
I hope this report will provide a sound basis for decision-making by the various levels of government and by the public and private sectors in relation to environmental issues. I would like to express my gratitude to Dr.Masoumeh Ebtekar, ex-Vice President and Head of DoE, the Offices of the Research Deputy and of the Deputy for Education and Planning of SBU and DoE for their fruitful collaboration. I would also like to greatly acknowledge the contribution of UNEP and team in Bangkok, Thailand for supporting the preparation of this report. In addition, special thanks to Mr. Mohammad Mehdi Rostami for his help in translating the text into English and to Dr. Janet Blake, Environmental Sciences Research Institute (SBU), for editing the English text and writing the executive summary and the concluding chapter. I extend my thanks to the Deputies of the DoE and the Ministries of Energy, Petroleum, Jehad-Agriculture and Housing, Tehran Municipality and the Statistical Centre of Iran, all of which were involved in preparing data and statistics needed for this report. Further, I would like to thank my colleagues at SUB and graduate students of Statistics Department (SBU) who reviewed this report and provided valuable inputs for shaping in its present form.

Mohammad Zokaei, Ph.D
Chair and Editor-in-Chief
Dean of Faculty of Mathematical Sciences
Shahid Beheshti University, Tehran, Iran
December 2007

Table of Contents

List of Tables

List of Figures



Executive Summary

This report presents an analysis of the state and trends of environment, and emerging problems in Iran and promotes specific recommendations for future actions. This analysis is based on analytical framework of Global Environment Outlook(GEO) Drivers- Pressure-State-Impact-Response (DPSIR) framework.

The first section serves to provide an overview of the country's socio-economic situation as well as its current management of the environment and its resources, including the legislative and administrative approaches taken to this end. These can be regarded as historical factors that set the stage for assessing the key environmental issues which are addressed in the following seven chapters of the second section. The final section summarizes the analyses given and identifies a number of measures for ameliorating existing problems and preventing any future deterioration.

The Iran is blessed with a high level of biological diversity ('biodiversity') due to its rich variety of climatic and geophysical zones that flourishes in its diverse habitat and vegetation types. It has, for example, 164 different mammal species, a number almost equal to that of Continental Europe. There are about 8,000 different floral species in Iran of which 1,727 (22%) are indigenous. This compares favourably with 12,000 different species in the whole of the Continent of Europe. There are, in addition, 517 bird species, 174 fish species, 200 reptile species and 38 species of amphibians.

By 2006, there were altogether 93 Protected Areas and 72 other such zones (national parks, national natural monuments, wildlife sanctuaries etc.) in Iran. Currently 7.23% of the country's total area is under such protection and this shows an impressive increase of 50% between 1998 and 2006. However, it is still lagging behind the international standard of 10% of a country's area given over to protected areas and similar zones. Moreover, forests cover only 7.6% of the total dry area of land, constituting a per capita area of 0.2 hectares. This is very low and is under further threat from deforestation as a result of human activities, including rearing livestock.

Iran is the second largest oil producer in OPEC, a fact that obviously has significant impacts not only on the country's economy but also on its environment. In 2004, the total amount of energy resources available was the equivalent of 3,066.6 barrels of crude oil, with petroleum products making up 69.2% of this and local and/or imported natural gas 26.43%. Renewable energy sources (including water) made up only 0.84% of this total, while coal accounted for 0.43% and imported electricity 0.4%.

The first chapter deals with the country's socio-economic background and factors affecting its environmental status. This contextual chapter presents such aspects of the country's situation as: physical geography and climate zones; culture
and education/training system; level of public participation; welfare, health and socials security; consumption patterns in different economic sectors; transport arrangements; employment and wealth distribution; energy; and human development. The following chapter deals with the environment and resource management, and is arranged around the environmental media, resources and activities that impact on them: air, water and land; forests; protected areas; mining; mountain and desert ecosystems; wetland areas; and biological diversity, including wildlife and their habitats.

The third chapter presents the development of environmental regulation in Iran and the current status of the legislation and related administrative structures for the protection of Iran's environment. The DoE was established in 1977 and Its tasks include: studying and monitoring environmental threats; encouraging the use of environmentally-friendly technologies; introducing best land-use practices; identifying endangered habitats of high ecological value; adopting environmental standards and regulations for the environmental media, waste disposal and management and the use of ecosystems; increasing public environmental awareness; enforcement of anti-pollution legislation; and expanding regional and international co-operation.

Environmental legislation is a relatively recent area of law to be developed in Iran and, as a result, further legislative work remains to be done. The Third and Fourth Five-year Socio-economic Development Plans (the latter being the current one) both place an importance on environmental protection as does the revised Constitution adopted in 1990. The interactive institutional environment (nationally, regionally and internationally) within which the DoE operates and the role of National Commission on Sustainable Development are introduced and it is noted that existing activities to encourage cross-sectoral co-operation among government bodies should continue and be extended as far as possible. This is in order to implement Iran's obligations to ensure environmentally sustainable development. Furthermore, on-going monitoring and evaluation of the effectiveness of the legislative framework and the enforcement of laws and regulations is recommended.

The second section that deals in detail with key environmental issues facing Iran starts at Chapter 4 and follows closely the aforementioned PSIR model in each chapter's presentation of the relevant information and analysis. Of course, many of the elements cited as pressure factors such as population, for example, will be common to different key environmental issues and so they will not necessarily be repeated in this summary for each section to which they may be relevant.

Chapter 4 is concerned with air and deals with the following factors in terms of pressure (direct and indirect), state, impact and response. The main pressures identified in this report are population growth (leading to urban 'sprawl' and growing demands for energy and infrastructural development), increasing numbers of motor vehicles on the roads and inefficient fuel consumption, lack of pollution control facilities in industrial plants and increasing releases of pollutants into the air from burning fossil fuels. The average annual growth in petrol consumption, for example, was 802% between 1999 and 2004 and SPM pollution (from both man-made and natural sources) in Tehran is chronic although NO2 levels are falling. The main responses of DoE and other national bodies include: monitoring pollution emissions from motor vehicles, static sources etc.; further national planning to optimise energy consumption; enforcing and developing legislation for reducing air pollution from industrial sources; conducting research on the various sources of air pollution (from mobile telephones and electricity cables to domestic heating systems); providing training concerning sources of air pollution; reducing the air pollution from natural sources; motor vehicle emission testing, introducing catalytic convertors and better traffic management; public education programmes concerning the environment and pollution.

Chapter 5 addressed the environmental medium land. The land's chemical and physical properties as well as the effects of water and wind erosion are described. The pressures that we can identify here can be categorised as both indirect – climate, population, agricultural and industrial activities– and direct ones. The direct pressures are: changes in land use; urbanisation; deforestation; overgrazing of rangelands; over-exploitation of agricultural land; burning crop residues; and mining activities. Certain specific factors are also identified that have negatively affected the state of the land/soil in Iran, such as wheat monoculture (which has depleted the soil of vital nutrients), inappropriate management of evapotranspiration zones (leading to increased soil salinity levels) and erosion caused by water and wind. FAO has reported that between 3 to 4 billion tons of soil is displaced annually by such erosion, five times the international standard. Responses from the government and DoE to the above pressures and other factors that cause deterioration of soil and land quality include: farmer education on better land use (crop rotation, irrigation methods, resting cultivated and grazing land etc.); better management of water catchments and rangelands; researching means of reducing the erosion of soil from natural causes; carbon off-set projects; monitoring activities that place indirect pressures on the land; preventing further deforestation and planting trees as appropriate to prevent soil erosion.

The status of Iran's inland waters is addressed in Chapter 6 in terms both of their quantity and quality. The inland waters in Iran are unevenly distributed with 50% of total precipitation falling on 30% of the landmass. The fact

that per capita water use in Iran is below the international average suggests that much of the country is deficient in water. Equally, in Tehran, per capita water consumption is currently at 300 L/day (more than twice that of Europe) and the aim is to reduce it to 150 L/day. Pressure factors presented include uneven water distribution and shortages; misuse of water resources and inappropriate consumption patterns; pollution from industry, agriculture and sewage. The status of inland waters is presented in relation to precipitation, surface and ground water, lakes and rivers, dam building activities and drinking water along with impacts such as depletion of underground water tables and pollution from activities mentioned above.

Responses to these include making water resources and access to them an axis in any future development and establishing a comprehensive approach to water utilization that incorporates land use and water resource management into development planning. A further response is to develop a national water supply and sewage strategy (giving priority to drinking water not water for agricultural use) and improve domestic and commercial/industrial water consumption patterns, using such tools as water metering and financial incentives. Water distribution networks should be improved, wastage reduced, over-expansion of urban centres prevented and sewage and sanitation facilities improved. Certain actions in the agricultural area are also proposed, such as reducing wastage and using recycled water where possible, introducing biological pest control measures and non-chemical forms of fertilizing soil where possible and controlling and reducing agricultural run-offs and industrial effluent. Lastly, work is being carried out to raise public and government awareness of the need for and participation in wise use of water.

Chapter 7 deals with coastal and marine waters, addressing those of the Caspian Sea (in the North) and the Persian Gulf and Sea of Oman (in the outh/Southwest) separately, although some commonalities obviously exist. For both of these sea areas, population growth (and distribution) and consequent increased demands, over-exploitation of marine living resources, are important pressures. Other pressures include the introduction of exotic species (such as Menemiopsis Leidiyi into the Caspian Sea) and pollution from industrial effluent, household sewage, agricultural run-off, extraction of hydro-carbons and marine accidents. For the Persian Gulf and Sea of Oman, pollution resulting from the oil and gas exploitation, oil-related accidents and war in the region is clearly an important pressure as is over-fishing. The status of the Caspian Sea is described in terms of its coastal rivers, water quality and heavy metals and that of the Persian Gulf in terms of its salinity, tidal movements and pollution from petro-hydrocarbons and heavy metals.

Responses from the DoE, the Ministry of Energy and the Harbours and Shipping Organization include national and regional projects (the latter determined by the regional character of the sea areas in question). Such co-operation is within the frameworks of regional sea agreements/programmes and international maritime Conventions (such as OPAC, 1990). Other responses are the monitoring of pollution levels in seas and rivers and adopting regulations to reduce marine pollution from shipping and oil extraction activities. Radioactive pollutants in the Caspian Sea and heavy metals and hydro-carbons in the Persian Gulf and Sea of Oman are also monitored. Marine living resources are conserved in a manner geared towards their conservation and wise use and wetlands are protected and sustainably developed. The current state of the coral reefs of the Persian Gulf is under assessment and marine coastal reserves have been established where necessary for the protection of the coastal ecosystems.

Chapter 8 describes Iran's high level of biological diversity, both floral and faunal, the threats to it and the responses to these. Pressures include a failure hitherto to give sufficient priority to biological diversity, changes in land use (especially those resulting in deforestation), the over-use of chemical pesticides and over-exploitation of faunal and floral species themselves. These result in impacts such as imbalance in ecosystems, loss of habitat and depletion

of food resources. The responses to these include the National Biodiversity Strategy, development of the country's system of wildlife sanctuaries and protected areas and action in relation to specific species under threat and reintroduce native species where appropriate. Other activities aimed at preserving and enhancing this important resource are: placing a greater importance nationally on biodiversity and environmental values; improved natural resource management and conservation strategies; preventing the over-exploitation of Iran's floral and faunal resources; controlling the capture, taking and illicit trade in species of fauna and flora; controlling with extreme care the introduction of GMOs into Iran; improved management of agricultural activities that adversely affect the faunal and floral species and/or their habitats and encouraging farmers to use agricultural practices that enhance biological diversity; and controlling or prohibiting the introduction of exotic species.

Chapter 9 addresses natural disasters which are a significant aspect of Iran's overall environmental picture. Iran is a disaster-prone country due both to its geological and climatic situation (facing both flooding and drought). The diversity of these pressures reflects the wide diversity of climatic and geophysical zones in the country. Deforestation and desertification are also significant pressures and the former may also intensify the effects of natural disasters such as floods. In terms of state and impacts, relatively frequent earthquakes and occurrences of flooding and drought as well as heavy snowfalls are all noteworthy. Appropriate responses to the above include: disaster planning in order to mitigate the environmental and other impacts of natural disasters and reducing deforestation and de-desertification actions. Improved earthquake prediction, research and monitoring, implementing earthquake-proof building regulations throughout the country and research into the pollution fall-out from natural disasters are also necessary responses. Public training and education in responding to natural disasters is also an important action here.

Human settlement, in particular the environmental impacts of increasing urbanization, is dealt with in Chapter 10. Here again, population density and distribution is a major pressure factor as are transportation (mainly urban) issues such as vehicle age, numbers and fuel use. Use of energy resources and water consumption patterns as well as disposal of urban, industrial and hazardous wastes and sewage are all significant pressures related to human settlement. The state and impacts noted include effects of urbanization such as poor air quality, noise and light pollution, encroachment on green spaces, illegal settlements, and waste disposal and recycling. Other issues mentioned here relate to public health and sanitation. Responses from DoE and government Ministries include strategies to prevent water and land resource degradation and pollution, the introduction of new environmental standards and M&E activities. Further responses include: preventing the over-expansion of urban areas and, in particular, encroachment into the green belt and preventing the building of illegal 'shanty towns'. Reducing noise and light pollution and increasing the available green spaces in urban centres as well as controlling changes in land use, particularly from green spaces or agricultural land to residential areas are all responses taken. Ensuring the earthquake resistance of buildings and avoiding/reducing developments in earthquake-prone zones is also an appropriate response in relation to human settlement as well as disaster planning.

It is obvious that the success of any model directly depends on the degree of reliable and consistent data which exists. In view of the weakness and lack of necessary information and data related to the environment as well as possible unintentional errors made by analysts, some deficiencies may be found in this report. It is expected that any such deficiencies will be studied and reflected upon by experts in order to eliminate them from future SoE-reports for Iran.

Notes

i) The Iranian calendar year (A.P.) usually runs from 21 March of each Christian calendar year to 20 March of the following year.
ii) In order to convert years from the Iranian to the Christian calendars, we have added 622 years to the reference (Iranian) year. For example, the Iranian year 1383 is converted to 2005, actually starting from 21 March 2004 and ending on 20 March 2005.
iii) In this report, the $ sign refers to US dollars.
iv) Currency Equivalent: $1 = 9300 Rials.
v) In this report, tons (t) refer to metric tons (1,000 kg).
vi) The views and interpretations presented in this publication are those of the authors

Section I
Background

Evan Lake, Qazvin

1 Socio-Economy

Socio-Economy

1 Geographical Profile

Iran, covering a territory of 164,019,500 ha, is located in the southern half of the northern temperate zone, between latitude 25 degrees, 3′ and 39 degrees, 47′ north of the equator and longitude 44 degrees, 14′ and 63 degrees, 20′ east of the Greenwich meridian.

Almost 90% of the country's landmass is found in the vicinity of the Iranian Plateau. More than half of the total land area is mountainous and elevated terrain and a quarter of the area is covered by plains. The remaining land is arable land currently under

Source: Map No. 3891 Rev.1 UN (with boundries modification of the new provinces). Jan.2004

cultivation.

The average altitude of Iran is 1,200 m above sea level while the altitude of southern coast of the Caspian Sea is 28 m below Open sea level.

The highest point of Iran is the summit of 5,628 metre-high Mount Damavand in the Alborz mountain chain and its lowest point is in Chaleh Loot (the "Loot Ditch") which is 56 m below sea level.

The Islamic Republic of Iran's neighbouring countries and features are: the Republics of Turkmenistan, Azerbaijan and Armenia and the Caspian Sea to the North, Afghanistan and Pakistan to the East, the Sea of Oman and the Persian Gulf to the South and Iraq and Turkey to the west.

Iran is administratively divided into 30 provinces that, up untill 21st March 1994, comprised 316 cities, 939 towns and 843 rural districts; each district covers a number of villages, with 2,353 villages in all. (Statistical Centre of Iran, 2004 and 2005)

2 ■■ Socio-Economic Facts

2.1 ■ Culture

As any country that has a long flourishing civilisation and a rich culture, Iran has a history which dates back to antiquity. There is much evidence, such as scientific, religious, artistic and cultural books and other works or inscriptions and archeological findings, etc. which prove the existance of an ancient and a rich culture and civilisation in a defined geographical area.

In Iran, there are certain national holidays and festivals marking both religious and sacred or secular and popular celebrations. These occasions, each with a special ritual of its own, are amongst the most significant annual events in the country that pass on the rich traditions of the Irano-Islamic culture.

Among the secular festivals are Nowrooz which is an ancient ceremony to mark the start of the Persian New Year (based on the solar calendar), charharshanbehsoory which falls on the last Wednesday of the Persian year, mehregan the harbinger of autumn and the harvest season and yalda to celebrate the longest night of the year. There are also several religious and sacred holidays tied to the (lunar) Islamic calendar, including: ghadir khom, a Shiite celebration; fitr to mark the end of the fasting month of Ramadan; qorban that celebrates the end of the Hajj pilgrimage; and mabath, marking the commencement of the mission of the Prophet Mohammad (PBUH).

The arts especially theatre, the visual arts, Ta'zieh (the presentation of the true story of the martyrdom of Imam Hossein) and authentic Persian music all have a history dating back several thousand years. Religion, personal, collective and tribal beliefs have always been the main elements of Iranian national culture, and have played a prominent role in all cultural domains.

Undoubtedly, the historical civilisation and culture of Iran owes a great deal to the significant presence of the different ethnic groups and minorities. According to the last census in 1997, Iran's total population comprised 99.55% Muslims, 0.13% Christians, 0.05% Zoroastrians, 0.02% Jews, 0.1% followers of other faiths and about 0.15% of undeclared faiths.

As the nexus of a strong and secure social life, the family in Iran is considered to be a sacred institution that provides identity and gives coherence and meaning to people's lives. Marriage is a religious obligation and a sacred act worthy of approval.

2.2 ■ Demographics

According to the latest census administered in 1997, the total population of the country was 60 million, with an average age of 24 years and a median age of 19.4. Males comprised 51% of the population and females 49%. A demographic assessment made in 2005, based on the population growth rate between 1992 and 1997 and assuming that the other effective growth factors remained constant, showed the population to be 67,477,500, of which 44,771,946 lived in urban and 22,705,554 in rural areas. (Statistical Centre of Iran, 2004 and 2005) In accordance with the latest surveys, the country's population growth rate has risen no faster than 1.6 % (Figure 1-1). Iran's population has rapidly shifted over the last three decades from a semi-urban/rural to an urban or urban-prone population, so that the urban quotient has increased from 47% (16 million) in 1977 to 66% (44.8 million) in 2005; that is to say that urban population has more than doubled over this period, to 2.8 times to be exact, while the rural population has increased by 1.3 times. Population growth, especially in the urban areas, has had some repercussions mostly because the social structures as well as the social facilities have not grown accordingly. (Statistical Centre of Iran, 2002).

• Note: In the process of preparing SoE-report, Population and Housing Census was done in Nov.

Tehran University Main Entrance

Figure 1-1: Changes in the average percentage of annual population growth rate, 1966-2002
Source: Statistical Center of Iran, 2004

2006 by Statistical Center of Iran. On the basis of this census the total population of the country was 70'495'782 persons (comprising 50.9% male and 49.1% female. Out of whom 77% settled in urban areas (Statistical Pocketbook of the I.R.Iran, March 2006-March 2007)

Life Expectancy

Many factors have contributed to the increase in life expectancy, from 70 years in 2002 to 71.7 years in 2005. Amongst the more significant of these, to name but a few, have been: a fast improvement in welfare and healthcare services, immediate accessibility to these services for the people, an increase in the level of literacy throughout society, equipping rural areas with health and hygiene facilities, improvement in life styles and a reduction in the infant mortality rate (Statistical Centre of Iran, 2004 and 2005).

Migration

One of the main shortfalls in demographic statistics is in migration censes. No systems have been designed to register the number of emigrants to foreign countries nor, even, is there any clear data available to show the interstate movements of those who leave villages to settle in cities and towns or those who move from one province for another (Statistical Centre of Iran, 2004 and 2005).

2.3 Public Participation

The policy established by the Iranian Department of the Environment (DoE) to enhance as well as improve the quality of public participation in preserving Iran's environment has led to the adoption of several programmes for identifying supporters of the environment. The DoE has attempted to create intellectual challenges and environmental concerns among these supporters and tried to provide the necessary preconditions for environmental NGOs to develop. Some of the outcomes of these policies include the following.

- An increase in the number of environmental NGOs from 44 in 1998 to 630 by July 2005 (approx. 14 times)(Figure 1-2).
- Conclusion of co-operation agreements and letters of understanding with government ministries and organizations to promote public as well as organizational participation.
- Establishment of a special organization responsible for following up public organizational participation.
- Introducing the Green Pioneers Scheme whose task will be to attract contributions from different strata of society to environmental issues.

The Department of the Environment has spared no efforts to stimulate as well as enhance the level of environmental knowledge of these groups and to promote social environmental interaction between non-governmental organizations. The main step taken by the Department in strengthening relevant NGOs was providing assistance in forming a countrywide network of their own. Some notable actions taken with regard to strengthening NGOs include the following:

- Holding annual public meetings in the seven regions of the country.
- Holding four national gatherings for environmental NGOs.
- Setting up a data-bank for NGOs and an Internet site for the Office of the Public Participation.
- Developing environmental NGOs into national, provincial and regional networks.
- Establishing environmental cooperatives.
- Strengthening environmental NGOs through donation of equipment, provision of financial support, presenting educational and training programmes, holding meetings and giving legal advice.
- Referring the implementation of small-scale projects to NGOs, financed by the Global Environmental Facility.
- Introducing the Green City Scheme with the aim of achieving minimum environmental standards and improving people's living conditions.
- Introducing the Environment Assistants Home Scheme with the aim of introducing environmental NGOs to mayors and district mayors. This project has so far been carried out in some cities as well as in some of the districts of Tehran Municipality.

2.4 Health Care

Amongst the most crucial factors for human development are health and medical treatment. The Health and Therapy Unit, entrusted with the vital responsibility of improving the levels of physical, mental and social health in society within the framework of specific policies, has achieved conspicuous success in the recent years. Some of the most important indices in this area may be summarized as

Figure 1-2: Number of NGOs from 1998 to July 2005
Source: Office for Public Participation, DoE, 2006

follows:
• The maternal mortality rate for every hundred thousand live births has been reduced from 56.8 instances in 1990 to 37.4 in 2005.
• Vaccination of 95% of children.
• More than 96% of villages now have access to safe drinking water.
• Health infrastructure facilities have been provided to rural areas.

2.5 ■ Education and Training

● Literacy

The significance of education as an essential component of development is self-evident. Iran has been one of the most successful countries in combating illiteracy. The high rate in the growth of literacy in recent years corroborates this claim. The literacy rate increased to 79% in 1997 from 62% in 1987. Approximately 84% of men and 75% of women are able to read and write.

● Educational Infrastructure

The country's educational system falls into two general categories: (1) public education and (2) vocational and technical education. Each of these conducts curricular as well as extra-curricular activities within its own area. (Statistical Centre of Iran, 2004 and 2005)

● Vocational and Technical Training

• Human resource development is an indispensable part of sustainable development. In order to provide proper conditions for increasing the efficiency of human resources, great attention has been paid to the educational sector, especially the vocational and technical training sector.
•The proportion of female students of the total number of the students in order to asses the equivalent opportunity of training skills shows an increased from 36.9% to 37.8%.

● Higher Education

The higher education sector supplies the need for highly educated manpower and its activities are structured within 16 (8 training and 8 non-training) programmes. The operative bodies in this section include the universities and other higher education institutes affiliated to the Ministry of Science, Research, and Technology, the Ministry of Health and Medical Education, the Islamic Azad University and non-governmental, non-profit-making centres for higher education. The curricula in these institutions are offered in the form of day-time, night-time, part-time and equivalent courses.
• The total number of university students increased from 1,438,781, in 2001 to 1,887,960 in 2005, showing an average annual growth rate of 7%. The public sector share has been 40% and the private sector share 60%;
• In the public sector, the number of students in the universities affiliated to the Ministry of Science, Research and Technology increased from 477,226 to 645,600, showing an average annual growth rate of 7.8%;
• The number of full time faculty in the universities and other higher education institutions increased from 30,110 to 39,617, of which the 72.1% share of the public (state) universities decreased to 62.4% while the 27.9% share of the non-governmental, non-profit-making institutions increased to 37.6%.
• The welfare of dormitory facilities for single students was at 60%.

● Research and Technology

•Funds for research and technology in 2001-2005 have been, respectively: 1,779.7, 2,515.6, 3,509.9, 5,515.3 and 6,516 Billion Rials. The highest rate of growth was 57% in 2004, compared with 2003, and the lowest being 18% in 2005, compared with 2004.
• Research funds (to purchase consumables as well as assets) in 2001-2004 have been, respectively: 327.6, 440.3, 536.9 and 629.6 Billion Rials.
• In accordance with the information given out by the Statistical Centre of Iran, the number of full-time as well as part-time researchers was 24,940 in 2001, decreasing to 23,410 in 2003, showing a 22.4% reduction. The number of researchers per one million of the population in 2001, 2003 and 2005 was 392, 295, and 346, respectively.
• The average annual growth rate in the export of sophisticated/semi-sophisticated technological commodities was 109.6% during that period. This shows the positive surging ahead of the country in this realm, compared to an average annual growth rate for non-petroleum exports of 92.8% over the same time span

● Internet Users

Utilization of communication and information technology (IT) by Internet users soared so fast during 2001-2005 that it increased 13.7 times in the period. The number of Internet users has enjoyed a growth rate of 139.6% over the same time span.

2.6 ■ Social Security and Welfare

Being one of the main elements of development, the social security system has numerous functions in the advancement of welfare levels and, undoubtedly, is one of the most effective tools for the dissemination of social justice. With a view to achieving development objectives and social justice, the social security system taking its inspiration from Article 29 of the Constitution of the Islamic Republic of Iran, is designed as a collection of plans, supports and services to protect people at different strata of the society against the consequences of economic, social and natural events. Such outcomes include retirement, unemployment, old age, accidents, physical, mental and psychological disabilities etc. The basic system for social welfare in Iran relies upon social insurance and is composed of two sections: insurance-related matters (social security) and non-insurance matters (welfare).

● Social Welfare

The social welfare index has been rising during the period 2001-2005 due to the growth in per capita income and relative improvement in the distribution of wealth. The average annual growth rate of this index has been 6% and the growth rate for the social welfare index was 8.4% in 2005.

— Insurance Services

• Various types of insurance services, based on contributions from the employee, the employer and the Government, are offered by governmental as well as non-governmental bodies. Organizations active in this field are: the Social Security Organization, the Medical Services Organization, the State Pension Organization, the Social Security Organization of the Armed Forces and many different retirement funds affiliated to Ministries and other administrative bodies.

•The proportion of the population covered by medical insurance services increased from 87.7% in 2001 to 93.8% in 2005.

•At present, 21 million rural inhabitants and 5 million disadvantaged and less well-off people benefit from different types of insurance services.

— Welfare

•Establishment of the Ministry of Welfare and Social Security in line with improvements in the social security system as well as social development.

•Protection of the needy through continual financial, social and cultural support (insurance subsidies have been paid to over 4.5 million needy people to cover their medical expenses).

•Attempts have been made by various welfare organizations to help vulnerable families become self-sufficient and self-supporting. To achieve this goal, as many as 151,000 job opportunities were created and a budget of 1,570 Billion Rials was allocated during 2001-2005.

•Expansion of street children rehabilitation.

•A plan for dealing with chronic psychiatric patients.

•Public education and awareness in order to prevent illnesses such as lazy eye and physical and mental disability as well as social harms.

•Emerging Comprehensive Plan for Assistance and Rescue.

• Security of Society

Security is essential for ensuring the stability and survival of any society. In Iran, the authority responsible for the security of the country is the Police. Another institution engaged in safeguarding the security of society is the Judiciary which, according to Article 156 of the Constitution of the Islamic Republic of Iran, is an independent power protecting individual as well as social and collective rights. It is entrusted with the wide ranging duties such as disseminating social justice, guaranteeing the legitimate constitutional and natural freedoms of the people, overseeing the proper enforcement of laws and regulations, adopting measures to prevent crime and reforming criminals.

A survey of the indicators and quantitative goals of the judicial system of the Islamic Republic of Iran shows an increasing number of judges per every one hundred thousand of the population. However, the large and unprecedented explosion in the number of incoming cases has affected the statistics in such a way that the number of cases referred to each judge increased from 977 in 2001 to 1,153, in 2003. This indicates an average annual growth rate of 1.01%. Table 1-1 contains some further relevant pieces of information.

2.7 ■ Consumption Patterns

• Economic Status

Some indices for certain economic features of the country were as follows in 2001-2005.

•Gross Domestic Product (GDP) improved during the course of 2001-2005 so that, at current prices in 1998, it showed an average annual growth of 5.5% (compared with an average annual growth rate of 3.8% during the Second Development Plan) and rose from 320,069 Billion Rials in 2001 to 398,234 Billion Rials in 2005. Average annual economic growth, excluding petroleum-related sources, was also 5.8% in the course of 2001-2005 while average annual growth for production during the same period was 3.8%.

•The average annual investment growth rate was 9.3%.

Figure 1-3 shows GDP and shares of sectors 1998-2005 at current prices in 1998.

• Industry and Mines

The industrial, mining, electricity, water, gas and construction sectors had an 11.1% share of the total 3.1% contribution of the average annual growth to GDP. More than 2% of the total 5.5% average annual growth rate of the Third Development Plan related to industry and mining.

• Services

The average annual growth rate in this sector was 4.8% during 2001-2005. The country's average annual economic growth rate was 5.5%, of which 2.5% belonged to the service sector. In 2005, the maximum growth in this sector occurred in general trading, hotels and restaurants (2.3%), real estate

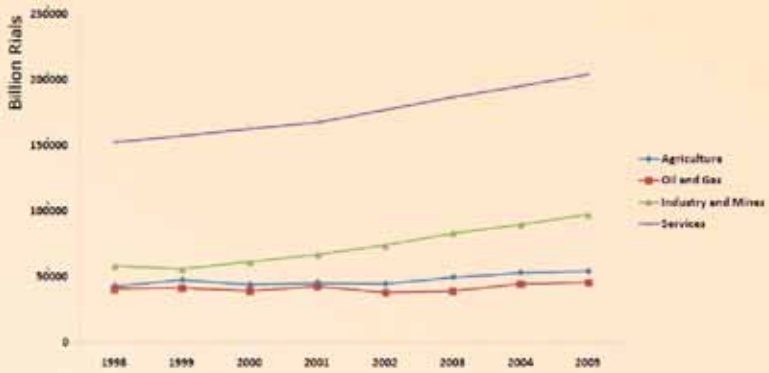


Figure 1-3: GDP and shares of sectors 1998-2005 at current prices in 1998

Source: Central Bank of Iran , Office of Economical Statistics

(0.6%) and transport and communication (0.9%). Altogether, these accounted for 3.8% of growth in the service sector with other areas accounting for the remainder of the growth. The service sector showed an average annual growth rate of 4.8% in 2005, contributing 51% of total GDP.

- **Agriculture**

The average annual growth rate in this sector was 4.3% during 2001-2005. The agricultural sector enjoyed an average growth rate of 2.2% in 2005, and contributed 13.7% of total GDP.

- **Oil and Gas**

The average annual growth rate in this sector was 3.3% during 2001-2005. This sector showed an average growth rate of 2.6% in 2005, compared to a 12.9% growth rate in the previous year. This shows that the contribution of the export of the raw materials to GDP has given way to other more rational types of exports.

2.8 ■ Agriculture and Natural Resources

•In 2005, this sector accounted for 13.7% of GDP, remaining constant according to process current in 1998 , 19.7% of the total value of non-oil exports, about 20% of employment, more than 82% of the food supply and 90% of the raw materials needed in agricultural conversion industries.

•Agricultural products which had been about 44.7 million tons in 2001, decreased to 14.2 million tons in 2005.

•Horticultural products which had been 12.3 million tons in 2001, decreased to 5.9 million tons in 2005, showing a 500,000 ton decline compared with the previous year.

•Fish and shrimp production was 424,500 tons in 2001 and 456,100 tons in 2005. Reproduction of aquatic species amounted to 988 million units in 2001 and 1,668.2 million units in 2005.

• Red meat production was 729,000 tons in 2001 and 784,900 tons in 2005.

•Egg production was 579,000 tons in 2001 and 645,000 tons in 2005.

•The level of livestock immunity against infectious diseases was, respectively, 94.3, 90.7, 89.9, 94.3, and 96.2 % in the years from 2001 to 2005.

•Extension training was given to 223,000, 445,000, 888,500, 904,300, and 1,935,000 persons per day, respectively, in the years from 2001 to 2005.

2.9 ■ Industry and Mines

The industrial and mining sector is one of the most significant economic sectors and is considered to be the engine of economic growth in most countries. Strengthening this sector and improving its competitiveness not only increases economic growth but the exports and employment as well.

•The industrial sector saw a 57% growth in the issuing of operating licences to industrial workshops by the Ministry of Industry and Mining in 2001-2005. During this period, the employment capacity of industrial workshops grew more than 140% and investment in those workshops also multiplied by 7.8 times (See: Table 1-2). In 2005, as many as 3,043 workshops with an investment of about 37.5 billion Rials owned by the private sector became operative. Those workshops directly created as many as 86,200 jobs for employees.

•In 2005, 610 operating licences were issued in the mining sector. The known deposits of the mines in question amounted to about 2,221.8 million tons. The volume of the investment made in relation to those permits was 960.7 billion Rials, creating directly 6,437 jobs.

•The volume of industrial and mining sector exports increased from $1.91 billion in 2000 to $4.56 billion in 2005, showing an average annual growth rate of 19%.

• Petrochemical production capacity increased from 14.2 million tons in 2001 to 18.2 million tons in 2005 and the marketable petrochemical products increased from 6.7 to 10.1 million tons. The volume of investment in operational petrochemical projects was $2.827 billion, equal to 6140 billion Rials.

•Petrochemical product exports increased from $339 million in 2000 to $1730 million in 2005, showing an average growth rate of 38.54%.

•The nominal production capacity of raw steel and steel products increased, respectively, from 6.7 and 7.1 million tons in 2000 to 11 and 13.5 million tons in 2005. The production of raw steel rose from 6.2 to 9 million tons, and that of steel products from 6.5 to 10.5 million tons. The volume of exports also grew in this period from 1.1 million tons, valued at $206 million, to 1.97 million tons, valued at $930 million. The size of investment in the steel industry was $1290 million plus 13,215 billion Rials.

2.10 ■ Transport

•Road transport has played an extensive role in passenger as well as cargo movements. Statistics

Table 1-1: Some significant information concerning security of society during 2001-2003

Year	General Court	Appeal Court	Revolutionary Court	Ratio of Judges per 100,000 of the Population	Protective Measures Covering Inmates' Families (Households)	Ratio of Independent Forensic Centres to Judicial Units (%)
2001	2260	226	226	8.3	2812	34.09
2002	2403	240	223	8.5	3700	46.82
2003	2582	252	245	9.7	4070	48.74

Source: Statistical Centre of Iran, 2005; Management and Planning Organization, 2005

for 2005 show that about 93% of total cargo transfers plus 93% of total passenger journeys in the country were by road;

•In 2005, as many as 440 million passengers travelled and 418 million tons of cargo was moved by public transport. Compared with 2000, the figures show a 12.7% increase in the number of passengers and 69% increase in the amount of cargo.

•By the end of 2005, motorways and highways were recorded to have covered 1,240 Km. and 4,462 Km, respectively. Main roads covered 24,544 Km, 1.5% more than the previous year. In 2001-2005, the average annual growth rates in total the length of the country's motorways, highways and main roads were 8.8, 8.2, and 2.1 %, respectively. During the same period, in order to increase the capacity of the public transportation fleet, create new jobs and reduce the operating age of the fleet, a budget of 59.2 billion Rials was allocated in the form of subsidies to cover the exchange rate, to be paid to city bus manufacturing companies and for the purchase of up-to-date technologies. In 2005 as many as 369 new buses entered the transportation fleet and, consequently, 1,476 jobs were created. In 2001-2005, 2,530 buses, 1,643 trucks, and 805 trailer trucks were purchased at a cost of 561 billion Rials. This was paid from funds allocated for industrial and credit aids and 15,854 new jobs were duly created.

•In 2005, more than 17.3 million passengers and 29.5 million tons of cargo were transported by train.

•In 2005, more than 22.4 million international air passengers arrived at and departed from the country's airports. In the same year, there were 8.9 million domestic air passengers, of whom 37.2% used non-governmental airlines.

•The marine transport sector successfully achieved its goals in 2005. In that year, using 100% of their nominal capacity, the country's commercial ports loaded and unloaded many different types of petroleum and non-petroleum commodities, which far exceeded 93.4 million tons, showing a more than 9% rise compared with the 85.6 million tons of 2004;

•The transit of petroleum as well as non-petroleum cargos through the commercial ports of the country reached 5.83 million tons in 2005, showing a 1% increase compared with 5.78 million tons in the previous year.

2.11 Energy

•An increase in the production capacity of crude oil to 4,230,000 barrels per day in 2005, showing an additional 337.4 barrels per day compared with production levels in 2000.

•A 3.4% growth in consumption of the five main petrochemical products in 2001-2005.

•Equipping 46,050 households with natural gas over the same period.

•Increasing the average output of the power stations to 103,000 Mega Watts (compared to that of 2000);

•Increasing electrical energy generation to 51.4 billion KWH per year (compared to that of 2000);

•Establishment by NIOC of the required platforms for refueling CNG vehicles.

2.12 Foreign Trade and Balance of Payments

Taking into account the surplus on the current as well as the capital accounts balance, there was a growth overall of about $8.3 billion in the country's international hard-currency deposits in 2005. The surplus balance in the current account was $4 billion, an increase of $3.2 billion over the previous year. The trade balance, having grown by $3.3 billion over the previous year, showed a surplus of $7.8 billion. The $10.4 billion increase in exports, despite an increase in imports of $7.1 billion compared with the previous year, led to a growth in the trade balance and, consequently, in the current account balance. A $9.5 billion rise in oil and gas exports caused exports to rise overall. Ultimately, the country's oil export revenues amounted to $31 billion over the course of the five years.

In 2001-2005, approximately $28.2 billion worth of non-petroleum commodities were exported. The export of services alone earned the country $23.8 billion while exports of commodities and services together, with an average annual growth rate of 18%, amounted to $182 billion. In the same period, the import of commodities and services amounted to $160 billion, with an average annual growth rate of 24.2%. (Management and Planning Organization, 2005)

2.13 Human Development

The human development index (HDI) for Iran rose from 0.71 in 2001, to 0.791 in 2005. The average growth rate of the HDI was 2.1% in 2004. Such a rate makes the growth more concrete than in previous years. The improvement in oil export revenues has been the most significant factor for the economic growth of the country.

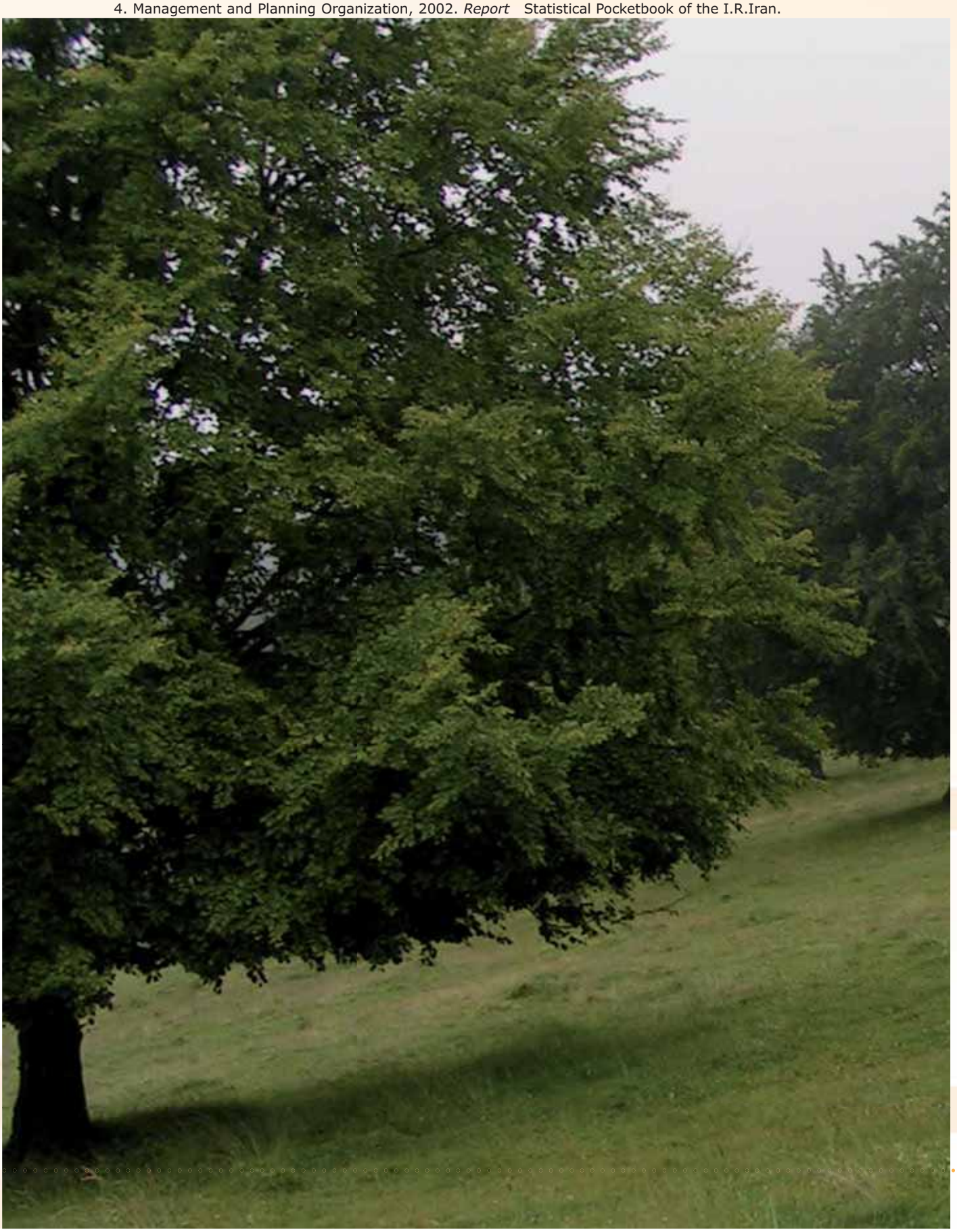
Table 1-2: Number of operating licences, the volume of employment and investment in industrial workshops during 2001-2005

Year	Number of Permits	Employment (Persons)	Investment (Billion Rials)
2001	3246	56492	6462
2002	3550	74578	13023
2003	4147	77296	18059
2004	4482	113372	28875
2004	5152	137579	50144

Source: Management and Planning Organization, 2004; Statistical Centre of Iran, 2005

REFERENCES

1. DoE, Office for Public Participation, 2006.
2. Central Bank of Iran, Office for Economical Statistics, 2005.
3. Management and Planning Organization, 2004. *News and Analysis Weekly, Special Edition for Third Development Plan Outcomes*. Presidential Report to Parliament, 6 August 2004.
4. Management and Planning Organization, 2002. *Report of the Government's Achievements.*
5. Management and Planning Organization, 2005. *Report of the Achievements of the Islamic Regime over a Quarter of a Century.*
6. Statistical Centre of Iran, 2004. *Statistical Yearbook.*
7. Statistical Centre of Iran, 2005. *Statistical Yearbook.*
8. Statistical Centre of Iran, March 2006-March 2007. Statistical Pocketbook of the I.R.Iran.



2 Resource and Environmental Management

1. Air

1.1 Climatic Conditions

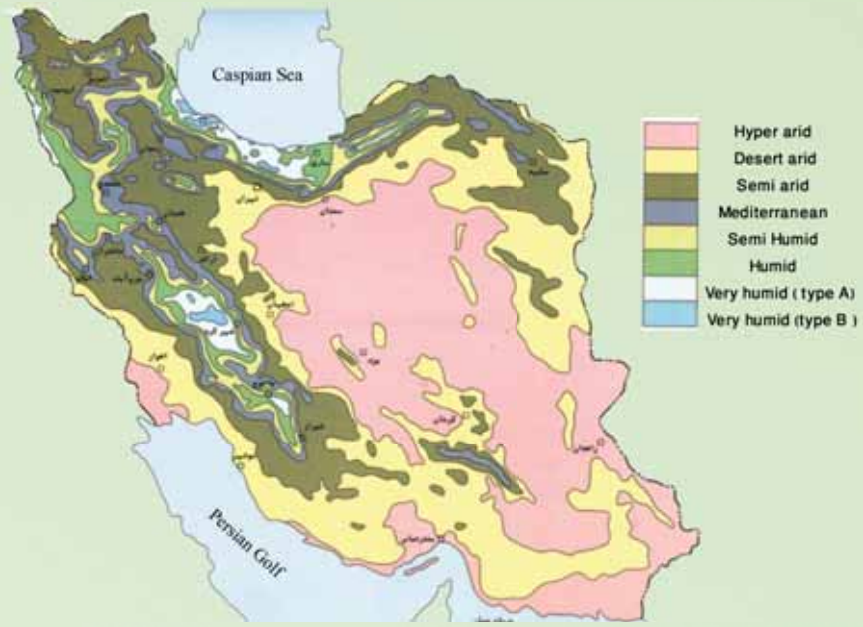
Iran is among those countries that have many and varied climatic zones and is located in the arid, desert belt of the world. In fact, Iran's deserts are among the world's driest regions and equatorial heat passes through them in July/August. Eight climatic zones have been identified in Iran; a brief account of each is given below. (Picture 2-1)

- **Arid Climate**

About 64% of the country's area has this type of climate. An arid climate may be divided into two sub-divisions: hyper-arid and desert arid. Iran's islands, the Persian Gulf, the Sea of Oman coastline, the border regions with Pakistan and the central deserts of Iran, along with a small region in the southeast of the country, all have a hyper-arid climate. The eastern and western slopes of the Zagros mountain chain, the heights of the southern Zagros and the southern slopes of the central Alborz mountain chain, along with the heights of the eastern and central mountains, are situated in the desert arid climatic zone.

- **Semi Arid Climate**

About 20% of the area of the country is affected by this type of climate whose natural locations are: the North and the Northeast of Khorassan, the Alborz



Picture 2-1: The Climatic Divisions of Iran

mountain slopes, the Orumiyeh plains in Azerbaijan and some parts of the Aras basin. Some vast regions on the slopes and the heights of western Zagros and Fars Zagros mountains, along with a long section of the Sefidrud riverbed, are also in this climatic zone. Almost half of the area in this zone has potential for cultivation, even irrigated by rainwater.

