

WATER, WETLANDS AND CLIMATE CHANGE

Building Linkages for their Integrated Management

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COUNTRY BASELINE STUDIES MEDITERRANEAN REGION WATER, WETLANDS AND CLIMATE CHANGE TURKEY BASELINE REPORT ON CLIMATE CHANGE

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IUCN Centre for Mediterranean Cooperation



Global Water Partnership – Mediterranean

Preface

The Global Water Partnership (GWP), the Dialogue on Water and Climate Change, and IUCN - The World Conservation Union, have joined forces to facilitate an exchange of views on the common challenges faced by Mediterranean societies in adapting to climate change.

Scientific consensus is that climate change will have a pervasive influence on the future demand, supply and quality of fresh water resources in the Mediterranean, and add pressure to water and environment resources, and coastal systems in the region currently under stress. All sectors of the economy, environment and society may be vulnerable to one degree or another, to greater hydrological variability, more frequent flood and drought extremes, and to the longer-term effects of gradual mean temperature and sea level rise.

Under Article 4 of the UN Framework Convention on Climate Change (UNFCCC-1992), it was agreed that all Parties would develop short, medium, and long-term strategies for climate change mitigation and adaptation in a phased manner, taking into account the different socio-economic contexts. A number of Mediterranean countries have already taken preliminary steps to identify strategies and integrate responses to climate change in their current water resource management policies and activities. Other countries have yet to initiate processes to enable steps to moderate the significant vulnerabilities, or to benefit from the opportunities associated with climate change.

This document is one of twelve country base-line studies and thematic papers prepared as background material for a Roundtable meeting in Athens, Greece in December 2002 on the linkages between climate change, water and wetlands resource management in the Mediterranean region. While the primary aim is to exchange views, perspectives and experience on possible directions and priorities for climate change adaptation planning, the discussion would also explore opportunities to enhance synergies in the responses to the UNFCCC and Ramsar Conventions.

Eight country base-line studies were prepared for:

- | | |
|----------|-----------|
| ✍ Cyprus | ✍ Morocco |
| ✍ France | ✍ Spain |
| ✍ Greece | ✍ Tunisia |
| ✍ Italy | ✍ Turkey |

The four crosscutting thematic papers are:

- ✍ Mediterranean Water Resource Planning and Climate Change Adaptation
- ✍ National Approaches to Drought Preparation in the Mediterranean
- ✍ Adaptation Strategies for Improved Flood Management in the Mediterranean
- ✍ Biophysical and Socio-Economic Impacts of Climate Change on Wetlands in the Mediterranean

Electronic copies of the reports and papers noted above may be downloaded from the web page of The IUCN Centre for Mediterranean Cooperation at www.uicnmed.org. Project funding for this initiative was provided by the Global Dialogue on Water and Climate Change. The IUCN Centre for Mediterranean Cooperation receives core funding from the Spanish Ministry for Environment and the Junta of Andalusia.

Disclaimer:

The information, views, conclusions, and recommendations contained herein are those of the authors, and are not necessarily the views of the Governments of the countries concerned, the GWP, the Dialogue on Water and Climate Change, or the IUCN.

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EXECUTIVE SUMMARY

The World Conservation Union (IUCN) has developed a collaborative programme to assist member countries to better integrate climate change considerations in their water and wetland resource management policy and practices; and, to advance climate change adaptation planning complying with the United Nations Framework Convention on Climate Change (UNFCCC) and compatible with the provisions of the Ramsar Convention. Under the Mediterranean component of the programme, the present country baseline study has been prepared for Turkey.

The main objective of Turkey's environmental policy is defined as environmental protection and improvement towards sustainable development, which can only be achieved by developing and preserving the natural resources. This policy requires the rational management of natural resources whilst ensuring the protection of human health.