- **Mediterranean Climate**

The area influenced by a Mediterranean climate, comprising almost 4.9% of the total area of the country, is surrounded by the semi-arid and semi-humid climate zones. This type of climate may be observed in highland regions too. Some types of this climate roll up in a belt-like shape around the slopes and high plains of Azerbaijan, the Alborz mountains, the western Zagros mountain range, Fars and some highland areas in Kerman Province.

- **Semi-humid Climate**

This type of climate covers 3.4% of the total area of the country. The natural locations of this climate are: the heights on the western side of Orumiyeh Lake, the highland regions of Azerbaijan, the regions bounded by the west Zagros range, a vast stretch on the high slopes of the Alborz Mountains and some parts of Gorgan plain.

- **Humid Climate**

This climate type covers 3.6% of the total area of the country. The natural locations of this climate are: some regions in western Azerbaijan and northeast Khuzestan across the border from Turkey, the heights of the Alborz range, some sections of the eastern Caspian coastline and, finally, a circular region around the West Zagros and Fars Zagros mountains.

- **Very Humid climate (type A)**

This type of climate may be identified on the heights of the Zagros Mountains and the Caspian Sea coast. It covers about 3% of the total area of the country.

- **Very Humid climate (type B)**

Some regions on the southwest Caspian coastal plains, on the heights of the Alborz range and also on some parts of the western heights of the Zagros Mountains (around Koohrang) have this type of climate (Ministry of Energy, n.d.).

1.2 ■ Temperature

The average annual daily temperature in different parts of the country varies between 27 °C on the low plains of the south and zero °C at altitudes above 3,000 metres in Azerbaijan. In summer in some parts of Iran, the temperature rises above 50 °C , in winter in the highlands and it falls down to 30 °C below zero (Figure 2-1).

On the basis of the relationship of altitude to temperature, Iran can be divided into four homogeneous regions with regard to temperature variations. This classification demonstrates the fact that the temperature falls as the altitude rises, moving from the Northwest to the Southeast, from the West to the East and from the North to the South. The homothermous and temperature regions map of Iran (Picture 2-2) shows the average annual temperature in all the four homothermous regions. (Ministry of Energy, n.d.).

2. ■■ Land

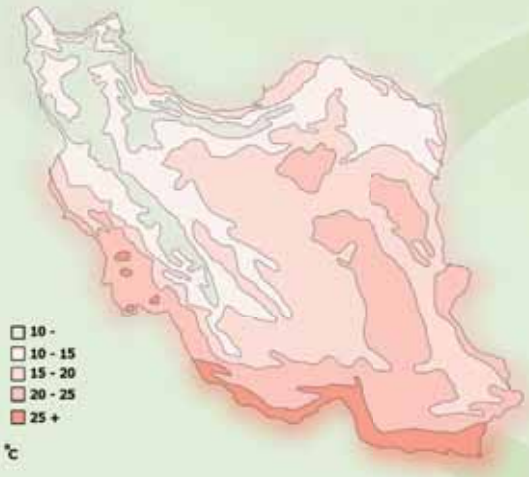
Iran is a mountainous country 52% of whose land is covered with linked as well as separated mountain ranges and hills. The lowest point in the country at 187 metres below sea level is located in the Loot Desert; the highest point is the summit of Mount Damavand in the Alborz Range at 5,671 metres above sea level. In general, four completely distinguishable physiographic units may be observed in Iran:

- **Alborz and Zagros Mountain Ranges**

These start in Azerbaijan, in the Northwest of the country, and extend towards the Northeast and Southeast enclosing the central Iranian Plateau in a triangle.

- **The Central Plateau**

The central Iranian Plateau is located between the Alborz and Zagros ranges, beginning in the North-



Picture 2-2: Homothermous Map of Average Annual Temperatures

east at a height of 2,500 metres and finishing on the lowlands as well as the Eastern and Central deserts. The Loot and Namak (or "salt") Deserts are the most arid regions in that part of the country.

- **Khuzestan's Vast and Level Plain**

This may be said to be the continuance of the Mesopotamian plain and is essentially made up of alluvial land from the Karoon and Karkheh Rivers

- **Caspian Coastal Lowlands (Polders)**

These are located about 30 metres below open sea level, starting adjacent with the sea and continuing towards the northern slopes of the Alborz range. The distribution of highlands in Iran is as follows.

- Land at an altitude of 1,000-2,000 metres, covering about 53.3% of the country.
- Land not higher than 28 metres, covering about .07%.
- Land 28-500 metres high, covering about 20%.

Inland lakes cover about 0.9% of the total area of the country. In other words, regions over 500 metres above sea level cover about 87.3% of the country (Sustainable Development Committee, 2004).

Similar to the distribution of the highlands, the types of land found in Iran are also varied. Mountains, covering 30.4%, take up the largest part of the total area of the country, and sedimentary plains, covering 0.5%, take up the least. Plateaux cover about 16.6%, hills about 15.8%, sloped plains 5.1%, river plains 2.5%, saline lowlands 3.6%, flood plains 6.7%, colluvial fans 9%, alluvial fans 2.5%, mixed lands 3.4% and miscellaneous lands 3.9% (Figure 2-2).

The differences in the types of land found in Iran depend upon their different forming factors, such as climate, vegetation and height, as well as their original comprising matter, time and the kind of human activity affecting them. As a general classification, Iran's land may be divided into four main types:

- **Valleys and plains**, covering 18.5% of the total area of the country;
- **The plateaux**, covering 28.5%;
- **The Caspian coastal lowlands**, covering 3%; and

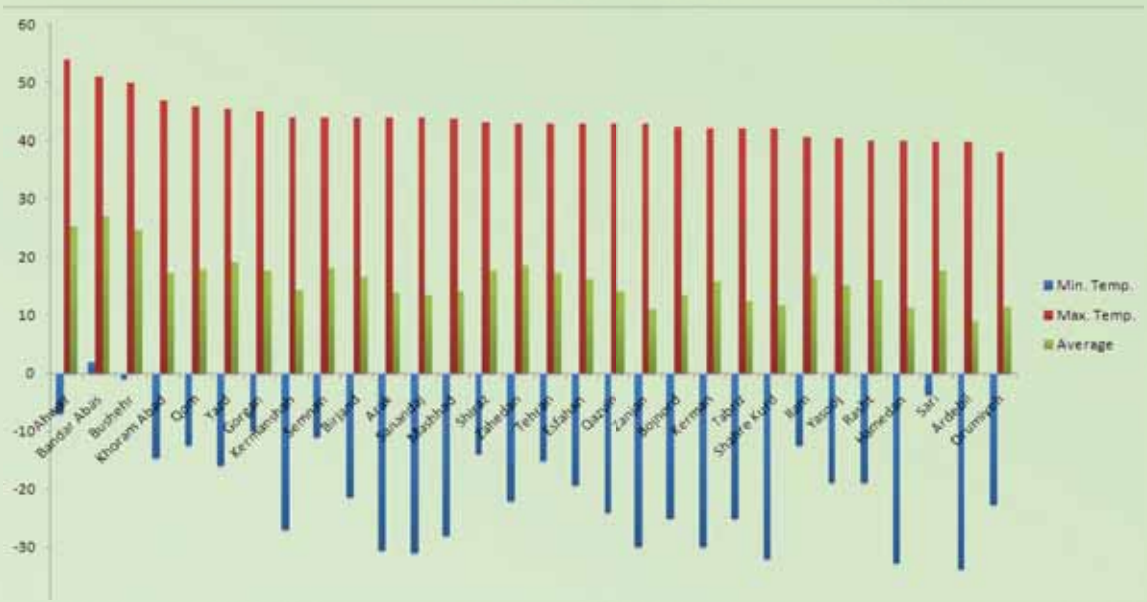
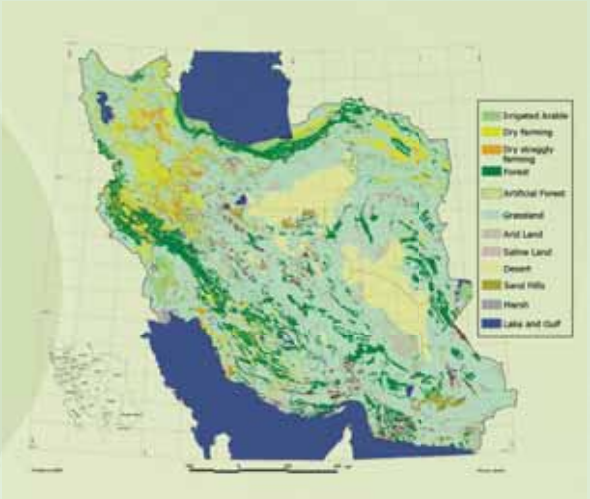


Figure 2-1: Absolute minimum, maximum and average temperature (°C) of the provinces (centers) for 30 years period
Source: Statistic center of Iran, 2005



Picture 2-3: Land application and vegetation map of Iran

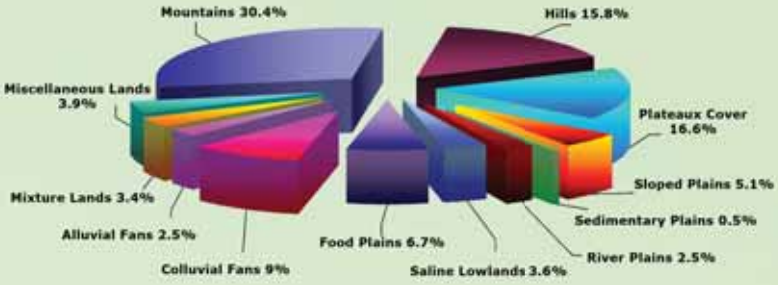


Figure 2- 2: Percentage of the various land types in Iran
Source: Sustainable Development Committee, 2004

- **The mountains and mountainous regions,** is the most common type, forming 52.2% of the land.

One reason that explains the wide variety of the country's soils is that half of the land is mountainous and has formed around saline, gravelly and rocky deserts, creating a closed region that contains a diversity of lands.

Almost 80% of the country is composed of arid and semi-arid regions. According to statistics from 2004, 17,665,000 ha of the land are arable, 46.97% irrigated and the remainder using rainfall (see Picture 2-3).

2.1 ● Forests

The latest survey on the area and dispersion of the country's forests was conducted in 1994, according to which the area of the forests was estimated to be 12.48 million ha; 10.51 million ha of these were forest reserves (excluding the northern forests) and 1.97% were northern forests. This means that 7.6% of the dry land of the country is forest and, considering the total population, the per capita share is 0.2 ha. Compared with the global per capita average forest share of 0.8%, this shows the severe poverty of Iran in this regard. It is worth mentioning that Iran is placed 45th among 56 countries with forests (Ministry of Agricultural Jihad, 2004).

Fars Province, with 1.2 million ha of forests, holds the first place in the country and Mazanderan, with more than 1 million ha, has the maximum forest area of all the Northern provinces. The forests of Hormozgan Province cover more than 800.000 ha, mostly mangrove (Sustainable Development Committee, 2004). The Arasbaran forests, inscribed as a Biosphere Reserve by UNESCO in 1977, used to cover 250,000-300,000 ha 50 years ago but they have, unfortunately, been deforested over time and have been reduced to 164,000 ha at present.

Despite the fact that about 100,000 ha of forest are reclaimed and rehabilitated every year, this Figure seems very small when placed against the deforestation that occurred many years ago. Due to the great dispersion of the forests, except for the northern ones, and because of the effect of the introduction of human settlement and livestock, forests are in serious danger. Annually, Iran loses an average of 142,000 ha of forest and was 10th in 1991-1996 among countries of the Asian-Pacific region with a high rate of deforestation.

3. ■■ Rangelands

More than half of the area of the country is rangeland and this may be categorized as follows:

- **Grasslands for Summer Grazing.** These cover 14 million ha, mostly in the high, cold regions, and produce 290 Kg of grass per ha which may be used to feed the livestock in the warmer seasons of the year.

- **Bushlands for Winter Grazing.** These cover 60 million ha mostly of warm, low regions and produce 92 Kg of grass per ha which may be used in the cold seasons of the year. These bushlands are not in a good condition owing to over-exploitation.

- **Desert Rangelands (on the desert margin)**. These cover 16 million ha of the arid, desert regions and produce 25 Kg of grass per ha. This type of rangeland is in poor condition with regard to its vegetation and grass production (Ministry of Agricultural Jihad, 2002-2004).

Rangelands may also be classified according to quality into fine, medium or poor. Only 10.3% of the rangelands fall within the range of fine quality. Rangelands of medium quality comprise 41.5% of the total and those of poor quality comprise 28.2%. Khorassan Province has the largest area of fine quality rangelands while the highest ratio of fine quality rangelands to the total amount of rangelands in any province is found in Khuzestan, leaving most other provinces with poor or medium quality rangelands. It should also be mentioned that there are some notable fine and medium quality rangelands in the northern provinces.

4. ■■ Deserts

Located in the arid belt of the northern Hemisphere,

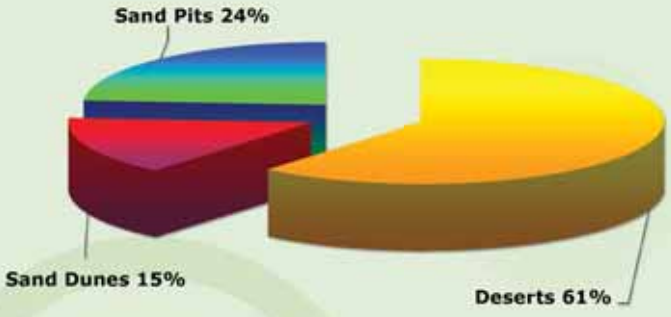


Figure 2-3: Classification of the country's deserts
Source: Ministry of Agricultural Jihad, 2002-2004)

Picture 2-4: Map of the Basins

the Iranian Plateau has very few water resources and low precipitation, a very high annual rate of evaporation and scant vegetation cover. Such severe conditions have potentially placed the country in danger of desertification. The geographic and climatic conditions, as well as harmful wind currents in the central deserts of Iran, have caused about 80% of the country's total 164 million ha area to fall into the categories of arid and semi-arid. The annual rainfall in these regions is 50-250 mm.

At present, the area covered by deserts and sand is 34 million ha, with a further 16 million ha of poor, desert rangelands (Figure 2-3).

It is most unfortunate that misuse and inappropriate exploitation over the past centuries have severely damaged and degraded the desert forests of Iran, leaving them bare and barren where they were once green with a variety of vegetation and plants. It is estimated that an average of 1% of desert margin land becomes desert every year.

5. Mountains

Iran is a mountainous country with an average height of 1,100 metres above sea lF It resembles a bowl with raised edges. Mountains along the borders with neighbouring countries form a circle surrounding the inner plateau and prevent humidity from permeating into the inner regions and, consequently, impose arid conditions upon the plateau. The mountain ecosystems of Iran are amongst the richest in the world in terms of the variety of vegetation. Thanks to such conditions, Iran's mountains are home to one of the most significant biodiversity areas in the world. The Alborz, Zagros and Arasbaran Mountains have formed the richest of these biomes. Iran's mountainous region includes the aforementioned Alborz and the central and southern Zagros ranges that contain vast agricultural and animal husbandry areas as well as forests and woodlands.

Iran's mountains may be classified into five ranges: the mountain ranges to the North of the plateau (the orogenic belt of the Alborz), the mountain ranges to the West and South of the plateau (the orogenic belt of Zagros), the mountains of the North of the Sea of Oman (Macran nappe), the mountains to the East of the plateau (Iranshahr-Birjand region) and the mountains of the central parts of the plateau (Central Iran).

6. Water

6.1 Inland and Coastal Waters

Water is the most important resource as well as one of the most vital elements of Nature on which the survival of human beings and all other living creatures depends. In examining the topographic characteristics of Iran, six main basins have been identified as follows:(picture 2-4)

- **The Caspian Basin:** With an area of 175,000 Km^2, includes the northern regions of Azerbaijan, the northern slopes of the Alborz mountain range and some parts of the eastern and northern slopes of the Zagros range.

- **The Persian Gulf and Sea of Oman Basin:** Covering an area of 424,000 Km^2, includes a substantial part of the highlands, western and southern slopes of the Zagros mountain range and the southern slopes of Bashagard Mountains.

- **The Orumiyeh Lake Basin:** With an area of 52,000 Km, covers the northern slopes of the Zagros Mountains, the eastern slopes of the mountains on the Iran-Turkey border and the southern and western slopes of Mount Sahand.

- **The Central Plateau Basin:** Covering an area of 824,000 Km^2 (the largest in the country), includes all the regions whose water runs off towards the lakes, moors, saline lands and the central deserts of Iran.

- **The Eastern Border Basin:** With an area of 103,000 Km^2, includes all the regions whose water runs off towards the country's moors and saline land, whether inland or in the border region with Afghanistan and Pakistan.

Table2-1: Reservoir dams operational in 2004

Time Span	Quantity	Designed Capacity (Million m^3)	Volume (%)
Before the Islamic Revolution	13	13414	46.1
1979 – 1989	32	5522.2	19
1989 – 1999	69	2034	7
1999 – 2004	55	8146.3	27.9
Total	169	29116.5	100

Source: Institute of Planning and Agricultural Economy,Ministry of Agricultural Jihad, 2004

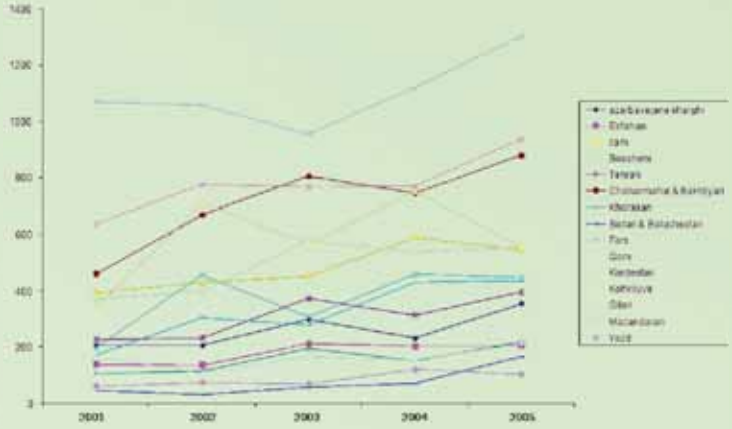


Figure 2-4: Average of yearly precipitation (mm) in selected provinces.(2001-2005)
Source: Statistical center of Iran, 2005

● **The Qareh Qom Basin:** With an area of 44,000 Km^2 (the smallest in the country), includes those parts of the East of the country whose water runs off towards Qareh Qom (Ministry of Energy, n.d.).

6.1.1 Annual Rainfall

Existing statistics assessing water resources show that precipitation is the main source of the country's water resources.Figure 2-4 shows the average of yearly precipitation (mm) in selected provinces(2001-2005). 30% of the 250 mm average annual precipitation falls as snow and the rest as rain. Thus, average annual precipitation amounts to 427 billion m^3. Of this, however, 38 billion m^3 permeate into underground water tables and 297 billion m^3 evaporate, leaving only 92 billion m^3 available as surface running water.

Out of the 427 billion m^3 of precipitation, about 25 billion m^3 are directly used to recharge underground water tables and another 13 billion m^3 run into those tables through underground currents. This renders the total amount of renewable water supplies as much as 130 billion m^3 (30.4% of the total precipitation) (Statistical Centre of Iran, 2004).

6.1.2 Reservoirs

Monitoring the compliance of dam operations with the operating guidelines as well as providing and checking the accuracy of information about the identity of dams are among the main tasks of the Water Sector. As many as 13 reservoir dams with regulating taps, holding 950.5 million m^3 of water, were operational in 2005. (Table 2-1)

6.2 ■ Coastal and Marine Areas

Considering its extremely long sea border, Iran occupies a special position in terms of water, marine resources and their unique environment. More than 16% of the country's population live in coastal provinces, making it necessary to monitor all the various human activities, be they industrial, agricultural or even household, that may affect the quality of the water supply.

● **The Caspian Sea**

This is the largest saline lake of the world and is situated in the North of the country, between the latitude of 36 degrees, 34 minutes and 47 degrees, 13 minutes North and the longitude of 46 degrees, 38 minutes and 54 degrees, 44 minutes East. The Caspian Sea is approximately 1,200 Km long from North to South and, at its widest region, is 466 Km wide. The area of the lake is 386,400 Km^2 and its depth is 184 metres, holding a water deposit of 71 Million m^3 (Ministry of Energy, 2004a). The length of Iran's coastal border in Caspian, taking the Gorgan Gulf coastline as its basis, is approximately 1,000 Km. The Caspian Sea may be divided into three sections - the northern, middle and southern parts. The average water-level of the Caspian Sea is below open sea level, although the level has varied in different years. In 1995, the average level of water in the Caspian reached 26.42 metres below sea level. The average amount of precipitation falling into the Caspian Basin has been 73.2 billion m^3 over the last 23 years, comprising 17.8% of annual precipitation falls in the country. Various rivers flow into the Caspian Sea, with the River Volga, the largest of them, accounting for 80% of its total water intake. Rivers running into the Caspian Basin from inland parts of the country account for 4-5 % of the total water inflow. The maximum amount comes from the Sefidrud River's tributaries.

The Northern Caspian Sea receives 88% of the total water inflow and, thus, is the richest part in terms of biological reproduction in Caspian Sea. (Sustainable Development Committee, 2000-2001) (Table 2-2)

● **The Persian Gulf and Sea of Oman**

The Persian Gulf is situated to the South and Southwest of the country, lying adjacent to Khuzestan, Bushehr and Hormozgan Provinces. The water limits of the Persian Gulf lie at a latitude of 24°, 30' North and a longitude of 48°, 57' East. The Strait of Hormoz connects the Persian Gulf with the open sea. The Persian Gulf covers an area of about 239,000 Km^2, its average depth being approx. 35 m and its deepest point, the northeastern part of its Iranian side, is about 90-100 m. Its average width is about 240 Km. The dominant climate type in the Persian Gulf is warm and humid. All the water flowing into the North and Northeast of the Persian Gulf originates from Iran and Iraq.

The Sea of Oman, situated in the Northeast of the Indian Ocean, is bordered on three sides by land

Table 2-2: Variety of life forms in the Caspian Sea

Region	Daily Production (gr/Carbon/ Liter)	Annual Carbon Production (gr/m^2)	Region's Annual Production			Total Regional Production (Million Tons)
			West	Center	East	
Northern Caspian	0.76	273	-	-	-	24
Inner Caspian	1.12	369	21.5	23.4	6.09	51
Southern Caspian	0.89	335	11.2	20.2	9.5	41
Total	0.92 (Mean)	325.7 (Mean)	-	-	-	116

Source: Sustainable Development Committee, 2000-2001

and connects to the open sea from one side only. The length of the Sea of Oman, from the Strait of Hormoz to the Indian Ocean, is 610 Km and its average width is less than that of the Persian Gulf. The Sea of Oman is about 3,398 m deep at Chahbahar, but it becomes shallower as it moves towards the West where it reaches 73 m near the Strait of Hormoz (DoE, 2004).

The potential for biological reproduction in the Persian Gulf and Sea of Oman, in particular in the Persian Gulf excluding the mouths of inflowing rivers, depends on general variations of the tides. According to surveys conducted by a Japanese vessel, the average daily primary reproduction potential was estimated at 500 mgC/m^2 (0.12 – 1.27 mgC/m^3) in the region. The total amount of zoo-plankton organic mass in the region varied from between 0.03 to 0.24 ml in 1993. The average daily production was estimated to be about 32 mgC/m^2 , a high percentage of which was composed of Ostra plankton compost. It is worth mentioning that primary and secondary plankton production plays a major role in feeding small-planktovore fish like sardine and mottplanctovoreo and some other marine creatures (Sustainable Development Committee, 2000-2001).

7. Biodiversity

The composition of a society in terms of the differences between and varieties of floral, faunal and ecosystem types is referred to as biodiversity. To be exact , as defined by the Biodiversity Convention (1992), biodiversity is the potential for variety amongst organisms from any source, be they land, marine, or any other aquatic ecosystems, as well as their complex ecological compounds. The definition includes variety within species, between species and of ecosystems

The number of wild mammal species of Iran is 164, almost equal to the total number of all mammals on the Continent of Europe. The floral species of Iran are estimated to total about 8,000, of which 22% (1,727 species) are indigenous. In comparison with the total amount of floral species on the Continent of Europe (12,000), the variety of floral species in Iran is outstandingly large. In the registered index of the species of Iran, there are also 517 species of birds, 174 species of fish, 200 species of reptiles and 38 species of amphibians.

The variation in altitude ranges from 26 to 5,770 m, in temperature between 25 and 50 °C, in average rainfall from 200 mm in the southern parts of the Caspian region to 10 mm in the desert areas. Each of these variations plays a significant role in enriching the biological resources of the country. As a matter of fact, Iran's biodiversity owes its wonderfully wide range to those seemingly contradictory factors.

7.1 Wildlife and Habitats

7.1.1 Vegetation Regions

- ***Hirkani Region (Caspian Forests)***

This region, known in Iran as Hirkani, is bounded by the Caspian coastal strip and the Arasbaran region. Its broadleaf deciduous forests of the Fourth Geological Epoch, having survived the Glacial Periods in the fourth geological epoch and formed a refugium, have a special significance. The high rainfall (200-600 mm annually) distinguishes this region from all the others. Amongst 65 arboreal species of the Southern Caspian coastline, still relic species, evidence of the Third Geological Epoch may be found. Out of 80 forest plant species which have so far been reported in the region, 45 species or about 55%, belong to the late Pleistocene era.

- ***Irano–Turanian Region***

This region covers the largest area of the country and contains mountainous as well as flat lands and deserts. The altitude from sea level in this region is 1,500 m and above. Annual rainfall varies between 200 to 400 mm. The greatest variety of species lives in the mountainous areas of this region. The Zagros and Alborz ranges in the West and North of the region, Mount Shirkooh and Mount Siahkooh in the centre, Mount Lalehzar and Mount Hezar in the South and the Taftan range in the East are habitats for many exclusive species. The Irano-Turanian vegetation region consists of two distinct parts: the Zagros vegetation and the Irano-Turanian vegetation.

Maraqeh Fossil Zone

The Maraqeh Fossil Zone was registered as a national natural monument in accordance with a decision made by the Supreme Council for the Environment in 2006. The Zone whose main complex is about 40 ha wide, has fossils of approximately 7 million years old. Pre-excavation and preservation surveys for the site have already been initiated. The Fossil Center of Maraqeh is also ready to operate in anticipation of this.

• ***Seharasandy Region***

This green region starts from the highlands in the Southwest of Iran and continues towards the Persian Gulf coast, along the border with Iraq on one side and with Pakistani Baluchestan on the other. The altitude from sea level varies between zero to 1,000 m. Rainfall is limited to winter and does not exceed 100 mm per annum in most parts. The vegetation is very poor in terms of species and species variation.

7.1.2 • Mammal Habitats

Iran's most important habitats may be classified into the following seven groups:

• ***Caspian Forest***

This consists of the forests on the northern slopes of the Alborz Range and stretches from Golestan Park to the Astara Forests which hold many different arboreal species, shrubs and highly concentrated herbaceous plants. The relative average humidity and annual rainfall rates are very high, compared to other regions of the country. The mammals exclusive to this habitat include, amongst others: red deer, chamois (rose deer) and forest mink.

•***Mountain***

Prominent characteristics of this habitat include: high areas which stand on a rocky outcrop or high hilly forms, lower temperatures and higher rainfall rates in comparison with neighbouring areas. The vegetation consists of grassland and bush land. The mammals that live in this habitat include the snowy vole, Persian ibex and panther. Animals in this habitat have high amounts of body fat stockpiled and their long hair changes to a light colour, even completely white, in winter.

• ***Zagros Forest***

This habitat comprises the forests on the Zagros Range which stretches from Northwest to Southeast. The vegetation includes cold-region plants in its eastern parts and warm-region plants in its western parts. Oak trees are dominant in most parts while grassland and bush land tends to decrease as the altitude rises to 2,300 m above the sea level and above. The mammal exclusive to the Zagros forest habitat is the Persian squirrel.

• ***Khuzestan Woodlands and Tropical Forests***

High temperatures, rivers and streams with an abundant water supply and, low plains are the main characteristics of these regions. Vegetation is scarce and scattered except for some areas on river banks where woodlands crowded with such trees as the Sind poplar and tamarisk are found. Yellow Persian deer and various kinds of insectivorous and honey-eating animals are amongst the mammals exclusive to this region.

• ***Desert***

This covers a vast section of the central region of the country which consists mostly of sandy deserts. Hot weather during the day and very cold weather at night are notable features of this desert habitat. Vegetation in these areas is scarce and limited to shrubs and bushes. To come to terms and adapt with the fatally hot daytime temperatures, most of the mammals of the region have chosen a nocturnal, underground life, supplying their water needs from dew and succulent plants. The harsh conditions of this environment have physically affected the fauna and provided them with long hair, broad ears and big, flat soles that facilitate their walking on the shifting sands. Notable mammals in this habitat include bipeds, sand foxes and sand cats.

• ***Baluchi***

The Baluchi habitat covers the coastal areas of the Sea of Oman and, some parts of the Persian Gulf coasts where humidity and temperature are high. Vegetation is fairly dense in some parts and includes such trees and shrubs as acacia and screw bean. The fauna in this habitat are very much like the ones that live in India. The black bear (Ursus americanus) and the Baluchi squirrel are among the mammals exclusive to this habitat.

• ***Steppe***

This habitat type covers the largest area of the country and consists of vast and relatively high plains situated between the mountain ranges of Alborz and Zagros, extending to the Pakistan and Afghanistan borders. The rainfall is relatively low. The weather can become freezing cold and frost is common in most parts in winter. Vegetation is of short and dry types such as artemisia and Astragalus acutus. Mammals of this habitat usually have long legs that enable them to run fast and escape predators

Table 2-3: Number and extent of the four special management zones

YEAR	1998	1999	2000	2001	2002	2003	2004	2005	2006
Natural Monument	5	5	5	6	7	12	16	16	19
National Park	10	10	11	11	12	16	19	19	19
WildLife Sanctuary	23	23	24	24	26	33	33	33	34
Reserved Zone	43		82	82	88	91	91	91	93
Total (Number)	81		122	123	133	153	161	161	165
Area (1000 ha)	7931.4	8131.5	9235.6	9235.6	11229.3	11766.4	11848.8	11848.8	11859

Source: DoE, 2006

when there is no hiding place or to hunt and catch other animals. Gazelle and cheetahs are among the fauna exclusive to this habitat.

7.2 Areas under Special Protection (Protected Areas)

In accordance with Article 3(a) of the Environmental Protection and Improvement Law, natural spaces such as national parks, national natural monuments, wildlife sanctuaries and all other Protected Areas are under the overall control of the national Department of the Environment (DoE). Any changes to the land of the aforementioned spaces should be in compliance with the rules and regulations set forth in the current Law. The Department of the Environment, on behalf of all other governmental organizations and ministries, is in charge of enforcing the law. For the protection and preservation of wildlife, the Department may designate some areas as reserved for a specified period of time in addition to the four special zones (shown in Table 2-3). No Hunting areas, as well as some rivers, wetlands and marine habitats are among those which have been designated as areas under DoE protection.

The number and size of areas protected by DoE have increased over recent years. In 1967, there were 27 zones with a total area of 2,168,995 ha, rising to 81 zones covering 7,931,443 ha in 1998. These included ten national parks, 43 nature reserves, 23 wildlife sanctuaries, and five national natural monuments. In the first quarter of 2006, there were 165 zones covering an area of 11,859,026.48 ha including as many as 19 national parks, 93 nature reserves, 34 wildlife sanctuaries and 19 national monuments (Table 2-3 and Figures 2-5 and 2-6).

According to international standards, such spaces should cover a minimum of 10% of the total area of any given country. In Iran, however, the total area of these spaces under the protection of the DoE, at 11.86 million ha does not exceed 7.23% of the country's total area.

Zones under the management of the DoE grew in extent (50%) and number (103%) during 1998-2006. During the same period, the average annual increase in the number of such zones has been 9.2%, and of the area covered, 5.2%(DoE. 2006).

Picture 2-6 shows distribution of protected areas in Iran.

7.2.1 National Parks

A national park is a natural resource of forests, rangelands, woodlands, woods or plains and mountainous areas that represents an outstanding feature of Iran's natural environment. It has been designated as such in order to enable the DoE to preserve it unchanged in its natural state and to establish an appropriate environment in which the flora and fauna of the zone can reproduce and grow. Shooting, hunting, grazing of livestock, cutting trees and also trespassing are activities prohibited in national parks. National parks used to number ten covering an area of 1,371,177 ha in 1998, increasing to 19 parks covering a total area of 1,751,427 ha in 2006 which comprise for 14.8% of the total area of the Four Special Management Zones under the protection of the DoE.

National Parks have grown by 90% in terms of numbers and 28% in terms of their area by 2006, compared with 1998. There are between 1-3 national parks in 13 provinces, their distribution in a descending order being: Tehran and Khorassan (three each), Semnan, Fars and Mazanderan (two each) and West Azerbaijan, Isfahan, Bushehr, Chahrmahal va Bakhtiyari, Kerman, Golestan and Guilan (one each).

7.2.2 National Natural Monuments

These represent rare and exceptional specimens of flora and fauna, outstanding and excellent landscapes or areas containing special natural features such as ancient trees or of historical significance that are designated as Reserved in order to ensure their safety. Grazing livestock, cutting down trees and bushes, damaging the environment and generally carrying out any activities that may destroy the vegetation or cause harmful changes to the ecosystem are prohibited by law. Passage in and out of the zones shall comply with regulations issued by the Iranian Department of the Environment.

There were as many as five national natural monuments with a total area of 2,118.23 ha in 1998; there are 19 such monuments now in 2006, covering 1, 8449.46 ha and comprising almost 0.2% of the total area of the four Reserved Zones.

The distribution of the 19 national natural monuments throughout the 11 provinces where they exist may be set out in a descending order as follows:

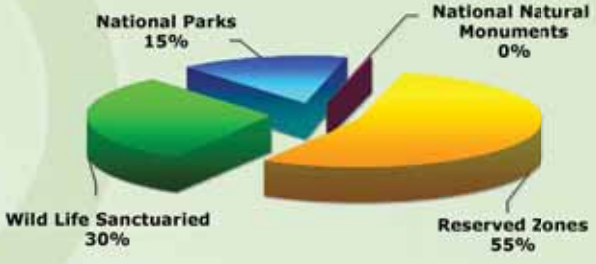


Figure 2-5: Percentage distribution of areas under DoE management in 2006
Source: DoE, 2006

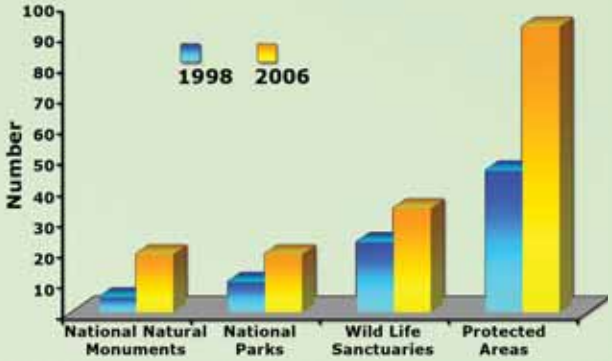


Figure 2-6: Comparison of the number of areas within the four special management zones, 1998-2006
Source: DoE, 2006

Mazanderan (three), Ardebil (two) and in Sistan and Baluchestan, Guilan, Eelam, East and West Azerbaijan, Kirmanshah, Chaharmahal-o-Bakhtiyari, Hormozgan, Yazd, Kerman, Lorestan, and Markazi (one each).

7.2.3 ● Wildlife Sanctuaries

This is an enclave that may be part of a forest, a range, a plain, woodlands or mountainous as well as aquatic environments that contains special habitats and has specific, climatic conditions making it suitable for the fauna that live in it. Sanctuaries are under special legal protection and neither hunting nor fishing is allowed in them except in certain appropriate seasons when the DoE announces that special permits for hunting or fishing may be obtained.

In wildlife sanctuaries, cutting trees or bushes, burning wood to make charcoal, damaging the environment and, generally, any actions that may harm the vegetation or affect the ecosystem are prohibited. Grazing of livestock may be carried out under the supervision of the DoE. A minimum of 20% of the area of the sanctuaries has been declared as "Safe Zones" where grazing is absolutely prohibited.

The number of the wildlife sanctuaries has increased from 23 in 1998, covering an area of 1,346,310 ha, to 34 covering 3,581,670 ha by 2006

The wildlife sanctuaries are scattered throughout 15 provinces. Some provinces boast up to five sanctuaries, while some others have only one. The distribution of wildlife sanctuaries over different provinces in a descending order is: Mazanderan and Guilan (five each), Yazd, Isfahan, Khuzestan and Khorassan (three each), Semnan, Kerman and Markazi (two each) and Fars, Hormozgan, East Azarbayejan, Kirmanshah, Zanjan and Bushehr (one each).

Management Actions Taken to Preserve Designated Areas

Many actions have been taken to increase the level of protection of parks and areas under the management of the DoE, such as:

- *Developing and strengthening the Wireless Network.*
- *Providing vehicles and arms.*
- *Establishing special visitor centres and equipping them with the necessary facilities.*
- *Combating poachers and trespassers who damage and degrade the environment.*
- *Interaction and co-operation with villagers and local people.*
- *Providing accurate maps of areas and their biodiversity specifications.*
- *Providing comprehensive zone-management studies.*
- *Controlling hunting and fishing to ensure no harm is done to the environment.*
- *Holding training courses to improve the legal and practical expertise of the conservation guards.*
- *Putting into practice draft Management Plans.*
- *Conducting brief as well as in-depth studies of the country's Four Protected Areas.*
- *Implementation of a crisis management scheme for degraded ecosystems.*
- *Increasing the number of the Conservation Guards from 328 in 1998 to 566 in 2005, as well as equipping them with wireless communication means, cars, motorcycles and other useful facilities.*

Ecosystem Management Plans have been designed and implemented in the more sensitive ecosystems, especially in Orumiyeh Salt Lake which required urgent attention. The number of areas under the management of the DoE has doubled since last year, bringing it to 165 areas at present.

The total area of the zones under the management of the DoE has also increased from 7,931,443 ha (4.5% of the country's area) to 11,859,026.48 ha (7.23% of the country's area).

Photo : The symbiosis of local people with Hamoon Lake

7.2.4 • Protected Areas

A protected area is an enclave of the country's natural resources, be it a forest, a range, a plain or an aquatic or mountainous area, that has a special significance due to the role it plays or may play in the reproduction and preservation of flora and fauna and in keeping the natural conditions of the zone unchanged. The rules and regulations governing protected areas are similar in some respects to those governing wildlife sanctuaries.

The number of protected areas increased from 43 in 1998 to 93 in 2006, and they cover an area of 6,507,480 ha which comprises 55% of the total area of the Four Special Management Zones under the protection of DoE. The growth rate in the number of protected areas has been 48%, with a corresponding growth rate of 166% of the total area, in 2006 compared to 1998.

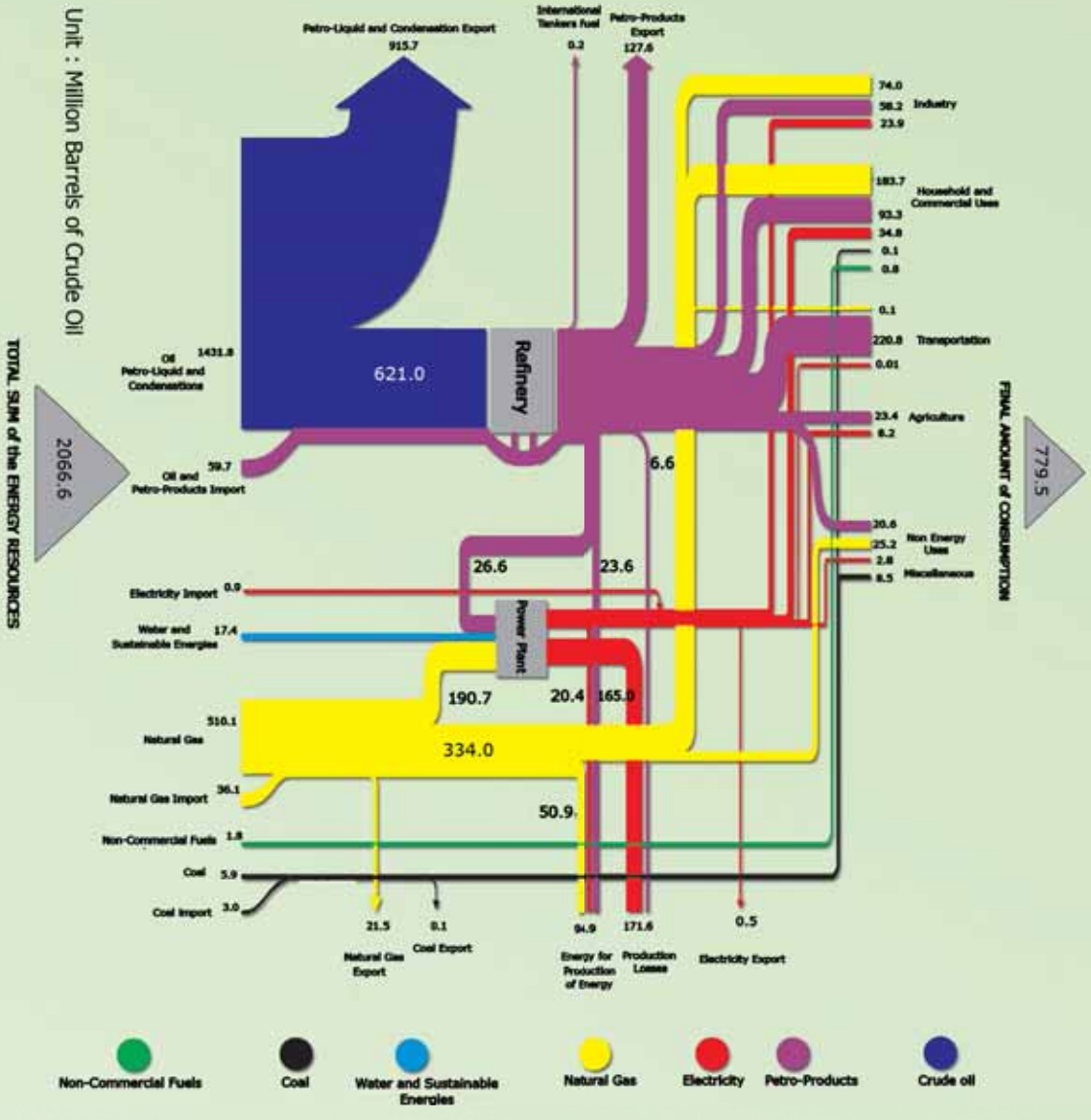
Protected areas are scattered throughout all of Iran's provinces except Qom and Isfahan. The distribution of protected areas between different provinces, in a descending order, is: ten in Mazanderan; eight in Hormozgan; seven each in Fars and Khorassan; six each in Guilan and Kohkiloyeh va Boyerahmad; five each in Khuzestan and, Sistan va Baluchestan, four in Yazd, three each in Golestan, Ilam, Chaharmahal-o-Bakhtiyari, Semnan and Kirmanshah; two each in Hamedan, Tehran, Markazi, West Azerbaijan, Lorestan, Zanjan and Bushehr; and one each in Ardebil, Qazvin, Kordestan, East Azerbaijan, Kerman and Mazanderan/Tehran (sharing).

7.2.5 • Other areas

The other areas under the management of the DoE are as follows:

• No Hunting Zones

These are zones of great potential that, if the nec-



Picture 2-5: Energy flows in 2004
Source: Mininstry of Energy

essary requirements are fulfilled, would preserve the country's natural resources in the form of a natural ecosystem and so are entitled to be designated as protected. A temporary ban is put on hunting for a specific period of time (say 3 to 5 years). In fact, the period also serves as a trial period to evaluate the zone's potential to join the country's network of Protected Areas or wildlife sanctuaries.

The number of No Hunting Zones was 75 in 1996 covering an area of 4,460,922 ha and has increased to 106, covering an area of 5,876,722 ha in 2006.

• Rivers

All the six principal rivers - the Jadjrud, Chaloos, Sardabrud, Karaj, Lar and Haraz Rivers - as well as all wetlands and gulfs adjacent to the Caspian Sea and all the other rivers in neighbouring coastal provinces that run into the Caspian Sea or the aforementioned rivers and wetlands are under legal protection.

• Wetlands

The number of lagoons of international significance has increased from 18 in 1996 to 22 in 2006. Other than lagoons, there are 34 aquatic zones under the management of the DoE. Lagoons are distributed throughout the different provinces in the following descending order: Hormozgan (21); Guilan (15); Mazanderan, West Azerbaijan and, Khorassan (14 each); Golestan (13); Khuzestan and Lorestan (12 each); Fars and Sistan va Baluchestan (10 each); Tehran and Hamedan (11 each); Bushehr (5); Ardebil, Isfahan and Chaharmahal-o-Bakhtiyari (4 each), Markazi, East Azerbaijan, Kermanshah and Kordestan (3 each); and Kohkiloyeh va Boyerahmad (1 each).

8. ■■ Renewable and Non-renewable Energies

As one of the most significant factors for production and one of its unavoidable end-products, energy plays an undeniable role in the economy. Picture 2-5 shows that the total amount of the energy resources is 2,066.6 million barrels of crude oil in 2004. Crude oil, liquids and spirits comprise 69.28% and extracted as well as imported natural gas comprises 26.43% of total energy resources. Other energy carriers, including imported oil and petroleum products, water and sustainable energies, locally extracted and imported coal, non-commercial fuels and imported electricity count respectively for 2.89, 0.84, 0.43, 0.09, and 0.04 % of total energy consumption.

The total amount of energy consumed in 2004 corresponded to 779.5 million barrels of crude oil, 53.4% of which was petroleum products, 36.3% natural gas, 9% electricity, 1% coal and 0.3% non-commercial fuels. Per capita use of energy in 2002-2004 was, respectively, 9.89, 10.53 and 10.82 equivalent barrels of crude oil, showing an average growth rate of 3% over that period.