In this report, the country context giving an overview of the climate, variability and change, as well as the natural resources situation are presented in the first part. In the second part institutions/processes and networks relating to water, wetland and climate change issues are analysed putting emphasis on national and international activities of Turkey. Section three gives an outlook for the integration of water and wetland resource management policy and practices with regard to climate change. Finally the last section on adaptive strategies focuses on what needs to be done as far as policy setting and measures to be taken are concerned.

Turkey, located in the Mediterranean basin and surrounded on three sides by the Mediterranean, the Aegean and the Black Sea has a total land area of 780 600 km²; its littoral totals 8333 km. Situated in the temperate zone, she has various climate types in different regions. A Mediterranean climate prevails in Turkey's Mediterranean and Western Anatolian regions, a temperate climate with high precipitation in every season along the Black Sea coast, a continental climate in the inland regions and a semi-arid climate in Central and South-eastern Anatolia. Most precipitation occurs in the winter months. Total annual rainfall is least in the low-lying areas of eastern Anatolia (220mm), and highest along the eastern Black Sea coast (2420mm). The average annual rainfall for the entire country is 643mm, generating a water potential of 501 billion m³/year. Turkey has an average runoff coefficient of 37% corresponding to 186 billion m³/year. Although water resources in Turkey are considered to be sufficient compared to the world average, with an annual ratio of approximately 2000 m³/capita, the resource availability does not coincide with the demand in time and in place. Situated at the crossroad of three continents the country has rich biodiversity; where mountains, steppes and wetlands constitute the main ecosystem types.

According to the Hadley Centre climate model, Turkey is predicted to be affected by climate change resulting in the variation of the annual mean temperature of about 1.5°C by the year 2050. A drastic decrease is expected for winter precipitation just over Turkey according to the recent assessment for Europe . The figures indicating climate-related natural hazards show that flooding on major rivers and flash floods in built-up areas on small streams cause significant damages in most of the cities and towns of Turkey. Climate model scenarios predict that Turkey's arid land would be affected by climate change declining to desertification.

Turkey has not become yet a signatory to the UNFCCC. A formal amendment proposal was made at the Hague Conference requesting the deletion of Turkey from Annex II and retaining its name in the Annex I list, subject to the condition that Turkey should enjoy favourable conditions in accordance with the 'common but differentiated responsibilities' principle of the UNFCCC, taking into consideration the fact that Turkey is at an early stage of industrialisation. This proposal was accepted with consensus in 2001 at the Marrakech Conference.

Turkey has started activities related to climate change issues at national level after the Rio Summit held in 1992. More than ten institutions are directly involved in these activities . The Ministry of Environment ensures coordination between local governmental institutions as well as international cooperation. National activities are realised through working groups formed by representatives from institutions concerned. These are mainly:

- ? The National Climate Coordination Group
- ? The Coordination Committee on Climate Change
- ? The Specialised Commission on Climate Change

Climate change is an emerging issue and according to various studies, it may have serious consequences and adverse impacts on natural resources affecting vulnerable ecosystems, human life and health and socio-economic sectors. Although being aware of the situation, at present, there is no legal provision introduced into the regulations by the government, directly aiming at reducing and/or limiting emissions of greenhouse gases. However, there are a large number of laws and other legal instruments pertaining to environmental protection and energy conservation that intend to reduce such emissions indirectly. The situation is similar when the impact of climate change on water and wetlands is concerned. As yet, no legal mechanism exists taking into account climate change issues in water resource planning and wetlands preservation. The applied practices are limited to protection, mitigation and emergency measures caused by natural hazards. There is no disaster warning technology being applied in Turkey for flood hazard. There is no automated disaster information system to effectively communicate needs and capabilities during and immediately following a disaster. Climate change adaptation strategies do not exist either in the regulations.