• Energy Intensity

Among the development indicators for any country, those for energy intensity and for the total supply of primary energy to GDP compared with the population should be mentioned. The energy intensity index shows the amount of energy used to produce a certain amount of commodity or services. The study of this index for energy intensity shows an average annual growth rate of 3.4 % over 1968-1998;

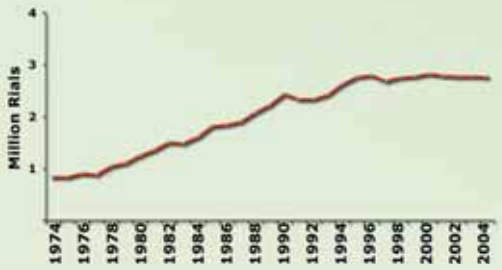


Figure 2-7: Variations in energy intensity against 1998 constant prices, during 1978-2004
Source: DoE, 2006

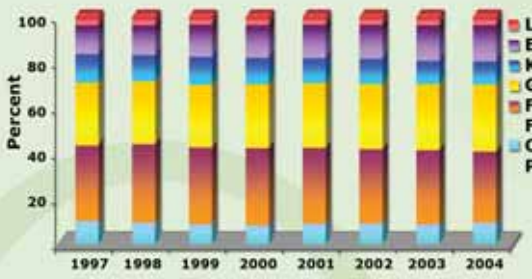


Figure 2-8: Combination of the production of petrochemical products, 1997-2004
Source: Ministry of Energy, 2004b

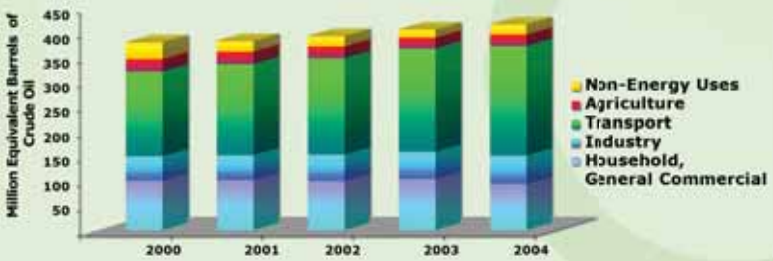


Figure 2-9: Consumption of petrochemical products in different sectors, 2000-2004
Source: Ministry of Energy, 2004**b**

however, it dropped to 0.2% in 1998-2004 (Figure 2- 7).

• Energy Coefficient

To explore the relationship between energy use and economic development, this coefficient is used as an indicator. It is obtained by dividing the rate of energy consumption by the rate of economic growth. Iran's energy coefficient was 1.37 in 1993-2003; however, it has improved over recent years, having reached 0.76 in 2004 (Ministry of Energy 2004).

8.1 • Non-renewable Energy

Considering its characteristics, energy may be said to have two contrasting attributes: renewable and non-renewable. Petroleum products electricity and fossil fuels are among the non-renewable types of energy.

8.1.1 • Petroleum Derivatives

Oil: Iran, the second oil-producing country in OPEC, has rich deposits of crude oil as well as natural gas and thus supplies 7% of world demand for these invaluable materials. Extractable deposits of crude oil and condensed gas were estimated at 132.74 billion barrels in the beginning of 2005. Thanks to efforts made to increase its extraction capacity, Iran is now able to extract 4.2 million barrels of oil per day. The actual deposits, land as well as sea, count for 82.2 and 17.8 %, respectively, of the country's extractable liquid hydrocarbons. Oilfield deposits increased by 2% and production by 5.2% during 2004, compared to 2003. Land deposits comprised 90.8% and marine deposits covered 9.2% of the total accumulated production.

In 2004, from the total petroleum production, 59.1% belonged to light and semi-distilled products, 31.2% to fuel-oil and the rest to other heavy products and sediments (Figure 2-8). In the last two years, the quality as well as the quantity of light and semi-distilled petroleum products has increased, however, fuel-oil production has decreased. In 2004, the consumption of the main oil products amounted to 72.6 billion litres, showing a 0.6% growth over 2003 (Figure 2- 9).

Natural Gas: Compared to other fossil fuels, natural gas has the least value in terms of heat generating power; moreover, it does not convert into high added-value materials as easily as other hydrocarbons. However, as a clean fuel, it helps to reduce environmental pollutants. The total extractable deposits of natural gas have been estimated at 27.45 trillion m^3 by the end of 2004.

Most of the country's needs for natural gas are provided by the land oil-fields which cover 92.1% of total production; while the marine oil-fields produce 7.9%. In 2004, the total production of natural gas was 510.1 million barrels equivalent of crude oil (Figure 2- 10). Figure 2-11 shows an increasing trend in enriched gas production during 1997-2004 (Ministry of Energy, Energy Balance Sheet. 2004b).

8.1.2 • Electricity

Nominal power station capacity under the supervision of the Ministry of Energy was 33,415.4 megawatts, showing a 9.2% growth over the previous year (Ministry of Energy, 2004b). The mean capacity of the actual power of these stations was 31,295.8 megawatts and the electricity produced was 146,676 giga watt hr (Ministry of Energy, 2004a). Per capita

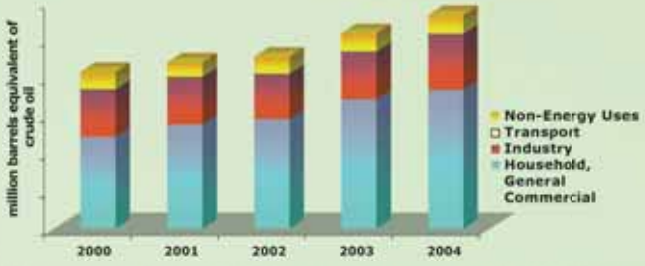


Figure 2- 10: Consumption of Natural Gas in Different Sectors, 2000-2004
Source: Ministry of Energy, 2004b

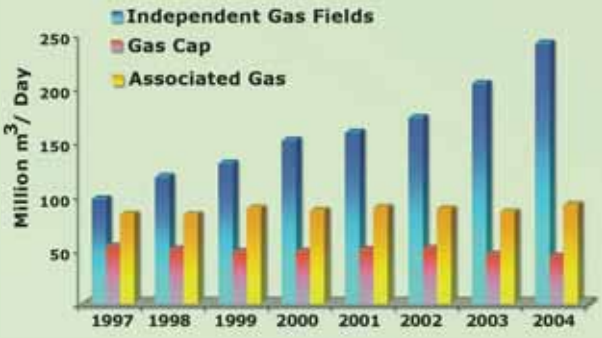


Figure 2- 11: Production trend of enriched gas, 1997-2004
Source: Ministry of Energy, 2004b

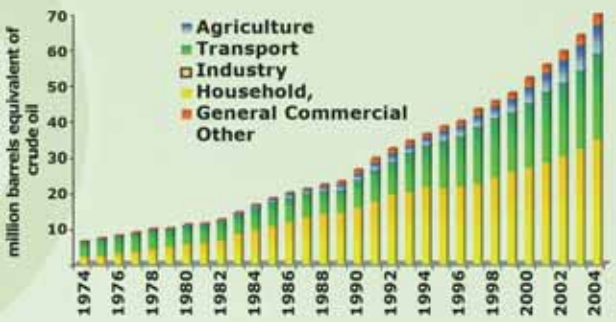


Figure 2-12: Electrical energy consumed by different sectors
Source: Ministry of Energy, 2004b

electricity production was 156 kilowatt h in 1968 and increased more than 14 times to 2234 kilowatt hr in 2004.

Final electricity consumption was 69.71 million equivalent barrels of crude oil (Figure 2-12).

8.1.3 ● Solid Fuels

Coal: The heat generating value of the various types of coal nationally available is 6000-8900 kilocalories/kg. There were 137 coal mines (active, inactive or in the installation phase) and a certain reserve of 560 million tons of coal in the country in 2004. Public sector mining companies extracted 1.58 million tons and private companies 0.32 million tons of coal from 114 active mines operating in 2004.

The principal user of coal in Iran is the Isfahan Steel Plant that uses coal in an industrial steel production process and 1502 thousand tons of coal was used in 2004.

Iran both exports and imports coal. In 2004, as many as 1,280,200 tons of coal were imported while only 20,200 tons were exported (Ministry of Energy, 2004).

Non-Commercial Fuels: In 2004, the production of forest products was 1,037.4 thousand m^3, 40% more than the year before. Of that amount, 385.5 thousand m^3 are firewood and 21.2 thousand m^3 are charcoal, traditionally used for cooking and barbecuing as well as for heat generation in many villages and towns. The value of various forest products was 475.9 billion Rials showing 18.4% growth over the previous year (Statistical Centre of Iran, 2004).

8.2 ■ Renewable and Nuclear Energy

These types of energy include hydro-electrical, ground-thermal, wind and solar and nuclear energies that account for 0.8 % of total energy resources.

8.2.1 ● Hydro-electricity

Even in antiquity, Iranians considered the efficient utilization of water resources to generate energy, and so it is only fair to say that Iranians have been amongst the pioneers of using water as an energy source. The first small-scale hydro-electric station, with two generators, was installed at Alvand in Hamedan in 1930. However, the first main hydro-electric power station generating 150,000 megawatts hr electricity per annum was the Karaj Dam Power Station, built to support the national grid at peak consumption times. Currently, the Shahid Abbaspour Power Station is the largest hydro-electric power plant in the country and can produce 2,000 megawatts of electricity (Ministry of Energy 2004 b)(Table 2-4).

8.2.2 ● Wind Power

A Wind Atlas is being prepared to provide accurate information about the wind potential of different parts of the country. In 2005, 42 wind turbines were constructed in the three windy regions of Manjil, Rudbar and Harzville which produce 16.6 megawatts electricity, with a capacity to produce 27.8 million kilowatt hr electricity. (Ministry of Energy, 2004b).

8.2.3 ● Solar Power

As the name suggests, solar energy comes from the sun. In regions where a minimum of 1,800 kilowatt hr/m^2 of annual direct sunlight is available, construction of a solar power plant is recommended. The electricity generated by photo-voltaic power plants was 78.5 MWH in 2004b.

To take the optimum benefit from solar energy, the Solar Bath and Solar Boiler Plans have been carried out in some warm cities and towns where a natural gas heating system has not been developed. At present, 10,000 boilers that use solar energy to heat water are installed in houses in certain cities (Ministry of Energy, 2004b).

8.2.4 ● Ground-thermal Energy

Energy originating from the decomposition of radioactive matter from the centre of the earth and from inner-earth chemical reactions is called ground-thermal energy. Meskinshahr Ground-Thermal Power Plant that the Ministry of Energy began construction of in 1996 is now in its completion phase. It is estimated that it will produce 260 megawatts equivalent of electricity. According to the timetable presented by the Ministry, this power plant should have been operational by the end of 2006 (Ministry of Energy, 2004a).

8.2.5 ● Nuclear Energy

Currently, the only atomic power plant with an output of 1,000 megawatts is under construction in Bushehr. The construction started in 1996 and it was expected to be finished by 2006.

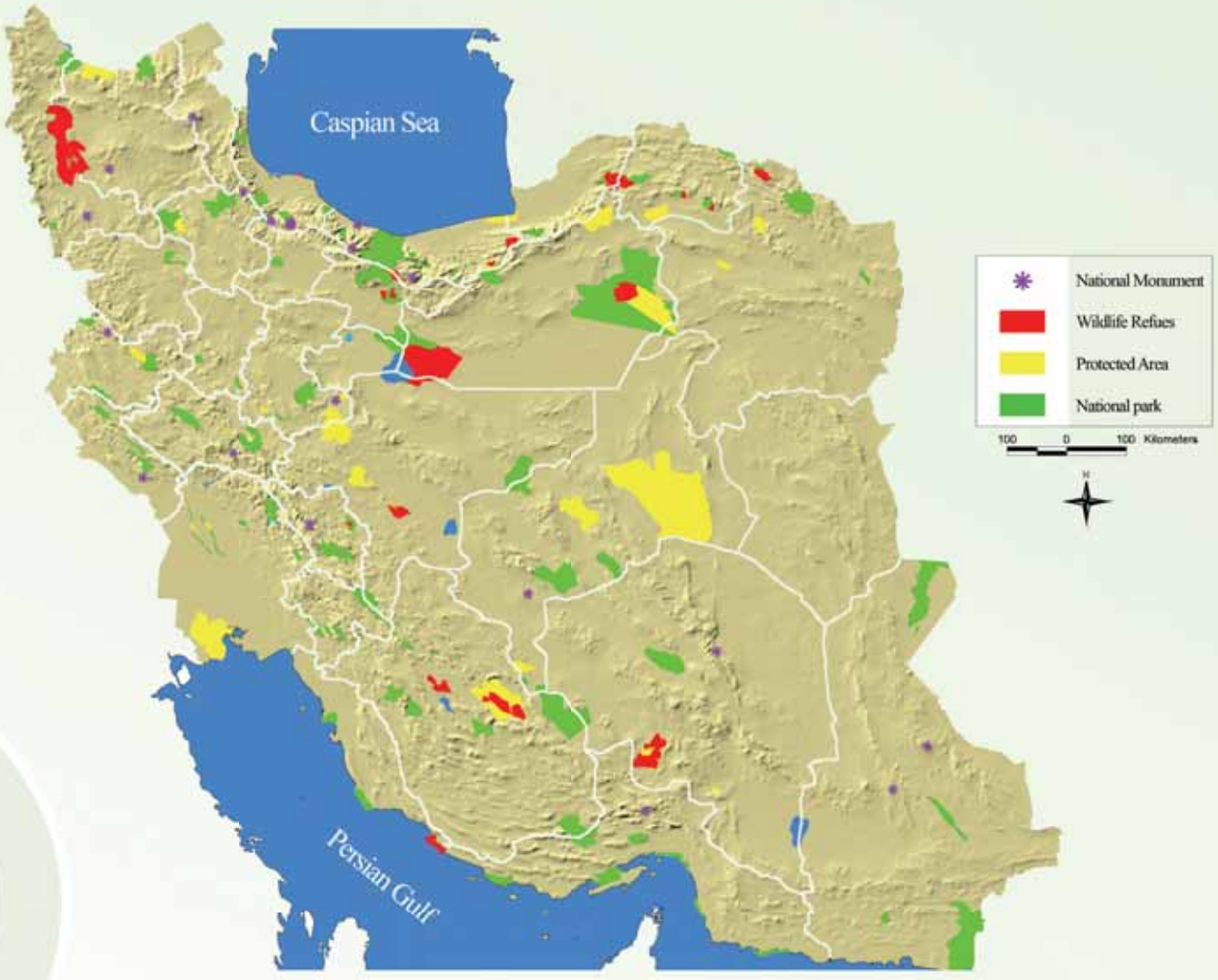
Table 2-4: Nominal capacity and production of hydro-electricity 2004

Power Station	Total Capacity (Megawatt)	Produced in 2004 (Megawatt-hour)
Large and Medium Size Stations	4378.50	10989161
Small Scale Stations	45.29	109331
Total	4423.79	11098492

Source: Ministry of Energy, 2004

REFERENCES

1. Consulting Engineers in JAMAB, *Report on the Synthesis of the National Water Comprehensive Plan*. Ministry of Energy, n.d.
2. DoE, Office of the Marine Environment, 2004. *State of the Persian Gulf Environment* (RAPMI Marine Area).
3. DoE, 2006. *Eight-year Performance Report*.
4. Institute of Planning and Agricultural Economy, Ministry of Agricultural Jihad, 2004.
5. Ministry of Agricultural Jihad, *Statistics on Agriculture. 2004.*
6. Ministry of Agricultural Jihad, *Statistics on Agriculture, 2002-3 and 2004.*
7. Ministry of Energy, *A 25-year Report. 2004a*.
8. Ministry of Energy, *Energy Balance Sheet. 2004b.*
9. Statistical Centre of Iran, *Statistical Yearbook. 2004*.
10. Sustainable Development Committee, *SoE Report for Iran. DoE, 2000-2001.*
11. Sustainable Development Committee, *SoE Report for Iran, DoE, 2004.*



Picture 2 - 6 : Distribution of protected areas in Iran

Source : DoE

Lar Plain

Bakhtegan National Park , Fars

3 Environmental Laws and Legislation

1. Introduction

On the threshold of the third millennium, conservation of the environment makes sense from the viewpoint of rational human thought and actions, aimed at achieving sustainable development as well as building a bright future in which the rights of future generations may be better guaranteed. It is the most significant as well as an indispensable task and responsibility for all governments in the world to maket this happen. The increasing trend towards environmental degradation, the population explosion and the shortage and destruction of natural resources, leading inevitably to natural environmental catastrophes, have lowered the quality of human life. These terrifying nightmares as well as concern as to what may yet be in store have led the international community, States and other responsible bodies to adopt laws and regulations to prevent, or at least mitigate, environmental pollution and destruction. In our country, legislation specifically addressed to the environment is a recent phenomenon not much more than three decades old. However, comprehensive laws and regulations about various aspects of environmental issues have been adopted and enforced.

2. Department of the Environment (DoE)

The Hunting and Fishing Organization of Iran was the predecessor to DoE. The existing environmental rules and regulations relating to the conservation of the wildlife and protection of ecosystems were adopted after DoE was established. However, the Hunting Law (adopted in 1955) was the first relatively comprehensive piece of legislation that provided legal protection for wildlife and established an independent body, the Hunting Institute, to control hunting. Later, in 1968, a new law - the Hunting and Fishing law – enlarged the scope of the previous law by adding regulations on fishing. Finally in 1971, DoE was set up and it replaced the previous authority. Once established, an immediate task facing the DoE was to fill the gaps where the lack or ineffectiveness of conservation legislation was a problem. The systematic revision of old and inefficient regulations and the adoption of up-to-date, enforceable rules became top priorities. It was after the glorious victory of the Islamic Revolution that conservation reached its full significance, judged worthy of a place in the Constitution. Principle 50 of the Constitution of the Islamic Republic of Iran, ratified in 1979, emphasizes the urgent need for protecting the environment as the one and only place in which both present and future generations may enjoy a fulfilling social life.

DoE is legally required to carry out the following tasks:

- •Studying destructive and polluting factors detrimental to the environment.
- •Employing environmentally-friendly technologies and presenting executive regulations for the identification of the most appropriate sites for industrial and agricultural projects and residential areas.
- •Identifying habitats of a high ecological value that are in a critical situation.
- •Expanding regional and international co-operation on environmental issues.
- •Adopting environmental standards and criteria for: the management and utilization of resources such as water, land and air; waste disposal and recycling, in cities, towns and villages; and the control and prevention of over-use of ecosystems.
- •Enhancing public environmental awareness.
- •Collecting, documenting, preserving and displaying various species of the flora and fauna by holding exhibitions and in museums.
- •Monitoring and law-enforcement to prevent environmental pollution and degradation.

2.1 ■ Administrative Structure

Iran's DoE is affiliated to the Office of the President and its Head of the Department is also a Vice-president and a full-member of the Cabinet.

The DoE's organizational chart makes clear the tasks entrusted to it. According to this chart, the Deputies for the Human Environment, the Natural Environment and Biological Diversity and Education and Planning are all directly involved in the task of building a proper environmental culture in society. Lastly, the Deputy for Support carries out supportive and administrative activities. The Environmental Protection High Council is a coordinating and supervisory body that brings together various senior members, each of whom has a role to play in trans-sectoral environmental issues and in setting DoE policies. Its members are:

- The President of the Islamic Republic of Iran (Chairman)
- Head of DoE (Secretary)
- Minister of the Interior
- Minister of Agriculture
- Head of the Planning and Budget Management Organization
- Minister of Industry and Mining
- Head of the Standards and Industrial Studies Institute
- Minister of Housing and Urban Planning
- Minister of Health and Medical Education
- Four officials and experts

2.2 ■ Interactive Institutional Environment

One of the projects which was done for preparing eight-year performance of DoE, 2006 was a qualitative interview study in Tehran about the tasks and responsibilities of the DoE . A sample of more than 90 experts from DoE and others whom somehow were related to the environmental activities was selected. Some of the results are as follow:

1. Environmental elements, such as water land, and air have both a national and international dimension and this makes DoE activities and responsibilities complicated.
2. Other than DoE, many governmental as well as non-governmental organizations are, in one way or another, involved in environmental activities that affect DoE activities.
3. Given their trans-sectoral nature, it will take a long time before the mechanisms employed by DoE will be able to enforce effectively environmental laws and institutionalize an environmentally-friendly culture in society such that an informative and comprehensive overview of the efficiency of DoE can be given.

This means, then, that the impact of DoE activities should be looked for in the successful operation of organizations other than DoE itself.

The interactive/institutional environment in which the Department operates can be divided into four different areas, each one embracing a range of national, regional and international dimensions:

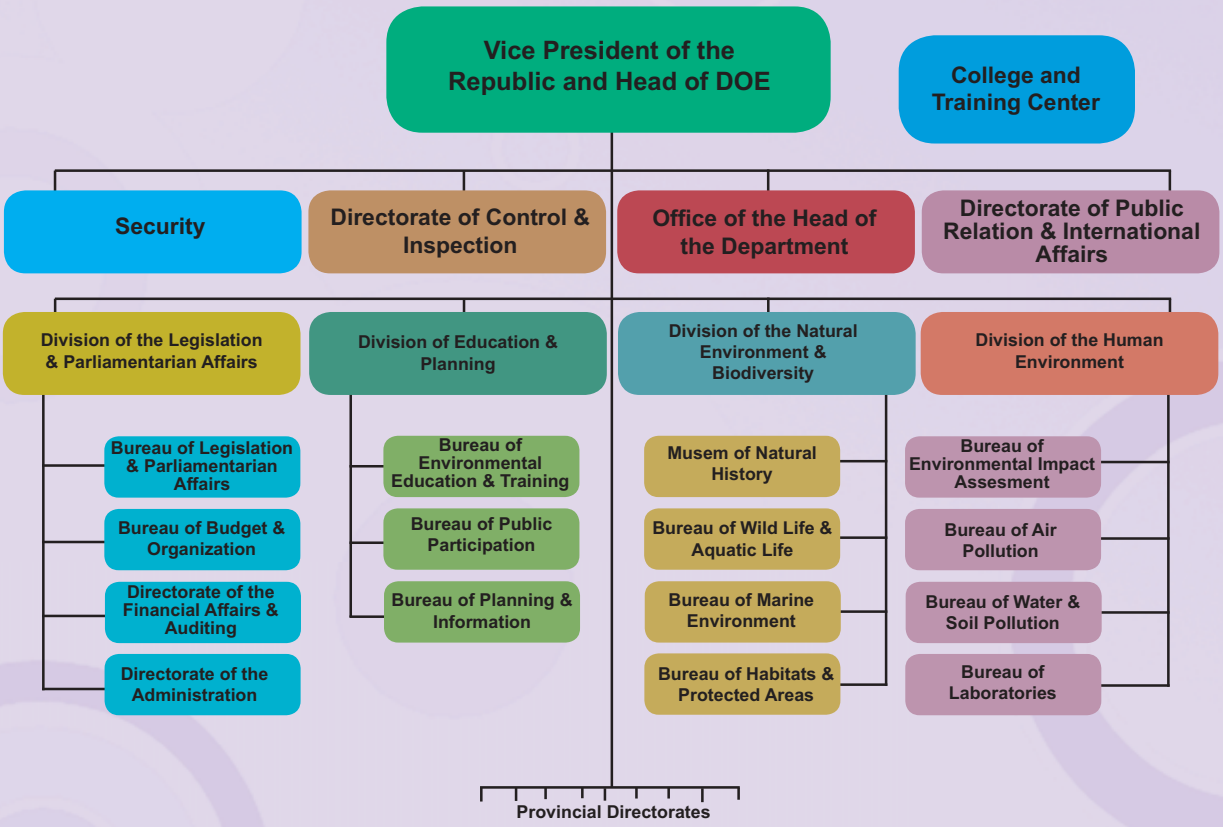


Figure 31: Organizational chart of DoE.

- **Government**

On the national level, interaction with Government consists of:

- With the Cabinet and other relevant Ministries and governmental organizations to build national macro-planning capacity and provide tools for executive actions.
- With the Legislature to create a positive legal dynamic.
- With the Judiciary to create monitoring mechanisms etc.

On a regional level, interaction with Government consists of:

- Meetings of Ministers responsible for the environment to discuss possible regional co-operation frameworks, such as ROPME and the Caspian Environment Program.

On an international level, such interaction is mostly in the form of ministerial meetings such as the UNEP Directors Council and the Global Summit of Ministers for the Environment.

- **Economic Enterprises**

DoE has close relationship with the industrial, service and agriculture sectors on the national level. Regionally as well as internationally, DoE cooperates with the World Bank and with UNDP to enhance or maintain the quality of the environment.

- **NGOs**

On the national level, DoE provides assistance in establishing environmental NGOs and strengthening their capabilities by performing environmental projects in country.

On the regional and international levels, such assistance takes the form of co-operation with regional and international NGOs.

- **The Public**

DoE has mutual relationships with academics and other researchers with environmental expertise who act as consultants and attend international and regional scientific meetings, to enhance public education and awareness about environmental issues and build an environmental culture.

3 International Agreements

Concern about environmental issues has become as much an everyday worry for Governments, national and international organizations as it has for the man on the street. The nature of environmental concerns requires international co-operation of all countries to address them. Hence, international Conventions and Protocols are needed to establish common preventive as well as incentive policies. The Islamic Republic of Iran is amongst those active countries in the world that have provided the conditions for sustainable development, taking into consideration environmental issues.

Iran has assumed responsibility on environmental issues by becoming a party to international conventions and concluding memoranda of understanding in order to work and Co-operation with other countries on crucial issues concerning of the environment.

- **Principle 50 of the Constitution of the Islamic Republic of Iran**

The preservation of the environment, in which the present as well as the future generations have a right to a flourishing social existence, is regarded as a public duty in the Islamic Republic. Economic and other activities that inevitably involve pollution of the environment or cause irreparable damage to it are therefore prohibited.

3.1 ■ Bilateral Agreements

• Bilateral agreements on environmental co-operation have so far been concluded between the Islamic Republic of Iran and the following countries: Germany, Morocco, Bahrain, France, China, Saudi Arabia, Armenia, the Netherlands, Norway, Austria, Hungary, Sweden, Algeria, Tunisia, Lebanon, South Africa, Slovenia, Azerbaijan, Tajikistan, Sri Lanka, South Korea, the Philippines, Italy, Poland and Japan.

• DoE has signed an environment agreement with the Saudi Arabian National Commission for Development and Conservation of Wildlife to study and protect Hubre's Wildlife.

• Memoranda of understanding have been signed with 33 countries and the process for performing those letters is being underway.

• International environmental co-operation is being enhanced through the exchange of experiences, conclusion of agreements and communication with international environmental specialized agencies.

3.2 ■ International Projects

Those international research projects emanating from international conventions and international organizations that have been adopted and carried are the following:

• Implementation of the international Protocols on the Protection of the Ozone Layer.

• Co-operation with regional conservation agencies such as the Regional Agency for the Persian Gulf Environment, the Caspian Sea Environment Program and the Economic Cooperation Organization (ECO).

• Co-operation with the World Bank for the adoption of major environmental projects such as the Water and Air Strengthening Project an intra-departmental scheme and an Urban Waste Management Project with other organizations.

• Drafting the International Potentiality Plan and the Enhancement of Environmental Effects Appraisal, jointly with UNDP.

• Strategic Environmental Assessment project (SEA).

• Compiling a strategy and national action plan for the conservation of biodiversity.

• Project for the conservation of biodiversity in the Zagros Mountain ecosystems (design and study phase).

• Project for the development of wetland areas and migratory routes to protect Siberian Crane and other Asian water birds.

• Conservation of Iranian Wetland project (executive management of Orumiyeh Lake National Park and Parishan Lagoon in Fars).

• Conservation and management of Anzali Lagoon, jointly with JICA.

• Joint project to study and protect the slender-billed curlew.

• Project for strengthening and improving administrative efficiency to be prepared for implementing the Montreal Protocol.

• The Malleh Declaration on the Control and Prevention of Air Pollution and its Probable Trans-Boundary Effects in South Asian Countries.

• Project for the improvement of air quality management in the Tehran megalopolis.

• Project for the air quality of Shiraz.

• Caspian Sea Environment Project (CEP).

• Iran's claims for war damage to the marine environment.

• Regional Organization for the Protection of the Marine Environment (ROPME).

• Project for enabling Iran to present the First National Report on Climate Change to UNFCCC.

• Project for energy environmental surveillance in IR Iran.

• Project for strengthening environmental management.

• Project for monitoring water and air pollution.

• Project to enable the drafting of a National Law on Bio-safety.

• Project on Persistent Organic Pollutants (POPs).

• Follow-up activities related to Iran's membership of various regional and international Conventions and Protocols (12 such instruments).

• Payment of contributions to international Conventions.

3.3 ■ Ratification of Recent Regional and International Conventions

• The Caspian Sea Environment Convention ('Tehran Convention', 2004).

• The Protocol on the Movement of Hazardous Wastes in the Persian Gulf (ROPME, 1999).

• Rotterdam Convention on the Necessity of the Prior Consent in the International Trade of Hazardous Chemical Materials and Pesticides (2005).

• Stockholm Convention on the Environmental Management of Twelve Persistent Organic Pollutants (POPs)(2006).

ROTTERDAM CONVENTION

The Rotterdam Convention, also known as the Prior Informed Consent (PIC) Convention, was signed by 61 countries in Rotterdam, the Netherlands, in 1998. Its main objective is to limit the trade and consumption of potentially dangerous chemical substances, such as pesticides, and to share the responsibilities and related activities amongst the States Parties to minimize the danger of and protect the environment against such compounds. So far, 31 chemical substances have been listed as hazardous. The Parties undertake not to export such chemicals to each other's countries unless the prior consent of the importing country has been obtained. Iran's Cabinet of Ministers ratified the Convention in 2003 and it was then approved by Parliament. DoE co-operates with the PIC Secretariat and takes part in the specialized workshops convened by the Secretariat.

• Kyoto Protocol on Control of Greenhouse Gases (2006).
• Cartagena Protocol on Biosafety (2005).
• London Convention (designating the DoE as the National Authority).
• International Union for Conservation of Nature and Natural Resources (IUCN).

4. National Legislation

Other than Principle 50 of the Constitution of IR Iran that sets out a public duty of conservation, a number of national laws have also been enacted.

1. Municipality Act, 1966 (Article 55).
2. Vegetation Preservation Act, 1968; led to foundation of Vegetation Preservation Organization affiliated to the Ministry of Agriculture.
3. Forest and Rangeland Utilization and Conservation Act, 1968.
4. Hunting and Fishing Act, 1968 (as amended in 1997).
5. Environment Conservation and Improvement Act, 1975 (as amended in 1993) entrusting all environmental issues to DoE.
6. Law for the Conservation of Marine Areas and Frontier Rivers against Petrochemical Pollution, 1976.
7. Law for the Punishment of Illegal Fishing in the Caspian Sea and Persian Gulf, 1980.
8. Preservation and Extension of Urban Green Spaces Act, 1981.
9. Fair Distribution of Water Act, 1983; emphasizes the national public ownership as well as preservation of water resources.
10. Preservation and Fixation of Frontier River Banks and Beds Act, 1984.
11. Petroleum Act, 1988 (Article 7).
12. Urban Water and Sewage Network Act, 1991.
13. Committee for Reduction of the Impacts of Natural Disasters Act, 1992.
14. Maritime Zones in the Persian Gulf and Oman Sea Act, 1994.
15. Air Pollution Prevention Act, 1996; prohibits any action leading to air pollution.
16. Act for Maintaining Agricultural and Horticultural Land-use, 1996.
17. Preservation and Utilization of Aquatic Resources Act, 1996.
18. Nine specific articles in the Criminal Code of Iran dealing with environmental and pollution-related crimes.
19. Mining Act, 1999; includes some articles on the environmental impacts of mining.
20. Solid Waste Act, 2005.
21. Part of the legislation related to national financial affairs and the Budget is assigned to protection of the environment.
22. Tax Payment Act; requiring all polluting industries to pay a 1% pollution tax annually.

5. Regulations Approved by the Cabinet

More often than not, laws require by-laws for their enforcement. Such by-laws are usually ratified by the Cabinet, in lieu of Parliament, and addressed to the relevant Ministry for enforcement.

For environmental matters, about 51 such by-laws have been adopted so far. The following list includes a few of them.

• Air

1. Executive By-Law to Prevent Noise Pollution, 2000; DoE is responsible to relocate sources of noise pollution from the city or, otherwise, restrict the time and places of such sources.
2. Vehicles Exhaust Emission Standards, 2000.
3. Prohibition on the Production and Importation of Diesel Engine Vehicles Not Meeting European Standards, 2001.
4. Standards for Authorized Levels of Emissions from Factories and Industrial Workshops, 2001.
5. Comprehensive Plan for Air Pollution Reduction in Tehran, 2001.
6. Executive By-Law to Prevent Air Pollution, 2001; air pollution sources defined and some restrictions and monitoring measures to be considered for them.
7. Executive By-Law of Article 134; sets out the relevant fine for polluting sources.
8. Applying European standards to importing or producing motorcycles (2001).
9. Executive By-Law on Testing Vehicle Emissions and Issuing Licences for Tested Vehicles (2004).
10. Executive By-Law on De-commissioning Old Cars (2004).
11. Executive By-Law on Replacing or De-commissioning Old Taxis (2004).
12. Technical Regulations for the Import and Export of Vehicles (2004).
13. Banning Re-sale of Old Cars (2004).

• Natural Forest Management Standards

The Environment High Council adopted standards for the management of natural forests in 2006. The indicators, showing various aspects of the biodiversity present and revealing the quantity as well as quality of the forests, demonstrate how much pressure is placed upon the management and what decisions need to be made in this regard. The indicators are in line with the latest global criteria and provide a useful means for comparison.

On the basis of the National Report on Sustainable Development and the "Adoption of the Strategy and National Action Plan for the Conservation of the Biodiversity", the High Council approved the following guidelines.

1. Raising public awareness of biodiversity to attract public participation.
2. Establishing bio-information and research systems.
3. Sustainable use of biodiversity resources.
4. Adopting systematic management approaches to preserve biodiversity.

14. Defining the Age of Old and Worn-out Cars (2005).
15. By-Law for the De-commissioning of 200 Thousand Old Cars (2006).

- **Water**

16. Executive By-law for the Preservation and Fixation of the Frontier River Banks and Beds Act, 1985.
17. Executive By-law for the Water Pollution Prevention Act, 1995.
18. Procedural By-Law for the High Council of Oceanography, 1995.
19. Executive By-Law for the Conservation and Utilization of Water Resources, 2000.
20. Guidelines for Establishing the Quality Control and Conservation Committee for Karoon River, 2003.
21. Guidelines for Establishing the Quality Control and Conservation Committee for Zayandehrood River, 2005.
22. By-Law of Paragraph 1,Article 106; to use water for agriculture properly.
23. By-Law for river banks and beds, floods, ponds, water supply system and irrigation and water drain (2001).

- **Land**

24. Executive By-Law for Article 104 concerning Implementing Guidelines for the Third Development Plan.

- **Forests**

25. Executive By-Law for the Conservation and Improvement of the Environment Act, 1976.
26. Executive By-Law for the Conservation and Utilization of Forests and Rangelands Act, 1994.
27. Executive By-Law for the Forest Conservation Act, 2002.
28. Executive By-Law for Conservation and Protection of Natural Resources and Forests (1995).
29. Executive By-Law for Maintaining Agricultural and Horticultural Land-use (1996).

- **Biodiversity**

30. By-Law for the Hunting Act, 2003.
31. By-Law for the Sustainable Utilization of the Natural Caves Act, 2003.
32. By-Law for the Ecotourism Act, 2006.

- **Industry, Development and Human Habitats**

33. By-Law for Establishment of Housing and other Premises Outside City Limits, 1978.
34. Hazardous Ray Safety Regulations, 1991.
35. Environmental Health By-Law, 1993.
36. By-Law for the Waste Act, 2006.
37. Articles of Association of the National Fund for the Environment, 2006.
38. Regulations approved by Cabinet to remove polluting industries from Tehran (1991).
39. Executive By-Law for Establishing a National Committee to Reduce the Impacts of Natural Disasters (1994).
40. Executive By-Law for Maintaining Agricultural and Horticultural Land-use (1996).
41. Regulations and Criteria for Establishment of industries (2000; amended in 2002).
42. Executive By-Law on Prevention of Noise Pollution (2000).
43. Executive By-Law for Article 121; defining and categorizing energy equipment and their technical specifications.
44. Executive By-Law for Article 122; supplying financial support for private power plants which do not use fossil fuels.
45. Executive By-Law for Prohibiting the Sale

Extract from the Twenty-year Strategic Plan for Iran:

Iran, occupying the first rank among regional countries from an economic, scientific and technological point of view, shall be considered as a developed country with an Islamic revolutionary identity, as a source of inspiration in the Islamic World and engaging effectively and constructively in international relations.

The ideal Iranian society of the future would enjoy health, wellbeing, security, welfare, equal opportunities, a fair distribution of wealth, firm family foundations and a desirable environment free from poverty, corruption and unjust discrimination, and enjoying favorable environmental conditions.

The general policies laid out by the country's Supreme Leader in the Twenty-year Strategic Plan place an emphasis on conservation of the environment, rehabilitation of natural resources, consideration of the economic, political, security and environmental values of water as well as the acquisition of biotechnology.

The First Parliamentary Green Group in the Islamic Parliament

At the outset of the second year of the 6th Parliament, 130 Members of Parliament joined together to form the first Green Group to support environmental legislation. This parliamentary group has played a significant

role in the adoption of annual budgets for environmental purposes, waste management projects and the environmental chapter of the 4th Development Plan. Recently, a similar group has also been established in the 7th Parliament.

or Exchange of Urban and Rural Non-residential Land (2000).
46. Quantitative goals and specifications for the mining and industry sector, environment and electricity (2002).

6. Regulations Approved by the Environmental High Council

1. Conservation and Improvement of Inland and Coastal Waters, 1998.
2. Prevention of Air Pollution in Tehran.
3. Designation of National Parks, Natural Monuments, Wildlife Sanctuaries and Protected Areas.
4. Regulations for a Gradual Reduction of Asbestos from Products.
5. Hunting and Fishing Permit Regulations.
6. Taxidermy of Wild Animals.
7. Definition of Wild Animals.
8. Forest Management Standards.
9. Noise limits in the Iranian environment.
10. Timing the gradual dismantling of diesel fuel buses and mini buses.
11. Protection of 10% of all forests in the country.

7. Short- and Long-term Planning

7.1 National Resolution Plan to Preserve the Environment

In 1998, DoE presented to the Cabinet a list of the most pressing threats to the environment, along with a list of the problems causing those threats. The Cabinet accordingly adopted an immediate plan to combat environmental threats and entrusted DoE with the task of sparing no efforts in removing the causes of those threats.

DoE acted promptly and, with assistance provided by many other governmental and non-governmental organizations, devised a plan later known as the National Resolution Plan to Preserve the Environment. This Plan was approved by Cabinet and appeared in the Preamble to the First Development Plan of IR Iran.

7.2 The Environment in the Economic, Social and Cultural Development Plans of Iran:

Under Paragraph 13 of the First Development Plan (approved in January 1990) legislation has been developed for policy-making and planning to prevent environmental pollution and to require factories and industrial workshops, the main sources of industrial pollution, to compensate for environmental damage as the polluter (0.1% of total sales from the production of any manufacturing unit must be paid towards environmental protection purposes). By the end of that period, any credit remaining from the First Plan Law under this Paragraph should be placed as a separate provision under Article 45 of the Law for Receiving Part of Government Income. Public environmental education, raising public awareness and knowledge of environmental issues, attempts to remove the causes of all kinds of pollution and actions that unexpected natural phenomena may initiate are amongst the routine activities carried out by DoE.

8 National Committee for Sustainable Development

The Committee was established by the Environmental High Council, in 1994, to establish policies and coordinate economic and social development

Future Outlook of DoE

- Achieving the first rank among regional countries in environmental improvement.
- Achieving national and international standards for the human as well as the natural environment.
- Taking account of sustainable development in plans and projects for natural resource utilization.
- Giving priority to the principle of prevention rather than compensation for environmental damage.
- Removing and cleaning up pollution.
- Establishing a culture of conservation in all strata of society.
- Taking environmental decisions on the basis of research.
- Involving public participation in all conservation issues.

Judicial Power in the Greening Process

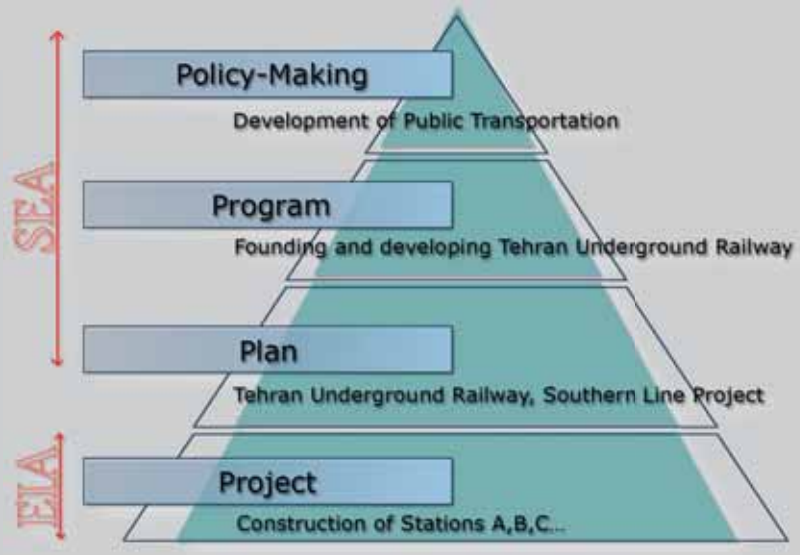
To explain the environmental elements of judicial decisions that have an environmental impact and to set out various aspects of the environmental legislation, the First Conference on Environmental Law was held. This was followed by training courses and workshops to refresh the judges' memories or to deepen or make more practical their knowledge of the environment law. As instructed by the Constitution of IR Iran, His Excellency the Head of the Judiciary issued an order for the establishment of ad hoc environmental courts. The Ad Hoc Council for the Investigation and Prosecution of Environmental Crimes, such as illegal land possession, was another significant innovation of the Judiciary.

STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)

In 2005, a project for the adoption of a national system for EIA was completed jointly by DoE and UNDP. In the same year, the parties agreed to further their co-operation beyond the adoption of a national system for EIA and to attempt to adopt a national system for Strategic Environmental Assessment (SEA). Finally, in January 2004, the document for a new project - The Sustainable Development Strategy: Providing Capacity for Strategic Environmental Assessment - was signed by both DoE and UNDP. This 18-month long project was designed to achieve the following objectives:

- *Training a group of experts, from different national organizations and institutions and transforming them into the central specialized kernel to provide the necessary technical and legal framework.*
- *Adoption of a legal-administrative framework to guarantee the implementation of the SEA.*
- *Provision of technical instructions to be utilized by SEA practitioners.*
- *Public information dissemination on EIA, along with the collection and transfer of information.*

Strategic Environmental Assessment (SEA) shares its principles and roots with Environmental Impact Assessment (EIA), and their only difference lies in the fact that EIA usually takes place at project level while SEA goes beyond that level to cover more general strategic decision-making.



RAMSAR CONVENTION

The first ever multilateral environmental conservation Convention was concluded and adopted at Ramsar, in 1971. The Ramsar Convention on Wetlands is regarded as an important agreement for the protection and conservation of the world's wetlands. Thus, historically Iran is the pioneer country in the conservation of the environment in the world. Since that date, different Conventions have been concluded on conservation issues and Iran has also become a Party to many of them and has been an active member. During the last eight years, DoE has been able to become an active member of some new Conventions and international organizations related to the natural environment and biodiversity, such as the CBD 1992 and IUCN and to present itself as one of the organizations active in protecting the world's natural heritage.

Ramsar Hotel, Mazandaran

BASEL CONVENTION

The Convention on the Control of the Trans-boundary Movement of Hazardous Wastes was signed by 35 countries in Basel, Switzerland, in 1989 and entered into force in May 1992. The main objectives of the Convention are:

- *Reducing the trans-boundary movement of hazardous waste;*
- *Minimizing the production of hazardous waste.*
- *Preventing its transport to countries where proper disposal facilities are not available.*

Iran signed the Convention in 1993 and the Islamic Consultative Assembly of Iran ratified it in 1994. However, the active participation of Iran in the Convention's activities did not start until 1998. Since then, Iran's capabilities and potentials, especially in terms of laboratory know-how, have been declared to the Convention's Secretariat.

programs. Conservation of the environment and follow-up actions to the Rio Summit are its general tasks and the Committee takes care of the following in particular:

1. Examining the draft Sustainable Development Strategy and the Environment in order to present consultative viewpoints to the High Council.
2. Developing and extending databases and documentation centres.
3. Acting as a consultant to the High Council on issues related to the adoption of and participation in international Conventions and other instruments in a coherent and coordinated manner.
4. Planning and implementing joint research projects on the implementation of regional Conventions.
5. Offering advice on any issues referred to it by the High Council.

- **Members of the National Committee for sustainable Development**

Presided over by the Vice-President of the Islamic Republic of Iran and the Director of DoE, the Committee has 18 permanent members including a Vice-chairman and 16 representatives from different Ministries and other related organizations.

- **Secretariat**

The Secretariat of the National Committee is administered by the Secretary of the Committee and is located on the premises of DoE.