National policies and measures should be developed jointly by implementing the following three major strategies so as to mitigate the adverse impacts of climate change. These should be:

- ? Emergency measures
- ? Adaptive strategies
- ? Long-term strategy

As a first step, it will be of utmost importance to focus on mitigation measures comprising hazard reduction plans relating to water resources management and wetland protection:

- ? Basin flood protection
- ? Modernisation of monitoring, forecasting and warning systems
- ? Investment in flood protection infrastructure improvement
- ? Flood and landslide risk reduction and mitigation
- ? Improvement of disaster response capabilities
- ? Measures related to floodplain mapping and landslide prone area mapping for land-use management
- ? Drought preparedness in semi-arid regions
- ? Less-water consuming technologies in irrigation in drought-prone areas
- ? Mitigation projects to minimise impacts of climate change on wetlands (e.g. deltas, lagoons, marshes)
- ? Environmental impact assessment taking climate change impact into consideration when designing water projects (e.g. dams, irrigation projects)

At present, a national policy considering the climate change impact on long-term water resources planning (e.g. irrigation, beneficial use of water resources, wetlands) is missing in the management tools. However concerns related to the climate change issues stipulated in the report of the ‘Specialised Commission on Climate Change’ will take place in the development plans of Turkey for the first time and for the period of 2001-2005.

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PART A-THE COUNTRY CONTEXT

1-General Framework

Turkey is located in the northeast hemisphere between 26°- 45° East, 36°- 42° north and is surrounded on three sides by the Mediterranean, the Aegean and the Black Sea. The Sea of Marmara located between the Black Sea and Aegean is a water body connecting these two basins via the Turkish Straits (Istanbul and Çanakkale). Turkey's littoral totals 8 333 km including islands, the Aegean and Mediterranean coasts, extending from Çanakkale in the north to the Syrian border, accounting for 4 170 km. Turkey's total land area covers 780 600 km², of which 23 600 km² is located in Europe and 757 000 km² in Asia.

Most precipitation occurs in the winter months. Total annual rainfall is least in the low-lying areas of eastern Anatolia (220mm), and highest along the eastern Black Sea coast (2420mm). The average annual rainfall for the entire country is 643mm, generating a water potential of 501 billion m³/year.

Water resources are unevenly and disproportionately distributed over the country; this situation has led to the implementation of large water conveyance projects for utility water supply to large metropolises.

Topographical and geological conditions in some drainage basins do not permit the construction of dams for the storage of water for consumer use. Therefore approximately only half of the water potential can be made economically available for consumption.

The existing water potential on a national scale is considered to be adequate for the distant future so long as it is provided at the times and places required and according to the purpose for which it will be used.

2-Climate

Turkey, situated in the temperate zone, has various climate types in different parts of the country; a Mediterranean climate prevails in Turkey's Mediterranean and Western Anatolian regions, a temperate climate with high precipitation in every season in the northern regions and a continental climate in the inland regions. More specifically, Turkey is divided into five basic climatic regions as defined below: **(See Annex 1-Geographic and Climatic Regions of Turkey)**

2.1 The Mediterranean Climate: The most marked characteristic of this climate is hot and dry summers with mild and rainy winters on average conditions. The highest mean annual temperatures reach about 20°C in the eastern parts of the coast. This

climate is dominant mainly over the Mediterranean and Aegean regions and it is divided into two sub-types as:

- a) humid Mediterranean climate and
- b) Semi-humid Mediterranean Climate

Humid Mediterranean climate: Snow and frost events are very rare on the low coastal belt. Mean January temperature varies from 8 °C to 10°C. July temperature is high with a mean of 27°C to 28°C. The rainy season is winter. Summer months receive the smallest amounts of rainfall. The ratio of summer precipitation corresponds to less than 2% of the annual amount in almost every location along the coastal belt. Summer dryness lasts during the long period from late spring to mid autumn. Annual rainfall is about 1000mm.

Semi-humid Mediterranean climate: Mean temperature vary among 5°C and 8°C in the coldest month of January. In winter months, short-term frost events are more frequent than that in the humid Mediterranean climate. The rainy season is winter. The annual amount of rainfall is less than the humid Mediterranean climate with a mean precipitation of 600-800 mm. Summer months are dry and the ratio of summer to annual rainfall is less than 5% in almost every location. In both of these two sub-types, the evaporation is high throughout the year and particularly in summer.