- **Sub-Committees**

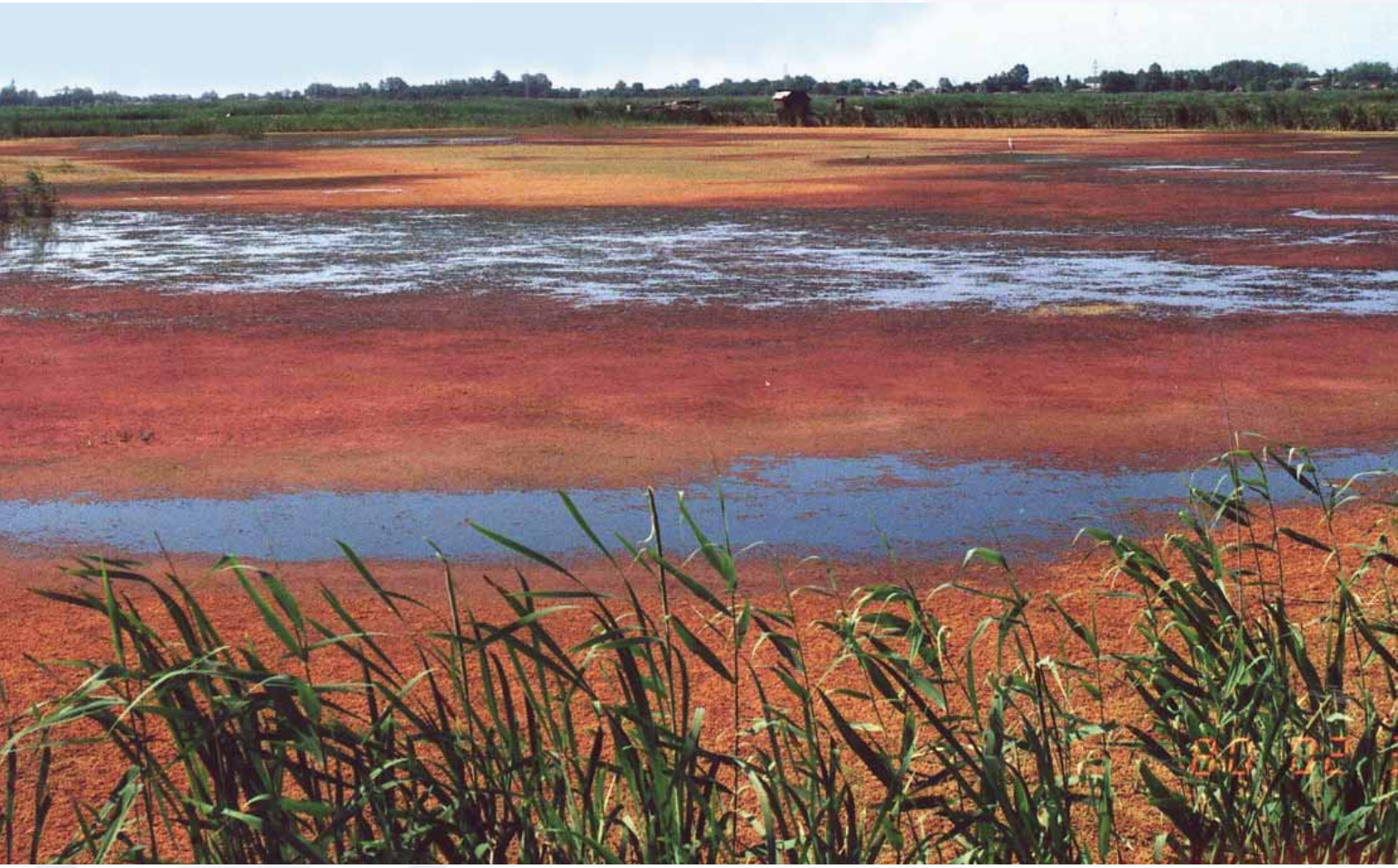
At present, there are 11 sub-committees under the National Committee. These are:

1. Sub-committee on Hazardous Chemical Wastes.
2. Sub-committee on the Ramsar Convention (on wetlands).
3. Sub-committee on Biodiversity (CMS and CITES).
4. Sub-committee on Seas and Oceans (international waters);
5. Sub-committee on Climate Change.
6. Sub-committee on the Global Environment Facility (GEF).
7. Sub-committee on the Forests Principles.
8. Sub-committee on Agenda 21.
9. Sub-committee on Sustainable Urban Development Management.
10. Sub-committee on Sustainable Rural Development Management.
11. Sub-committee on Green Consumption and Clean Production.

The address for the bilingual website of the Secretariat is: www.ncsd.irandoe.org

REFERENCES

1. DoE, 2004. *Collected Laws and Regulations on Environmental Protection*.
2. DoE, Office for Parliamentary and Legal Affairs.2005.
3. DoE, 2003. *International Conventions and Protocols*.
4. DoE, 2006. Eight-year Performance report.



Section II

Key Environmental Issues

4 Air

AIR

Introduction

Air pollutants may be divided into natural and synthetic pollutants and a large proportion of air pollutants are of a natural origin. Only 20% of SO_2, 10% of CO, 5% of O, 5% of CH and 6% of aerosols are synthetic. The significance of pollutants from human activities is due to the speed of their release compared with natural ones.

Synthetic pollutants are mainly produced from energy sources, in particular fossil fuels. The dust produced by factories such as cement and plaster factories also contributes to air pollution.

1. Drivers

1.1 Driving Forces

1.1.1 Population Growth

Fast population growth causes the unplanned development of urban areas and unusual changes in consumption patterns that lead to substantial demand for energy as well as other basic, infrastructural needs. Naturally, such factors increase pollution. There are, of course, some other factors that affect air quality for better or worse, such as air currents, topography and the amount as well as the number of pollutants discharged from various sources.

1.1.2 Increasing Energy Consumption

The ever increasing demand for the various types of energy is the obvious consequence of urbanization and industrialization.

Energy consumption increased by 5.1% in 2004 over the previous year in the industry (11.7%), agriculture (7.8%), transport (5.7%) and household (1.4%) sectors and reached the equivalent of 725.1 million barrels of oil.

All the different types of fossil fuels were increasingly consumed in 2004; petrol consumption reached 20.5 billion litres, showing an average annual growth rate of 11.4%. Tehran Province consumed the greatest amount at 23.8%. The average annual growth rate for petrol consumption was 8.2% during the period 1997-2004 while diesel fuel consumption increased by 1.37% in 2004. The consumption of natural gas increased annually on average by 9% over

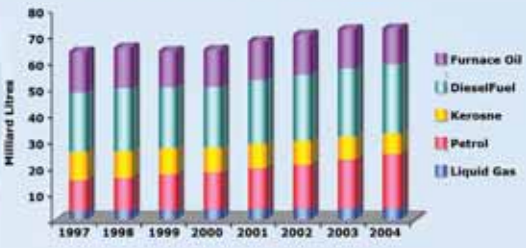


Figure 4-1: Consumption of petroleum products during 1997-2004
Source: Ministry of Energy, 2004

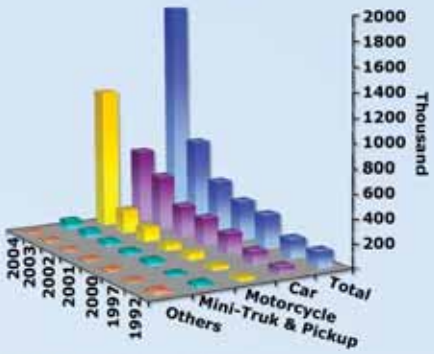


Figure 4-2: Types of motor vehicles registered in 1992-2004
Source: Statistical Centre of Iran, 2004

various sectors during 1997-2004, increasing by 10.9% in 2004 compared with 2003. This was a positive point since natural gas is less harmful to the environment. Use of the other types of energy decreased in 2004 compared with 2003; liquid gas decreased by 1.3%, kerosene by 9.1% and fuel oil by 8%.
(Figure 4-1)

1.1.3 Increase in Motor Vehicles

Approximately 45,000 vehicles were issued number plates in 1989. With an average annual growth rate of 28.4%, the number of vehicles registered in 2004 increased to 2 million. The number of vehicles registered in 2004 showed a 157% increase over 2003. The reason for this unexpected increase was that six times more motor-cycles were registered in 2004 than 2003 (Figure 4-2). This unexpected increase in issued license pates is because of the new enforcement law that every motor-cycle which didn't have a license plate prior to that year has to apply for one.. The total number of motor vehicles registered by the end of 2004 reached 5.9 million that 32.6% were only registered in 2004.

1.1.4 Inefficient Fuel Consumption Patterns

The make of a car as well as its age determine how much fuel it needs to run for, say, 100 Km. Among common cars in Iran, the Matiz by Daewoo uses the least fuel (about 8 L/100 Km) and the Nissan Pickup uses the most (32 L/100 Km).The Peykan, with a fuel consumption of 15 L/100 Km, is also among the most popular cars in Iran.(see: Figure 4-3)

In Iran, the average fuel consumption of cars and vans is 10.75 litres per day, while it is 1.9 litres in France, 2.5 litres in Japan and Germany, 3.5 litres in UK, 6.5 litres in Canada, 7.8 litres in Mexico and 7.3 litres in the USA (Fuel Consumption Optimizing Company, 2005).

Depreciation of the vehicles as well as old age increase fuel consumption. In 2004, the average age of passenger transport vehicles in Iran was 18.2 years, five months more than in the previous year. The average longevity for buses is 13.5 years, for minibuses 20.8 years and for cars 14.9 years. The average age of freight vehicles was 21.6 years in 2004, about three months more than in the previous year.

1.1.5 Industry

The industrial sector includes all types of small and large factories and workshops. According to the latest census administered in 2003, there were about 480,000 industrial workshops countrywide. The number workshops with 10 or more employees increased by 22% between 1997 and 2003, from 13,371 to 16,305.The number of these workshops increased 48% in 2003 compared with 2002. The number of workshops with 50 or more employees increased by 43% between 1997 and 2003 and showed a 21% increase in 2003 compared with 2002.

It is worth mentioning that in 2002, 977 out of 10,987 industrial workshops with 10 or more workers (8.9%) boasted pollution control facilities. However, 18.6% workshops had such facilities in 2001 which demonstrates a decrease. About 28% of workshops produce industrial waste material of different types, 26.5 million tons of solid wastes, 14.6 million m^3 of liquid waste and 5.8 million m^3 of gas wastes (Statistical Centre of Iran, 2001 and 2002).

1.2 Pressures

1.2.1 Pollution Released into the Atmosphere

• In 2004, the energy sector, from production to consumption, released various types of pollutants into the atmosphere (*Ministry of Energy, 2004*):

1.11 Million tons of NO ;
1.12 Million tons of SO_2 ;
333.5 Million tons of CO_2 ;
0.015 Million tons of SO_3 ;
7.4 Million tons of CO ;
1.7 Million tons of CH ; and
0.3 Million tons of SPM.

•The rates of increase of the various pollutants released into the atmosphere in 2004 over 2003 were:

1.6% for CO_2 ;
5% for NO ;
5.4% for SPM ;
11.3% for CH ; and
11.8% for CO.

The release of SO_3 and SO_2 decreased by 3.7% and 4.2%, respectively, due to a reduction in the use of fuel oil and diesel over the same period.

Figure 4-3: Fuel consumption of various makes of cars
Source 11: Ministry of Energy, 2004

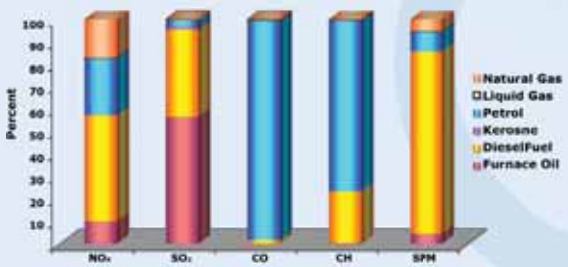


Figure 4-4: Contribution of the various types of fossil fuels to pollutant release
Source: Ministry of Energy, 2004

•Fossil fuels contributed in the release of the gas and greenhouse gas pollutants too. The greatest quantities of CO (97.9%) and CH (76.3%) pollutants were from petrol consumption. Similarly, the greatest amounts of NO (47.3%) and of SPM (81.3%) were from diesel fuel consumption and the highest amounts of SO_2 (56.7%) and of SO_3 (66.2%) came from fuel oil consumption. The largest quantity of CO_2 (45%) came from natural gas consumption (Figure 4-4).

•In 2004, 151.1 grams of carbon, 1.7 grams of SO_2 and 0.8 grams of nitrogen oxide per one KW/h electricity were released by power stations. The total release of gas and greenhouse gas pollutants (especially CO) from the country's energy sector has increased in the period from 1968 to 2004 (Figure 4-5).

1.2.2 Gas and Greenhouse Gas Pollutants Released by Energy-Consuming Sectors:

Energy consuming sectors that release pollutants may be studied under five headings:

(1)Household, Commercial and General

In 2004, the largest percentage of total kerosene consumption (94.6%) was in this sector, showing 1.6% increase compared with 2003. 12.7% of all diesel fuel, 11.3% of all fuel oil, 36% of all natural gas and 82% of all liquid gas was also consumed in this sector. As far as pollutants are concerned, 12.8% of the total amount of SO_2, 12% of SO_3, 0.9% of CO, 0.7% of CH and 3.5% of SPM released into the atmosphere came from activities in this sector (Figure 4-11 and Table 4-1). In 2004, the greatest percentage of the total amount (30%) of CO_2 released into the atmosphere came from this sector. This was mainly because almost all the kerosene as well as 36% of the natural gas that was consumed in the country was used in this sector. The release of CO2 in this sector in 2004 showed 1.8% increase over 2003.

(2)Industrial

The most prevalent fossil fuels used for industry in 2004 were fuel oil (48%), natural gas (14.4%) and diesel fuel (7.5%). This sector produced 29.9% of all SO_2, 15.1% of all CO_2, 34.1% of all SO_3, 0.3% of all CO, 0.4% of all CH and 4.3% of all SPM released into the atmosphere (Figure 4-11).The release of CO_2 in this sector decreased in 2004 (15.1%) compared with 2003(16.9%) while the consumption of CFC gas in 2002 decreased by 41% compared with 2001. Figure 4-7 shows that pollutant release by the industrial sector has been increasing over the three last decades, although this process slowed down in the mid-1990s.

(3)Transport

In 2004, about 30.4% of the total amount of energy consumed was used in this sector and there was a 5.7% increase over 2003. This sector consumes 57% of the total amount of all petrochemical products in the country, mainly petrol (20 billion litres) and diesel fuel (15 billion litres). The maximum amount of all fuel oil consumed, 624.4 million barrels, was used for sea transport. The largest share of pollutants released from fossil fuel consumption belonged to this sector too. 64.3% of all nitrogen oxides, 29.3% of all SO_2, 27.5% of all CO_2, 24.8% of all SO_3, 98.6% of all CO, 96.3% of all CH and 79.2% of all SPM produced were released by this sector

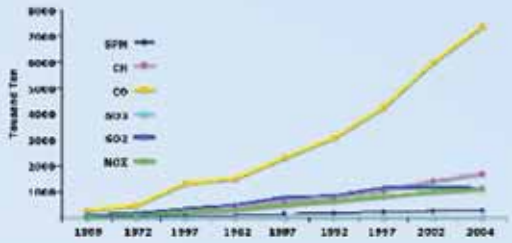


Figure 4-5: Gas and greenhouse gas pollutant release(1968-2004) (energy origin)
Source: Ministry of Energy, 2004

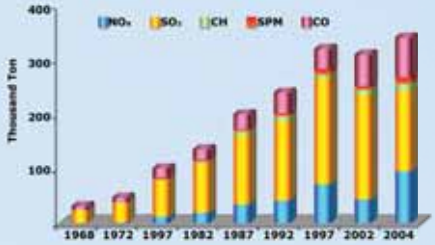


Figure 4-6: The trend of pollutant release
Source: Ministry of Energy, 2004

Table 4-1: Gas and greenhouse gas releases by energy-users (tons) in 2004

	SO_3	SPM	CH	CO	NOx	SO_2	CO_2
Household, Commercial and General	1766	10591	11758	69468	97121	143377	100206121
Industry	5059	12916	6737	19067	116127	336564	50207812
Transportation	3651	238642	1642621	7282205	715088	329081	91835364
Agriculture	367	25712	41264	17845	58959	60410	9946162
Power Plants	3884	13427	4168	171	123953	254413	81268496
Total	14727	301288	1706548	7388756	1111248	1123845	333463955

Source: Ministry of Energy, 2004

(Figure 4-11). Considering the increasing number of motor vehicles entering the roads in recent years, this increasing rate of pollutant release is not unexpected (Figure 4-8). Petrol and diesel fuel are the two most common types of energy used in road transport and they are responsible for many of the damages inflicted on the environment. The damages corresponded to 52,050 billion Rials, in 2004 alone; 58% of the amount was caused by the transport section. The total cost of damage to the environment from the release of SO_2 , CO_2, CO, CH, SPM and NOx breaks down as follows: industry sector (29.9%), household and Commercial sectors (30.1%) and transport sector (98.6%, 96.3%, 79.2% and 64.3%).

(4)Power Plants

The section consumed 5.5% of all the diesel fuel, 36.3% of the furnace oil, 36% of the natural gas and produced 11.2% of all the Nitrogen Oxides, 22.6% of the SO_2, 24.4% of the CO_2, 26.4% of the SO_3, 0.2% of the CH and 4.5% of the SPM consumed and produced in 2004 (Figure 4-11)., Release of SO_2 had decreased by 2004 compared to 1997, however, the release of the nitrogen oxides increased during the same period (Figure 4-9). The Carbon Release Index per KW hr electricity had decreased in the various types of the power stations by 2004 (Figure 4-10).

(5)Agriculture

Using 3,670.5 million litres of diesel fuel, 80.3

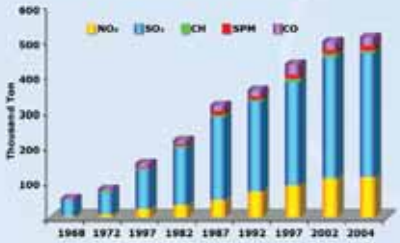


Figure 4-7: Changing trend of gas pollutants released by industry
Source: Ministry of Energy, 2004

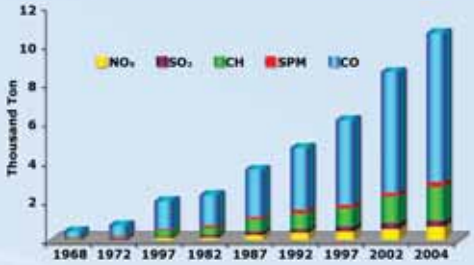


Figure 4-8: Changing trend of gas pollutants released by the transport sector
Source: Ministry of Energy, 2004

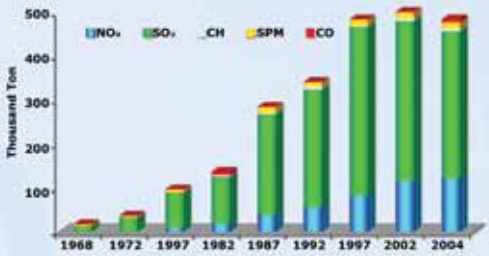


Figure 4-9: Changing trend of gas pollutants released by power stations
Source: Ministry of Energy, 2004

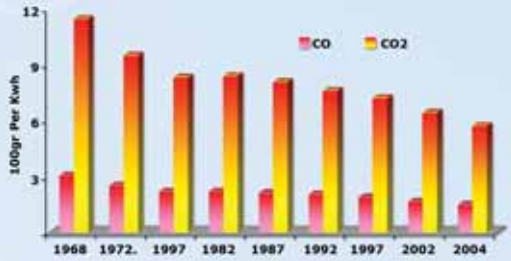


Figure 4-10: Changing trend of gas pollutants released by thermal power stations
Source: Ministry of Energy, 2004

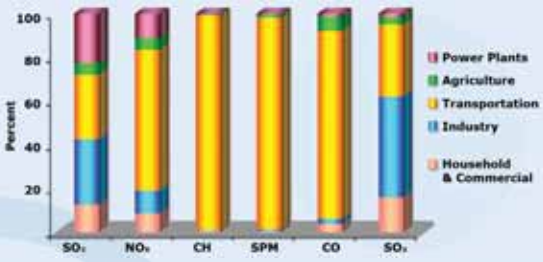


Figure 4-11: Contribution of energy-using sectors to the release of gas and greenhouse gas pollutants
Source: Ministry of Energy, 2004

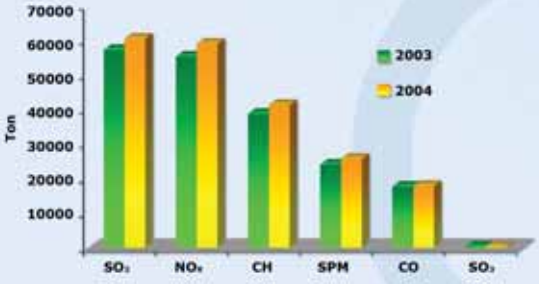


Figure 4-12: Changing trend of gas pollutants released by the agriculture sector
Source: Ministry of Energy, 2004

million litres of kerosene and 141.1 million litres of petrol, the agriculture sector was among those sectors that consumed the least energy in 2004. The sector's share in the release of pollutants such as CO, SPM and SO_3 was 5.3%, 0.2% and 2.5%, respectively, and was also minimal (Figure 4-11).

While the emission of CO_2 has been on the rise in all other sectors. It is to be noted that ideal or otherwise, CO_2 is itself a pollutant and, as far as the greenhouse gas pollutants are concerned, it is a harmful gas.

1.2.3 Ozone-depleting Substances

Ozone is a scarce element in and around the atmosphere. It is mostly (85% of the total) found in the stratosphere at an altitude of 15-30 Km. Its maximum concentration is 300 ppm. Despite the fact that ozone is considered to be a pollutant in the lower layers of the atmosphere, it is absolutely essential at higher levels to preserve the Earth. As a matter of fact it plays a vital role as a shield that prevents the hazardous, harmful radiation from ultraviolet rays from reaching us. Emissions of CFCs and some other gases have caused serious damage to the Ozone layer in various parts of the world in the recent years. In Iran, the use of ozone-depleting substances which was only 1,331 tons in 1987 had increased to 7,050 tons by 1998. Attempts were made to slow down that trend and the use of such materials was curbed

CO_2

In the fossil fuel combustion cycle when Carbon and Oxygen react, the ideal expected result would be production of CO_2. An incomplete reaction of these two elements results in CO which is a much more hazardous pollutant. Figure 4-13 shows the CO_2 released by the various energy-user sectors in 1997-2004. As this fig. shows, only in the agricultural and industrial sectors has the release of CO_2 decreased or remained constant,while the emission of CO_2 has been on the rise in all other sectors. It is to be noted that ideal or otherwise, CO_2 is itself a pollutant and, as far as the greenhouse gas pollutants are concerned, it is a harmful gas.

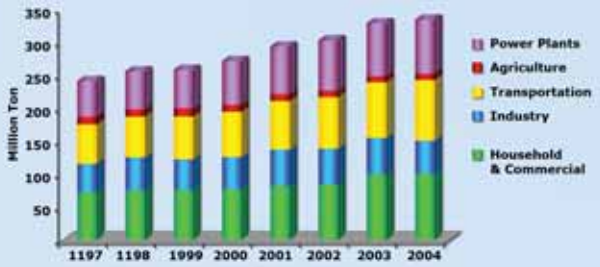


Figure 4-13: Changing trend of CO_2 releases in different sectors
Source: Ministry of Energy, 2004

in 1999-2000. Unfortunately, however, a new and unprecedented surge has already begun (Figure 4-14).

1.2.4 Other Pollutants

- Pollution caused by mining activities and release of dust.
- Air pollution caused by dust and sand storms.
- Air pollution caused by burning waste vegetation.

2. State and Impact

2.1 Nitrogen Oxides

NO and NO_2 are among the most significant air-pollutants. NO_2 is a visible gas that changes to suspended nitrogen particles (NO_3) as a result of complicated atmospheric reactions. Humidity reacts with NO and NO_2 to form nitric acids which corrode metals and construction materials. If the concentration of NO_2 exceeds 0.25 ppm, visibility is considerably reduced. In an environment containing an NO_2 concentration of 0.5 ppm or more, plants lose much of their growing potential within 10-12 days. Monitoring revealed that the average annual concentration of NO_2 showed a decreasing trend in Tehran in the period 2002-2004 and reached 0.04 ppm in 2004 (Figure 4-15).

2.2 Sulfur Dioxide

SO_2 is a heavy colourless gas produced from the combustion of fossil fuels, especially diesel fuel. It is detrimental to both plant and human health. It is also an important component of acid rain. It can affect the sense of taste in concentrations of 0.3-1 ppm and it smells foul in concentrations of 3 ppm or more. Diesel fuelled vehicles, despite having a small share of all traffic, produce almost all of the SO_2 originating from fixed sources. Monitoring of SO_2 in Tehran revealed that the average annual concentration is within environmentally safe limits. The concentration of this gas in 2001 compared with 2000 showed a dramatic decrease to reach the standard level and remained the same up to 2004 (Figure 4-15).

2.3 Carbon Monoxide

CO is a colourless, odourless and poisonous gas that is dangerously harmful to all animals, humans included, even at a low density. The higher the altitude, the worse the effects of CO. CO is generated by the incomplete combustion of fossil fuels. CO becomes fatal if the concentration exceeds 750 ppm. In urban areas, CO concentration depends on the traffic load as well as the climatic conditions. Figure 4-16 shows the level of CO release in Tehran during 2000-2004, as monitored in the seven stations run by DoE. The average annual concentration of CO during 2000-2004 was at the standard level (9 ppm).

2.4 Suspended Particle Matter (SPM)

A particle matter is any substance other than

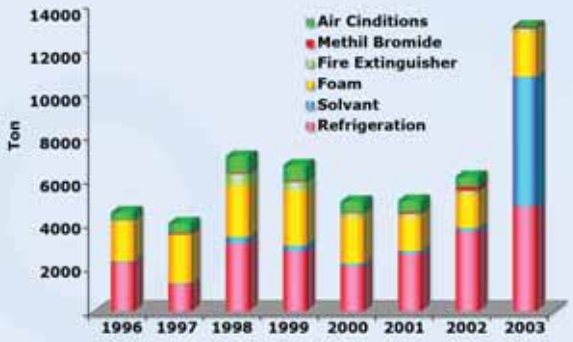


Figure 4-14: Use of ozone-depleting substances by various sectors 1996-2003
Source: Office for the Protection of the Ozone Layer (DoE), 2004

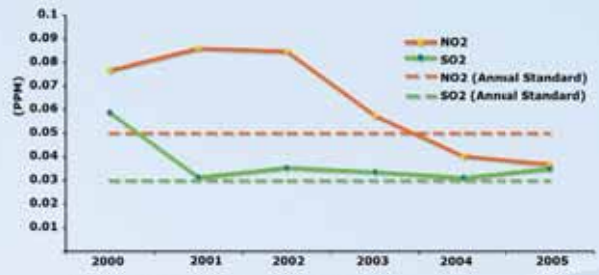


Figure 4-15: SO_2 and NO_2 releases in Tehran, 1999-2004
Source: Office for Air Pollution (DoE), 2004

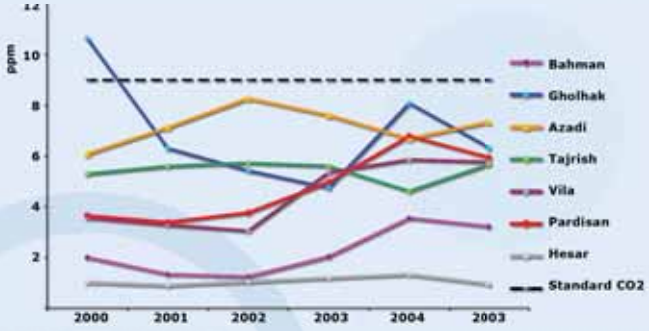


Figure 4-16: Average annual release of CO in seven stations in Tehran, 2000-2004
Source: Office for Air Pollution (DoE), 2004

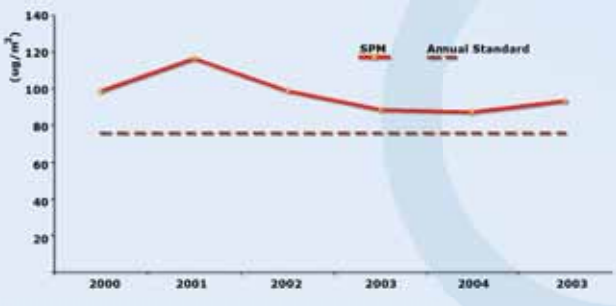


Figure 4-17: Trend of SPM release in Tehran, 2000-2004
Source: Office for Air Pollution (DoE), 2004

pure water that exists in the atmosphere, in solid or liquid form, under normal conditions. Particle matters may come from natural sources or from combustive processes and industrial activities. If the size of the particles is more than 1 micron (and less than 500 microns) they may remain suspended in the atmosphere for a few seconds or even a few months. Such particles darken the air and obscure visibility in cities and towns; the more the particles the more polluted the air.

The standard, authorized amount of SPM in the air is 92.6 ug/m^3. SPM pollution in Tehran has become chronic and, despite the reduction in the number of the critical days, the average annual release of the SPM is very high (Office for Air Pollution DoE, 2004). Figure 4-17 shows the trend of SPM release during 2000-2004 in Tehran.This showed a dramatic increase in 2001 compared with 2000, but it decreased from 2001 to 2004 and then showed a further increase over the standard level (92.6 ug/m^3).

2.5 Air Quality in Tehran

Figures 4-18 and 4-19 show air quality as extracted from the data obtained from 11 air quality-monitoring stations in 2004 and 2005. In 2004, there were 165 unhealthy days and 200 healthy days which means that 45% of days were unhealthy. In 2005, there were 87 unhealthy days and 279 healthy days, meaning that 23.1% unhealthy days. Unhealthy days in 2005 were therefore 47% fewer than in 2004.

Despite the fact that the number of the motor vehicles has increased daily in Tehran over recent years, the air pollution has not. The levels of some of the polluting elements have remained constant or even decreased.

3. Response

3.1 DoE Activities

The Department of the Environment (DoE), following specified strategies and in accordance with the principle of maintaining the stability of air quality, has taken extensive measures to reduce air pollution in the country. These actions include the implementation of national as well as international projects.

3.1.1 Monitoring Air Pollution

Currently, there are 11 Monitoring Stations (seven stations are under the management of DoE and four stations are run by the Air Pollution Control Company of Tehran Municipality) as well as two Mobile Monitoring Stations, in Tehran. Data obtained by these stations are transferred to a centre through a network on a daily basis. Each station measures the amount of O_3, PM10, CO, SO_2, THC and NMHC according to the standards specified and determines the pollution level.

There are also 17 Monitoring Stations operating under local branches of DoE in some cities.

There is a programme to increase the number of the monitoring stations to 30 in Tehran and to 80 throughout the country; 22 new monitoring stations have been bought and will be installed

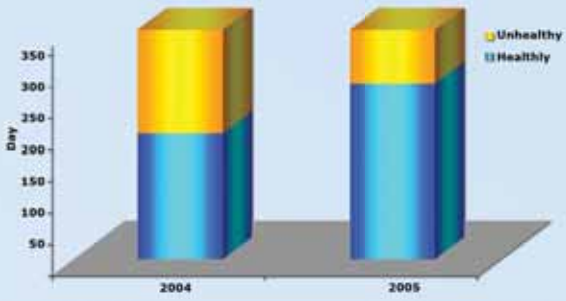


Figure 4-18: Comparison of (environmentally) safe and unsafe days, 2004-2005
Source: Office for Air Pollution (DoE), 2004

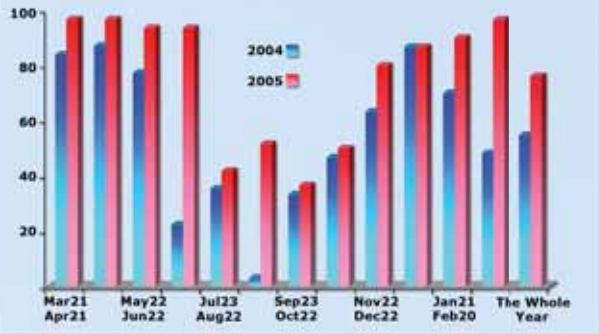


Figure 4-19: Monthly comparison of the Perectanage of (environmentally) safe and unsafe days, 2004-2005
Source: Office for Air Pollution (DoE), 2004

by 2005.

3.1.2 Monitoring Motor Vehicle Pollution

Carrying out tests to determine the polluting potential of brand new cars is one of the responsibilities of DoE. The establishment of the Vehicle Pollution Research Centre was a successful undertaking of the Department. This plan was initiated by an agreement concluded between the Department and the Ministry of Industry and Mining in 2002. The Centre was later expanded to cover the testing of motorcycles in 2005.

The Centre was officially inaugurated in early 2006. It boasts some of the most sophisticated testing equipment, enabling it to offer its services even beyond the boundaries of the country. A supervising committee of the representatives of Tehran Municipality, the Traffic Organization and DoE has been set up to oversee the Centre's activities. By 2005, 3,476 different tests were performed on vehicles and only 20 cases did not meet the standards.

3.1.3 Pollution from Fixed Sources

•DoE has taken many steps to reduce air-pollution caused by fixed sources:

•Following up projects to transform power stations from fuel to natural gas;

•Following up efforts to provide natural gas for fuelling power stations;

•Establishment of an Instant Monitoring System for cement mills;

•Use of solar energy in Chaharmahal Bakhtiyari Province;

•Installation of solar cells for lighting in Pardissan Park;

•Conducting research projects to investigate the environmental effects of the pollutants from fixed sources;

DoE Actions to Eliminate Ozone-depleting Substances

Since 1994 till the end of the year 2005, by using the financial resources obtained through the implementation of 112 investment projects, 209 industrial units that used ozone depleting materials as defined in the Montreal Protocol, were given financial support to stop using such materials. In this way, about 4,428 tons of ozone-depleting substances were removed from the production cycles of those units using the materials (Figure 4-20). There remained 843 tons of such substances to be removed by the end of 2006. That being accomplished, 95% of all Freon gas used in refrigeration and 71% of other types of harmful gases, used in foam industry, shall no longer be used.

Legal Actions and Law Enforcement:

- Ratification of the Vienna Convention for the Protection of the Ozone Layer.
- Ratification of Montreal Protocol and the London and Copenhagen Additional Protocols.
- Prohibition on the import of compressors that use ozone-depleting substances.
- Prohibition on the issuing of operating licences for starting businesses that use ODS.
- Prohibiting the development of businesses that use ODS.
- Collection of information about all businesses that import ODS.
- Reduction of custom duties on non-Freon compressors.
- Establishment of the system of acquiring import-export permits for ODS

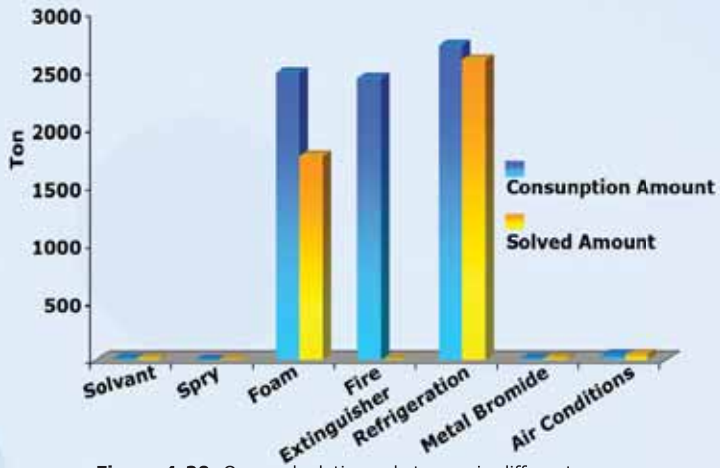


Figure 4-20: Ozone-depleting substances in different units, both used and removed
Source: Office for the Protection of the Ozone Layer (DoE), 2004

•Developing noise pollution standards;
•Efforts to gradually eliminate asbestos.
•Monitoring all industries for environmental problems;
•Encourage the use of natural gas in place of other fuels in factories and workshops.

3.1.4 National Projects

(1) Optimizing Energy Consumption

The achievement of the following goals was the intended outcome of this project:
•Reduction in air-polluting substances;
•Optimizing energy carrier consumption;
• Improving and renewing energy consumption systems;
• Reducing petrol consumption of privately-owned cars.

(2) Petrol Station Repair and Rebuilding Project

•There are eight cities in the country with air pollution problems from vehicle exhaust emissions. This project is being implemented to reduce the pollution to a standard level in those cities.
• Adjusting taxi and car engines to emit less harmful gases; 12 billion Rials was saved from the reduction in fuel consumption as well as a 52% reduction in CO, 73.4% in CH and 52% in CO2;
• Optimizing car ignition systems with Electronically-controlled Utility; in cars less than 10 years old achieved an average 0.5 L/100Km reduction in fuel consumption and, hence, saved 1.5 billion Rials;
• Removing sump from the engine and cleansing it in cars and public minibuses less than 10 years old;
• Procuring and installing electronic carburettor systems; up to now 2000 REEC kits were installed in vehicles which helped to stablilise adjustment of the engines;
•Optimizing car ignition systems by installing

TEHRAN

Tehran, the capital city of the Islamic Republic of Iran, spans an area of 570 Km^2 and it is located at a longitude of 51 degrees, 17' and 51 degrees, 33' East and a latitude of 35 degrees, 36' and 35 degrees, 42' North. Its altitude at Mehrabad Airport is 1,191 m above sea level. Tehran is bounded in the North by Shemiran or 'Tajrish' (1,700 m above sea level), in the South by Shahreray (1,060 m) in the East by Damavand (1,960 m) and in the West by Karaj (1,320 m). Being surounded by highlands to the North, West and East and covering a fairly vast area, Tehran has a very specific climate. Climatologically speaking, Tehran belongs to the Mediterranean Dry Zone with an average annual rainfall of 25.04 mm. Prevailing winds blow in the West of Tehran from West to East and in the East of the city from South to North, or vice versa.

Most of the static pollution sources can be located in the South, West and Southwest of the city. So it is clear that winds blowing through the pollution sources carry pollutants into and scatter them all over the city. Atmospheric inversion is another factor that affects Tehran throughout the year, rendering air movements almost non-existent and the concentration of the pollutants very high. According to the census administered in 1997, Tehran housed 6.5 million people, almost 4.5 times its population of 1.5 million in 1957. The Iranian Statistical Centre estimated Tehran's population at 7.5 million in 2004. It is ironic that as many as 2,731 new motor vehicles receive number plates every day and enter the streets in Tehran, making its already polluted weather even worse.

Azadi Squre, Tehran

CDS; in public vehicles, pollution from exhaust pumps was reduced by 10% and the vehicle's performance increased by 10%.It also reduced fuel consumption by 1L in 100 L and saved 36 billion Rials;

- Converting 1,500 taxis to CNG, saving 20 billion Rials annually;
- Installing three-way catalytic convertors in public transport vehicles, reducing pollution by 20%;
- Equipping vehicle testing centres; 50 vehicle test centre kits have been bought and 50 further will be bought and installed.

(3) Study, Research, Monitoring and Training Project

- The goal of this project was to determine commuting patterns, to establish a better energy consumption culture and to mobilize the public to alter their energy use habits. To achieve these goals, the following projects are being carried out:
  - Enhancing technology and developing a plasma to eliminate exhaust from diesel fuel engines;
  - Development of national standards for the release of gases from domestic heating systems;
  - Investigating the effects of electromagnetic fields on the human immune system;
  - Development of standards for mobile telephone electromagnetic waves;
  - Studying methods for dismantling old and obsolete cars;
  - Examining and comparing the technical-economic advantages of electric vehicles over combustion-engine vehicles in public transport;
  - A Comprehensive Plan for raising public awareness about reducing air pollution.

(4) Reduction in Air Pollution from Natural Disasters

The following sub-projects are to be carried out:

- Establishing a database;
- Studying the air pollution potential of atmospheric phenomena, such as inversion;
- Examining the quantitative and qualitative effects of man-made air pollution as well as

Table 4-2: Some projects carried out to reduce air pollution

Title of the Project	Outcome
Preventing the burning 241 million Ft^3 of Gas through AMAC	Reduction of Pollutants Release (18000 Tons) in the Air
Preventing the burning of 320,000 Barrels of Oil through MOT	Forestalling National Capital Loss
Installing Spare High Pressure Gas Compressors	Forestalling the Burning of 90 Million Ft^3 of Gas
Collecting and processing 40 Million Ft^3 of Sour Gas per day	Reduction of Nitrogen Oxides in the Air

Source: Ministry of Petroleum, 2006

Figure 4-21: Use of LTE in Tehran refinery
Source: Ministry of Petroleum, 2006

that caused by natural phenomena;
- Education and Training;
- Surveying the means of remedying air pollution caused by the running gas network in the event of a natural disaster in large cities;
- Surveying forest natural resources to calculate their pollution potential in the event of accidents.

(5)Comprehensive Air Pollution Programmes

The most notable achievements of the DoE in this area have been in the eight cities of Isfahan, Arak, Ahwaz, Tabriz, Tehran, Shiraz, Karaj and Mashhad. The project was initiated in 2000 following the adoption of a ten-year comprehensive programme and it has so far accomplished many of its goals. In Tehran, the programme hinges around **seven axes** as follows.

Axis 1: Automotive Industry: In 2001, in accordance with the Air Pollution Prevention Act and its related by-laws, DoE was given the task of controlling the polluting potential of all cars manufactured in the country. The following standards had to be observed by all car-makers:

- Standard 1504–ECE, resulting in a 50% reduction in emissions from car exhausts, started in 2001 and ended in 2003;
- Standard EURO II was introduced in 2004 and is still being carried out. This standard replaced ECE according to consumption of lead free petrol;
- EURO I for diesel fuel engine vehicles was introduced in 2005 for new vehicles. Providng number plates to diesel fuel engine minibuses was prohibited in 2002 in Tehran and from 2004 in other cities;
- Standards 01 and 40 ECE for motorcycles; started in 2005.

Axis 2: Worn-out cars: surveys show that ageing, worn-out cars are responsible for 80% of air pollution in Tehran. Attempts are being made to improve the condition of such cars or to stop them running and remove them from the streets. In 2005, a law was ratified providing that factories can have a 15 million Rials discount for removing old white-number plate cars and 30 million Rials for old red number plate cars which led to the

CLEAN-AIR DAY

The Executive Committee on Air Pollution Reduction declared 19 January every year as Clean Air Day to sensitise the public about environmental issues. Taking account of the axes of the comprehensive programme for reducing air pollution in Tehran, a specific topic has been attached to the Clean Air Day in each year. This began in 2002 and continued as follows:

•2002 The Year of Technical Testing of Motor Vehicles; •2003 The Year of Clean Fuel, Clean Air (CNG Year) •2004 The Year of Green Public Transport; •2005 The Year of National Determination to Substitute Worn-out Cars; •Develop Approaches to Reduce Air-Pollution;

•Develop cooperation among regional countries and establish monitoring systems for the release of sulfur, nitrogen and evaporating organic compounds;

Clean Air Day , Pardisan Park

removal of 20 thousand worn-out cars.

Axis 3: Public Transport:

- Putting 1,700 CNG Buses into service in Tehran and 10 other major cities.
- Improving rail transport in some cities, including Tehran.

Axis 4: Fuels: improving fuel quality and substituting highly-polluting fuels with less-polluting ones play an important role in reducing pollution.

Axis 5: Motor Vehicle Technical Testing: this is the easiest and cheapest way to ensure car safety and to reduce pollution caused by inefficient fuel combustion. There are sixm testing centres in Tehran (able to test 5,000 vehicles daily) and one centre is currently under construction. If carried out completely, this programme can save 15%, the equivalent of Tehran's annual 500 million litre fuel consumption.Testing centres were also built in other cities, such as Tabriz(1), Shiraz(1) and Mashad(2).

Axis 6: Traffic Management: traffic jams are the most notorious cause of air pollution and cause many economic, psychological and social problems. Traffic Management is the modern, scientific solution to traffic problems. over-loaded and jammed cross-roads; designating certain districts of Tehran as Traffic Zones where a special permit is required for the cars to enter those zones, and other decisions of this kind are discussed in traffic management courses.

Axis 7: Education and Training: among other factors the, enhancement of public awareness of the environment plays a significant role in preventing rather than remedying pollution. The following activities were carried out in relation to this.

- Nomination of certain days for environmental events such as Clean Air Day;
- Establishing the Blue Sky Site: www.iranbluesky.net;
- Publication of the Clean Air Periodical;
- Holding a National Congress on Air Pollution;
- Presentation of specialized scientific articles;
- Production of environmental films to be shown on TV.

3.1.5 Environmental Activities and International Co-operation

Activities in this domain include the signing of an Iran-France Letter of Understanding aimed at enhancing the level of public awareness, reviewing and revising rules and regulations for pollutants in Tehran and providing assistance in taking useful future technical decisions. An Iran-Japan Joint Programme for Air Quality Management has run from 2002 to 2005 and it is focused on training expert manpower able to make use of modern technologies for air quality control management.

World Bank Financial Facilities for Strengthening Environmental Management have also been employed for strengthening environmental management in Iran, increasing the DoE's capacity for monitoring water and air pollution and improving the enforcement of laws and standards concerning water and air quality.

The 7th Session of the Governmental Council for the South Asia Cooperative Environment Programme (SACEP) approved the Male' Declaration Project with the aim, amongst other things, of investigating the origin and causes of air pollution in the region. Iran is very active member of this Project and its activities in this regard include: establishing an air pollution data bank; identifying air pollutants and their source of emission and establishing their volume; evaluating national schemes in combating air pollution; submitting reports on monitoring and evaluation, assessment instruments, impact assessment, review of measures to mitigate and prevent air pollution; conducting meteorological studies in the regions under consideration; and identifying three border points in the Iranian provinces of Ilam, Kermanshah and Khorasan as entry points of trans-boundary pollutants based on criteria determined by the project State of the Environment.

The monitoring site had been localized 40 kilometers south of Ilam province close to the Iraqi border, the site is being established by DoE.

3.2 Environmental Performance of Organizations and Ministries

Fuel Consumption Optimization Organization of Iran

- CNG Project (two-phase);
- Bringing a gas network to Chaharmahal-o-Bakhtiyari Province;
- Increasing the output of kerosene heaters and teaching their correct utilization;
- Project for using solar energy to heat water;
- Manufacturing and distributing high output heaters and water heaters;

Ministry of Petroleum

- Growth of natural gas share in the total national energy basket from 38% in 1997, to 57% in 2005,
- Supplying 10 million households with natural gas facilities in 2005;
- Building 71 CNG filling stations in 19 cities;
- Reducing the burning of gases accompanying crude oil extraction in the southern oil fields, from 45% in 1993 to 26.34% in 2004;

- Total elimination of lead from petrol and the distribution of lead-free petrol throughout the country since 2003;
- Reducing the use of lead tetra ethylene (LTE) in Tehran Refinery (Figure 4-21);
- Distributing low sulfur diesel Fuel in Tehran, Isfahan, Shiraz and Karaj since 2001;
- See Table 4-2 for some projects carried out to reduce air pollution.

4. Recommendations

Considering the direct and indirect factors that impose great pressures on air quality in Iran, the adoption of preventive policies and controlling measures to decrease vehicle emissions (cars, long- as well as medium-sized vehicles and motor cycles), certain measures are recommended as follows: adoption of the relevant standards, rules and regulations and strengthening their enforcement sanctions; building a comprehensive monitoring system; facilitating and accelerating economic policies aimed at the renovation and optimization of vehicles in the country's transportation fleet; cooperating in mitigating the impacts of global warming and decreasing the hazards of ozone layer depletion within the framework of national legislation; and, finally, ensuring readiness to confront man-made environmental crises.

REFERENCES

*1.*DoE, 2003. *First Research Periodical on the Environment.*
2.DoE, 2004. *Government Report on the Environment*.
3.DoE, 2005a. *SoE Report of Iran*.
4. DoE, 2005b Office of Air Pollution Survey, *Report on the Comprehensive Programme for Air Pollution Reduction in Tehran and other Polluted Cities.*
5. DoE, 2006. *Eight-Year Performance Report*.
6. Fuel Consumption Optimizing Company Website: http://www.ifco.ir.
7. Ministry of Energy,2004. Deputy for Energy Affairs, Office of Energy Planning.
8. Ministry of Petroleum, 2006. *A Review of the Major Activities.*
9. National Transportation and Terminals Organization, 2005. *Transport at a Glimpse*.
10. Office for Air Pollution (DoE), 2004. *Eight-year Performance Report.*
11. Office for the Protection of the Ozone Layer (DoE), 2004. Statistical Office for Ozone-depleting Substances.
12. Statistical Centre of Iran, 2004. *Statistical Yearbook*.
13. Statistical Centre of Iran, 2003. *Statistics on Workshops with a Workforce of Ten or More.*
14. Statistical Centre of Iran, 2001. *Environmental Impacts of Industrial and Mining Activities from a Statistical Viewpoint.*
15. Statistical Centre of Iran, 2002. *Environmental Impacts of Industrial and Mining Activities from a Statistical Viewpoint.*
16. Tehran Transportation Traffic Comprehensive Studies Company, 2005. T*ransport at a Glimpse.*

Shahrchay Park , Oroumieh

5 Land

Land

Introduction

Land is one of the Earth's natural resources and, as such, it is limited. Apart from climate, land is considered to be the most important component of the environment and it is also an ecological ecosystem. It is composed of a variety of diverse biological societies in a voluminous bed of minerals and organic as well as inorganic substances that are widely dispersed and have complicated, sophisticated interrelationships that present them all as a unique living body.

1. Drivers

1.1 Driving Forces

Indirect factors such as climate, population growth and economic activities play a role in the land's degradation. As the climate changes in different parts of the country, it affects the land differently. The land in the Caspian coasts, for example, is mostly affected by water erosion; while the land in the desert is mostly eroded by wind. A larger population also means using, or even overusing, the land more than its capacity allows. Iran's population has more than tripled over the last 40 years, during which time the usable area of the country has decreased. Economic factors force people to use and reuse land repeatedly, causing a deterioration in land quality. Soaring land prices, using agricultural land for housing and the lucrative business it provides are amongst the factors that lead to changes in land use.

1.2 Pressure

1.2.1 Agriculture

Among the factors that lead to land degradation are the following.

•Use of chemical fertilizers and pesticides; soil of Iran has insufficient nitrogen and phosphorus therefore, using chemical fertilizers has increased so that in 2004 the consumption of chemical fertilizers increased 21.5% compared with 2003. Long term use of chemical fertilizers can diminish the quality of soil and it's productivity and lead to erosion of land.Figure 5-1 shows use of different fertilizers including nitrogen, phosphate and potassium which decline but in 2004 compared with 2003, distribution of them increased 11.9%, 22.5%, 39.6% respectively. Increasing the variety of fertilizers from 4 in 1992 to 16 in 2005 can be a factor in decreasing the negative effect of them.

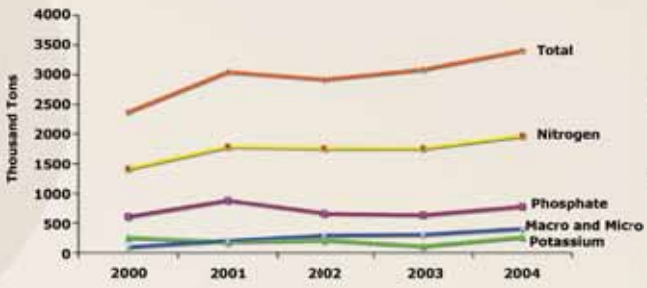


Figure 5-1: Use of different types of chemical fertilizers in 1998-2004
Source: Statistical Centre of Iran, 2002

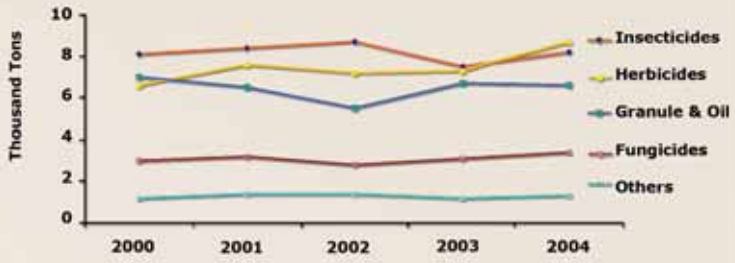


Figure 5-2: Different types of botanical pesticides sold in 1998-2004
Source: Statistical Centre of Iran, 2002

Pesticides can kill other creatures which exist in soil and therefore change the balance of the ecosystem.Some pesticides cannot be degraded in soil and cause pollution in soil. Figure 5-2 shows a 9.2% increase in the sale of botanical pesticides in 2004 compared with 2003. Some measures have been taken from 2005 to reduce the consumption of these pesticides.

- Inappropriate choice of products for cultivation;
- Traditional methods of irrigation and ploughing;
- Repeated use of the land;
- Over grazing.

1.2.2 Urbanization and Changes in Land-Use

Some of the factors influencing land quality include:

- Migration from villages to larger towns and cities;
- Development of villages into towns and towns into cities;
- Population growth;
- Need to build new roads, more houses and other facilities.

1.2.3 *Forest exploitation*

Forests, one of the most valuable and treasured assets a nation may boast, are home to a vast variety of wildlife. Endangering the life of forests endangers our own lives. Cutting down trees and destroying the forests affect the ability of the forests to retain rainwater. Without the requisite humidity more trees and vegetation are then lost. The less the vegetation, the greater the erosion of land - the vicious cycle is endless!

Surveys show that the area of the forests has decreased from 18 million ha to 12.4 million ha over the last few decades. Northern forests have also decreased from 3.4 million ha to about 1.8 million ha.

- **Commercial:** Industries such as carpentry, papermaking, or home and office decoration and appliances, are responsible for much of the man-made deforestation.Figure 5-3 shows the increase in production of timber products in 2004 compared with 2003, for example, but a decrease in production of different types in 2004 as compared with 2000.
- **Non-Commercial:** The result of inappropriate methods of forest and woodland exploitation has also contributed to deforestation, despite the fact that some vast areas have been allocated to tree plantation in recent years. According to some surveys, about 3 million m^3 wood is collected annually without permission from the northern forests and 10.7 million m^3 from forests in other regions of Iran. Figure 5-4 shows the amount of unauthorized wood collecting and charcoal production which has been reported by scouters 1998-2004.
- **Land clearance:** Clearing the land of trees for growing crops is another human activity that leads to deforestation.
- **Fire:** This is another important cause of forest destruction and human activity is the commonest cause of forest fires. In 2004 alone, more than 500 cases of fire have been reported in the forests of the country, burning about 5,000 ha of forest (Figure 5-5).

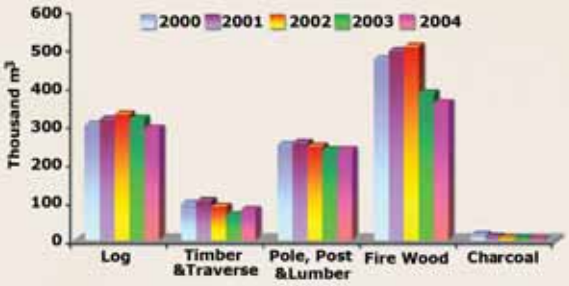


Figure 5-3: Wood products from the northern forests
Source: Statistical Centre of Iran, 2002

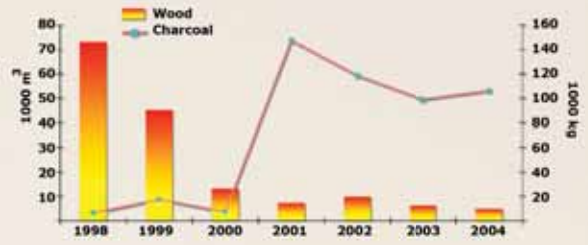


Figure 5-4: Unauthorized wood collecting and charcoal production 1998-2004
Source: Energy Planning Office, 2004

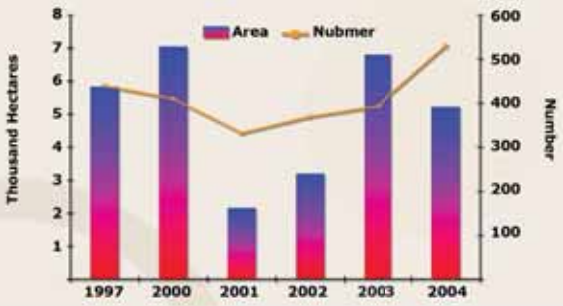


Figure 5-5: The number of forest fires and the areas burnt, 1997-2004
Source: Statistical Centre of Iran, 2004

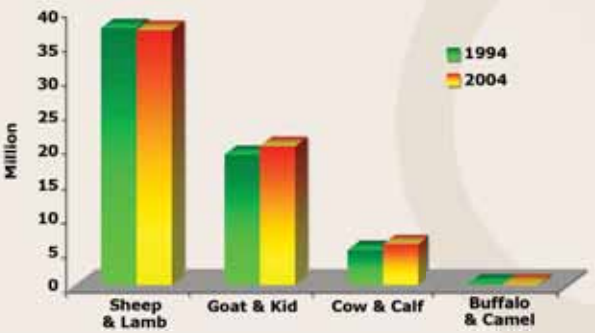


Figure 5-6: Different types of livestock in the country, 1994-2004
Source: Statistical Centre of Iran, 2002

1.2.4 Rangeland Utilization

Over the last 15-20 years, ground cover vegetation has been degraded due to various factors. Hydro-climatic reports show that precipitation has decreased and evaporation has increased, causing the condition of vegetation to deteriorate even further. The main reasons for the reduction of the number and density of the rangelands include:

- **Over-grazing of Livestock (See: Figure 5-6).**
- **Fires (See: Figure 5-7).**

1.2.5 Burning Crop Residues

After the harvesting crops such as corn, wheat or rice their residues in the form of roots, stems, and stalks, remain on the land and are a food source for the micro-organisms that live in the land. It is unfortunate that most farmers burn these, causing the better part of the carbon they contain (50 to 70 % of the organic substance) to be wasted.

1.2.6 Mining

Iran is rich in mines and mining is a common activity in most parts of the country. Mining, the use of explosives, digging and excavating all affect the environment and degrade not only the surface of the land, but deep inside it as well.

In 2003, there were 2,955 active mines in the country, 2.2% more than in 2002.

2. State and Impact

2.1 Chemical Properties

Iran's land has been under the monoculture (planting only one type of crop) system of cultivating wheat. This means that some specific ingredients of the soil, even from deep down, have been repeatedly extracted and used by the plants' roots over the course of many consecutive years, causing the soil to become weak and lacking in terms of those elements. Although accurate information is not available, sporadic surveys show that continuous use of monoculture causes an imbalance in the nutritional capacity of the land. One such survey was conducted in Marvdasht, Fars Province, where wheat is the predominant crop and is grown abundantly. 1,700 visual observances and 6,000 laboratory experiments were statistically analyzed. The dispersion and change pattern and, the dynamic, dependent-managerial properties of the soil, including N, P, K, OC (organic carbon) and BD (physiognomic specific gravity of land) that indicate the quality of the soil, were also studied. Some of the results are as follows. The lower control limits (LCL) and the upper control limits (UCL) in control chart figures are standards which has been proposed by the United States department of agriculture.

2.1.1 Soil Nitrogen

Figure 5-8 demonstrates that nitrogen is greatly insufficient in almost all the cases that were studied. Nitrogen is also very scantily dispersed throughout the region.

2.1.2 Available Phosphorus

Although the level of phosphorus in the soil in that region is more or less sufficient (Figure 5-9), at the lower levels of the ground (at depths of 50-100 Cm) there is very little of this element available (Figure 5-10).However, the overuse of

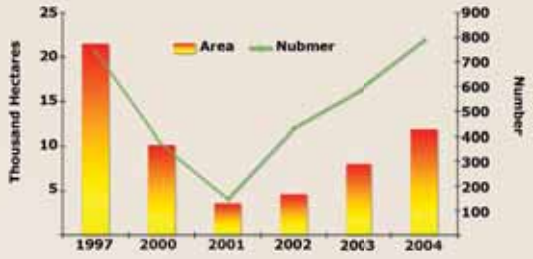


Figure 5-7: Number of fires and areas of rangeland burnt, 1997-2004
Source: Statistical Centre of Iran, 2002

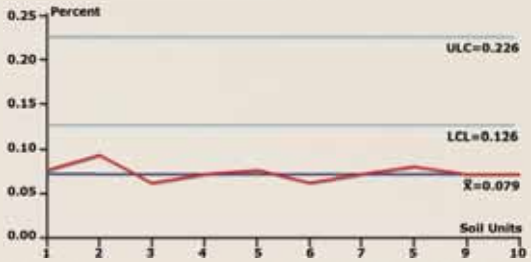


Figure 5-8: Control chart of soil nitrogen
Source: Ministry of Agricultural Jihad, 2005

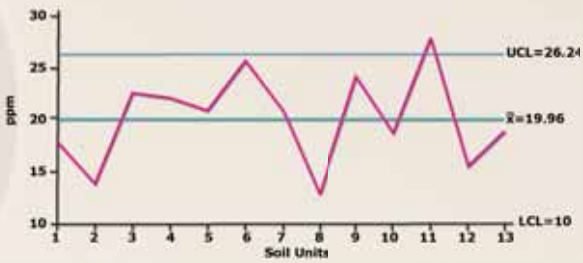


Figure 5-9: Control chart of soil phosphorus
Source: Ministry of Agricultural Jihad, 2005

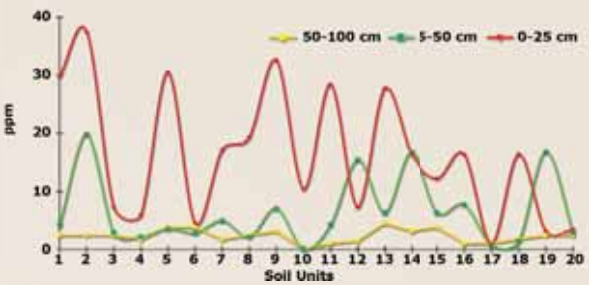


Figure 5-10: Phosphorus at different soil depths
Source: Ministry of Agricultural Jihad, 2005

fertilizers containng phosphorus raised the level of phosphorus in the upper layers of ground (a at depth of 0-25 Cm) to a optimial level. At a depth of 25-50 cm, the amount of phosphorus depends on the upper and lower levels of soil. As soil in Iran has insufficient organic carbon, any increase of phosphorus in the upper layers of soil is due to fertilizers.

2.1.3 Available Potassium

The availability of potassium in the region is very much like that of phosphorus (Figure 5-11). It is uncommon for farmers to use potassium fertilizers since the potassium available is sufficient because of the rich soil.

2.1.4 Soil Organic Carbon

Figure 5-12 shows the control chart of soil organic carbon. The maximum and minimum level of sufficient organic Carbon is 2% and 0.8%. Except for one area for the rest of areas, soil lacks organic Carbon. Burning crop residues is one of the main reasons which convert Carbon to CO_2 and makes the soil lack organic Carbon.

2.2 Physical Properties

2.2.1 Soil Specific Gravity

One of the physical properties of the soil is its specific gravity which varies very sensitively under the influence of such factors as land, water and land-use management. The physiognomic specific gravity of the soil is understood in different ways. Soils with a high specific gravity have a resistance against roots that need to penetrate deep into the soil to obtain water and nutriments. The physiognomic specific gravity of the soil is higher than the control in Iran.

2.2.2 Soil Salinity

There are many evapo-transpiration zones

Impact of Some of the Pressure Factors

- **Agricultural Activities:** These cause the coverage of domestic plants to break up or even be removed totally. They also remove the organic matter and nutritious substances from the soil. They increase soil acidity and cause erosion.
- **Urban Development:** This permanently destroys natural habitats and causes hydro-climatological changes in the area. It interferes with the biological activities of the soil and leads to an increase in waste materials.
- **Forest Degradation:** This reduces the vegetation cover and, causes surface waters to run off the land and be wasted. It also causes soil erosion and destroys or substantially changes habitats.
- **Fires:** These result in a break down of the forest habitats and changes in the age structure of the forests. Among the other consequences of catastrophic fires are: a substantial reduction in the population of micro-organisms, a deterioration in land quality, a reduction in the soil permeability, increase in susceptibility to erosion and wastage of a great deal of carbon.
- **Over-grazing:** This increases water as well as wind erosion and leads to a consequent loss of nutritious substances from the soil as well as changing the density and the make-up of the species of vegetation cover. As a result, it makes way for weeds to grow.
- **Pesticides:** These cause a wide range of types of pollution, an imbalance in ecosystems and a concentration of poisonous substances that threaten the environment with water and land pollution.

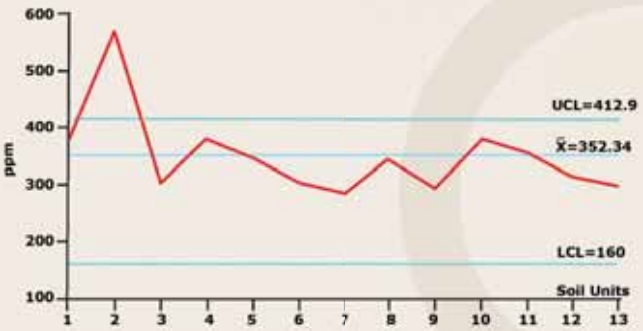


Figure 5-11: Control chart of available potassium
Source: Ministry of Agricultural Jihad, 2005

and salt domes in Iran. It is unfortunate that inappropriate methods of using and managing those zones and domes have threatened many ha of land with salinity. Most of the saline land is found in the South (the Central Desert) and the West as well as in swamps with too much saline water (Figure 5-14).

2.2.3 Plaster Soils

Lands containing plaster in their soil cover about 25 million ha and are mostly in the central plateau, Khuzestan and the coastal plains of the South. Salt flats, salt domes and dunes are regarded as the various types of terrain that contain plaster sediments of different origins, along with the plaster *maranha* that cover 58 ha of the country's lands (Figure 5-15).

2.3 Water and Wind Erosion

Soil maps of Iran show that there are 40 million ha of arable land of high or medium quality. At present, only 20 million ha of this arable land are under cultivation. This means there remains great future potential for agricultural development.

Most of the country's soils are affected by the impacts of wind and water that destroy billions of tons of soil each year. Iran has the highest soil erosion rate of South Asian countries. More than 14 million ha of land are affected by water erosion and 6.5 million ha by the wind, causing a great deal of damage to the country.

According to FAO, erosion moves as much as 3-4 billion tons of soil in Iran each year. Although the source of this comment has not been published and domestic estimates show the annual level of erosion to be 1.5 billion tons. However, this is still five times greater than international standards and is definitely a cause for concern.

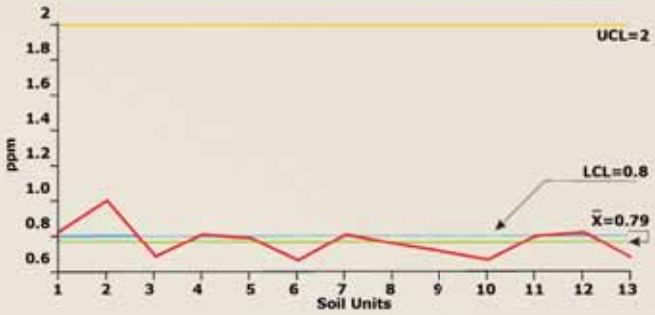


Figure 5-12: Control chart of soil organic carbon
Source: Ministry of Agricultural Jihad, 2005

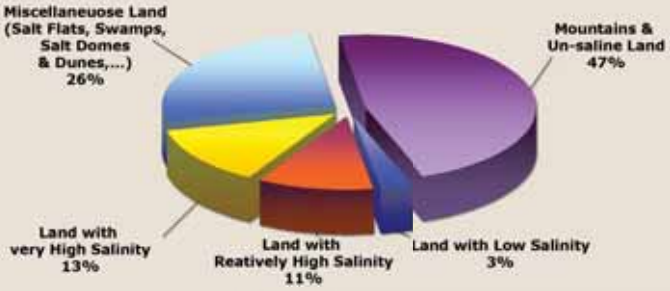


Figure 5-14: Dispersion of saline soils in Iran
Source: Ministry of Agricultural Jihad, 2005

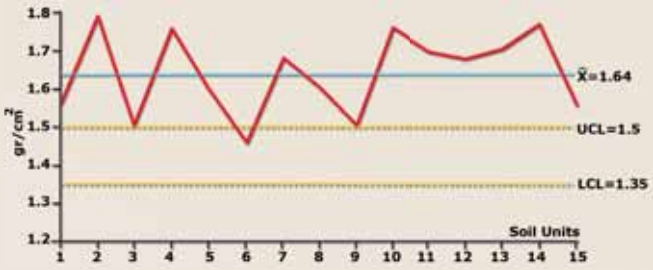


Figure 5-13: Control chart of the physiognomic specific gravity of soil
Source: Ministry of Agricultural Jihad, 2005

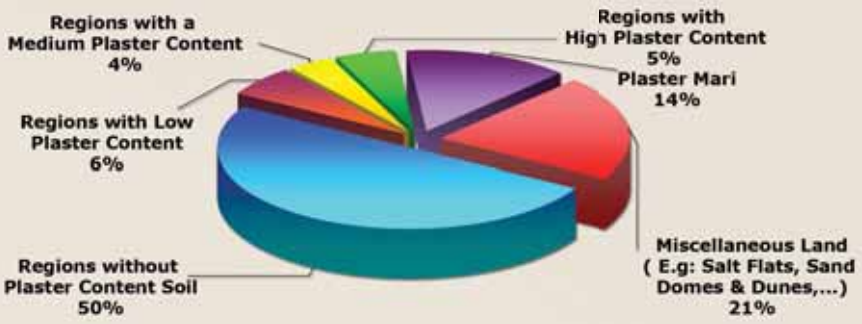


Figure 5-15: Dispersion of the plaster soils in Iran
Source: Ministry of Agricultural Jihad, 2005

3. Response

3.1 Governmental Organizations and Ministries

This section sets out the environmental performance of various government organizations and Ministries.

3.1.1 Ministry of Agricultural Jihad

During the period from 2001 to 2005, the Ministry of Agricultural Jihad and the Forests and Rangelands Organization have undertaken a variety of plans of projects. These have included integrated management projects, plans for the improvement, rehabilitation and development of horticulture, a project on retaining soil humidity in steeply sloping orchards and the Tooba (lit. 'cleaner') Project. There have also been projects for de-desertification and dune stabilization, greenhouse cultivation development, water catchment-aquifer and for expanding the irrigation system from 31thousand ha in 2001 to 55 thousand ha by 2005. Further more, they have undertaken livestock-rangeland balancing projects, established a National Plan for the improvement of rangelands and moved livestock out of the northern forests (144 thousand in 2001 and 152 thousand in 2005).

3.1.2 DoE

Activities of the DoE in relation to this have included membership in bodies such as the Committee for Monitoring the Use of Herbicides and the Committee for Monitoring the Use of Livestock Toxins. It has also addressed the management of livestock grazing in Protected Areas, increased the coverage of protected areas from 4.25% to 7.5% and placed 10% of the nation natural forests under protection (under a scheme adopted by the Supreme Leader). Regulations for Forest Preservation have also been adopted.

In relation to waste management, the DoE has instituted soil preservation through the management of hazardous industrial waste, developed the first national Waste Management Law and management plan and prevented land pollution through monitoring industrial activities. A survey of the movement of heavy metals and organic pollutants and their behaviour in the soil and underground water has been conducted as well as a survey of the land as an origin, source or receptor of pollutants. A thorough study of the challenges of land management in mega-cities has been carried out in collaboration with the University of Essen, Germany. Soil pollution maps have been prepared for urban areas, with the different layers and elements separately identified, a data bank of arable and urban land established and an Environmental Management System for urban and arable land set up. Evaluation systems have been expanded to improve their quality, usability, health and sensitivity.

3.2 International Environmental Cooperation

The Carbon Off-Set Project is carried out through investment from the UN Global Environment Facility (GEF) and the Commission for Desert Reduction in Southern Khorassan. Follow-ups to the project include establishing over two million ha of forests deserts through hand-planting trees by hand, the conservation of land resources in residential areas and arable lands and development of the biological productivity of arid regions, establishing ecological balance and preserving biodiversity.

Involvement in this activity has been enhanced through Iran's membership of the World Union for Combating Desertification (UCD), the International Union for the Conservation of Nature and Natural Resources (IUCN), INCCPR and the Interstate Project for Monitoring Desertification and Preserving Dry and Semi-Dry Regions Natural Resources in Southwest Asia. Iran is also a Party to the UN Convention on Combating Desertification (Paris, 1994) and is active in providing the necessary follow-up to Iran's ratification of the POPs and PIC Conventions (through the DoE).

Further relevant activities include the Water and Land Management Project (at Hableh Rood), establishment of a National Committee for Desertification and opening a DPO office in Tehran.

•Providing the necessary background and
f
o
o

3.3 Training Activities

•In textbooks at various educational
l
d
C
a
a
f
n
•Sustainable indicators are being
d
g
•Holding training courses at different
l
c
n
•Publication of books about land
s

4. Recommendations

Considering the state of land in Iran and the pressures mentioned in this chapter, we strongly recommend the implementation of preventive management through the monitoring of soil pollution, adoption of soil pollution standards and an environmental directive on soil-polluting activities as well as emphasizing the adoption of comprehensive soil legislation. The revision and up-grading of the regulations and standards for the optimization production and consumption of agricultural manure and pesticides should also be considered in order to minimize pollution and destruction. Requiring polluting units to restore, revitalize and regulate soil resources and exploitation of vegetation as well as improving ploughing and tilling methods on steep lands are also recommended.

REFERENCES

1. DoE, 2004. *Government's Environmental Performance in 2004.*
2. Energy Planning Office, *Energy Balance Sheet, 2004*.
3. Management and Planning Organization, 2006.*Weekly News Analysis,* Third Development Plan Achievements.
4. Ministry of Agricultural Jihad, *Water and Land Studies Institute, 2005. Iran's Soils.*
5. Ministry of Agricultural Jihad, Agriculture Research. *Training and Promotion Organization, 2001.*
6. Moameni, A., 2003. *An Appraisal of Land Resources of Iran*: a Contribution to a Project.
7. Municipalities Organization of Iran, *Solid Waste Landfill and Recycling Management.*
8. Siadat et al., 1990. *Potassium Content of Soils in Iran Status andTrends.*
9. Statistical Centre of Iran, *Statistical Yearbook, 2004*.
10. Statistical Centre of Iran, S*tatistical Yearbook, 2004*.
11. Sustainable Development Committee (DoE), 2004. *SoE Report of Iran.*

Zinc Mine , Angooran

6 Inland Waters

Inland Water

1.Water Quantity

1.1. Driving and Pressures

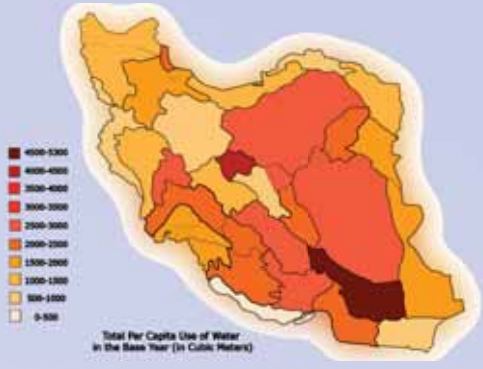
1.1.1 Uneven distribution of water *resources*

There are six main catchment areas in the country and their distribution is uneven. The central catchment areas and the Persian Gulf as well as the Hamoon area all face a shortage of rainfall, while the Caspian Sea and Orumiyeh Lake generally enjoy a healthy situation as far as rainfall is concerned. The Comprehensive National Water Studies Plan shows that:

- The uneven distribution of precipitation is such that 56% of precipitation falls on only 30% of the land.
- The level of rain varies between 50 mm in the Loot Desert and 1,800 mm in the southwest of the Caspian coastline and the Zagros Heights which indicates that water resources are not evenly distributed throughout the country.

1.1.2 Water shortages

- Water consumption for various uses was 74.5 billion m^3 in 1989. With an annual average growth rate of 1.4 billion m^3, it increased to 88.6 billion m^3 in 1999, of which 93.7% was used for agriculture and 6.3% for industry as well as drinking water (Ministry of Energy 2005).
- The per capita use of water was estimated to be 1,405 m^3 in 1995. Picture 6-1 shows that the Jazmoorian catchment area, with an annual per capita use of 5,280 m^3 and the Persian Gulf coastal catchment area, with an annual per capita use of 426 m^3, are the maximum and the minimum users of water in the country, respectively.
- According to available statistics, more than 43% of the total population of the country lived on the central plateau in 1995, while about 23 % lived in the Persian Gulf and Sea of Oman coastal areas. The per capita water use in all these areas has



Picture 6-1: Map of water consumption in different catchment areas, 1995

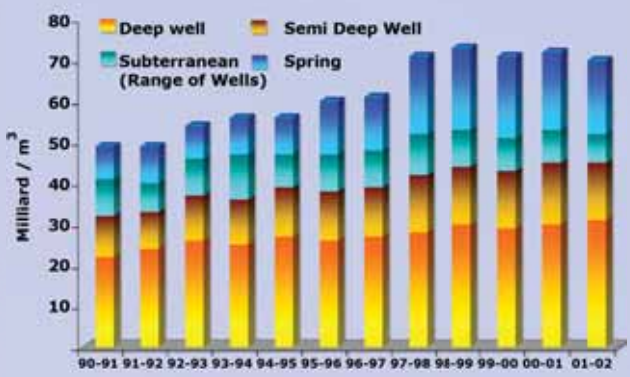


Figure 6-1: Water discharge from underground water tables 1990-1991 and 2001-2002
Source: Statistical Centre of Iran, 2004

been lower than world standards (of 1,000 m^3) which verifies the fact that there is a shortage of water.

1.1.3 Overuse of underground water sources

- The high population concentration in the central plateau and the scant rainfalls (34.4%) in that region not only cause water shortages but also affect underground water sources as well. The evaporation rate is also very high, being the highest of all six catchment areas.
- During 1989-1999, the extra drinking water from underground waters was taken from aquifers (8.3 billion m^3) of which a notable quantity of water was taken from deep wells in regions which face serious water shortages.
- 53% of total water consumption came from underground sources.
- During the last 30 years, the water intake to aquifers has been about 50.5 billion m^3 while the volume of the water discharged from hose aquifers has been 54.3 billion m^3, this means that 3.8 billion m^3 more water has been discharged than entered the aquifers. The drought in the recent years has caused even more water to be discharged from underground water tables, raising this figure to 6 billion m^3. (See: Figure 6-1)

1.1.4 Agriculture, Industry and Mining

- The average annual growth rate of water use in agriculture was 2.3% over the course of the 10 years from 1983 to 1994.
- The total water used in agriculture in 2002 was 85 billion m^3 and half of it was from underground sources.
- The average annual growth rate of water use in large industrial workshops (with more than 10 employees) has been 10.7% over the course of the 10 years from 1984 to 1994.
- The average annual growth rate of water use in mining has been 11.9% over the course of the 10 years from 1984 to 1994.

1.1.5 Urban and rural water consumption

- The average annual growth rate of the urban population was 4.05% between 1982 and 1995. This increase in urban population led to a 5.5% average annual growth rate in the consumption of drinking water over the same period.
- The per capita use of water in urban areas was 221 litres per day in 1984 and increased to 250 litres by 2005.
- The average annual growth rate of the rural population was been 0.94% between 1982 and 1995; the average annual growth rate in rural water use was 4.33%;
- The per capita use of water in Iran of 250 litres per day is twice that of Europe. Residents of Tehran alone consume 300 litres of water per day, while the National Committee for the Establishment of a Water-use Pattern has set an average daily water use target of 150 litres.

1.2. State

1.2.1 Rainfall

The total volume of precipitation was 424.53 billion m^3 from September 2004 to March 2005. This amount is equal to 257.6 mm of rainfall, compared with an average for same period over 36 years (213.7 mm) showing a 21% increase; compared the with same period of the previous year (202.2 mm) shows 27% increase (see: Figure 6-2).

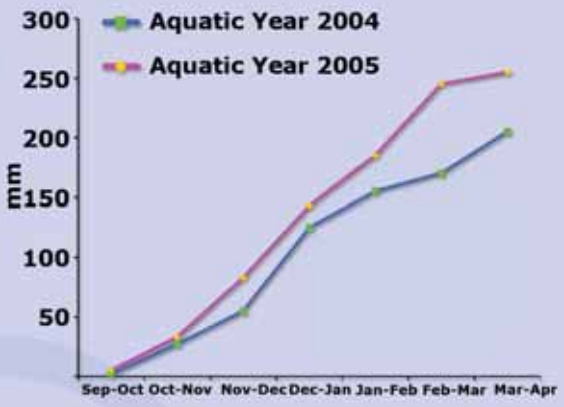


Figure 6-2: Comparison of the levels of rainfall in the present and previous years
Source: Water Resources Management Organization, 2005

Orumiyeh Lake

1.2.1 Surface water

The quantity of surface water in all six areas in 2005 was 63 billion m^3 compared with an average, over the long term of 56 billion m^3. This shows a 12% increase overall and a 29% increase compared with the previous year (49 billion m^3). (Figures 6-3 and 6-4))

1.2.1 Dams

According to Table 6-1 the total volume of water in major dams in the six catchment areas measured during 2005 has shown a 25% increase over the previous period. The inflow and outflow of water to and from these dams has also shown 59% and 93% growth, respectively, over the same period. The greatest volume of water inflow and outflow belongs to Persian Gulf catchment area.

1.3. Impact

- The uneven distribution of water resources causes unequal access and water shortages in some of the sub-regions, so that the per capita use of water in those areas is below the standard water shortage threshold. Such a situation has definite impacts on the residents of these catchments.
- Overuse and emptying of the underground water tables in plains designated as prohibited or critical in terms of water supply is the main factor causing the level of the static reserve to drop. Recent droughts that persisted until 2005 were also another factor which doubled the pressure on underground water resources. The most important effects of this drop in the level of the underground water tables include: lower water flow in wells, springs and *karizes* (subterranean chains of wells); having to change the locations of wells and digging them deeper and deeper; negative effects from landslides; decreased capacity of natural water tables; the deteriorating quality and increasing salinity of drinking water; restrictions on agricultural, industrial and drinking uses; and, finally, the already high costs of energy soaring.
- The growth in the use of water for agriculture, given that that 93% of the total amount of water used in 1989-1999 was allocated to agriculture, is the main factor for emptying the underground water tables. Such a situation naturally affects the use of water for industrial or even household uses.
- Although the use of water in other sectors - such as industry, mining or drinking - showed no

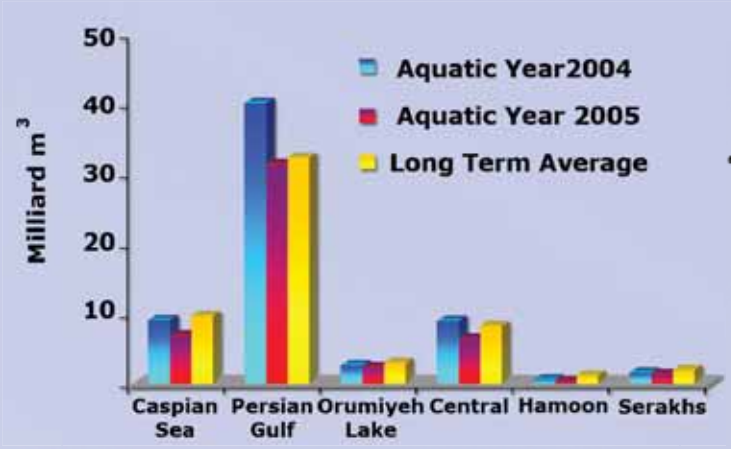


Figure 6-3: Volume of surface water in the main catchment areas, up to the March , 2005.
Source: Water Resources Management Organization, 2005

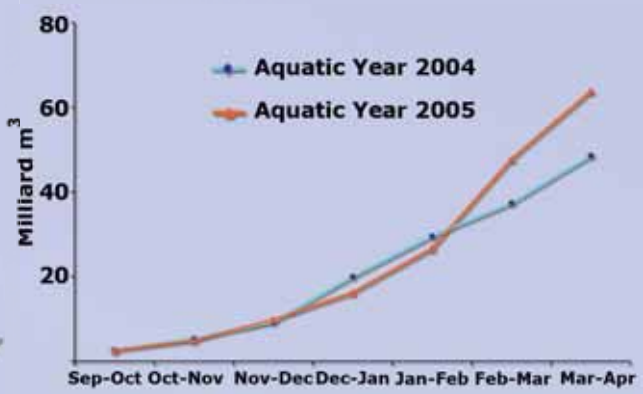


Figure 6-4: Comparison of the volume accumulation of surface water in the present and the previous year.
Source: Water Resources Management Organization, 2005

Table 6-1: Statistics on reservoir dams in the country

Catchment Areas	Number of Dams	Designed Volume	Volume				Incoming				Outgoing	
			April 21		March-April		From the beginning of the aquatic year till March 21		March-April		From the beginning of the aquatic year till March 21	
			2005	2004	2005	2004	2005	2004	2005	2004	2005	2004
Caspian Sea	22	4968	2754	2934	1692	1400	26040	22090	1014	782	25600	20055
Persian Gulf	15	18194	14602	10858	9016	5249	113580	111533	8655	3934	110755	108713
Orumiyeh Lake	5	1049	889	886	530	433	7604	6960	417	310	7267	6371
	16	3835	2824	2453	890	739	12330	11395	666	519	11648	9860
Hamoon	1	700	643	388	140	.	776	429	.	30	98	93
Serakhs	7	1415	293	23	214	10	381	109	6	2	123	90
Country Total	66	30160	22005	17541	12481	7831	160711	152515	10758	5575	155491	145182

Source: Water Resources Management Organization, 2005

more than a 6% growth over the same period, it also played a role in causing a water shortage in underground tables.

1.4. Response

Several responses to this impact can be identified in Iran. A high importance is given to land use spacing, to making water resources and capacity an axis for future development and preventing the overexpansion of population centres. Increasing public as well as the authorities' knowledge, sensitivity and awareness of such matters is also a priority.

National water supply and sewage disposal approaches have been adopted in both urban and rural areas along with a comprehensive approach to resource utilization, giving priority to the supply of healthy drinking water (rather than to water used in agriculture or industry). Long-term planning is being undertaken for both quantitative and qualitative preservation of drinking water resources. Moreover, the Iran-Netherlands Cooperation Committee on the Water Sector has been supported in its investigation of ways of preventing water shortages and devastating floods in the Sistan plains and seeking solutions for water-related questions in Orumiyeh Lake and Esfahan. The Ministry of Energy is a member of the Norwegian International Water Academy (TIWA).
Attempts are being made to establish healthy consumption patterns for drinking water based upon the climatic conditions of each region and to reduce per capita use of water within the framework of existing regulations. A water pricing system to encourage appropriate consumption patterns and advanced technological tools to reduce water consumption by final users, encouraging and supporting the manufacturers, are also being employed. Methods of water distribution are also being diversified.
Regional policy-making is being undertaken to develop industries with regard to the quantitative and qualitative restrictions on water resources of each region. Attempts are being made to establish correct water-use practices in future generations (especially children and young adults) through expanding public education on improved consumption patterns among users and developing public participation in the different aspects of water consumption management.

The amount of waste effluent in water is being reduced by transforming water and sewage system designs inside houses and attempting to install individual pipelines for each flat in a building complex. The drinking water network is also being developed to respond to population growth and the expansion of the towns, cities and villages and to facilitate access to sanitary water. Recycled water is also being used for purposes other than drinking, especially agricultural, to save energy and to preserve the environment.
The optimum water use project has been implemented in collaboration with a German company, following the conclusion of the Iran-Germany Agreement for Mutual Co-operation.

An appropriate means of taking in water in banned regions is to be established by providing and preparing financial support and a balance between incoming and outgoing water in underground water reservoirs is to be achieved to cover the 25% decrease of water in them. A long-term decrease of water uptake from underground water resources from 54% to 45% is aimed at alongside an increase water intake from surface waters from 46% to 55% over the next 20 years.


Bakhtegan Lake , Fars


Lar Lake , Tehran

2. Water Quality

2.1. Driving and Pressures

2.1.1 Industrial pollution

- Industrial effluent is amongst the threats to the country's water resources due to a lack of comprehensive planning and a failure to take account of environmental considerations.
- In 2002, of 10,987 workshops, with more than 10 workers only 1,547 (14.1%) had some sort of sewage system. 61.34% of these workshops discharged their waste into wells and rivers or onto agricultural and non-agricultural land.
- According to some surveys, the total volume of industrial effluent is about 393 million m^3. Many of the smaller workshops with no sewage systems discharge their wastes directly into the environment causing much pollution.
- Case studies show that industries located on the Karoon-Dez catchment areas pour 198 million m^3 of effluent, mostly containing organic, mineral and hazardous substances, into the surrounding environment.

2.1.2 Agricultural chemicals

- Chemical fertilizers and pesticides are among the most significant pollutants of water sources and, consequently, of the environment. More than 3,408 tons of fertilizers were distributed among farmers in 2004 for use on their land. That figure is 53% larger than that for 1997.
- In 2004 as many as 28,000 tons of pesticides were used, showing a 78% growth compared to 1996.

2.1.3 Household sewage

- According to 1995 statistics, the total volume of the household sewage was 3,121.96 million m^3, out of which 59.5% was discharged below ground and the rest into surface water sources.
- In those parts of the country where the level of underground water is high or the ground is permeable, the traditional method of digging absorbent wells disperses microbial pollutants into the underground water tables.

2.1.4 Solid waste

- As surveys reveal, as many as 32,000 tons of solid wastes were produced on average every day in 2000, 70% of which were perishable.
- 42% of 7,917,000 tons of solid waste produced by industrial workshops with more than 10 workers is buried. The locations in which such waste is being buried are usually inappropriate, increasing the danger of polluting water sources, especially underground water sources.

2.2. State

2.2.1 Rivers

- Water is an efficient solvent and so it contains various impurities; rain water contains 63% nitrogen, 34% oxygen and carbon dioxide and 3% of other gases.

Table 6-2: River water quality classification

River	Province	Quality	River	Province	Quality
Sarbaz	Sistan va Baluchestan	1	Zayandeh rood	Isfahan	3
Kor	Fars	3	Zayandeh rood	West Azarbaijan	3
Ghare soo	Kermanshah	3	Simineh rood	West Azarbaijan	1
Talvaar	Kordestan	1	Talkheh rood	Eest Azarbaijan	3
Ghezel owzon	Kordestan	1	Mand	Boushehr	3
Shafa rood	Gilan	3	Hele	Boushehr	3
Gorgan rood	Gilan	1	Atrak	Khorasan	3
Zar joob	Gilan	3	Karoon	Khuzestan	2
Ghare soo	Mazanderan	3	Dez	Khuzestan	2
Gharechay	Hamedan	2	Zayandeh rood	Zanjaan	2
Shahrood	Semnan	3			

Source: Ministry of Energy, n.d.

Table 6-3: Classification of underground water quality

Rigion	Province	Quality	Region	Province	Quality
Kerman plain	Kerman	1	Zahedan plain	Sistan & Balouchestan	2
Semnan plain	Semnan	1	Garmsar plain	Semnan	2
Shabaankare & Dalaky plain	Boushehr	1	Majan & Shahrood	Semnan	2
Khuzestan plain	Khuzestan	2	Isfahan plain	Isfahan	3
Shiraz plain	Fars	2	Lenjaan plain	Isfahan	3
Yazd plain	Yazd	2	Damghan plain	Semnan	3

Source: Iranian Topography Organization, 2002

(1) moderately polluted, (2) semi-polluted and (3) highly polluted

- Rivers with an electric conductivity of less than 750 Micro m/cm^3 generally originate from the Alborz and Zagros mountain chains and are of sufficiently good quality to be used even for drinking. These include the Gorgan, Haraz, Tajan, Jajrud, Karaj, Karkheh, Karoon, Dez, Zayandehrud, Harirrud and Kor Rivers.
- The large tributaries that derive from the main bodies of the rivers and flow into the plains as rivers themselves have an electric conductivity of more than 750 and less than 2,000 Micro m/cm^3. The water in such rivers may be drunk with care since its hardness is not usually more than 400 milligrams/litre. Amongst these, we may mention Qarachai River in Saveh, Zayandehrud River in Isfahan and Karoon River in Ahwaz.
- River water with an electrical conductivity of more than 2,000 and less than 5,000 micro m/cm^3 is unsuitable for drinking, but may be used for irrigating plants resistant to salty water.
- Based upon information obtained from the water sources monitoring plan conducted in 1999, rivers are divided into three groups in terms of the degree of pollution: (1) moderately polluted, (2) semi-polluted and (3) highly polluted. (see: Table 6-2).

2.2.2 Lakes

Orumiyeh Lake has the highest (325,000 mm/cm^3) electrical conductivity and Tashak Lake, in Fars Province, has the lowest (255 mm/cm^3).

2.2.3 Underground water sources

Along with the rivers, underground water tables were also monitored and, accordingly, divided into 3 groups on the basis of the degree of pollution: Table 6-3 gives the names and locations of some catchments.

2.2.4 Drinking water

The significance of drinking water to human life is without question. One of the basic indicators for judging water quality in terms of its suitability for human use is its freedom from any microbial pollution. Figure 6-5 shows the increase of free chlorine from 76% in 1997 to 96.4% in 2003 which shows the standard level for microbial free water. In line with increase of free chlorine, we can see a decrease in the number of patients contaminated with water-borne microbes.