2.2 The Black Sea Climate: Along the Black Sea coasts all seasons are rainy and maritime effects appear strongly. Mean annual temperature varies between 8 to 12°C. Most of the precipitation occurs in autumn and winter and the annual mean exceeds 1000mm on the western and eastern coasts. Almost all parts of the region are generally influenced by the humid air masses associated with mid latitude frontal cyclones.

2.3 The Semi-humid Marmara Climate: All the Marmara Region with the exception of the Black Sea coast of this region is influenced by this climate. Mean temperature is approximately 23-24°C in July, the hottest month. The mean temperature in January, the coldest month is about 3-5°C. Maximum annual precipitation occurs in winter. The ratio of summer rainfall to the annual average is 10-15%. Mean annual precipitation varies between 500mm and 700mm. Frost is more frequent than in the Mediterranean climates and snow is quite normal.

2.4 The Steppe Climate: All Central Anatolia and its surroundings including the Lakes District, the Mid-west Anatolia, western district of the Eastern Anatolia and the South-eastern Anatolia show characteristics of this semi-arid climatic type. Due to the differentiated thermal and humidity particularities, the steppe climate is divided into two main sub-climate types:

- a) **The Semi-arid Central Anatolia Climate:** Winters are cold and the intensity increases towards northeastern part of Central Anatolia. Mean temperature in the coldest month of January varies between 0° C and -3°C. Mean July and August temperatures are 20° C and 22° C. Most of the rainfall occurs in spring and in some districts in winter. The ratio of summer precipitation is about 10%. Mean annual precipitation varies between 350mm and 500mm.

- b) The Semi-arid Southeastern Anatolia Climate:** Summers are very hot and mean temperatures are greater than 30° C in the hottest months of July and August. Mean temperature in the coldest month of January varies between 2° C and 5° C over the region. Dry period in summer is much intensive and long lasting. The amount of annual precipitation varies between 350mm 800mm over the region. Because of the high temperature and high rate of evaporation, this climate regions the most arid region of Turkey.

2.5 The Continental Eastern Anatolia Climate: Mean winter temperature is less than 0° C. Mean temperature in the coldest month of January varies between -8° C and -10° C. Mean temperature of the warmest month does not exceed 20° C. The amount of annual precipitation is more than 500mm with the exception of low basins, plains and deep valleys. The largest precipitation occurs mostly in the northeast from late spring to mid-summer and in the rest of the region during winter and spring. This region is covered with snow during the cold period and frosts are frequently observed.

3-Natural Resources

3.1-Air Quality

Data relating to particulate matter and sulphur dioxide indicate that with the exception of some localized areas, air pollution is no longer a serious problem. In major cities, an intensive effort has been made to shift from low quality coal to natural gas for domestic heating and to encourage consumption of unleaded gasoline. The capital city Ankara was badly affected by heavy air pollution, but abatement measures have proved successful.

3.2 WaterResources

Although water resources in Turkey are considered to be sufficient compared to the world average, with an annual ratio of more than 2000 m³/capita, the resource availability does not coincide with the demand in time and in place. Moreover, the fact that river flows are irregular makes the gap between the total and usable water potential quite significant. One third of the population lives in the biggest metropolises located in the western part of Turkey where most of the industries exist, whereas in this part of the country water resources are scarce.

Precipitation averages 501 billion m³/year; of this total 186 billion m³/year transforms into flows corresponding to a run-off coefficient of 37% and 41 billion m³/year seeps underground to form groundwater reserves. Technically and economically exploitable water potential is 95 billion m³/year for surface water and 12 billion m³/year for groundwater. Taking into account the allocation of 16 billion m³/year of surface water to neighbouring countries Iraq and Syria and an incoming flow generated outside Turkey of 7 billion m³/year, of which only 3 billion m³/year of technically and economically exploitable, the balance shows 94 billion m³/year of readily exploitable water potential.