2.3. Impact

- Effluent from industrial workshops is one of the pollutants of water sources such as wells, springs and rivers. Lead and mercury are two common, poisonous metals that can very easily be transferred into the human body through eating produce from land polluted by effluent from workshops.
- Since the level of the underground waters is very high and close to the land's surface in some parts of the country, microbial pollutants can easily penetrate into the water tables and enter the water cycle; they then transfer the pollutants to other water sources and, finally, to the human body.
- Burying waste materials can also pollute water tables, if the location is not correctly selected and insufficiently efficient methods of burial are employed.
- Polluted rivers transfer pollution and cause a great many diseases to spread.

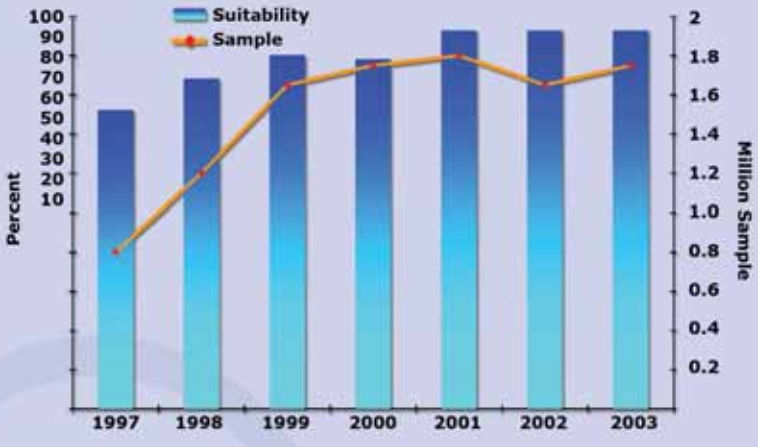


Figure 6-5: Changing trend in the number and suitability of chlorine-meters for urban running water, 1997-2003
Source: Water and Sewage Engineering Company of Iran, 2002-2003

2.4. Response Activities and Studies

2.4.1 Ministry of Energy

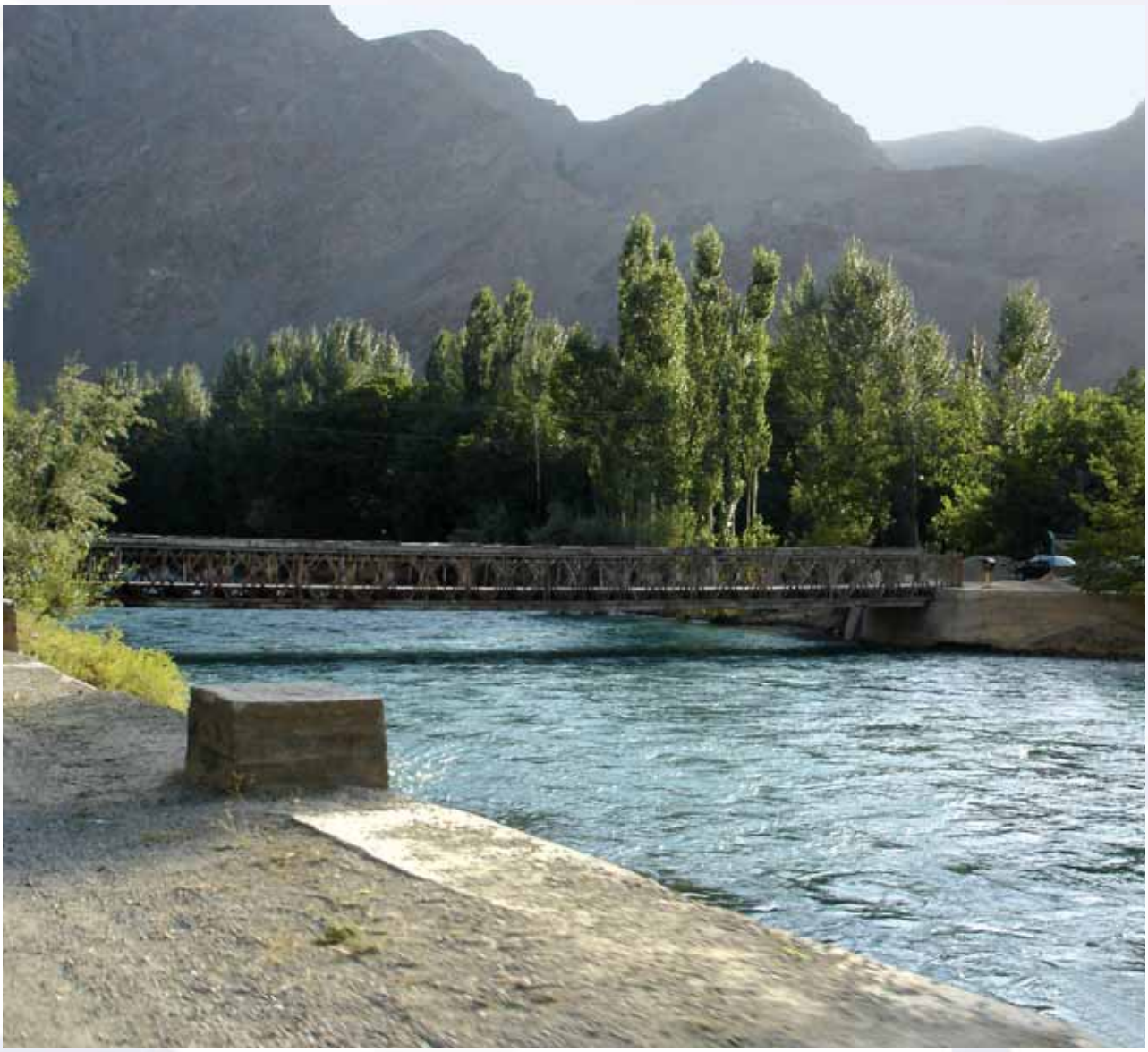
- Iran-Switzerland Co-operation over joint water management, technology transfer and human resource development, comprehensive planning on environmental issues related to hydro-electric power stations and dam resistance, based upon the experiences of Switzerland on irrigation network plans, water resource management, collecting and treating sewage and environmental management.
- Providing support to the Water High Council.
- Adopting a Comprehensive Plan for the preservation of water quality.
- Establishing a Comprehensive Management System to manage all water cycles on the basis of the principles of sustainable development and land zoning in different water catchment areas of the country.
- A public awareness programme to enhance preservation of water quality and quantity and ensure the optimal utilization of resources;

2.4.2 DoE

- Adoption of a strategy for the control and reduction of water pollution and presenting the respective implementation program.
- Providing the infrastructure for the environmental management of water resources.
- Establishing the authorized load of effluent waste discharged into the environment.
- Developing a comprehensive model for grading hazardous water pollutants.
- The River Pollution Reduction Plan, with 60 out of over 160 major rivers chosen for implementing this Plan

REFERENCES

1. DoE, 2006. Eight-Year-Performance Report.
2. Iranian Topography Organization, 2002. Iranian National Atlas of the Environment.
3. Ministry of Energy, JAMAB Consulting Engineering Company, 1992 and 2001. Report on the Synthesis of the Water Comprehensive Plan.
4. Ministry of Energy, 2005. 25-Year Performance Report.
5. Ministry of Energy, n.d. Atlas of Water Resources.
6. Ministry of Interior, Office of Reconstruction Planning, Centre of Urban Planning Studies, 2000. Statistical Extract Report on Urban Solid Waste Management.
7. Statistical Centre of Iran, 2001. Results of the Survey on the Environ¬mental Statistic of the Industrial and Mining Activities.
8. Statistical Centre of Iran, 2002. *Results of the Census on Industrial Workshops with a Labour-force of Ten or More.*
9. Statistical Centre of Iran, 2004. *Statistical Yearbook*.
10. Water and Sewage Engineering Company of Iran, 2002-2003. *Biennial Report on Water Industry Performance.*
11. Water Resource Management Organization, 2005. *Locations of Iran's Rivers.*
12. Water Resource Management Special Edition, 2006.



Zayanehrood , Isfahan

7 Coastal Waters

Coastal Waters

1. THE CASPIAN SEA

1.1. Drivers and Pressure

1.1.1 Population Growth

Taking into account that three northern provinces are adjacent to the Caspian Sea, the population factor exerts pressure upon the sea. The growth in the population of these three provinces, to 6.8 million in 2005 from 5.5 million in 1992, meant more water consumption as well as more pollution, especially by household sewage discharged into the environment.

1.1.2 Marine Resource Exploitation

- The per capita use of marine living resources was 5.2 Kg in 2003, 30% more than in 1995 (4 Kg). Marine products from northern waters comprised 28% of total national production.
- The northern waters' fishery began to decrease in 2000, mostly due to the reduction in the 'Big-eyed' shad catch. It is worth mentioning that the sharp decline in the shad catch over recent years, has been due to the appearance of Monemiopsis Leidyi (an aggressive fish of the Ctenophora family) in the Caspian ecosystem.

1.1.3 Exotic Migratory Species

In a study conducted in the Caspian Sea in 2000, the emergence of Monemiopsis Leidyi was recognized for the first time. The population growth of that exotic species of fish was so fast that it exceeded one Kg/m^3 of the coastal waters of Iran and the neighbouring Azerbaijan Republic. This fish had been brought into the Caspian by ships passing through the Volga Channel into the Caspian Sea. Having no natural enemies in the Caspian, they reproduce enormously each year as the weather gets warmer and, enjoying the neo-planktons that are abundant in the seawater, they have no plans to leave.

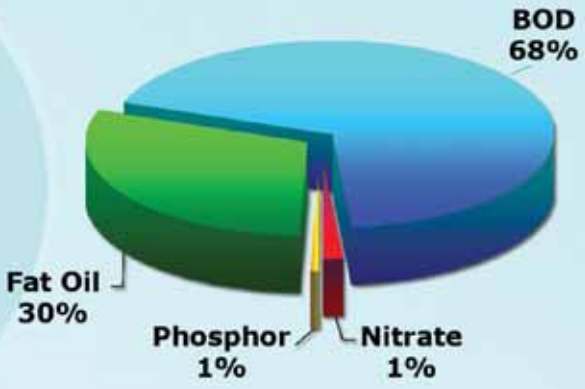


Figure 7-1: Pollution dispersed by the various industries on the northern Caspian coastline, 2000
Source: Caspian Environment Programme, 2002

Caspian Sea coast, pollution

1.1.4 Pollution Dispersion

(1) Industrial Effluent

- According to studies conducted in 2002, industrial workshops with more than 10 workers in the northern provinces of Guilan (52 workshops), Mazanderan (34) and Golestan (21) produced 15,747 million m^3 of sewage. About 74.7% of the workshops had sewage refinery systems and 29.9% discharged their sewage into rivers.
- According to research statistics from 2002, industries located on the Caspian Sea coastline discharged 28,200 tons of BOD, 600 tons of nitrates, 210 tons of phosphorus and 12,500 tons of fat oil into the Sea (Figure 7-1).

(2) Agricultural Run-off

About 241,000 tons of chemical fertilizers, especially ammonium compounds and ammonium phosphate are used on the southern coasts of the Caspian Sea. The agricultural run-off is discharged into the rivers, carrying with it some of the fertilizers that pollute the water. Table 7-1 reveals the names of the rivers and the types and percentages of the discharged materials in the Caspian Sea. According to Table 7-1, the Sefidrud River is the most polluted river with an annual discharge of 1,840 tons (80.42%) of phosphates and nitrates and 15.296 tons of pesticides into the Caspian Sea. The Sefidrud River comprises 50% of chemical fertilizer pollution discharge with the Astara, Chaloos and Babolrud Rivers the next polluted ones.

(3) Household Sewage

- In 2002, about 395 million m^3 of drinking water was supplied for use in urban and rural households in the northern provinces adjacent to the Caspian coast. Considering that 75% of the water used in a household returns as sewage discharge, it is estimated that the northern provinces produce about 292.5 million m^3 of sewage waste water.
- The sewage effluent from of residential areas is usually polluted with different types of detergents, oil and fat. Detergents decrease the oxygen dissolved in water and they often contain enough phosphate easily to pollute water resources (Figure 7-2).

(4) Tourist and Recreational Centres

Tourist and recreational centres are usually very close to the Caspian Sea coastline and the easiest way to get rid of the huge amounts of sewage produced in such centres is to discharge it into the sea. Rivers like the Ashar, Ramsar, Salman, Chaloos and Noshahr are in a critical condition in terms of pollution.

1.2. State

1.2.1 Physical Factors

- **Salinity:** Although the salinity of the water in the Caspian Sea differs at different latitudes, the average is 13.05 ppt 1,000, making it salty.
- **Water temperature:** It changes considerably

Table 7-1: Phosphates and nitrates discharged into the Caspian Sea from rivers

River	Water volume (m^3)	Phosphate		Nitrate		Total (tons)	%
		Weight (tons)	%	Weight (tons)	%		
Ghareh sou	101	11.11	3.63	27.27	1.37	38.38	1.68
Tajan	207.40	18.66	6.09	62.22	3.13	80.88	3.53
Babol rud	425	25.50	8.33	95.75	4.93	123.25	5.39
Chaloos	372	40.92	13.37	130.20	6.56	171.12	7.48
Nashtarud	30.7	2.76	0.90	7.36	0.37	10.12	0.44
Sefidrud	4000	200	65.35	1640	82.70	1840	80.42
Astara	101	7.07	2.31	17.17	0.86	24.24	1.06
Total	5237.10	306.02	100	228.92	100	2288	100

Source: DoE, 2003a

Sewage discharged near the Caspian Sea, Ramsar

with the latitude. In winter, the water temperature fluctuates between 0 and 0.5 degrees Celsius in the northern sections, and between 10 and 11 degrees Celsius in the southern sections.

- **Evaporation:** Surveys show that in the Caspian Sea the surface water evaporation rate fluctuates between 700 and 1,400 mm throughout the year. The minimum evaporation occurs in the middle section of the sea and the maximum in the northern section near Baku. It should be pointed out that a sharp increase in the evaporation rate of the Caspian occurred in 1930s when an anti-cyclone weather system prevailed in most parts of the (then) Soviet Union. This phenomenon caused about 740 Km^3 of the water to evaporate, lowering the water level of the sea by 1.96 metres.
- **Winds and Waves:** The Caspian is regarded as a stormy sea since it is windy and turbulent most of the time. In the southern Caspian Sea the dominant winds in the western sea are from the North and Northeast, and in the east part from the North and Northwest. In winter, the sea is usually stormy and it is turbulent up to 170 days a year, on and off;
- **Tides:** There are few vertical movements in the water-level of the Caspian because it is cut off from the open sea. The extent of fluctuation at low and high tides does not exceed a few centimetres in each tide-cycle.
- **Water Currents:** Wind is the main cause of water currents. The average speed of the currents has been reported to be 20-40 Cm/Sec.

1.2.2 Coastal Rivers

It is necessary to know the chemical compounds of the waters of the rivers that flow into the Caspian Sea, considering the fact that most of the larger rivers in the three northern provinces end up in the Caspian.

- **Concentration of Chlorine Pesticides:** Experiments carried out in the deltas of the 22 rivers on the southern edge of the Caspian Sea show the concentration of chlorine pesticides. DDT in the Qarasu River, MOC in the Sorkhrud, and HC, HCH and ALD are the most prevalent in the Astara River. However, it should be noted that, despite the pollution they cause, they have not yet exceeded authorized levels.
- **Concentration of Phosphates and Nitrates:** Results from 19 sampling stations in three northern provinces demonstrate that the authorized level of pesticides has not been exceeded in any of the stations. The average concentration of phosphates and nitrates is higher in the eastern than the western part.

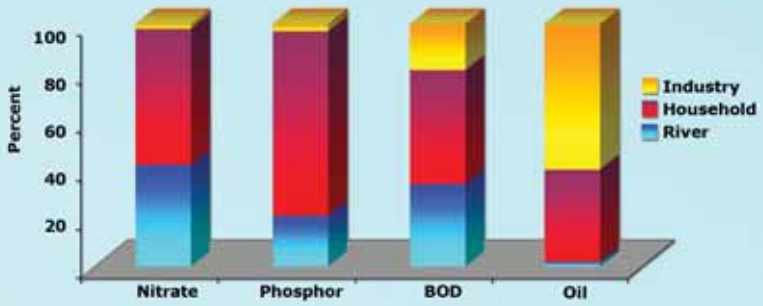


Figure 7-2: Contribution of rivers, household sewage and industrial effluent in the polluting the Caspian Sea by discharging oil, BOD, phosphorus and nitrogen
Source: Caspian Environment Programme, 2002

Indusrial waste entring the sea

1.2.3 Water Quality

Hydro Carbons

- **Petroleum Hydrocarbons:** Oil and other Hydrocarbons create slicks on the water surface that prevent the oxygen from permeating naturally into the water. Moreover, such substances poison aquatic creatures, block sunrays from entering the water and, consequently, interfere with the photosynthesis of aquatic plants. The concentration of all hydrocarbons in 2000 was 8.5 to 167 µg/g which was a better status compared with the Persian Gulf and Azerbaijan's coastal waters.

- **Poly-loop Aromatic Hydro Carbons(PAH):** The maximum and the minimum concentrations of these PAHs in the southern coastal waters of the Caspian are 954 and 72 Ng /g. This is while the National Oceanic and Atmospheric Administration (NOAA) minimum requirement for this concentration is 2,000 Ng/g and, thus, the Caspian coasts have not yet exceeded authorized limits (4,000 Ng/g).

1.2.4 Heavy Metals

In the coastal waters of the Caspian Sea on the Iranian side, 23 different types of heavy metals have been sampled. Measurements show that the rivers which flow into the Caspian are highly polluted with heavy metals, mostly due to geological factors. However, in the Sefidrud where various industries are located in the vicinity of the river's catchment area, pollution may also be a natural consequence of those industries.

- **Carbon Tri-oxide (CO_3):** Under the Caspian Sea Environment Programme, the participating Caspian coastal States managed to take 105 samples from the surface waters in different parts of the coastal waters and had them analyzed; 26 of these samples came from Iranian coastal waters. The results showed that there were fewer CO_3 compounds in Iran's and Azerbaijan's coastal waters than in the northern section of the Caspian Sea. However, the deeper the water, the more CO_3 compounds were found in all the coastal states.
- **Local Ecosystems:** Enjoying a high level of biodiversity, the Caspian Sea is acknowledged to be one of the most valuable ecosystems in the world. It boasts various wetlands and a diverse number of flora and fauna.
- **Wetlands and Coastal Gulfs:** The Ramsar Convention on Wetlands of International Importance (1972) gives an exact definition of a wetland. Anzali and Gomishan are two of the most important wetland areas in Iran.
- **Gorgan Gulf:** This Gulf is located in the southeast of the Caspian Sea and covers an area of 40,000 ha. It connects to the Caspian Sea via the Firth of Ashooradeh. The Gorgan Gulf bed is swampy in its eastern, western and southern parts, containing aeolian, littoral and sea deposits. As many as 34 indigenous or exotic species of fish, from 11 families and 28 genera, have so far been identified in the Gulf. The depth of the Gulf varies from 1 m in the West to 5 m in southeast.
- **Species Diversity:** Being on the migratory route of millions of birds, the Caspian Sea is a safe shelter for them as well as for many other rare species. Moreover, rivers such as the Sefidrud, Tajan and Gorgan, are appropriate places for many fish to lay their eggs and reproduce (See: Table 7-2).

2. PERSIAN GULF and SEA of OMAN

2.1. Drivers and Pressure

2.1.1 Population Growth

Based on a census conducted in 1996, the neighbouring provinces of the Persian Gulf and Sea of Oman - Khuzestan, Bushehr, Hormozgan and Sistan va Bluchestan - contained a population of 7,287 million corresponding to 12% of the total population of the country. Five years earlier, in 1991, the population in those provinces was 6.25 million and this shows an average annual growth rate of more than 3%. It goes without saying that a larger population means higher consumption of

Table 7-2: General specifications of species diversity in the Caspian Sea

Species	Number of Species	Comment
Phytoplanctons	450	
Zoo-planctons	315	
Phytabentoz	87	29 green and red algae, 13 brown algae
Zoo-Bentoz	380	of 13 different fauna classes
Fish	133	of 17 families 70% 0f which are: cobitidea
Mammal	1	Phoca Caspica
Birds	466	including 120 nests, 68 wintering, 278 Migratory
Invertebrates	1394	Comprising 77.1% of the fauna of the Caspian
Reptiles	2	

Source: Caspian Sea Environment Programme, 2002

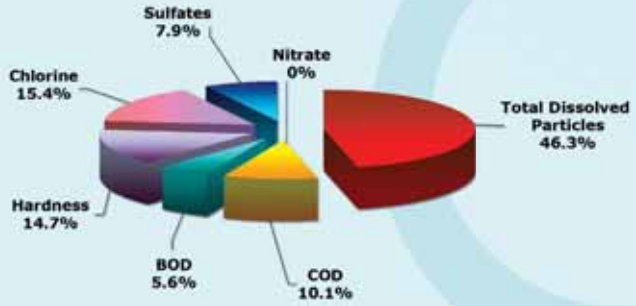


Figure 7-3: Total percentages of pollutants discharged into the Karoon and Dez rivers (rural and urban catchments)
Source: DoE, 2003a

the coastal water resources.

2.1.2 Water Resources

Despite the fact that Persian Gulf and Sea of Oman are rich with many varieties of aquatic creatures, fishing and aquaculture had little attraction for the regional countries, simply because they preferred to rely on their lucrative, easy oil incomes. However, Iran has chosen to take a different view from the attitude common to the other countries in the region. Iran alone produces 50% of the total fish products of the Persian Gulf and Sea of Oman. According to the information available, the maximum catch in the southern waters in 2003 comprises the large fish (49.4%) that live close to the water's surface as well the benthic fish (32.3%).

2.1.3 Pollution

(1) Industrial Effluent

In 2002, the following numbers of industrial workshops with ten or more workers were operative in the different provinces:

- **Khuzestan:** 214 workshops;
- **Bushehr:** 38 workshops;
- **Hormozgan:** 71 workshops;
- **Baluchestan:** 100 workshops.

Among these, 33 workshops in Khuzestan, seven in Bushehr, 8 in Hormozgan and two in Baluchestan had industrial sewage systems; however, only 14 workshops in Khuzestan, none in Bushehr, 7 in Hormozgan and one in Baluchestan had sewage refinery systems which means 42.4% of workshops in Khuzestan, none in Bushehr, 87.5% in Hormozgan and 50% in Baluchestan have sewage refinery systems.Those workshops with no sewage refinery systems simply discharged their effluent waste into wells, rivers and agricultural/non-agricultural land. Workshops in Khuzestan produced the maximum amount of polluted effluent. More than 36% of these workshops with sewage systems discharged their sewage into rivers, mostly the Karoon and Dez Rivers that are two of the most significant rivers of the region.

(2) Household Sewage

The fresh water used in the southern coastal provinces, both in urban and rural areas, was one billion m^3, in 2002, which was 20% more than the water consumption in 1995. Taking into account that 75% of the water used in households is discharged as effluent and, considering that southern provinces used 940 m^3 water, in 2000, the waste water thus discharged was 705 m^3; about 151.7 m^3 effluent entered into the Karoon and Dez Rivers. Ahwaz and Khorramshahr, two of the larger cities of the province, produced the largest amount of the pollutants(See: Figure 7-3).

(3) Dredged Substances

Statistics show that about 10% of the substances dredged become polluted through contact with other sources such as urban and industrial sewage and the effluent running off the land. Such substances may gradually release their pollutants into the surrounding habitats.

(4) Crude Oil Leakage

Hundreds of oil tankers pass through the Persian Gulf on a daily basis. Such traffic obviously disperses a high level of oil pollution throught the region. The Strait of Hormoz provides passage for as many as 25,000 oil tankers every year, resulting in an equivalent of two million barrels of crude oil to leak into the water.

(5) Major Accidents and other Incidents

Iran boasts various oil and gas fields in her coastal territory in which oil exploration, extraction and exporting activities are being carried out. The amount of oil extracted from off-shore oilfields varies between 200 barrels per day, in the Nowrooz oil-field, to 115,000 barrels per day in the Salman field. This operation definitely has an impact on the environment. Among the other factors affecting coastal water quality are accidents that cause oil spills from tankers. Such incidents also occur when war breaks out or an explosion takes place in an oilfield. The following are just a few such examples.

- In the Imposed War of Iraq against Iran, as many as 335 oil tankers and 145 ordinary ships were attacked, and some of these incidents caused significant marine pollution. The missile attack against Well No. 2 of the Nowrooz Oilfield in 1983 caused great damage to the installation and resulted in 2,000 barrels of crude oil flowing into the Persian Gulf every day over a period of 16 months.
- In 1991, during the nine-month Iraq-Kuwait war, 700 oil-wells were set on fire, four

Anzali Port - Oil pollution

tankers were capsized and sunk and oil was dispersed throughout the sea. Oil from Kuwait's terminals was also released into the Persian Gulf. Thus, the greatest environmental catastrophe of the last decade occurred. According to the official statistics published by the Kuwaiti authorities, 9 million barrels of crude oil spilled into the Persian Gulf. Moreover, the fire on the oil-wells burnt 6 million barrels of oil daily and 100 million m^3 of gas and smoke were scattered in the air and sky over the coast. That pollution incurred heavy damage not only to the marine environment of the Persian Gulf and the coastal land but also to the neighbouring firths and wetlands, such as Shadegan. The soil quality deteriorated as well.

- Explosions in Iran's, the United Arab Emirate's and Saudi Arabia's oil-wells are another factor impacting on the environment of the Persian Gulf. Two major explosions that occurred in Al-Ahmadi (Kuwait) and in Bahrain Bridge (Saudi Arabia) in 1993 and 1998, respectively, caused about 4,000 and 650 barrels of oil to enter into the sea. During 1998-2000 9,000 tons of oil entered into the sea because of tanker accidents.
- In 1994, a Russian commercial ship carrying chemical substances sank in the waters of the Persian Gulf. Large numbers of sardines were reported dead in the coastal waters of Iran, off Lavan and Kish Islands and, subsequently, a great many benthic fish died in the following months.

2.2. State

2.2.1 Physical Factors

- **Water Salinity:** In the Persian Gulf and Sea of Oman, water salinity decreases as the water runs from South to North. It also varies in the winter as fresh water running from the Arvandrud River changes its course and, as atmospheric events occur, especially that of evaporation in the Northwest of the sea, and increase the salinity. The surface Gulf Stream currents coming from the Strait of Hormoz into the Persian Gulf have a salinity level of 37 per 1,000 parts in the summer, and 39 per 1,000 parts in the winter.
- **Tides:** The tidal range (the vertical interval between high and low tides) in the Persian Gulf and Sea of Oman varies by more than one m. The midday tide is the most common type in the region. The tidal range varies between 1 and 2 m in Bahrain and between 3 and 4 m in Lengeh and Dubai harbours.
- **Winds:** Continental weather conditions are prevalent in the region. Northern winds in summer and winter are basically strong and blow with their maximum strength from late October to the next March, creating storm conditions. The wind pattern in the Sea of Oman is influenced by cyclones coming from the Arabian Sea. On the southern coasts of the Persian Gulf, westerly sea breezes blow in parallel with the coasts, leading any oil spills towards the southern coasts.
- **Water Currents:** The water level in the Persian Gulf is lower than that of the Sea of Oman causing the water to run into the Persian Gulf through the Strait of Hormoz. It moves at 20 cm/sec in summer and 10 cm/sec in spring and autumn.
- **Temperature:** In the RAPMI marine area (please refer to: SoE for Iran, 2004) the temperature varies between 12 and 35 degrees centigrade as the season moves from winter towards summer. The temperature variation in the western parts is more than 20 degrees centigrade and, in the Strait of Hormoz, more than 11 degrees.
- **Evaporation:** In 1998 the evaporation in the Persian Gulf was estimated to be 172 cm in year.

2.2.2 Qualitative Factors

- **Petro-hydrocarbons:** Samples taken from seven sampling stations in the Arvandrud River delta and the northeastern Persian Gulf in 1994-

Hara Forests , Hormozgan

5 showed the total mean of petro-hydrocarbons to be 7.8 µg/L, in soluble form, and 6.4 µg/L, in suspension.

- **Heavy Metals:** The concentrations of copper, nickel, zinc, magnesium and cadmium found in the sediments ata depth of less than 1 cm and 1-10 cm were measured in 1997. The concentrations of nickel and cadmium, at both depths, were greater than the NOAA Guidelines but that of copper and zinc were lower than the Guidelines require.
- **Coastal Ecosystems:** The Persian Gulf has major habitats with many and various marine living resources. The following are just a few of them:

(a) Soft sea-beds with marine grasses are suitable habitats for resident or passing marine creatures. The density of such creatures is low in Kuwaiti coastal waters but it is high in the Gulf of Bahrain. It is worth mentioning that more than 600 species of aquatic creatures have been identified amongst the sea-grasses of the Persian Gulf. Coral reefs, also known as sea gems because of their high biodiversity, colour and beauty and algal communities in brown, red and green are found in abundance (170 species) in the southern coastal waters of Iran. Mangrove trees, with the scientific name of Avicenna Marina and named after the world-renowned Iranian scientist Abu Ali Sina (Avicenna) the founder of Iran-Flora, and one other type of mangrove, locally called the Chandal Tree are amongst the spectacular scenery of the Persian Gulf region (Table 7-3).

Tidal Mud Nappes: Nappes have played a major role in the initial formation of the marine environments of the Persian Gulf and the Sea of Oman.

(b) Biological Resources: The region has diverse biological resources including fish, crustaceans, marine mammals, reptiles and birds.

3. Impacts

- Population growth in the northern and southern provinces together with the lack of efficient sewage systems in both urban and rural areas, allows pollution to take over the rivers and then transfer to the coastal areas. Rivers are polluted with human as well as animal faeces originating from sewage from residential and recreational centres. Such polluted waters can infect fish and the humans who eat the fish. Even those swimming in such waters are at risk.
- In Caspian waters, it should be noted that the growth of the aggressive Monemiopsis Leidyi (Ctenophora) has provided a lethal threat for the Big-eyed shads that provide part of human protein needs. The massive reduction in shad production directly affects the food chain and, consequently, leads to changes in the ecosystem.
- Effluent from factory sewage outlets carry various pollutants and heavy metals that end up in the rivers and coastal areas. Chemical fertilizers give off phosphates and nitrates that are carried by agriculture run-offs into water sources causing hazardous pollutions. This water provides the habitat for flora and fauna and any changes to the chemistry of the water changes their living conditions. Such changes may lead to the extinction of many invaluable species.
- Over-fishing has caused the marine living resources to decrease heavily in the southern waters of the Persian Gulf and Sea of Oman, endangering the future sustainable development of the region.
- Amongst the very hazardous pollutants in the southern coastal waters that directly affect the environment and degrade the ecosystem is the pollution originating from oil-spills and oil extraction run-offs.
- While discussing this state of affairs, we noted that wars and fires that broke out in the region caused the greatest environmental catastrophes, killing fish and other marine creatures in massive numbers and in a very short time-span. The continual leakage of oil from tankers is a daily event, polluting the waters and placing all the marine living resources under threat.

Table 7-3: Iran mangrove forest locations and extent

Province	Region	Area	Environmental Management
Bushehr	Malehganze	0.22	Protected Area
Bushehr	Dare Harbour	0.01	———
Bushehr	Naiband Gulf	3.75	———
Hormozgan	Khamir Harbour	20.02	———
Hormozgan	Qeshm	72.04	Protected, Biosphere Reserve , International Wetland
Hormozgan	Tiab	1.30	International Wetland
Hormozgan	Sirik	4.8	International Wetland
Hormozgan	Jask Town	0.02	
Hormozgan	Jask Firths	2.58	
Baluchestan	Guater Bay	2	International Wetland

4. Response

4.1 DoE – National and Provincial Projects

- Microbiological Studies in the Persian Gulf, as part of a project to study petroleum and non-petroleum pollution and to identify and count the number of bacteria as an index of faecal pollution.
- Implementing international projects (such as "Reducing Trans-boundary Damage in the Aras-Cura Catchment Area"), with DoE acting as the national implementing body.
- Implementing an international project for the ecosystem management of Sistan.
- Monitoring marine biomes in the Persian Gulf, Sea of Oman and Caspian Sea.
- Conducting oceanographical, physical, chemical and biological studies in the territorial waters of Iran to identify and address the pollution sources.
- Adopting the requisite rules, standards and regulations to control and combat environmental pollution originating from tanker traffic, loading and unloading cargo and unexpected incidents.
- Organizing two Pollution Monitoring and Joint Coastal Management Regional Centres within the DoE and one Marine Emergency Regional Centre within the Harbours and Shipping Organization of Iran; also supplying administrative equipment and electronic facilities.
- Patrolling the Caspian Sea to assess environmental pollution. This was begun by the Iran Centre for Pollution Monitoring in October 2000 and the job continued throughout 2001 and 2002.
- Assessment of the environmental monitoring situation in Iran and the region to adopt the Caspian Regional Monitoring Programme.
- Assessment of the conditions of laboratories located in Iran and in the region for participating in the Regional Monitoring Programme.
- Preparing a Report on the state of coastal zones in Iran.
- Preparing a Report on the state of marine accidents in Iran.
- Determining the pollution load of the major permanent rivers.
- Designating Sensitive Zones and National Parks in the Persian Gulf and Sea of Oman.
- Identifying and specifying the conservation range of marine mammals in the Persian Gulf and Sea of Oman.
- Dynamic survey of the coastal currents in the Persian Gulf.
- Surveying the ecology of (polycell) algae in the Persian Gulf and Sea of Oman.
- Survey of the structure of the areas in which mangroves grow in Jask and Govater on the coasts of Oman.
- Establishing a database and documentation centre as well as a website for the marine environment.
- Surveying and monitoring the 'Red Killer' and fish casualties in the Persian Gulf and Sea of Oman.
- Translation and publication of the Persian Gulf Environment Report.
- Survey of the hydrography and sediment pollution of the seabed of Chahbahar Bay.

4.2 International Environmental Cooperation and Activities

Various international scientific and technical cooperation activities have been undertaken including: between the DoE and the Iranian Atomic

Energy Organization, especially over the marine environment of the Caspian Sea, Persian Gulf and Sea of Oman; between DoE and the Fisheries Organization, with a focus on the marine environment of the Caspian Sea, Persian Gulf and Sea of Oman; between DoE and the Ministry of Foreign Affairs, especially over the legal affairs affecting the Caspian Sea, Persian Gulf and Sea of Oman, as well as international Protocols, Conventions, projects and funds for the marine environment.

Table 7- 4: Specifications of the reserved areas and international wetlands of Iran coasts

Name of the Wetland	Province	Area (Hectares)
Miankaleh Archipelago	Golestan	100'000
Anzali Wetland	Guilan	15'000
Shadegan Wetland	Khoozestan	400'000
Kiashahr Wetland	Guilan	500
Amirkelayeh Lake	Guilan	1'230
Alagol, Almagol, Ajigol	Golestan	1'400
Khooran Strait	Hormozgan	100'000
Rudshoor, Rudshirin Delta	Hormozgan	11'800
Rudekaz va Hara Delta	Hormozgan	15'000
Guter va Hooryahoor Bay	Sistan va Baluchestan	382'430
Shidvar Island	Hormozgan	160
Goumishan	Golestan	20'000
Bujaq	Guilan	3'278
Naiband	Bushehr	48'400

Source: DoE

Scientific and technical cooperation has also been undertaken between DoE and the National Commission for UNESCO and the Oceanography National Commission in Tehran, with VEP-ROWA (located in Bahrain), within the framework of the Ramsar Convention on the Wetlands (especially over waterfowl and seabird habitats), with UNEP (since 1912) and through the Iran-USSR Agreement on Commerce and Shipping (March 1940) and the Protocol on the Implementation of Environmental Conservation in the Caspian Region (1994).

4.3 International Projects

4.3.1 Caspian Sea

Some international projects have been conducted in the Caspian Sea area of Iran. These have involved such activities as identification of the pollution load of the major permanent rivers on the southern coastal areas of the Caspian Sea and determining the bio-accumulation of pollutants in the marine living resources of the southern Caspian Sea. The biological characteristics and accumulation of pollutants in Phoca Caspica on the southern coastal areas of the Caspian Sea have been surveyed as has the biological state and food chain of the Monemiopsis Leidyi in the southern Caspian Sea. Ecologically Sensitive Zones and National Parks have been in the southern coastal areas of the Caspian Sea. The environmental condition and pollutants of the coastal waters of the southern Caspian Sea have been monitored as have radioactive pollutants in the coastal Sediments of the southern Caspian Sea.

Special attention has been paid to the preservation and management of wetlands, a project initiated by an international expert (assisted by local experts) in 1999. This project established coordinated management for the proper, sustainable exploitation as well as preservation of the biodiversity of wetlands in Iran and pursued the following goals: determining the legal status of Protected Areas and their boundaries; implementing an Integrated Environmental Managerial Project for the Sustainable Development of Wetlands with the coordinated participation of local people and NGOs; raising public awareness of the project's goals, of reasonable exploitation of the wetland resources and of preservation of the wetlands' biodiversity; and establishing cooperation, at the national as well as provincial level and between Ministries for the management of wetland.

A project for the preservation and management of the Anzali Wetland was concluded between the Division for the Natural Environment and Biodiversity (DoE) and a group from the Japanese Institution for International Cooperation in March, 2002. This project pursued the following goals: preserving the wetland's biodiversity by reducing pressures from the local community; determining the factors degrading the wetland; identifying the correct actions for preventing degradation; designing an experimental plan for wetland preservation; developing an Integrated Management Programme to preserve the wetland's catchment area; and building local governmental organizations' capacity to implement the Management Programme.

4.3.2 Persian Gulf and Sea of Oman

In the Persian Gulf and Sea of Oman, Iran's project to claim compensation for damage caused to the marine environment of the Persian Gulf as a result of the Iraq-Kuwait War (1991) covers the following activities organised under six sub-projects (For further information, see: Iranian DoE Efforts in the International Arena).

Changes in the population of wetland birds are being monitored and the costs of remedying damage caused by the War estimated. The faunal environment layers of the Persian Gulf and Sea of Oman have been studied, covering both those layers that have been polluted by petrochemicals and those that have not polluted. The present ecological state of Iran's coral reefs has been assessed and the possibility of reconstructing the damaged parts in the Persian Gulf and Sea of Oman studied. The situation of heavy metals and petrohydrocarbons in the sediments and of seaweed biomes in the Persian Gulf and Sea of Oman, before and after the Iraq-Kuwait War, has been assessed. Methods for rehabilitating damaged mangrove forests have been chosen. The level of accumulation of remains of petrochemicals in Iran's coastal waters of the Persian Gulf has been assessed and methods of clearing and cleaning them up studied.

The quantitative and qualitative changes of the marine environment of the Iranian sections of the Persian Gulf after the War have also been determined and the level of damage incurred to Iran's marine environment assessed.

4.4 Establishing Coastal Reserves

Until the end of 2001 along the coasts of the countries of Persian Gulf region, as many as eight parks and reserves as well as 56 other places have been recommended to for designation as Protected Areas. The protected mangrove zone of Iran is registered with UNESCO, under the MAB programme and four international wetland sites are regulated by the Ramsar Convention (See: Table 7-4).

4.5 Environmental Performance of other Organizations

4.5.1 Ministry of Energy

- Follow-up of a Joint Project with the Caspian coastal States on studying industrial pollution and how they affect the ecosystem of the Caspian sea.
- Efforts to strengthen regional co-operation for the improvement of the condition of the Caspian ecosystem.
- Implementing the management of sanitary and industrial sewage systems.
- Developing pre-refinery and initial refinery units.

- Developing well-equipped effluent laboratories.
- Implementing the plan on the quantitative and qualitative evaluation of sanitary and industrial sewage systems and solid waste and ways of reducing it.
- Focusing attention on safe, fresh drinking water through building 79 water treatment plants in urban areas.
- Equipping water and sewage companies with laboratory units (368 units) capable of providing services related to bacteriology, chemistry, biology and testing the contents of sewage; as a result, the water sanity indices have improved by 4.97% recently.

(for the details of further projects, see: Annex I, appendix 7-4-5)

4.5.2 Iranian Harbours and Shipping Organization

Achievements with regard to the protection of the marine environment of the Caspian Sea:

- In 1998, the Iranian Harbours and Shipping Organization joined the International Convention on Preparation and Cooperation for Combating Marine Petroleum Pollutants (OPRC, 1990). To meet its obligations arising from the Convention, to increase the administrative capability of its staff and up-grade its equipment to combat pollutions, the Organization undertakes two pollution-combating national manoeuvres every year: one in the northern and the other in the southern harbours of the country. To preserve the marine environment of the Caspian Sea, it has coordinated with the Caspian Environment Protection Programme and an emergency centre has been established under the auspices of the Organization to manage, coordinate and take the necessary actions.
- Another action taken by the Organization in this regard was to join the International Convention on Preventing Marine Pollution (MARPOL) in 2002. Taking into consideration the present sensitivity of the subject of marine pollution, the Organization has also taken the following actions:
- Establishing Control Centres to monitor and prevent non-standard ships from entering northern harbours;
- Equipping the northern harbours (of Noshahr, Anzali and Amirabad) with pollution-combating facilities;
- Training personnel expert in the field of marine environment.

5. Recommendations

Considering the uneven distribution of water catchments in Iran and the existing pressures, such as high water consumption or pollution, and the responses noted in Chapters 6 and 7, we highly recommend the following actions. The adoption and implementation of a comprehensive water resource quality management plan, regulations for the sustainable utilization of maritime environments and the revision, completion and amendment of legislation governing marine areas, as well as management of water resource risk. The water production, distribution and consumption pattern, management of the utilization and preservation of aquatic resources and monitoring of the introduction of non-indigenous species should be optimized. The quality of the ground-level water resources should be protected against pollutions and aquatic resources should be conserved, revitalized and rehabilitated. Recognition of existing difficulties and of the natural as well as man-made anomalies of aquatic resources with economic values as well as the implementation of a comprehensive conservation plan to eliminate destructive factors and effect the allocation of an ecologically-sound water share are also priority actions.

REFERENCES

1. DoE, Office of the Marine Environment, 2003a. *Proceedings of the Seminar on the Consideration of the Biological Environment of the Caspian Sea* (Evaluation of National and Regional Programmes, Gorgan, 17-29 October 2003.
2. DoE, Marine Environment Office, 2003b. *State of the Marine Environment in the Persian Gulf* (RAMPI Marine Area).
3. DoE, 2003c. *Results of Government Activities related to Biology*.
4. Caspian Environment Programme, 2002. *Transboundary Diagnostic Analysis for the Caspian Sea,* vol.2. Baku, Azerbaijan.
5. National Cartography Organization, 2001. *National Atlas of Iran* – the Environment.
6. Sustainable Development Committee, 1999. *State of the Environment of Iran.*
7. Sustainable Development Committee, 2000. *State of the Environment of Iran.*
8. Statistical Centre of Iran, 1993. *Statistical Yearbook*.
9. Statistical Centre of Iran, 2000. *Impacts of Industrial and mining Activities on the Biological Environment from a Statistical Viewpoint.*
10. Statistical Centre of Iran, 2002. *Statistical Yearbook.*
11. Statistical Centre of Iran, 2003. *Statistical Yearbook.*

8 Biodiversity

Biodiversity

1. Drivers and Pressures

Various pressures on Iran's biodiversity can be identified, such as the lack of priority for environmental and biodiversity values as well as inappropriate resource management. Population growth and extension of human activities especially in ecologically-sensitive regions as well as changes in land use and encroachment on forest areas also put pressure on biodiversity. Other pressures identified include the overuse of chemical pesticides, fertilizers and similar substances, overexploitation of floral and faunal resources, water and land pollution due to various agricultural and industrial activities and the use of genetically manipulated (GM) species without due consideration.
Weakness and ineffectiveness of existing rules and regulations has resulted in the illegal trade in animal and plant seeds, poaching and the introduction of exotic species. The abundant availability of illicit arms (more than 500,000) has further exacerbated these problems.

2. State

2.1 Flora

Iran's flora are many and diverse thanks to the vast size of the country and the fact that it enjoys climatologically and ecologically diverse conditions. It is estimated that there is a total of 8,000 species of Spermatophytes in Iran. These can be divided into three groups: *Angiosperae* (covered seed), *Gymnospermae* (uncovered seed) and Ferns. In total, there are 167 families and 1,200 genera in the three Euro-Siberian, Irano-Turanian and Saharo-Sindian vegetation regions. 1,727 species (almost 22%) as well as 20 genera of the flora in Iran are unique i.e. only present in Iran but no family has been reported to be unique.

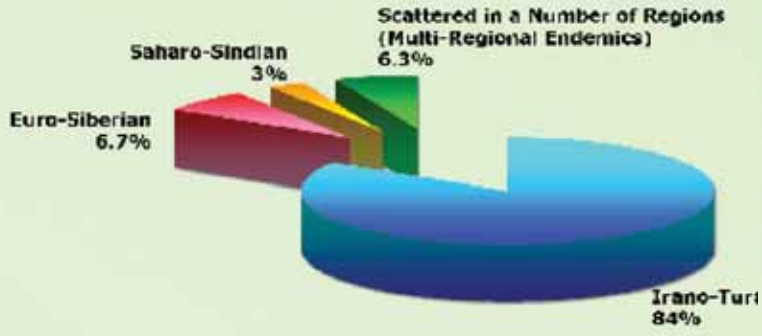


Figure 8-1: Distribution of indigenous flora in various phyto-geographical regions
Source: Jalili and Jamzad, 1999

Table 8-1: Phyto-geographical regions of the monotypic genera and their risk assessment

Family/Taxa	Status	Phytogeo-Graphical region	Provinces
Boraginaceae			
Heliocarya monandra Bge	DD	Irano-turanian	Esfahan,Yazd
Campanulaceae			
Zegundra iranica Davis	VU	Irano-turanian	Kermanshah
Cruciferae			
Acanthocardamum erinaceum (Boiss.)Thell	VU	Irano-turanian	Bakhtiari,Fars
Dielsiocharis kotschyi (Boiss.) O.E.Schulz	LR	Irano-turanian	Arak,Bakhtiari,Fars,Hamadan, Kerman,Khorasan,Lurestan, Mazandaran,Tehran,Yazd,Semnan
Elburzia fenestrata (Boiss.) Hedge	VU	Irano-turanian	Tehran
Heldreichia longifolia Boiss	VU	Irano-turanian	Bakhtiari,Lurestan
Micrantha multicaulis (Boiss.) Dvorak	LR	Irano-turanian	Bakhtiari,Fars,Kohgilouyeh,Lurestan
Pseudofortuynia esfandiarii Hedge	VU	Irano-turanian	Esfahan,Fars
Straussiella purpurea (Bge.) Hausskn	VU	Irano-turanian	Arak,Hamadan
Zerdana anchonioides Boiss.	LR	Irano-turanian	Bakhtiari,Fars,Kerman,Lurestan,Yazd
Frankeniaceae			
Hypericopsis persica Boiss.	LR	Irano-turanian	Fars
Labiatae			
zhumeria majdae Rech.f. & Wendelbo	EN	saharo-sindian	Hormozgan
Umbelliferae			
Alococarpum erianthum (DC.) H. Riedl. & Kuber	LR	Irano-turanian	Azarbaijan,Tehran
Demavendia pastinacifolia (Boiss. & Hausskn.) M.Pimen	LR	Irano-turanian	Arak,Esfahan,Hamadan,Kerman, Lurestan,Tehran
Azilia eryngioides (Pau) Hedge & Lamond	VU	Irano-turanian & saharo-sindian	Lurestan,Khuzestan
Dicyclophora persica Boiss.	LR	Irano-turanian	Fars,Hormozgan,Kerman,Khuzestan, Baluchestan,Bushehr
Haussknechtia elymaitica Boiss.	VU	Irano-turanian	Bakhtiari,Fars,Khuzestan, Kohgilouyeh,Lurestan

EN= Endangered, VU= Vulnerable, LR= Low Risk, DD= Deficient Data

Source: Jalili and Jamzad, 1999

Table 8-2: Total number of indigenous and other species of taxa in Iran and assessment of their risk based on IUCN classification

Family	No. of Taxa listed	No. of Endemics	Status		Family	No. of Taxa listed	No. of Endemics	Status	
			VU	EN				VU	EN
Aceraceae	2	1	-	-	Liliaceae	84	54	9	2
Amaranthaceae	1	1	-	-	Linaceae	6	4	-	-
Amaryllidaceae	2	1	-	-	Loranthaceae	1	-	-	-
Araceae	5	2	4	-	Lythraceae	6	-	-	-
Aristolochiaceae	1	1	-	-	Malvaceae	31	15	-	-
Asclepiadaceae	1	1	-	-	Oleaceae	6	2	-	-
Berberidaceae	1	1	1	-	Onagraceae	3	-	1	-
Betulaceae	1	-	-	-	Orchidaceae	21	4	1	-
Boraginaceae	78	73	4	-	Orobanchaceae	4	4	-	-
Buxaceae	1	-	-	1	Papaveraceae	8	3	-	-
Caesalpinaceae	1	-	1	-	Papilionaceae	580	394	216	9
Campanulaceae	18	17	2	-	Parnassiaceae	1	-	-	-
Capparidaceae	4	1	1	-	Plantaginaceae	5	1	2	
Caryophyllaceae	112	96	9	-	Plwnbaginaceae	74	64	-	-
Celastraceae	2	-	-	-	Polygalaceae	3	1	-	-
Chenopodiaceae	17	12	2	-	Polygonaceae	24	17	1	-
Cistaceae	1	-	-	-	Potamogetonaceae	2	-	1	-
Compositae	415	393	18	-	Primulaceae	30	27	17	-
Convolvulaceae	16	13	1	-	Ranunculaceae	41	34	1	-
Cornaceae	2	-	1	-	Resedaceae	6	3	1	-
Corylaceae	1	-	-	-	Rharnnaceae	7	3	1	-
Crassulaceae	8	6	-	-	Rhizophoraceae	1	-	1	-
Cruciferae	72	70	7	-	Rosaceae	59	38	23	-
Cupressaceae	3	-	1	-	Rubiaceae	22	14	-	-
Cyperaceae	16	2	3	-	Rutaceat	9	8	-	-
Dipsacaceae	20	12	10	-	Salicaceae	4	-	-	1
Ephedraceae	1	1	-	-	Santalaceae	3	-	-	-
Ericaceae	1	-	-	-	Saxifragaceae	6	4	2	-
Euphorbiaceae	17	15	1	-	Scrophulariaceae	55	46	1	-
Fagaceae	2	-	1	-	Solanaceae	13	7	2	-
Frankeniaceae	1	1	-	-	Sphenocleaceae	1	-	1	-
Furnariaceae	8	4	1	-	Tarnaricaceae	9	2	4	-
Geraniaceae	8	1	2	-	Taxaceae	1	-	-	1
Globulariaceae	1	-	-	-	Thymelaeaceae	2	1	-	-
Gramineae	85	11	2	-	Tiliaceae	4	-	-	-
Guttiferae	2	2	2	-	Ulmaceae	2	1	-	-
Hamamelidaceae	1	-	-	-	Umbelliferae	128	100	14	2
Hydrocharitaceae	1	-	-	-	Valerianaceae	8	-	-	-
Iridaceae	14	6	3	-	Violaceae	7	3	3	-
Juglandaceae	1	-	-	-	Zannichelliaceae	3	-	-	-
Juncaceae	5	-	1	-	Zosteraceae	1	-	1	-
Labiatae	163	129	44	5	Zygphyllaceae	14	-	7	-
					Total	2450	1727	432	21

Source: Jalili and Jamzad, 1999

2.1.1 Distribution of Floral Species in Iran's Vegetation Zones

The Irano-Turanian phyto-geographical region has the most species of flora. Of the total 1,727 species, 1,452 (84%) are in the Irano-Turanian region, 115 (6.7%) in the Euro-Siberian region and 52 species (3%) in the Saharo-Sindian region and 108 species (6.3%) scattered over a number of regions (multi-regional indigenous) (Figure 8-1).

With respect to the average number of indigenous species per unit area (million ha), there is an average of 10.46 over the whole country and 14 in the Irano-Turanian region, 12.5% in the Euro-Siberian and, 1.14% in the Saharo-Sindian.

Azerbaijan, Khorassan, Tehran, Fars and Mazanderan Provinces, respectively, provide a home to 120, 114, 78, 74 and 44 species, the highest number of species in the country. Chaharmahal va Bakhtiyari, Golestan, Tehran and Lorestan Provinces have the highest number of species per unit area (million ha) with 28, 25, 18 and 14 species, respectively.

Genera with high number of indigenous species within the Iranian flora are: *Astragalus*, *Cousinia*, *Nepeta*, *Onosma*, *Acantholimon* and *Dionysia*.

Astragalus is probably the largest genus of flowering plants in the world and in Iran too. All indigenous species of this giant genus, with only a few exceptions, occur in the Irano-Turanian region.

About 20% of Iran's flora are annual. This figure is 13% for the world's flora as a whole and so, in comparison, the Iranian flora is rich in annuals. Despite this, only 6.7% of Iran's annual species are indigenous plants; a fact also true for trees, shrubs and sub-shrubs(Table 8-1).

2.1.2 Floral Species at Risk of Extinction

Rare species and monotypic genera are amongst those plants in danger of extinction. Such factors as naturally occurring events and overexploitation of nature lead to extinction. Species in greatest danger include *Labiatae* and *Papilioneceae*, as well as those shown in Table 8-2 which is based upon the ICUN classification. As this table illustrates, out of the total number of the flora indigenous to Iran, about 1016 (60%) belong to four the families of *Papilioneceae* (pulses) with 394 species, *Compositae* (chicory) with 393 species, *Labiatae* (mint) with 129 species and *Umbellifrae* with 100 species.

2.2 Fauna

Iran's vertebrate fauna may be grouped into five classes: mammals, birds, reptiles, fish and amphibians. These five classes include 167 families of which as many as 1,059 separate species have so far been identified. Of the latter figure, 164 species are mammals, 517 birds, 200 reptiles, 174 fishes and 20 amphibians (Table 8-3).

Table 8-3: Diversity of the vertebrate fauna in Iran

Class	Family	Species	Kind of Species (Number)
Mammals	33	164	Insectivores (15) Rats(40) carnivore(20) Whales(10) monotrysia(1) Artiodactyla(8) Rodents(57) Rabbits (2) Dugong(1)
Birds	76	517	Passerine(200) Galliformes(27) Falconiformes(35) Anseriformes(21) Ciconiiform (21) Columbiformes(16) Gruiformes(13) Charadriiformes(12) Picidae(10) Phasianidae (9) Cuculidae(8) Pelicans(7) Procellarii(5) Podicipediformes(5) Caprimulgi(4) Apodi-Formes(4) Psittaciformes(2) Strigiformes(2) etc.
Reptiles	21	200	Testudines(30) Crocodylidae(2) Amphis baenia(1) Serpents(72) suborder of Sauria(112)
Fishes	20	174	Cyprinidae(70) Cobitidae(9) Clupeidae(20) Salmonidae(6) Mugilidae(4) etc.
Amphibians	6	20	Ranidae(13) Salamandridae(7)

Source: Firooz, 2000

2.2.1 Mammals

Mammals worldwide comprise three groups - oviparous, marsupial and copulatory. All Iranian mammals belong to the third group. Iran's mammals have been identified as belonging to nine orders, with 33 families and 164 species. The orders include rodents with 57 species, bats with 40 species, carnivores with 30 species, insectivores with 15 species, whales with 10 species, *artiodactyla* with eight species, rabbits with two species and *perissodactyla* and sea cows with one species each. In total, 111 species out of 164 mammals (68%) are insectivores, bats or rodents which, because they are nocturnal or live in secret dens, are rarely seen.

The Orders:

- **Insectivores**

This order comprises three families and 15 species. The families are: hedgehogs with four species, insectivores with nine species and *talpidae* (moles) with two species.

- **Bats**

This order comprises six families and 40 species. All bats in Iran are harmless, useful and worth preserving. The families are: *Peteropodidae* (fruit eaters), *Rhinopomatidae* (mouse-tailed), Dome-like, *Rhinolophidae* (horseshoe), *Hipposideridae*, *Vespertilionidae* (standard-tailed) and *Molossidae*.

- **Carnivores**

This order comprises seven families with 30 species. The following seven families have so far been identified in Iran: *Felidae* (catlike) with six species, *Canidae* (doglike) with 10 species, *Herpestidae* with two species, *Mustelidae* with eight species, *Hyaenidae* with one species, *Phocidae* with one species and *Ursidae* with two species.

The *Phoca Caspica* is the only marine mammal in the Caspian Sea that reproduces on the icy northern waters of the Caspian and feeds on fish and molluscs.

- **Whales (*Balaenopteridae*)**

Whales are the largest mammals in the world and also inhabit the Persian Gulf and Sea of Oman. This animal has lungs so it needs to come up to the surface to breath. Fishing or hunting for whales was so cruelly and excessively carried out in the past that it may take a century before the number of whales reaches the point of enabling them to avoid extinction.

- ***Perissodactyla***

This is an order of non-ruminant ungulate mammals, usually with an odd number of toes or hooves, and includes only one wild species in Iran, the zebra, which is from the same group as the donkey and horse. Zebras need large plains and wide steppes with hills and dunes as well as enough vegetation to feed on. To evade threats, zebra may run hundreds of kilometres far from its natural habitat to take refuge in semi-arid deserts where it can adapt well to the environmental

conditions.

It is unfortunate that the number of zebras has decreased very sharply over the three last decades. Few zebras still live in reserved regions and protected sanctuaries. This fascinating animal is at risk of extinction if serious attempts are not made to protect it.

•*Artiodactyla*

This is an order of non-ruminant ungulate mammals, usually with an even number of toes or hooves, and comprises three families with eight species. Wild Boar (*Sus Scrofa*), deer and ox are common *artiodactyla*. We should be concerned about the security of some of these species and stronger conservation policies need to be applied.

•Rodents

More than one third of Iran's mammals are rodents with six families and 57 species. The families of rodents comprise *Sciuridae* (squirrels), *Gliridae*, *Muridae* (mice), *Bipeds*, *Hystricidae* and *Capromyidae*. Some rodents, such as black or brown mice, are host to fleas that carry the typhus and plague viruses and can be very dangerous. Some 'dog-like' and 'cat-like' wild animals, owls and snakes play an important role in keeping the number of the pestilent rodents down. Many rodents are harmless or even useful animals. Hamsters and bipeds, by hiding seeds underground to store them, are a major factor in planting vegetation in forests.

•*Leporidae* (rabbits)

The rabbits of Iran comprise two families: common rabbits and *Ochotonidae*; each has only one species.

•*Trichechidae* (sea cows):

Sea cows, comprising only one species, are aquatic mammals that live in low-lying coastal and water-logged land on the Persian Gulf and Sea of Oman.

2.2.2 Birds

There are more than 517 species of birds in Iran and these have been classified in 20 orders, 72 families and 217 genera. This number of birds is equivalent to 5.62% of the total number of birds living in the whole Middle East. Being one of the significant migration spots of the world for many animals, Iran's birds mostly (68% or 340 species) consist of migrants. Out of the total of 517 species, about 63% (323 species) reproduce in Iran; one hundred of these species are indigenous.

In a recent census conducted on aquatic birds, three new species as follows were observed and reported for the first time.

i) Indian River Tern

Two marine swallows with the nomenclature *Sterna Aurantia*, belonging to the *Laridae* family of *Charadriiformes* were observed over Eemer Wetland, near Gonbad city in Golestan Province, on 29 January 2005. The natural flight migratory limits of the bird are from East Pakistan to South India and East Nepal to Northwest China (Yunnan) as well as the Mekong Delta, never having been seen before even in the Middle East.

ii) Sabine's Gull

One small gull with the nomenclature *Laridae*, *Charadriiformes*, was seen on the shores of the Caspian Sea, 20 Km west of Sari, on the same date mentioned above.

iii) Mountain Chiffchaff

Four warblers with the nomenclature *Phylloscopus Singianus* and belonging to *Sylviidae*, *Passeriformes* were seen on Jagin River's banks, 50 Km East of Jaask in Hormozgan Province, on 22 January 2005. Internationally, many ornithologists

Table 8-4 : The state of the several Iranian species in terms of risk or danger (IUCN *Red Book*).

p	t
Mammals	
Allactaga firouzi Talpa streeti	CR
Crocidura susiana Meriones zarudnyi Microtus kermanensis Myomimus setzeri Myotis schaubi Panthera tigris	EN
Capra aegagrus Eptesicus nasutus Equus hemionus Gazella subgutturosa Myomimus personatus Myotis bechsteini Myotis capaccinii Myotis emarginatus Ovis orientalis Panthera leo Pusa caspica Rhinolophus euryale Rhinolophus mehelyi Ursus thibetanusVulpes cana Vulpes cana	VU
Birds	
Grus leucogeranu Gyps bengalensis Vanellus gregarious	EN
Branta ruficollis Falco cherrug Neophron percnopterus Oxyura leucocephala	CR
Anser erythropus Aquila clanga Aquila heliacal Chlamydotis undulate Columba eversmanni Falco naumanni Haliaeetus leucoryphus Marmaronetta angustirostris Otis tarda Pelecanus crispus Phalacrocorax nigrogularis	VU

p	t
Amphibians	
Batrachuperus gorganensis Neurergus kaiseri	CR
Neurergus microspilotus	EN
Neurergus crocatus	VU
Reptiles	
Eretmochelys imbricate	CR
Chelonia mydas Rafetus euphraticus Vipera ursinii	EN
Crocodylus palustris Testudo graeca Testudo horsfieldii Vipera latifii	VU
Fishes	
Acipenser gueldenstaedti Acipenser nudiventris Acipenser persicus Acipenser stellatus Huso huso Sphyrna mokarran	EN
Gadus morhua Hemipristis elongatus Iranocypris typhlops Nebrius ferrugineus Paracobitis smithi Rhina ancylostoma Rhincodon typus Rhinobatos thouin Stegostoma fasciatum Taeniura meyeni	VU

Source: IUCN *Red Book*

CR= Critically at risk
EN= Endangered
VU= Vulnerable

believe that there are two sub-species of this bird - *P.S. Lorenzii* and *P. S. Brevirostis* - in the world. *Lorenzii* have laid eggs in northeastern Turkey and there are also reports of their wintering in Iraq. This bird was once seen in Colibar region during the mating season; however, there are no records of the presence of the birds wintering in Iran. The presence of this sub-species in Iran is to be verified by DNA testing.

2.2.3 Reptiles

Reptiles are scattered throughout many different locations in Iran. Amongst these, the central plateau, Alborz Mountains, Kapeh Dagh, Zagros area, Sistan va Baluchestan region, Makran coastline, the surroundings of Orumiyeh Lake, Moqan steppes, Turkaman Sahara, Caspian coastline and Khuzestan plain are the most common.

Iran's reptiles are classified into four orders, two sub-orders, 23 families and 200 species.

- Testudines comprise four families, seven genera and eight species. Three types of marine turtle - olive turtle, green turtle and hawks-billed turtle - have chosen salt water for their habitat. Five turtle species are at risk.
- Crocodiles have been reported to have only one family and one species, namely the short-snouted marsh crocodile. Crocodiles have been recognized as a vulnerable species.
- The *Sauvia* sub-order in Iran comprises eight families, 34 genera and 112 species. Few species of this sub-order have specific Persian names; they are commonly known under the vernacular name of lizard.
- *Amphisbaenia* of Iran comprise two families, two genera and two species.
- Typloidae of Iran include eight families, 30 genera and, 76 species.

2.2.4 Amphibians

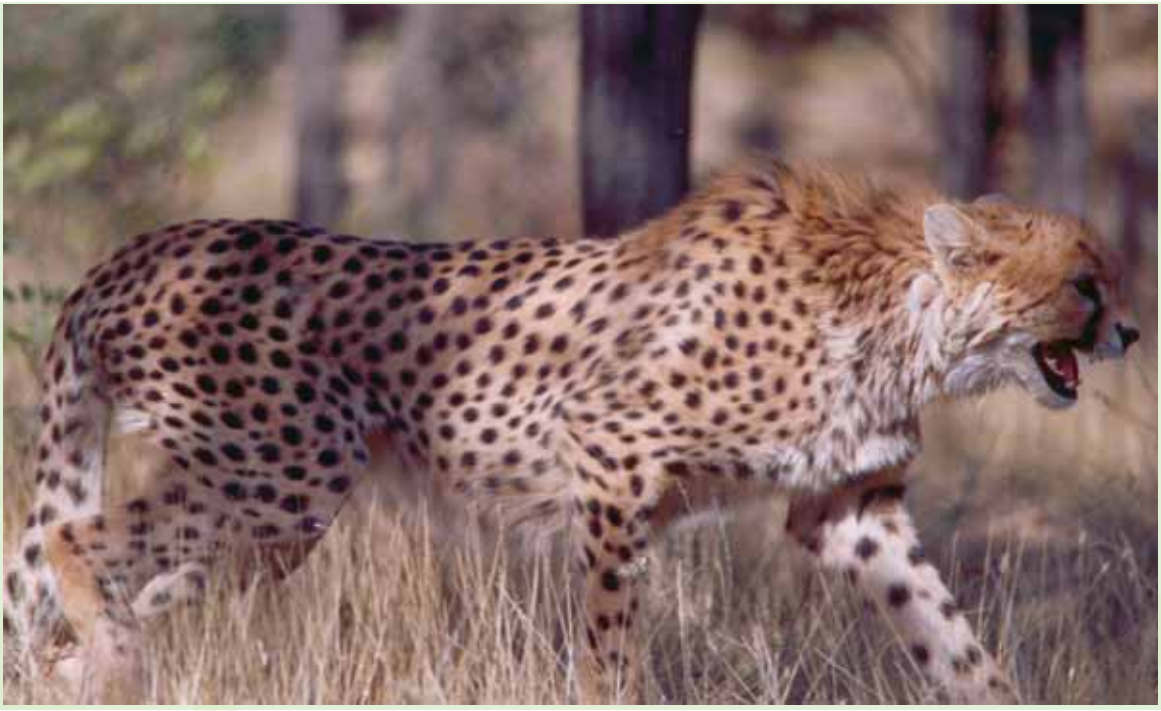
Amphibians cannot be compared with other fauna in terms of their number and variety. In total, there are only three orders and 35 families of them in the world. In Iran, there are six families (tailless, such as frogs and toads, or tailed, such as salamanders) with eight genera and 22 species. The population of amphibians has sharply decreased over the recent years in Iran. In some places, there are no longer any toads or frogs at all. Amphibians are very vulnerable creatures; pollutants and toxic substances as well as cosmic rays are among the factors that threaten their existence.

2.2.5 Fish

Freshwater fish (*Osteoglossiformes*) include 13 orders and 25 families, covering 66 genera passing 151 species living in localised waters. They mostly belong to *Ciprinidae*, two families of *Gobiidae* and, stream *Clupeidae*. Iran's fish fauna mostly consists of *Ciprinidae* with 31 genera and 74 species, *Gobiidae* with 12 genera and 24 species and stream *Clupeidae* with three genera and 20 species living in waters throughout the country. Expert opinion is that the sturgeon is about to become extinct in the Caspian Sea due to excessive taking. Iran, Kazakhstan, Azerbaijan and Russia have temporarily banned the fishing of sturgeons.

2.3 Invertebrates

Little comprehensive work has been carried out concerning many branches of invertebrates in Iran. The classification tree for invertebrates includes



sphagnums, *Anthozoa* (corals), sea anemones, worms, molluscs, echinoderms and arthropods. In Iran, two groups - echinoderms and butterflies - have been more extensively surveyed.

•Echinoderms

These are one of the significant groups of invertebrates living in the Persian Gulf and Sea of Oman and they boast the largest population of invertebrates. Sea bob (prawn or shrimp with the nomenclature *Pencidae*) is an important commercial produce of the southern regions. Iran's echinoderms have several classifications containing about 500 species.

•Butterflies

There are eight families with 402 species of diurnal-flight butterflies in Iran.

2.4 Vertebrates at Risk in Iran

The International Union for Conservation of Nature and Natural Resources (IUCN) publishes a yearly *Red Book* in which the world's endangered or at risk species are classified in accordance with the degree of the risk or danger they face. Table 8-4 shows the state of the several Iranian species in terms of risk or danger (IUCN *Red Book*).

3. Impacts

- The depletion of food sources for wildlife and destruction of flora.
- An imbalance in ecosystems and a reduction in the variety of existing genes and species in the country's ecosystems.
- A reduction in species of flora and fauna, as well as putting them at risk or even sometimes in danger of extinction.

4. Response

4.1 DoE's Activities on the National Level

The DoE has undertaken various activities at national level to respond to identified pressures on biodiversity and, at present, comprehensive management plans are being prepared for 51 districts (31% of the total number) that, in total, cover 5.83 million ha (50% of the total area) of the four types of protected regions. Topographic and satellite maps for the four types of protected regions are being prepared as well as a regional dispersion atlas. Up-to-date data for the Geographic Information System (GIS) is being provided and a GIS database for the protected regions is being prepared. The level of protection of these regions is also being enhanced.

A comprehensive programme for the protection of the northern forests and the protected forest regions is being prepared and data collected on the Protected Biosphere Areas to be presented to the Committee for Humans and the Biosphere. The criteria and indices necessary for evaluating the tests for judging the environmental sustainability of forest ecosystems are being identified and the level of changes in the northern forests surveyed. The country's wetlands are also being surveyed and their environmental values quantified.

Studies are being conducted on some viral, bacterial and parasitical infections of Iran's migratory birds and a database of migratory aquatic birds has been set up and made operational. The bio-reserves of Lar Lake and its tributaries have been studied and a limnological and biological study of the Karaj Reservoir and its tributaries undertaken. The pathological damage, microbial diseases and parasitical fauna in some wild carnivores and herbivores in the country has been surveyed. The habitat and the bio-condition of Iran's crocodiles

Deh Shour Mast , Savad Kouh

has been studied as well as of Chelonidae on the coasts and islands of the Persian Gulf and Sea of Oman. The habitat and the bio-condition of Iran's Great Bustard, of Gazella Subgutturosa and of Yellow Deer have been studied. A National Museum of the Natural History has been established.

(For information on the rest of these activities, please refer to Annex I, appendix 8-4-1).

4.2 DoE's Activities at the International Level

A significant accomplishment of DoE has been the extension of its scientific, and academic relationship with universities and research centres overseas to share experiences and trade technical know-how. In this way, during the last eight years (1998-2006), the way was prepared for a number of joint international projects to be carried out and for access to better training for the staff. Moreover, many plans, in the form of bilateral programmes between countries and the United Nations specialized agencies such as UNEP, UNDP and UNESCO were concluded. Many of these have been fruitfully implemented, with the following as a few examples.

1) Adoption of a National Action Strategy to Preserve Biodiversity

This project agreement was concluded in Tehran in 1997, with the assistance of UNDP and the GEF, and it was put into action in December 1998. The strategies chosen to achieve the predefined goals were:

- Increasing public awareness and understanding on biodiversity and the role of public participation;
- Setting-up Biodiversity Information and Research Systems;
- Sustainable exploitation of biodiversity resources;
- Establishing systematic management for the preservation of biodiversity.

2) Asian Cheetah and its related Ecosystems Protection Project

This beautiful creature has completely ceased to exist in India and other Asian regions as reports show. A limited few (maybe only 50) of them can be located in some small, marginal areas of Iran's deserts and in far-off, out-of-reach places that are hard to access. It is for this reason that, in many new documents and the related literature, the term 'Iranian Cheetah' is used instead of Asian Cheetah.

DoE was given financial assistance by UNDP and the GEF to carry out the project on the protection of the cheetah and to prevent this unique creature from becoming extinct. Their activities officially started on 10 September 2002 and two regions of the Naiband and Tooran National Parks were designated as Protected Areas, since they are the main habitats for the cheetahs.

3) Preservation of the Biodiversity of the Zagros Mountain Ecosystems

4) Expansion of the Wetland Regions and Flight Networks to Protect the Siberian Crane and other Aquatic Birds

The project began in January 2003. UNEP was in charge of the project and it was coordinated by the International Crane Foundation (ICF) and the Secretariat for the Convention on the Protection of the Migrating Birds.

5) Protection of Iran's Wetlands

Iran boasts hundreds of large and small wetlands, however, only 81 of them have been recognized as significant and only 22 significant enough to be listed among the Internationally Important Wetlands of the World as defined by the Ramsar Convention on Wetlands. A great many of the faunal species dependent on Iran's wetlands have been designated by IUCN as important species about to become extinct. Such species have been listed as species in need of protection.

6) Protection and Management of Anzali Wetland

The project began in March, 2002. Later, in 12 November 2003, an agreement was concluded between the Japan International Cooperation Agency, the DoE and the Ministry of Agricultural Jihad. Goals pursued by the project included:

- Identification of factors depleting the wetland;
- Identification of appropriate actions to decrease the depleting factors;
- Designing an experimental plan for the wetland's protection;
- Development of an integrated management programme to protect the wetland's catchment area;
- Increasing local governmental organization capacities to better apply the management programme.

7) Iran-Saudi Arabia Cooperation for Wildlife Protection

8) Joint Studies Project for the Protection of Slender-billed Curlews

9) Workshops, Seminars and International Meetings

- Sub-Regional Workshop on the Impacts of Urban Water Use on Natural Ecosystems, Shiraz.
- Second Meeting of Experts of the South and Central Asian Countries (SACAM) for Man and Biosphere Network (2005 Sep).
- Consultative Workshop on Decreasing the Impacts of Droughts (2005 Aug).
- Workshop on biodiversity and natural history.

5. Recommendations

Considering the biodiversity existing in Iran and the threats to it, some specific approaches are recommended. It is necessary to adopt principles, policies and criteria for the development of biotechnology and adapting them for use in biodiversity-related areas; the adoption and implementation of a comprehensive nature-tourism development plan are also necessary.
Taking part in the development plan and strengthening international and regional cooperation activities on biodiversity, introducing economic considerations into biodiversity resource management and introducing biodiversity considerations into Iran's comprehensive land-spacing plan are also recommended.

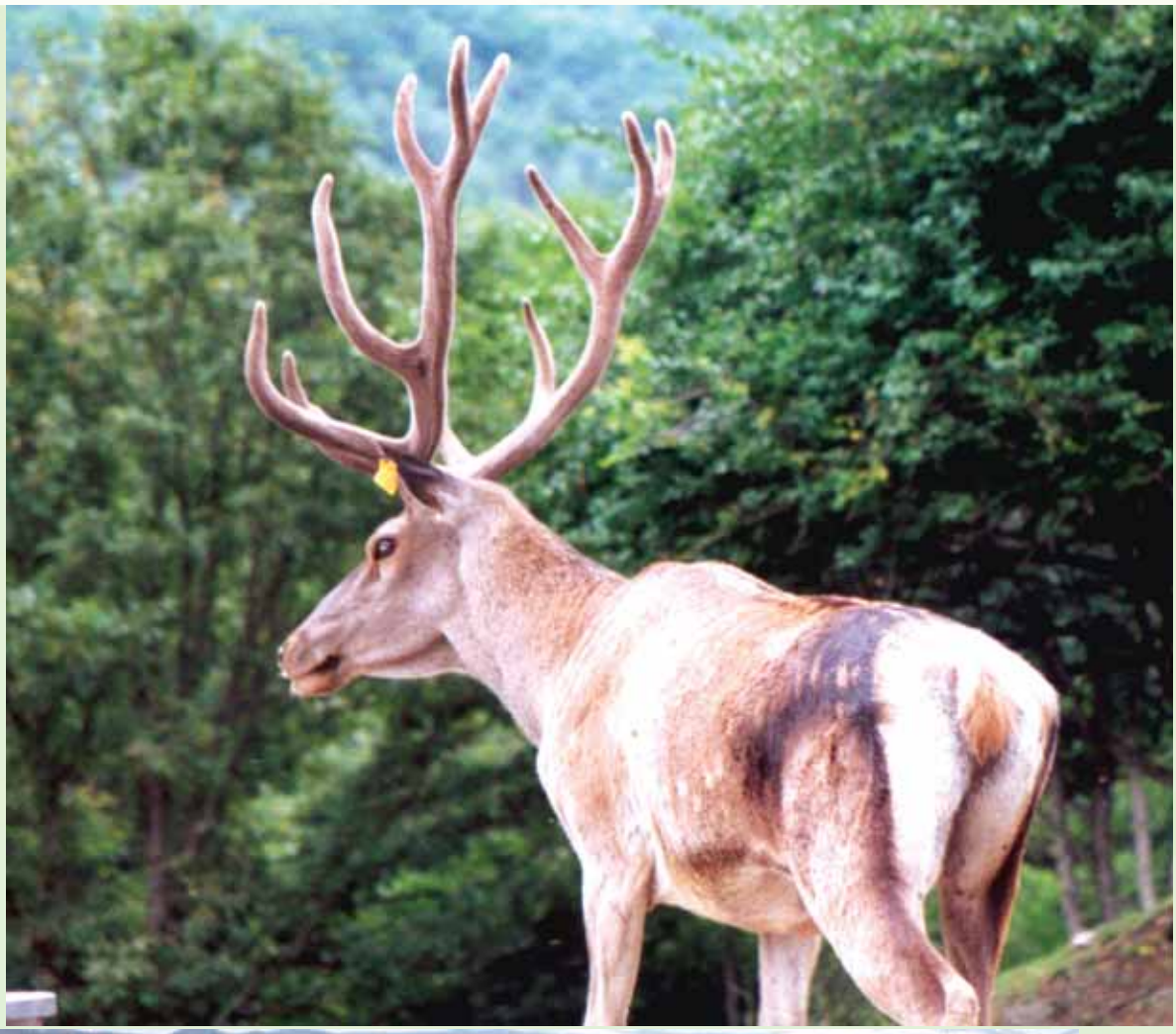
Our genetic heritage and coastal and maritime biomes should be preserved. Aquatic resources should be preserved, revitalized and rebuilt and depleted/damaged biomes should be also be restored. Strengthening the country's research system infrastructure on biodiversity is also recommended.

Picture: Some of the endangered Iranian species

It should be noted that the question of safeguarding biological diversity is a cross-cutting one that is implicated in most, if not all, environmental protection issues. As such, it cannot be addressed in one chapter alone and there are references to biodiversity-related questions in various parts of this Report. The most prominent of these are as follows: in Chapter 2, in sections dealing generally with biodiversity, wildlife and habitats and protected areas; in Chapter 3, in relation to national environmental legislation and international law; and in Chapter 7, with reference to exotic migratory marine species, the impacts of marine pollution on marine living resources and international projects in the Caspian Sea.

REFERENCES

1. DoE, Office of Parliamentary and Legal Affairs, 2004. *Collected Environmental Laws and Regulations of Iran.*
2. DoE, 2005. *Eight-year Performance Report*.
3. Firooz, I., 2000. *The Wildlife of Iran (Vertebrates)*.
4. Jalili and Jamzad, 1999. *Red Data Book of Iran*.
5. latifi, M. , 2000. *Snakes of Iran. Tehran*: DoE.
6. www.irandoe.org, website of the Iranian DoE.



Quri Gul, Tabriz

9 Natural Disasters

Events that cause a great deal of damage, including human and livestock casualties and all kinds of destruction, are referred to as natural disasters. In terms of their origins, natural disasters are either geological (such as earthquakes, volcanoes, landslides and floods) or ecological (such as drought, desertification, erosion and deforestation).

Iran stands among the ten countries most prone to unexpected events and natural disasters, inflicting upon the country human and financial losses as well as environmental damage every year. Therefore, knowing as much as possible about and being properly prepared for such events is vital for confronting and mitigating the impacts of these disasters.

In addition to direct financial and human losses, natural disasters leave a huge amount of debris where they occur, causing pollution and environmental degradation to such an extent that

life sometimes becomes impossible in the affected areas.

1. Drivers and Pressures

1.1 Geographical Situation

Iran is located in the mid-section of the orogenic, co-seismic belt of the Alp-Himalaya mountain range that is considered to be one of the most seismically active areas in the world. In general, Iran may be divided into four different seismic regions:

- **The ribbon-like folds pushed up by the Zagros range.**
- **Makran in the Southeast.**
- **The central plateau.**
- **Alborz Mountains.**

With active fault lines in its central regions (of Azerbaijan, Alborz and Kapehdagh), Iran is prone to large-scale quakes. More than 60 seismogenic faults have been identified in Iran, including at Koohbonan, Bam, Bagheh Feiz and Damghan.

1.2 Deforestation

Degradation of agricultural land and changing land use to construction and other purposes are all factors that greatly intensify the impacts of natural disasters, such as floods, as well as inflicting economic losses on the country. Vegetation usually slows down water flows and allows permeation, consequently flooding becomes less likely.

1.3 Low Rainfall

It is true that droughts are the result of low rainfall and that they usually occur in semi-arid climates. However, they can also occur in places where rainfall is common. In other words, there is a difference between a tendency for drought and aridity. Human activities are in accordance with levels of humidity and environmental precipitation; an annual rainfall of 200 mm may satisfy nomads but it is catastrophic for wheat fields that require 500 mm per year to reach the best quality.

1.4 Water Shortages

Iran, being located in the earth's arid belt, faces the problem of water shortages. An ever-increasing population growth and the need for more agricultural and livestock products all require more and more water while the supply is limited and overuse leads to depletion of the water-tables. The per capita water allocation was 4,000-5,000 m^3 in 1950s and has decreased to a current figure of 2,000 m^3. Should such conditions persist, it might lessen even more to 1,000 m^3 by 2022.

Following the droughts in Iran of 1999-2002, most of the rivers dried out or their water-flow diminished drastically (53% decrease on average). Moreover, Iran also faces the problem of an inappropriate dispersion of precipitation in terms both of time and place that further complicates the situation. Hence, the problem of water shortages

Table 9-1: Some of the more significant earthquakes in Iran, 1961-2005

Time of Occurrence	Place	Casualties	Time of Occurrence	Place	Casualties
March-April 1961	Lar City	450	July-Aug 1982	Kerman	1300
Sep-Oct 1963	Western Pparts	11000	June 1983	Rudbar	40000
Aug-Sep 1969	Khorasan Province	10000	Feb. 2, 1997	Ardebil	1100
March-April 1975	South of the Country	5044	May 10, 1997	Birjand	1613
March-April 1979	Isfehan	900	Dec 26, 2004	Bam	25000
Sep-Oct 1985	Tabas	25000	May 29, 2005	Firoozabad	35
Oct-Nov 1980	Northeast	600	March 2005	Zarand	602
May-June 1982	Kerman	1028			

Source: Seismological Engineering Research Centre, 2005.

Table 9-2: Frequency of flood-occurrences and the damage caused, 1953-2001

Census Course	Number of Occurrences	Houses Damaged	Roads Damaged(km)	Livestock Casualties	Fields Ruined (ha)
1953-62	192	31962	885	44075	9065
1963-72	251	35393	1157	45157	13628
1973-82	432	33932	853	73812	80573
1983-92	1046	65769	15290	232083	139217
1993-2001	1341	82882	13325	307136	998033

Source: Ministry of Agricultural Jihad, 2005.

or an even worse water crisis is an objective and unfortunate fact that our country faces. Droughts are only one consequence of this critical problem.

At present, the average annual rainfall volume is 417 billion m^3 the larger part of which (300 billion m^3) evaporates and thus becomes unusable, leaving only a small part available for filling underground water-tables and supplies of running-water above ground.

1.5 Desertification

According to the international definition, desertification means loss of land in arid, semi-arid and semi-humid regions. In these regions, floods and the damage caused by them are the most obvious consequences of desertification.

Arid and extremely arid conditions (less than 150 mm rainfall) that dominate huge sections of the country account for the vast (34 million hectares) area of desert land, including 12 million hectares of dunes.

1.6 Heavy Rainfall

Due to geographic and topographic conditions and climatic variety, heavy rainfalls cause a great deal of damage almost every year. Depletion of vegetation and ignoring the limitations of water-courses also intensify such conditions.

2. State and Impact

2.1 Earthquakes

The Iranian plateau in terms of its global position is located at the crossing point of the of Arabian (Arabia-Africa) Indian (India-Australia) and Eurasian (Europe-Asia) tectonic plates. The meeting of these plates has caused the earth crust of the plateau, which is weaker than the plates, to change shape and become surrounded by mountains; such as the Zagros in the West, Alborz and Tapehdagh in the North and Northeast, the mountains in the East and Makran in the Southeast.

The history of Iran is full of stories of earthquakes of great magnitude that devastated large areas and inflicted great losses not only in terms of property but also lives of humans and livestock. The Tabriz earthquake in 420 C.E. claimed 50,000 lives and it was repeated in the same year, taking the lives of 40,000 people. It was not yet finished and recurred in 1573 C.E. with 40,000 casualties, in 1721 with 250,000, in 1780 with 100,000 and finally, again, in 1871 with 100,000 casualties. The last notable earthquake occurred at Zarand, Kerman, on 23 February 2005 claiming 602 lives as well as inflicting a great deal of financial loss. Another earthquake, also in 2005 (on 29 May) occurred in a vast area of the northern provinces with a magnitude of 6.3 on the Richter scale. Its epicenter was in Firoozabad in Mazanderan

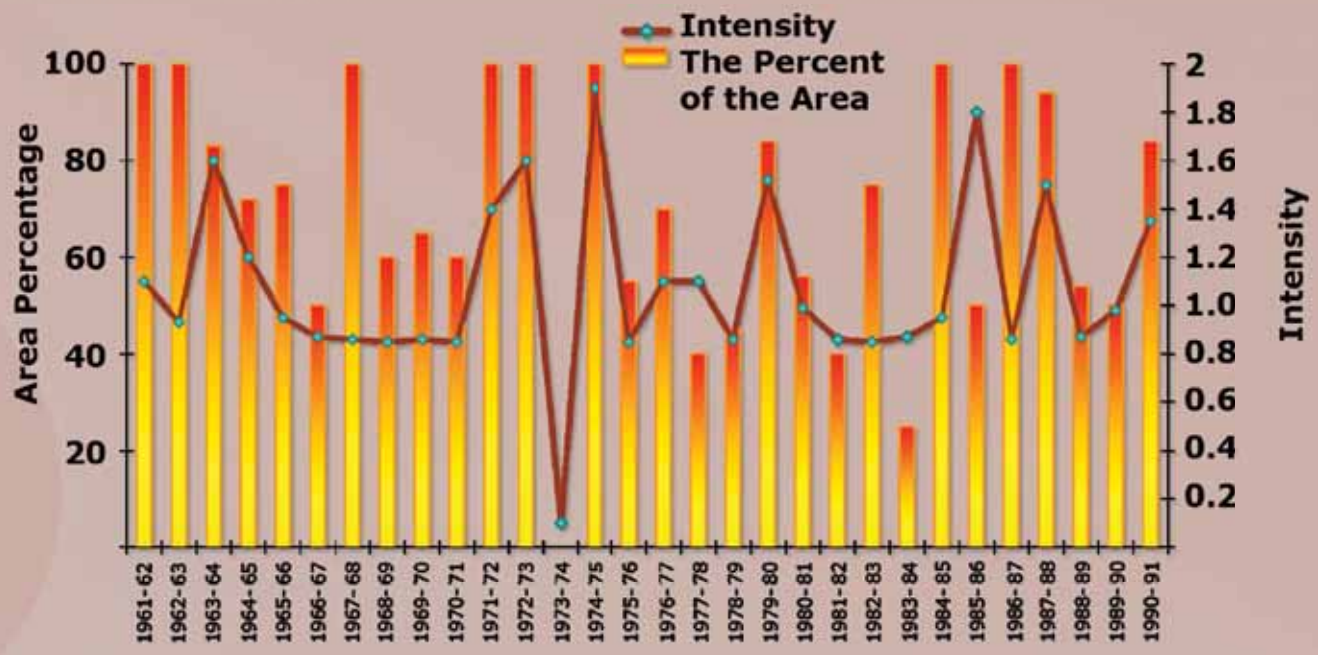


Figure 9-1: the intensity of the droughts and the area percentage of the affected regions, 1961-91
Source: Moradi, 2005.

Province and it killed 35 and injured 250 people. One of the most dreadful earthquakes in the recent years was the notorious Bam earthquake with a magnitude of 6.7 on the Richter scale in 2004 that reduced the historical city of Bam down to dust, killing more than 25,000 and injuring 50,000 people. During this incident, the historical monument of Arg-e Bam, the largest mud-brick complex of the world with a 2,000 year–old history, was largely distroyed (Table 9-1).

2.2 Flooding

Surveys show that floods are a widespread phenomenon in the country. Almost all regions have suffered great damage from floods. one way or another. According to statistics, the damage caused by floods in the last 50 years has increased by 250% (Table 9-2).

Among major flooding events in recent years, we should mention one that occurred in Golestan Province, to the Southeast of the Caspian Sea, in 2002. It covered an area of 5,000 Km^2 and killed more than 400 people and caused losses totalling 610 billion dollars.

2.3 Drought

Iran is located on the Earth's arid desert belt and so, climatologically, it is natural for Iran to be arid and short of water. Despite this, events that occurred in the course of its geological development provided some parts of Iran with very exceptional types of climates from the point of view of diversity. Still, many vast areas of the country are faced with water shortages in almost all seasons (See: Picture 9-1).

Besides Khorassan, other provinces that experience a large number of droughts include: Sistan va Baluchestan, Yazd, Fars, West Azerbaijan, Zanjan, Ardebil, Khuzestan, Hamedan, Golestan and Kerman. Surveys show that the rate of occurrence of droughts in Iran is very high; the highest belongs to Bandarabbas (50%), followed by Zabol (46.7%), Zahedan and Yazd (42%), Iranshahr (40%) and Kerman (27%) (Iran Remote Sensing Centre, 2005). Drought is common in the South and centre of Iran.

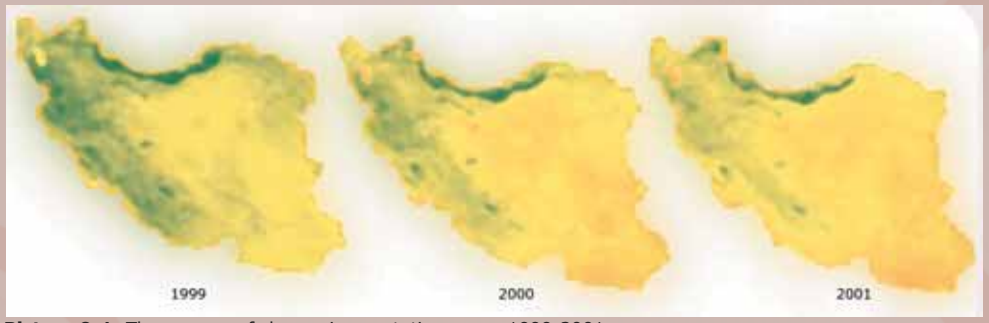
Figure 9-1 shows almost more than 50% of regions have been affected each year from 1961-1991.

2.4 Landslides

Being a seismic-prone country with occasional flooding and torrential rainfalls, another natural disaster Iran is prone to is landslides, an event that can be predicted. It is usually after an earthquake or flooding that the surrounding lands become unstable and start to move. In late 2005, a landslide caused by heavy rainfall almost buried a village in Khorramabad . Another landslide occured in Tonekabon in the same year which was caused by the earthquake in the previous year and inflicted a lot of financial losses and damage in villages.

2.5 *Heavy Snowfall*

Although not common, heavy snowfalls hit the country every so often. 2005 was an exceptional year in terms of snowfall, unprecedented in the last 30 years: it snowed heavily in many parts of the country and, for example, it snowed for 40 hours continuously in Gilan Province and the snow depth reached 2 metres causing a great deal of difficulty and damage. In the same year, heavy snowfalls in the capital city Tehran, unprecedented in the last 49 years, caused as many as 850 car accidents.



Picture 9-1: The process of change in vegetation cover, 1999-2001

3. Response

3.1 Organizational Activities and Achievements

3.1.1 DoE

- A National Seminar on Air Pollution with its emphasis on air pollution caused by natural disasters and how to confront them, September 2004.
- Membership of the National Committee for the Reduction of the Impacts of the Natural Disasters (1995-2004) and in a workshop held by the National Group for Assistance and Rescue in 2004.
- A project on surveying and researching air pollution caused by leaking gas networks in large cities at the time of natural disasters;
- A project on surveying and researching the quantitative and qualitative impacts of the air pollution caused by natural disasters and anthropogenic as well as natural phenomena.
- A project on surveying and researching prediction of air pollution and weather inversions.

3.1.2 International Research Centre

- Co-operation with national universities, research institutes, academic societies and organizations.
- Co-operation with overseas universities and research institutes.
- Co-operation with international agencies.
- Participation in international scientific gatherings.
- Joint research projects undertaken by the International Seismology Engineering and Research Center and various universities and research institutes in France, Russia, UK, Japan, Armenia, Norway and Italy.