Water Use

Water is supplied from surface and groundwater resources for all purposes. Agriculture is the highest water-consuming sector with an average rate of 75%, followed by domestic water use at 15% and finally the industrial sector at 10% according to the State Hydraulic Works records. Approximately 90% of the total water use for irrigation is withdrawn from rivers. An average 35% of energy production relies on hydroelectric power generation that represents only 29% of the national potential.

Non-conventional water resources are not used. However, in arid regions wastewater reuse is under consideration.

At present, almost the totality of the urban population is connected to the water supply network, and in rural area this ratio is close to 90%. A daily allocation of 170 litre/capita is made for drinking water supply. Unaccounted-for water has a high average varying from 35-65% depending on the network and location.

3.3 Wetlands

So far the protection of wetlands hosting mainly water birds and encompassing biologic and ecologic particularities as well as economic value has been a priority of the Ministry of Environment. Out of 58 wetlands, nine having international importance are classified under the Ramsar Convention. In 1991, soon after the establishment of the Ministry of Environment a unit with the duty of identification, protection, development and management of wetlands was formed. The General Directorate of Environmental Protection of the Ministry of Environment executes the preparation and implementation issues of the Turkish wetlands declared as 'Ramsar Sites', determines their biological and ecological status such as the Lake Manyas Management Plan completed in 2001. A new regulation on the conservation of wetlands has been prepared and put into force in order to establish a framework for the implementation of the Ramsar Convention. The division continues to carry out conservation studies within the framework of the regulations.

Turkey became a signatory to the Cartagena Bio-Security Protocol related to genetically modified organisms (GMO) since May 2000. UNDP/GEF allocated a grant for the identification of areas having genetically rich diversity and their in-situ protection through management plans with the aim of their sustainable usage. Within the framework of the Bern Convention ratified in 1984, Turkey became one of the three pilot countries of the 'Emerald Network' established for cooperation development aiming at the efficient protection of special areas.

Although Turkish legislation has many acts and regulations corresponding to the related EU directives, there are discrepancies between these and international treaties to which Turkey is a signatory since legal instruments have been designed by various institutions and at different time intervals.

Despite the pressure exerted on natural resources due to heavy agricultural activities, giving rise to over-use of fertilizers, and flood irrigation, deforestation and over-grazing on the one hand, and industrialization, urbanization, and tourism activities on

the other, the fact that Turkey has ratified all of the nature protection treaties with the exception of the Bonn Convention has raised awareness among relevant institutions for the sustainable management of natural resources. Besides NGO participation in protection projects and their influence in the decision-making process, public sensitisation can be assessed as an important tool in facilitating nature protection issues.

3.4 Biodiversity

The diverse climatic, topographic and geologic features of Turkey have generated a varied fauna and flora classified under three different bio-geographic regions; namely the European-Siberian, Irano-Turanien and Mediterranean regions. Sensitive habitats consist of wetlands of more than 1,35 million ha, mountains rising to 5 000m elevation (a home to various ecosystems), 28 million ha of steppes (the most important areas for genetic diversity), and shorelines merit special attention.

Turkey is a rich country in terms of biodiversity with more than 9 000 plant species identified, out of which 3 000 are endemic; these figures correspond approximately to 75% of the plant species found in Europe. Furthermore 132 mammal, 451 bird, 508 fish and 160 000 invertebrate species exist in their natural habitat. According to the Biodiversity Assessment Strategy and Action Plan of Turkey prepared in 1997, seven of the mammal species and one bird species are classified as threatened by extinction.

There are relatively few major protected areas, covering a total of nearly 3 000 km², with another 2 000 km² classified according to the 'Turkish National Parks Law' as protected areas that are subdivided into 33 national parks, 35 nature protection areas, sixteen nature parks, 118 reserves and 54 nature monuments. In addition, 750 natural sites and thirteen specially protected areas are classified according to the Conservation of Cultural and National Heritage Act and 'Decree on the Establishment of the Authority for the Protection of Special Areas' respectively.

3.5 Land Resources and Agriculture

Despite Turkey's large land mass only 35% is suitable for agricultural use. Moreover the fact that the distribution of fertile land is unbalanced and 30% is located in the regions where the population density is the highest has resulted in loss of this land in favour of urban, industrial and tourism activities.

The so-called GAP Project implemented in the wide watersheds of the Euphrates and Tigris Rivers of the South-eastern Anatolian Region is expected to bring a significant input to agricultural development with a planned 1,8 million ha of total irrigated land providing that appropriate environmental management measures are taken to avoid degradation of soil quality due to Stalinization in particular.

3.6 Forests and Erosion

Forests cover about 20% of Turkey's surface area out of which 48% is productive and rich in species. 41% consists of five pine species, 29% of twenty oak species and the rest consists of beech and spruce.

Since urbanization has developed mainly at the detriment of agricultural land, gaining new farm land by forest clearing has been one of the major reason of degradation in addition to fires that destroy 11 000 to 15 000ha every year. As a result, inefficient management of soil resources has led to erosion that carries away approximately 1 billion tons per year and affects 81% of the total land surface of the country. Severe erosion occurs primarily on steep lands where plots have been gained by forest clearing and in areas where agriculture is practiced without any soil conservation measures. Erosion abatement programs initiated by joint management of central administrations have been applied to only a minor part of land at risk. The adverse impact of erosion on siltation in dams is another matter of concern.

Inadequate forest cadastral survey, unclear property rights and frequent changes of regulations remain as the major legal issues.

4-Outlook for Climate Variability and Change

Global mean surface air temperature has increased by about 0.3°C to 0.6°C since the late 19th century (IPCC, 1996a). 1990s have been among the warmest years since 1860, despite the cooling effect of the 1991 Mt. Pinatubo volcanic eruption. Global mean surface temperature reached its highest value in 1997, which was 0.43 °C higher than the 1961-1990 base-period mean (WMO, 1998). Nighttime temperatures over land generally increased more than daytime temperatures. Regional changes are also evident. For instance, a general warming has been observed recently, over the mid-latitude continents, whereas there has been a cooling in a few areas, such as the North Atlantic and the Eastern Mediterranean with Turkey.

Changes in the amount of greenhouse gases and aerosols, taken together, are projected to change regional and global climate, climate-related parameters such as temperature, precipitation, soil moisture and sea level in the future. For the mid-range IPCC emission scenario assuming the best estimate value of climate sensitivity, which refers to the long-term change in global temperature following a doubling of atmospheric equivalent CO₂ concentration, and including the effects of future increases in aerosols, climate models project an approximately 2°C increase in the global mean surface air temperature relative to 1990 by 2100. A climate model by the Hadley Centre (UKMO, 1995) taking into account the combined effects of greenhouse gases and sulphate aerosols predicts a local cooling over some northern regions between 1900 (mean of 1880-1920) and the present (mean of 1970-1990). These regions of cooling also include the Eastern Mediterranean Basin and coastal regions of Turkey. Model predictions coincide perfectly with the observed cooling over the Eastern Mediterranean (ECSN, 1995) and with the results of some research studies that show a general cooling over most of Turkey and significant cooling over the coastal regions of Turkey during the period of 1970-1992. The cooling over Turkey was apparent particularly in the maximum air temperatures of Turkey. The Hadley Centre model predictions indicate warming almost everywhere over the



world from 1990 to 2050. In spite of the recent observed cooling and present and estimated high sulphate forcing, expected change in mean annual temperatures will be about 1.5 °C over Turkey and the Eastern Mediterranean Basin by the year 2050.