3.1.3 Ministry of Agricultural Jihad

- Plan for the prevention and control of floods, 2003 including river and watershed management.
- Studies on 48,540 thousand hectares of land to identify flood-prone areas, 1999-2002.
- Preparation of a database for floods.
- Plan for drought facilities for 22,297 hectares of land by the Water Catchment office, 2003.
- Plan for droughts (reconstruction) in 52,332 hectares of land by the Water Catchment office, 2003.
- Rangeland rehabilitation and drought combating (national) plan, 2000.
- Plan for rangeland rehabilitation and combating drought in 13,019.4 thousand hectares was prepared in 2003 and activities to combat desetification was realised on 495,828 hectares in the same year.

3.1.4 Other Achievements

- Adoption of the Comprehensive Plan for Assistance and Rescue, 2004;
- Ratification by Iran of the United Nations Convention on Combating Desertification (UNCCD).
- Membership of the Desertification Union (DU).
- Establishment of the DPO Office in Tehran.
- Adoption of a drought plan and national and provincial financial aid to combat drought.
- Adoption of a plan for management of drought impacts and preserving biodiversity in areas under the control of DoE.
- Training and performing plans of combating fires in preserved areas.
- Holding courses on management of natural disasters with the OCHA centre in Tehran in 2004

Natural Disasters in 2005

828 people lost their lives in 518 unforseeable car accidents.

396 earthquakes claimed many lives, although only 612 people died in Zarand as the result of an earthquake with a magnitude of 6.4 on the Richter scale.

40 cases of flooding in the current year alone have claimed 75 lives in various parts of the country, such as Sistan va Baluchestan and Southern Khorassan.

Another 82 unpredicted occurrences - such as storms, hail, sleet, snow, fire and drowning - also claimed lives and caused damage.

Fires mostly struck forests and rangelands.

Drought dominated the country for seven consecutive years, mostly in the southern and southeastern provinces, especially in Sistan va Baluchestan, Khorassan and Kerman.

Sudden cold that hit fruit gardens caused much damage in the horticulture sector.

Snowfalls in 2005 were unprecedented compared with the last 30 years.

The total budget allocated to provide compensation for unexpected events in 2005 was 5,000 billion Rials.

3.2 International Projects

- Project on complementary studies on seismic areas of Tehran.
- Identifying seismic springs in the Caspian Sea.
- Designing a Geographic Information System to predict the impacts of severe earthquakes;
- Predicting, assessing and identifying the earthquake-resistance of buildings and other facilities;
- Assessing the vulnerability of Tehran's water network;
- Assessing the vulnerability of Tehran's gas network;
- First Iran-Japan Specialist Workshop on recent earthquakes in both countries;
- Assessing the vulnerability of historic monuments and old buildings;
- Iran-Italy Specialist Workshop on strengthening historic buildings;
- Joint Iran-Armenia Studies on seismic regions in both countries;
- Public education and public awareness-raising as well as transfer of successful experience from Iran to Armenia.
- **Programme for Strengthening Capacities for Disaster Risk Management in Iran**:

  The National Society for Earthquake Technology – Nepal (NSET) has been providing technical assistance to Asian Disaster Preparedness Center(ADPC)/Thailand to implement the UNDP-Government of Iran Joint National Programme for Strengthening Capacities for Disaster Risk Management, a five year programme. The goal of the programme is the reduction of disaster vulnerability and prevention of loss of lives and damages to properties human settlements, infrastructure, and critical facilities in the Islamic Republic of Iran.
- **Up-streaming Community Based Approaches for Promoting Safer BuildingConstruction in Lorestan, Iran**

  An Institutional Contract between UNDP/Iran and NSET has been made to implement the programme in Iran. The overall objective is for up-streaming community based approaches for promoting safer building construction specifically: a)to discuss on community-based approaches for promoting safer building construction and explore potentials of the use ofsuch approaches in Iran, b)to select/localize/customize different available tools anddeveloping new tools for promoting safer building construction through mobilizing community and capacity development of end users, c)to discuss on possible modes of implementation and the role of different stakeholders, and d) to identify the related policies for supporting these activities and to suggest for favorable policy if felt necessary by the stakeholders.

3.3 The International Institute of Earthquake Engineering and Seismology (IIEES)

IIES is a comprehensive international research institute in the field of earthquake that was established in Iran based on the 24th UNESCO General Conference Resolution DR/250 and the Iranian government approval in 1989; as an independent institute under the Iran's Ministry of Science, Research and Technology. The main goal of IIEES is seismic risk reduction and mitigation both in Iran and the region by promoting research and education in science and technology related to seismotectonic, seismology and earthquake engineering as well as risk reduction. IIEES activity in research covers all aspects and components of earthquake risk assessment and management; and in education from public education to Ph.D. programme in seismology and earthquake engineering. IIEES is composed of 4 Research Centers: Seismology, Geotechnical Earthquake Engineering, Structural Earthquake Engineering, Risk Management; National Center for Earthquake prediction and Graduate School, Public Education and Information Division.

IIEES in past years had major contribution toward the development and implementation of the earthquake risk reduction programme in Iran as well as in decision making process and promoting the safety culture and public awareness.

International Cooperation:

Considering the IIEES scientific potential and its international mission in relation to its partnership with UNESCO, as well as the scientific interest on Iran's earthquake issues, cooperation and collaboration with the UN agencies and scientific institutions and organization is an integral part of IIEES research and scientific activities. Some of the activities are which related to all area of earthquake are:

- Active cooperation with UNESCO, UNDP, UN/ISDR, CTBTO, UNEP, ICTP, EMI, TWAS, GADR, ADPC and many international and scientific associations.
- Active cooperation with scientific associations specially IAEE and IASPEI
- Performing joint research with universities and research institutions in France, Russia, Norway, England, Armenia, Japan, Italy, China, Germany, USA, Turkey, India, Mexico, Switzerland, Algeria, Jordan, Kuwait, Saudi Arabia, etc.

4. Recommendations

The adoption and execution of preventive plans for confronting floods and droughts in the country's arable lands is recommended. Ensuring readiness to deal with man-made environmental crises is also necessary since Iran is a country highly prone to experiencing natural disasters. Disaster risk reduction programmes should focus on empowering local authorities and community-based groups to ensure effective rapid response to disasters.
Institutional arrangements for reconstruction; public awareness and information management; appropriate delivery mechanisms and community participation in shelter reconstruction, rebuilding critical infrastructure and promoting higher standards of safety; appropriate policies in livelihood sector recovery; and main considerations for recovery of social.

REFERENCES

1. DoE, Legal and Parliamentary Affairs Office, 2001. *Environmental Laws and Regulations Code Book.*
2. Forests, Rangelands and Water Catchment Organization of Iran*, 2005*. Seasonal Publication on Forests and Rangelands.
3. Geology Organization Web Site.
4. Iran Remote Sensing Center, 2005.
5. Jahangir, M. 2005. *Urban and Municipality Laws and Regulations*, Didar Publications.
6. Ministry of Agricultural Jihad, 2002. *Agricultural Statistics Periodical.*
7. Ministry of Agricultural Jihad, Water Catchment Deputy, 2005.
8. Moradi, E., 2005. *Survey of the Location and Patterns of Drought Dispersion, Location of Iran's Rivers.*
9. Permanent Committee for Reviewing By-Laws on Quake-Proof Construction Design, Construction and Accommodation Research Centre, 2000.
10. Seismological Research Centre, 2005.
11. Seismological Engineering Research Centre, 2005.
12. Sustainable Development Committee, 2000. *Iran SoE Report.*
13. Water Resources Management Organization of Iran, *State of Iran's Rivers, 2005.*

Section I
Background

Evan Lake, Qazvin

1 Socio-Economy

Socio-Economy

1 Geographical Profile

Iran, covering a territory of 164,019,500 ha, is located in the southern half of the northern temperate zone, between latitude 25 degrees, 3′ and 39 degrees, 47′ north of the equator and longitude 44 degrees, 14′ and 63 degrees, 20′ east of the Greenwich meridian.

Almost 90% of the country's landmass is found in the vicinity of the Iranian Plateau. More than half of the total land area is mountainous and elevated terrain and a quarter of the area is covered by plains. The remaining land is arable land currently under

Source: Map No. 3891 Rev.1 UN (with boundries modification of the new provinces). Jan.2004

cultivation.

The average altitude of Iran is 1,200 m above sea level while the altitude of southern coast of the Caspian Sea is 28 m below Open sea level.

The highest point of Iran is the summit of 5,628 metre-high Mount Damavand in the Alborz mountain chain and its lowest point is in Chaleh Loot (the "Loot Ditch") which is 56 m below sea level.

The Islamic Republic of Iran's neighbouring countries and features are: the Republics of Turkmenistan, Azerbaijan and Armenia and the Caspian Sea to the North, Afghanistan and Pakistan to the East, the Sea of Oman and the Persian Gulf to the South and Iraq and Turkey to the west.

Iran is administratively divided into 30 provinces that, up untill 21st March 1994, comprised 316 cities, 939 towns and 843 rural districts; each district covers a number of villages, with 2,353 villages in all. (Statistical Centre of Iran, 2004 and 2005)

2 ■■ Socio-Economic Facts

2.1 ■ Culture

As any country that has a long flourishing civilisation and a rich culture, Iran has a history which dates back to antiquity. There is much evidence, such as scientific, religious, artistic and cultural books and other works or inscriptions and archeological findings, etc. which prove the existance of an ancient and a rich culture and civilisation in a defined geographical area.

In Iran, there are certain national holidays and festivals marking both religious and sacred or secular and popular celebrations. These occasions, each with a special ritual of its own, are amongst the most significant annual events in the country that pass on the rich traditions of the Irano-Islamic culture.

Among the secular festivals are Nowrooz which is an ancient ceremony to mark the start of the Persian New Year (based on the solar calendar), charshanbehsoory which falls on the last Wednesday of the Persian year, mehregan the harbinger of autumn and the harvest season and yalda to celebrate the longest night of the year. There are also several religious and sacred holidays tied to the (lunar) Islamic calendar, including: ghadir khom, a Shiite celebration; fitr to mark the end of the fasting month of Ramadan; qorban that celebrates the end of the Hajj pilgrimage; and mabath, marking the commencement of the mission of the Prophet Mohammad (PBUH).

The arts especially theatre, the visual arts, Ta'zieh (the presentation of the true story of the martyrdom of Imam Hossein) and authentic Persian music all have a history dating back several thousand years. Religion, personal, collective and tribal beliefs have always been the main elements of Iranian national culture, and have played a prominent role in all cultural domains.

Undoubtedly, the historical civilisation and culture of Iran owes a great deal to the significant presence of the different ethnic groups and minorities. According to the last census in 1997, Iran's total population comprised 99.55% Muslims, 0.13% Christians, 0.05% Zoroastrians, 0.02% Jews, 0.1% followers of other faiths and about 0.15% of undeclared faiths.

As the nexus of a strong and secure social life, the family in Iran is considered to be a sacred institution that provides identity and gives coherence and meaning to people's lives. Marriage is a religious obligation and a sacred act worthy of approval.

2.2 ■ Demographics

According to the latest census administered in 1997, the total population of the country was 60 million, with an average age of 24 years and a median age of 19.4. Males comprised 51% of the population and females 49%. A demographic assessment made in 2005, based on the population growth rate between 1992 and 1997 and assuming that the other effective growth factors remained constant, showed the population to be 67,477,500, of which 44,771,946 lived in urban and 22,705,554 in rural areas. (Statistical Centre of Iran, 2004 and 2005) In accordance with the latest surveys, the country's population growth rate has risen no faster than 1.6 % (Figure 1-1). Iran's population has rapidly shifted over the last three decades from a semi-urban/rural to an urban or urban-prone population, so that the urban quotient has increased from 47% (16 million) in 1977 to 66% (44.8 million) in 2005; that is to say that urban population has more than doubled over this period, to 2.8 times to be exact, while the rural population has increased by 1.3 times. Population growth, especially in the urban areas, has had some repercussions mostly because the social structures as well as the social facilities have not grown accordingly. (Statistical Centre of Iran, 2002)

Tehran University Main Entrance

Figure 1-1: Changes in the average percentage of annual population growth rate, 1966-2002
Source: Statistical Center of Iran, 2004

Life Expectancy

Many factors have contributed to the increase in life expectancy, from 70 years in 2002 to 71.7 years in 2005. Amongst the more significant of these, to name but a few, have been: a fast improvement in welfare and healthcare services, immediate accessibility to these services for the people, an increase in the level of literacy throughout society, equipping rural areas with health and hygiene facilities, improvement in life styles and a reduction in the infant mortality rate (Statistical Centre of Iran, 2004 and 2005).

Migration

One of the main shortfalls in demographic statistics is in migration censes. No systems have been designed to register the number of emigrants to foreign countries nor, even, is there any clear data available to show the interstate movements of those who leave villages to settle in cities and towns or those who move from one province for another (Statistical Centre of Iran, 2004 and 2005).

2.3 Public Participation

The policy established by the Iranian Department of the Environment (DoE) to enhance as well as improve the quality of public participation in preserving Iran's environment has led to the adoption of several programmes for identifying supporters of the environment. The DoE has attempted to create intellectual challenges and environmental concerns among these supporters and tried to provide the necessary preconditions for environmental NGOs to develop. Some of the outcomes of these policies include the following.

- An increase in the number of environmental NGOs from 44 in 1998 to 630 by July 2005 (approx. 14 times)(Figure 1-2).
- Conclusion of co-operation agreements and letters of understanding with government ministries and organizations to promote public as well as organizational participation.
- Establishment of a special organization responsible for following up public organizational participation.
- Introducing the Green Pioneers Scheme whose task will be to attract contributions from different strata of society to environmental issues.

The Department of the Environment has spared no efforts to stimulate as well as enhance the level of environmental knowledge of these groups and to promote social environmental interaction between non-governmental organizations. The main step taken by the Department in strengthening relevant NGOs was providing assistance in forming a countrywide network of their own. Some notable actions taken with regard to strengthening NGOs include the following:

- Holding annual public meetings in the seven regions of the country.
- Holding four national gatherings for environmental NGOs.
- Setting up a data-bank for NGOs and an Internet site for the Office of the Public Participation.
- Developing environmental NGOs into national, provincial and regional networks.
- Establishing environmental cooperatives.
- Strengthening environmental NGOs through donation of equipment, provision of financial support, presenting educational and training programmes, holding meetings and giving legal advice.
- Referring the implementation of small-scale projects to NGOs, financed by the Global Environmental Facility.
- Introducing the Green City Scheme with the aim of achieving minimum environmental standards and improving people's living conditions.
- Introducing the Environment Assistants Home Scheme with the aim of introducing environmental NGOs to mayors and district mayors. This project has so far been carried out in some cities as well as in some of the districts of Tehran Municipality.

2.4 Health Care

Amongst the most crucial factors for human development are health and medical treatment. The Health and Therapy Unit, entrusted with the vital responsibility of improving the levels of physical, mental and social health in society within the framework of specific policies, has achieved conspicuous success in the recent years. Some of the most important indices in this area may be summarized as follows:

- The maternal mortality rate for every hundred thousand live births has been reduced from 56.8 instances in 1990 to 37.4 in 2005.
- Vaccination of 95% of children.
- More than 96% of villages now have access to safe drinking water.

Figure 1-2: Number of NGOs from 1998 to July 2005
Source: Office for Public Participation, DoE, 2006

• Health infrastructure facilities have been provided to rural areas.

2.5 ■ Education and Training

Literacy

The significance of education as an essential component of development is self-evident. Iran has been one of the most successful countries in combating illiteracy. The high rate in the growth of literacy in recent years corroborates this claim. The literacy rate increased to 79% in 1997 from 62% in 1987. Approximately 84% of men and 75% of women are able to read and write.

Educational Infrastructure

The country's educational system falls into two general categories: (1) public education and (2) vocational and technical education. Each of these conducts curricular as well as extra-curricular activities within its own area. (Statistical Centre of Iran, 2004 and 2005)

Vocational and Technical Training

• Human resource development is an indispensable part of sustainable development. In order to provide proper conditions for increasing the efficiency of human resources, great attention has been paid to the educational sector, especially the vocational and technical training sector.

•The proportion of female students of the total number of the students in order to asses the equivalent opportunity of training skills shows an increased from 36.9% to 37.8%.

Higher Education

The higher education sector supplies the need for highly educated manpower and its activities are structured within 16 (8 training and 8 non-training) programmes. The operative bodies in this section include the universities and other higher education institutes affiliated to the Ministry of Science, Research, and Technology, the Ministry of Health and Medical Education, the Islamic Azad University and non-governmental, non-profit-making centres for higher education. The curricula in these institutions are offered in the form of day-time, night-time, part-time and equivalent courses.

• The total number of university students increased from 1,438,781, in 2001 to 1,887,960 in 2005, showing an average annual growth rate of 7%. The public sector share has been 40% and the private sector share 60%;

• In the public sector, the number of students in the universities affiliated to the Ministry of Science, Research and Technology increased from 477,226 to 645,600, showing an average annual growth rate of 7.8%;

• The number of full time faculty in the universities and other higher education institutions increased from 30,110 to 39,617, of which the 72.1% share of the public (state) universities decreased to 62.4% while the 27.9% share of the non-governmental, non-profit-making institutions increased to 37.6%.

• The welfare of dormitory facilities for single students was at 60%.

Research and Technology

•Funds for research and technology in 2001-2005 have been, respectively: 1,779.7, 2,515.6, 3,509.9, 5,515.3 and 6,516 Billion Rials. The highest rate of growth was 57% in 2004, compared with 2003, and the lowest being 18% in 2005, compared with 2004.

• Research funds (to purchase consumables as well as assets) in 2001-2004 have been, respectively: 327.6, 440.3, 536.9 and 629.6 Billion Rials.

• In accordance with the information given out by the Statistical Centre of Iran, the number of full-time as well as part-time researchers was 24,940 in 2001, decreasing to 23,410 in 2003, showing a 22.4% reduction. The number of researchers per one million of the population in 2001, 2003 and 2005 was 392, 295, and 346, respectively.

• The average annual growth rate in the export of sophisticated/semi-sophisticated technological commodities was 109.6% during that period. This shows the positive surging ahead of the country in this realm, compared to an average annual growth rate for non-petroleum exports of 92.8% over the same time span

Internet Users

Utilization of communication and information technology (IT) by Internet users soared so fast during 2001-2005 that it increased 13.7 times in the period. The number of Internet users has enjoyed a growth rate of 139.6% over the same time span.

2.6 ■ Social Security and Welfare

Being one of the main elements of development, the social security system has numerous functions in the advancement of welfare levels and, undoubtedly, is one of the most effective tools for the dissemination of social justice. With a view to achieving development objectives and social justice, the social security system taking its inspiration from Article 29 of the Constitution of the Islamic Republic of Iran, is designed as a collection of plans, supports and services to protect people at different strata of the society against the consequences of economic, social and natural events. Such outcomes include retirement, unemployment, old age, accidents, physical, mental and psychological disabilities etc. The basic system for social welfare in Iran relies upon social insurance and is composed of two sections: insurance-related matters (social security) and non-insurance matters (welfare).

Social Welfare

The social welfare index has been rising during the period 2001-2005 due to the growth in per capita income and relative improvement in the distribution of wealth. The average annual growth rate of this index has been 6% and the growth rate for the social welfare index was 8.4% in 2005.

— Insurance Services

• Various types of insurance services, based on contributions from the employee, the employer and the Government, are offered by governmental as well as non-governmental bodies. Organizations active

in this field are: the Social Security Organization, the Medical Services Organization, the State Pension Organization, the Social Security Organization of the Armed Forces and many different retirement funds affiliated to Ministries and other administrative bodies.

•The proportion of the population covered by medical insurance services increased from 87.7% in 2001 to 93.8% in 2005.

•At present, 21 million rural inhabitants and 5 million disadvantaged and less well-off people benefit from different types of insurance services.

— Welfare

•Establishment of the Ministry of Welfare and Social Security in line with improvements in the social security system as well as social development.

•Protection of the needy through continual financial, social and cultural support (insurance subsidies have been paid to over 4.5 million needy people to cover their medical expenses).

•Attempts have been made by various welfare organizations to help vulnerable families become self-sufficient and self-supporting. To achieve this goal, as many as 151,000 job opportunities were created and a budget of 1,570 Billion Rials was allocated during 2001-2005.

•Expansion of street children rehabilitation.

•A plan for dealing with chronic psychiatric patients.

•Public education and awareness in order to prevent illnesses such as lazy eye and physical and mental disability as well as social harms.

•Emerging Comprehensive Plan for Assistance and Rescue.

• Security of Society

Security is essential for ensuring the stability and survival of any society. In Iran, the authority responsible for the security of the country is the Police. Another institution engaged in safeguarding the security of society is the Judiciary which, according to Article 156 of the Constitution of the Islamic Republic of Iran, is an independent power protecting individual as well as social and collective rights. It is entrusted with the wide ranging duties such as disseminating social justice, guaranteeing the legitimate constitutional and natural freedoms of the people, overseeing the proper enforcement of laws and regulations, adopting measures to prevent crime and reforming criminals.

A survey of the indicators and quantitative goals of the judicial system of the Islamic Republic of Iran shows an increasing number of judges per every one hundred thousand of the population. However, the large and unprecedented explosion in the number of incoming cases has affected the statistics in such a way that the number of cases referred to each judge increased from 977 in 2001 to 1,153, in 2003. This indicates an average annual growth rate of 1.01%. Table 1-1 contains some further relevant pieces of information.

2.7 ■ Consumption Patterns

• Economic Status

Some indices for certain economic features of the country were as follows in 2001-2005.

•Gross Domestic Product (GDP) improved during the course of 2001-2005 so that, at current prices in 1998, it showed an average annual growth of 5.5% (compared with an average annual growth rate of 3.8% during the Second Development Plan) and rose from 320,069 Billion Rials in 2001 to 398,234 Billion Rials in 2005. Average annual economic growth, excluding petroleum-related sources, was also 5.8% in the course of 2001-2005 while average annual growth for production during the same period was 3.8%.

•The average annual investment growth rate was 9.3%.

Figure 1-3 shows GDP and shares of sectors 1998-2005 at current prices in 1998.

• Industry and Mines

The industrial, mining, electricity, water, gas and construction sectors had an 11.1% share of the total 3.1% contribution of the average annual growth to GDP. More than 2% of the total 5.5% average annual growth rate of the Third Development Plan related to industry and mining.

• Services

The average annual growth rate in this sector was 4.8% during 2001-2005. The country's average annual economic growth rate was 5.5%, of which 2.5% belonged to the service sector. In 2005, the maximum growth in this sector occurred in general trading, hotels and restaurants (2.3%), real estate (0.6%) and transport and communication (0.9%). Altogether, these accounted for 3.8% of growth in the service sector with other areas accounting for the remainder of the growth. The service sector showed an average annual growth rate of 4.8% in

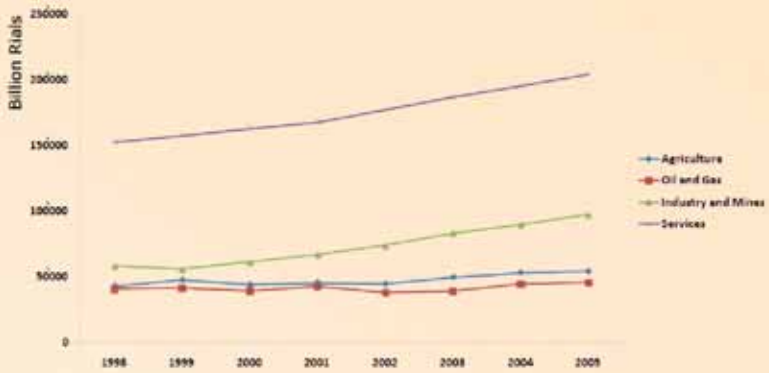


Figure 1-3: GDP and shares of sectors 1998-2005 at current prices in 1998

Source: Central Bank of Iran , Office of Economical Statistics

2005, contributing 51% of total GDP.

- **Agriculture**

The average annual growth rate in this sector was 4.3% during 2001-2005. The agricultural sector enjoyed an average growth rate of 2.2% in 2005, and contributed 13.7% of total GDP.

- **Oil and Gas**

The average annual growth rate in this sector was 3.3% during 2001-2005. This sector showed an average growth rate of 2.6% in 2005, compared to a 12.9% growth rate in the previous year. This shows that the contribution of the export of the raw materials to GDP has given way to other more rational types of exports.

2.8 ■ Agriculture and Natural Resources

•In 2005, this sector accounted for 13.7% of GDP, remaining constant according to process current in 1998 , 19.7% of the total value of non-oil exports, about 20% of employment, more than 82% of the food supply and 90% of the raw materials needed in agricultural conversion industries.
•Agricultural products which had been about 44.7 million tons in 2001, decreased to 14.2 million tons in 2005.
•Horticultural products which had been 12.3 million tons in 2001, decreased to 5.9 million tons in 2005, showing a 500,000 ton decline compared with the previous year.
•Fish and shrimp production was 424,500 tons in 2001 and 456,100 tons in 2005. Reproduction of aquatic species amounted to 988 million units in 2001 and 1,668.2 million units in 2005.
• Red meat production was 729,000 tons in 2001 and 784,900 tons in 2005.
•Egg production was 579,000 tons in 2001 and 645,000 tons in 2005.
•The level of livestock immunity against infectious diseases was, respectively, 94.3, 90.7, 89.9, 94.3, and 96.2 % in the years from 2001 to 2005.
•Extension training was given to 223,000, 445,000, 888,500, 904,300, and 1,935,000 persons per day, respectively, in the years from 2001 to 2005.

2.9 ■ Industry and Mines

The industrial and mining sector is one of the most significant economic sectors and is considered to be the engine of economic growth in most countries. Strengthening this sector and improving its competitiveness not only increases economic growth but the exports and employment as well.
•The industrial sector saw a 57% growth in the issuing of operating licences to industrial workshops by the Ministry of Industry and Mining in 2001-2005. During this period, the employment capacity of industrial workshops grew more than 140% and investment in those workshops also multiplied by 7.8 times (See: Table 1-2). In 2005, as many as 3,043 workshops with an investment of about 37.5 billion Rials owned by the private sector became operative. Those workshops directly created as many as 86,200 jobs for employees.
•In 2005, 610 operating licences were issued in the mining sector. The known deposits of the mines in question amounted to about 2,221.8 million tons. The volume of the investment made in relation to those permits was 960.7 billion Rials, creating directly 6,437 jobs.
•The volume of industrial and mining sector exports increased from $1.91 billion in 2000 to $4.56 billion in 2005, showing an average annual growth rate of 19%.
• Petrochemical production capacity increased from 14.2 million tons in 2001 to 18.2 million tons in 2005 and the marketable petrochemical products increased from 6.7 to 10.1 million tons. The volume of investment in operational petrochemical projects was $2.827 billion, equal to 6140 billion Rials.
•Petrochemical product exports increased from $339 million in 2000 to $1730 million in 2005, showing an average growth rate of 38.54%.
•The nominal production capacity of raw steel and steel products increased, respectively, from 6.7 and 7.1 million tons in 2000 to 11 and 13.5 million tons in 2005. The production of raw steel rose from 6.2 to 9 million tons, and that of steel products from 6.5 to 10.5 million tons. The volume of exports also grew in this period from 1.1 million tons, valued at $206 million, to 1.97 million tons, valued at $930 million. The size of investment in the steel industry was $1290 million plus 13,215 billion Rials.

2.10 ■ Transport

•Road transport has played an extensive role in passenger as well as cargo movements. Statistics

Table 1-1: Some significant information concerning security of society during 2001-2003

Year	General Court	Appeal Court	Revolutionary Court	Ratio of Judges per 100,000 of the Population	Protective Measures Covering Inmates' Families (Households)	Ratio of Independent Forensic Centres to Judicial Units (%)
2001	2260	226	226	8.3	2812	34.09
2002	2403	240	223	8.5	3700	46.82
2003	2582	252	245	9.7	4070	48.74

Source: Statistical Centre of Iran, 2005; Management and Planning Organization, 2005

for 2005 show that about 93% of total cargo transfers plus 93% of total passenger journeys in the country were by road;

•In 2005, as many as 440 million passengers travelled and 418 million tons of cargo was moved by public transport. Compared with 2000, the figures show a 12.7% increase in the number of passengers and 69% increase in the amount of cargo.

•By the end of 2005, motorways and highways were recorded to have covered 1,240 Km. and 4,462 Km, respectively. Main roads covered 24,544 Km, 1.5% more than the previous year. In 2001-2005, the average annual growth rates in total the length of the country's motorways, highways and main roads were 8.8, 8.2, and 2.1 %, respectively. During the same period, in order to increase the capacity of the public transportation fleet, create new jobs and reduce the operating age of the fleet, a budget of 59.2 billion Rials was allocated in the form of subsidies to cover the exchange rate, to be paid to city bus manufacturing companies and for the purchase of up-to-date technologies. In 2005 as many as 369 new buses entered the transportation fleet and, consequently, 1,476 jobs were created. In 2001-2005, 2,530 buses, 1,643 trucks, and 805 trailer trucks were purchased at a cost of 561 billion Rials. This was paid from funds allocated for industrial and credit aids and 15,854 new jobs were duly created.

•In 2005, more than 17.3 million passengers and 29.5 million tons of cargo were transported by train.

•In 2005, more than 22.4 million international air passengers arrived at and departed from the country's airports. In the same year, there were 8.9 million domestic air passengers, of whom 37.2% used non-governmental airlines.

•The marine transport sector successfully achieved its goals in 2005. In that year, using 100% of their nominal capacity, the country's commercial ports loaded and unloaded many different types of petroleum and non-petroleum commodities, which far exceeded 93.4 million tons, showing a more than 9% rise compared with the 85.6 million tons of 2004;

•The transit of petroleum as well as non-petroleum cargos through the commercial ports of the country reached 5.83 million tons in 2005, showing a 1% increase compared with 5.78 million tons in the previous year.

2.11 Energy

•An increase in the production capacity of crude oil to 4,230,000 barrels per day in 2005, showing an additional 337.4 barrels per day compared with production levels in 2000.

•A 3.4% growth in consumption of the five main petrochemical products in 2001-2005.

•Equipping 46,050 households with natural gas over the same period.

•Increasing the average output of the power stations to 103,000 Mega Watts (compared to that of 2000);

•Increasing electrical energy generation to 51.4 billion KWH per year (compared to that of 2000);

•Establishment by NIOC of the required platforms for refueling CNG vehicles.

2.12 Foreign Trade and Balance of Payments

Taking into account the surplus on the current as well as the capital accounts balance, there was a growth overall of about $8.3 billion in the country's international hard-currency deposits in 2005. The surplus balance in the current account was $4 billion, an increase of $3.2 billion over the previous year. The trade balance, having grown by $3.3 billion over the previous year, showed a surplus of $7.8 billion. The $10.4 billion increase in exports, despite an increase in imports of $7.1 billion compared with the previous year, led to a growth in the trade balance and, consequently, in the current account balance. A $9.5 billion rise in oil and gas exports caused exports to rise overall. Ultimately, the country's oil export revenues amounted to $31 billion over the course of the five years.

In 2001-2005, approximately $28.2 billion worth of non-petroleum commodities were exported. The export of services alone earned the country $23.8 billion while exports of commodities and services together, with an average annual growth rate of 18%, amounted to $182 billion. In the same period, the import of commodities and services amounted to $160 billion, with an average annual growth rate of 24.2%. (Management and Planning Organization, 2005)

2.13 Human Development

The human development index (HDI) for Iran rose from 0.71 in 2001, to 0.791 in 2005. The average growth rate of the HDI was 2.1% in 2004. Such a rate makes the growth more concrete than in previous years. The improvement in oil export revenues has been the most significant factor for the economic growth of the country.

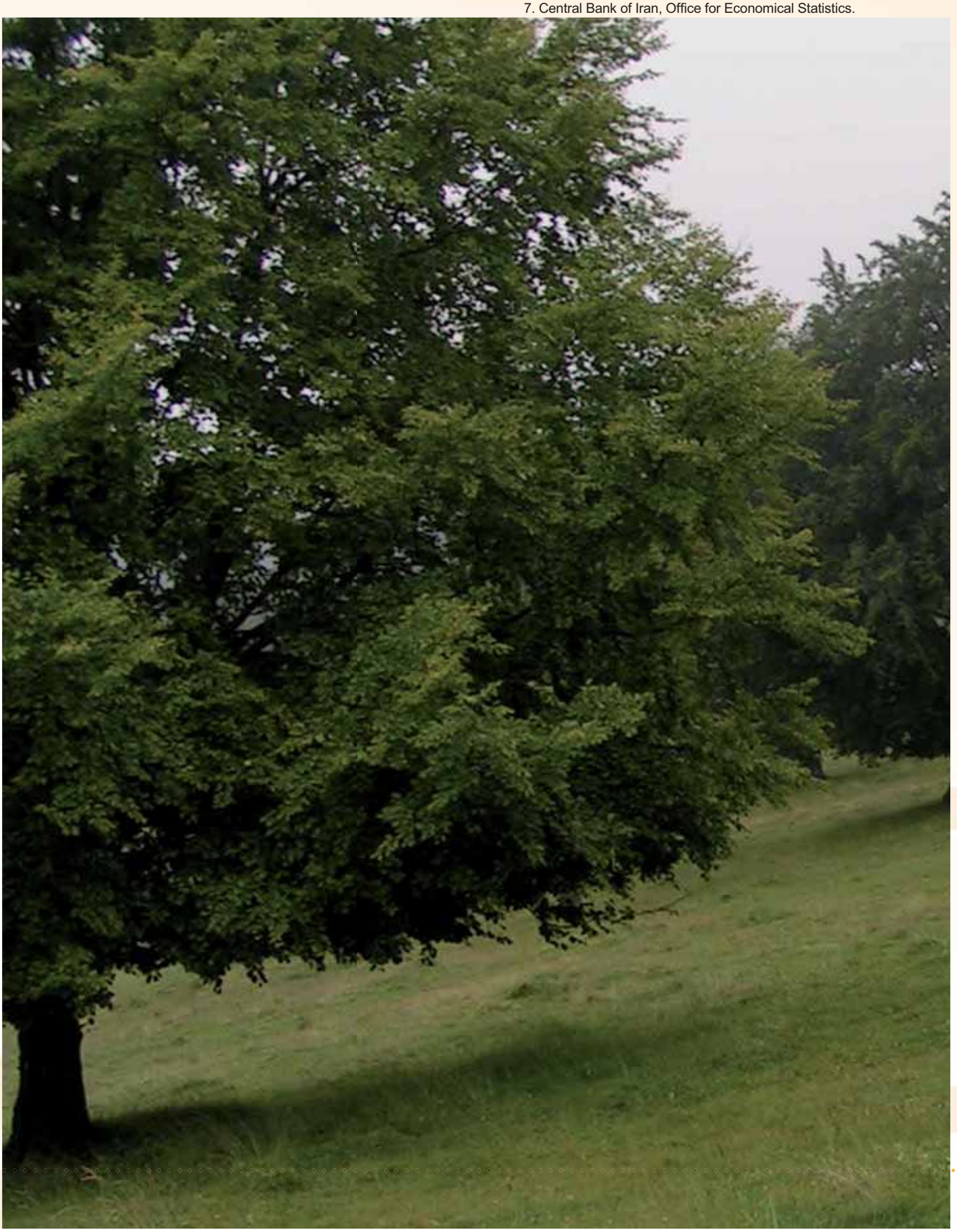
Table 1-2: Number of operating licences, the volume of employment and investment in industrial workshops during 2001-2005

Year	Number of Permits	Employment (Persons)	Investment (Billion Rials)
2001	3246	56492	6462
2002	3550	74578	13023
2003	4147	77296	18059
2004	4482	113372	28875
2004	5152	137579	50144

Source: Management and Planning Organization, 2004; Statistical Centre of Iran, 2005

REFERENCES

1. DoE, Office for Public Participation, 2006.
2. Management and Planning Organization, 2004. *News and Analysis Weekly, Special Edition for Third Development Plan Outcomes*. Presidential Report to Parliament, 6 August 2004.
3. Management and Planning Organization, 2002. *Report of the Government's Achievements.*
4. Management and Planning Organization, 2005. *Report of the Achievements of the Islamic Regime over a Quarter of a Century.*
5. Statistical Centre of Iran, 2004. *Statistical Yearbook.*
6. Statistical Centre of Iran, 2005. *Statistical Yearbook.*
7. Central Bank of Iran, Office for Economical Statistics.



Section IV

Annexes

ANNEX I

Appendix 7-4-5

- Establishing a sewage industry with the help of other supportive industries and extending urban and rural sewage systems
- Performing two national manoeuvres for combating oil pollution in Nuka and Bushehr harbours
- Purchasing floating units to combat and clean up marine oil pollution
- Using physical, chemical and biological refinery systems , carbon and sand filters, electrodialysis and reverse osmosis in order to refine the effluent in petrochemical complexes
- Eight out of nine production complexes to have industrial and sanitary sewage systems
- For five complexes, special areas are designed for burying the solid waste
- Holding the second and third stages of training courses in the sea (ASTP) and study and analysis of these training courses; submitting the report to CEP
- Studying seasonal bacterial pollution in the southern rivers of the Caspian sea
- Studying pollution from dry sources in the northern part of the Persian Gulf
- Putting into practice lessons learned about sources of industrial pollution in the southern coasts of the Caspian sea
- Two research patrols in the Persian Gulf
- Adopting 36 guidelines necessary for the water and sewage industry to reach accepted standards
- Publication of 16 specialized magazines about water and the environment
- Equipping water and sewage companies with bacteriology, chemistry and biology laboratories

Appendix 8-4-1

- Study of the habitat and bio-condition of the black bear.
- Preparing an identity card for the wetlands of Iran.
- Study of the habitat and bio-condition of birds of prey in Kerman.
- Study of the habitat and bio-condition of Hubareh in Yazd.
- Study of the habitat and bio-condition of zebra.
- Study of non-wetland habitats in order to prepare a survey pattern.
- Study and management of wetlands listed under the Ramsar Convention.
- Study of the effects of exploitation of mines in the four protected regions.
- Ecological study of reservoirs and filling out UNESCO forms.
- Project for constructing a taxidermy workshop
- Identification of big carnivores and a study of their habitats in Miandasht (pending).
- Study of the bio-condition of panthers in Sarigol (pending).
- Research on brown bears in the central Alborz (pending).

ANNEX II

UNITS

BOD/N Ratio	Biochemical Oxygen Demand/ Nitrogen Ration
cm	Centimetre
°C	Degree Celsius
cm/Sec	Centimetre per second
dBA	Decibel A
g	Gram
GWH	Giga Watt Hour
ha	Hectare
hr	Hour
Kg/m^3	Kilogram per cubic metre
km	Kilometre
km^2	Square Kilometre
km^3	Cubic Kilometres
KW/h	Kilo Watt per hour
L/100Km	Litre per 100 Kilometres
Ldn	Noise Level Average (day and night)
m	Metre
m^3	Cubic Metre
µg	Microgram
µg/L	Microgram per litre
mg/l	Milligram per litre
mg/m^3	Milligram per cubic metre
MW	Mega Watt
MWH	Mega Watt Hour
mm	Millimetre
Micro m/ cm^3	Micro metre per cubic centimetre
m/sec	Milligram per second
mg C/m^2	Milligram carbon per square metre
Ng/gr	Nanogram per gram
PM10	Particulate Matter (with a diameter equal to or less than 10 micron)
ppb	Parts per Billion
ppm	Parts per Million
PPT	Part per Thousand
Sec.	Second

Abbreviations

ALD	Aldrin
BOD	Biochemical Oxygen Demand
C.E.	Common Era
CEP	Caspian Sea Environment Project
CFCs	Hydrochlorofluorocarbon
CH_4	Methane
CMS	Convention on Migratory Species
CNG	Compressed Natural Gas
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
CO_3	Carbon Tri-Oxide

CR	Critically at Risk
DD	Deficient Data
DDT	Dichloro-Diphenyl-Trichloro ethan
DPO	Desertification Control Programme Office
DO	Dissolved Oxygen
DoE	Department of the Environment
DR	Dependency Relation
DU	Desertification Union
ECO	Economic Cooperation Organization
EIA	Environmental Impact Assessment
EN	Endangered
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
GDP	Gross Domestic Product
GIS	Geographic Information System
GM	Genetically Manipulated
HC	Hydro Carbon
HCH	Hexa-Chlorocyclohexane
HDI	Human Development Report
H_2S	Hydrogen Sulfide
ICF	International Crane Foundation
INCCPR	Iranian National Codex Committee of Pesticides Residuals
IUCN	International Union for Conservation of Nature and Natural Resources
JICA	Japan International Cooperation Agency
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LR	Low Risk
LTE	lead tetra ethylene
MAB	Man and Biosphere
MARPOL	International Convention for the Prevention of Pollution
min	Minimum
max	Maximum
MOC	Methoxychlor
MRTA	Metropolitan Rapid Transit Authority
MWA	Metropolitan Waterworks Authority
NEPO	National Energy Policy Office
NEQA	National Environmental Quality Act
NGOs	Non-Governmental Organizations
NH_3	Ammonia
NHA	National Housing Authority
NMHC	Non-Methane Hydrocarbons
NOAA	National Oceanic and Atmospheric Administration
NOx	Nitrogen Oxides
O	Oxygen
O_3	Ozone
ODS	Oil:Diesel
OPRC	Oil Pollution Preparedness, Response and Co-operation
PAH	Poly-loop Aromatic Hydro-Carbons
PCD	Pollution Control Department
PIC	Prior Informed Consent (Rotterdam –PIC)
POPs	Persistent Organic Pollutants
ROPME	Regional Organization for the Protection of the Marine Environment
SACAM	the South and Central Asia Countries for Man and Biosphere
SACEP	South Asia Cooperative Environment Programme

SEA	Strategic Environmental Assessment
SO_2	Sulfur Dioxide
SO_3	Sulfur Trioxide
SoE	State of the Environment
SPM	Suspended Particle Matter
SS	Suspended Solids
Temp.	Temperature
THC	Total Hydrocarbons
TSP	Total Suspended Particulate
TIWA	Norwegian International Water Academy
UCD	Union for Combating Desertification
UN	United Nation
UNCCD	United Nations Convention on Combating Desertification
UNDP	United Nations Development Programme
UNEP	United Nation Environmental Protection
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
USSR	Union of Soviet Socialist Republics
VU	Vulnerable
WHO	World Health Organization
WQMD	Water Quality Management Division
WWTP	Wastewater Treatment Plants

E

ANNEX III

This publication had been prepared by the collaborative effort of a number of individuals, and the following had been involved in different capacities.

List of Participants in a Training Workshop in Integrated Environmental Assessment and State of Environment Reporting held in Tehran, 5-7 March 2005:

Rajbahandari, Purna – UNEP
Srisakulchairak, Tunnie - UNEP
Yazdandoust, Aliya - DoE
Forghani, Amir Hossein – Shahid Beheshti University
Meftahpoor, Arezoo - DoE
Khaman, Azadeh - DoE
Blake, Janet - Shahid Beheshti University
Keivani, Elnaz - DoE
Azin, Farnaz - DoE
Shoaei, Farnaz - DoE
Gowdini, Hatam - Ministry of Petroleum
Motallebi, Hossein - DoE
Rafitabar, Katayoon - DoE
Korei, Khadijeh - DoE
Golavar, Laila - NGO (Green Front of Iran)
Sarabian, Leila - Ministry of Agricultural Jihad
Emamhadi, Mandana - Ministry of Roads and Transportation
Bozorgzad, Maryam - DoE
Ahmadi, Masoumeh - DoE
Layeghifard, Mehdi - Shahid Beheshti University
Sadat Najafi, Mehdi - Shahid Beheshti University
Dehghani, Mohammad - Shahid Beheshti University
Faghihi, Mohammad Reza – Shahid Beheshti University
Shahdadi, Mohammad - Ministry of Health and Medical Education
Zokaei, Mohammad - Shahid Beheshti University
Tehrani, Nadia - Iran Space Organization
Ghaemi, Pouneh - Atomic Energy Organization
Vaziri, Roya - ICI
Parvand, Shadan - Ministry of Housing and Urban Development
Ahmadi, Shadi - DoE
Bagherian, Shafagh - Ministry of Science, Research and Technology
Jolani, Shahab - DoE
Saboury, Tahereh – DoE

List of Working Group and Contributors:

Sadough, Seyed Hassan - DoE
Tahmasebi Nejad, Ayda – Shahid Beheshti University
Javaherian, Zahra - DoE
Sarabian, Laila - DoE
Khaman, Azadeh - DoE
Khedri, Ahmad - Shahid Beheshti University
Azin, Farahnaz - DoE
Goulavar, Laila - Green Front(NGO)
Fourghani, Amirhoussain - Shahid Beheshti University
Bali, Ali - DoE
Eslami, Ayda - Shahid Beheshti University
NaderKhani, Raziyeh - Shahid Beheshti University
Shoja Saffar, Bahareh – Khatam Institute of Higher Education
Kuchekzade, Mohsen - Shahid Beheshti University
Farid Rouhani, Mohammad Reza - Shahid Beheshti University
Faghihi, Mohammad Reza- Shahid Behrshti University
Hatefi, Mortaza - Shahid Beheshti University
Hasani, Hasan - Shahid Beheshti University
Zokaei, Mohammad - Shahid beheshti University
Layeghi Fard, Mehdi - Shadid Beheshti University
Parvand, Shadan - Ministry of Housing and Urban Development

Translators:
Rostami, Mohammad Mehdi
Shoja Saffar, Bahareh

English editor and contributor to the English version of the Report:
Blake, Janet - Shahid Beheshti University

Chair and Executive Director:
Zokaei, Mohammad - Shahid Beheshti University

List of Reviewers:
Ebtekar, Masoumeh, Vice President and Head of the DoE
Division of the Human Environment
Division of the Natural Environment and Biodiversity
Division of the Education and Planning
Division of the Legislation and Parliamentarian Affairs
Office of the Head of the Department
Directorate of the Public Relation and International Affairs
Surendra Shrestha, Regional Director, UNEP ROAP
Jinhua Zhang, Act. Regional Coordinator DEWA, UNEP RRC.AP
Subrato Sinha, Environmental Affair Officer, UNEP ROAP
Purna Chandra Lall Rajbhandari, Senior Program Officer, UNEP RRC.AP
Tunnie Srisakulchairak, Program Officer, UNEP RRC.Ap

Designers:
Imaghiyan. Amirhoussain - SBU
Ghollami, Maziyar - SBU
Sadat Najafi, Mehdi - SBU

Photos:
Division of the Natural Environment and Biodiversity - DoE
Division of the Human Environment, DoE
Zokaei, Reza - SBU
Zokaei, Zoha - SBU
Jafari, Mohammad Hassan - DoE

State of the Environment - Iran

(2005/06)