Precipitation is high over land in high latitudes of the Northern Hemisphere, especially during the cold season. An abrupt decrease in rainfall amount occurred after the 1960's, over the subtropics and tropics from Africa to Indonesia. There has also been decrease of precipitation amount in the Eastern Mediterranean Basin and Turkey. Recent dry conditions and long-term decreasing trends in rainfall series have been evident particularly over the winter-rainy western and southern regions of Turkey. Furthermore, a climate model by the Hadley Centre (UKMO, 1995) predicts a decrease in mean annual precipitation until 2050, over many parts of subtropics. These decreased rainfall regions include the Middle and Eastern Mediterranean, and the western and southern margins of Turkey. According to the recent assessment for Europe (ECSN, 1995), a drastic decrease is expected for winter precipitation just over Turkey. (*National Report on Climate Change, 1998*)

The figures of death, injury and destruction from climate-related natural hazards indicate that over the years flooding on major rivers and flash floods in built-up areas on small streams, which are often neglected during urban development in most of the cities and towns of Turkey cause major damage.

5-Key Vulnerabilities to Climate Change

Impacts on the climate change on temperature and precipitation conditions, natural vegetation, water resources and food supply over Turkey have been assessed by making use of the new model results from a very recent report by UKMO/DETR developed in 1999. The used model is called 'the second Hadley Centre Climate' model and has a climate sensitivity close to IPCC 'best estimate' value. (*Türkes, 2000; Climatic Change: Effects on Agriculture in the Mediterranean Region, 2000*)

Turkey and the Middle East region are assessed among the areas where water resources are under increasing stress with unmitigated emissions scenario and the two emission stabilisation scenarios of CO₂ concentration at 750 ppm and at 500ppm. The indicator used to compute water stress is the ratio of the total national withdrawals to the national average annual runoff. Based on several studies conducted at national and international level, it is seen that terrestrial and aquatic ecosystems and their functions are sensitive to both the rate and the extent of climate change. Turkey is no exception, it is predicted that climate change would also affect the arid lands of Turkey declining to desertification.

PART B- INSTITUTIONS/PROCESSES AND NETWORKS WORKING ON WATER, WETLAND AND CLIMATE CHANGE ISSUES

1-Overview of International and National Efforts and Circumstances

At the Intergovernmental Panel on Climate Change (IPCC), the impacts of global climate change on human life and health, ecological systems and socio-economic

sectors have been highlighted and it has been pointed out that the following direct and indirect consequences such as :

- ? decreasing snow cover, sea and land glaciers,
- ? increasing sea level,
- ? shifting climate zones and
- ? increasing the frequency and/or intensity of floods, droughts, land erosion, desertification, infectious diseases and agricultural pests and pathogens.

Raising awareness on this issue has led international organizations, especially the United Nations (UN), to conduct various activities and studies in order to reduce the adverse effects of human activities on the climate system since the late 1980s. These global efforts have resulted in the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol.

The UNFCCC and the Kyoto protocol are increasingly becoming more operational in limiting and reducing emissions of greenhouse gases by using legal instruments and influencing international trade, technology and capital movements.

1.1 Turkey's Position with regard to UNFCCC

Turkey has rather unique circumstances and difficulties in connection with the UNFCCC.

Initially Turkey was included in the Annex 1 and Annex II List with the OECD member countries and countries with economies in transition respectively at the UNFCCC Intergovernmental Negotiation Committee in May 1992, in New York.

A formal amendment proposal was made at the Hague Conference requesting the deletion of Turkey from Annex II and retaining its name in the Annex I list, subject to the condition that Turkey should enjoy favourable conditions in accordance with the 'common but differentiated responsibilities' principle of the UNFCCC, taking into consideration the fact that Turkey is at an early stage of industrialization. At the Seventh Conference of the Parties held in Marrakech in 2001 Turkey's proposal was accepted with consensus. The Conference adopted a decision that amended the Annex II list to the Convention by deleting Turkey and invited the Parties to recognize the special circumstances of Turkey, which, effective upon becoming a Party, places Turkey in a situation different from the other Parties included in the Annex I of the Convention. (*National Report on Sustainable Development, 2002*)

Table 1 shows Turkey's ranking in the world by basic CO₂ indicators.

Table1 Turkey's Ranking in the World by Basic CO₂ Indicators

	1995	1996	1997	1998	1999
Total CO ₂ Emissions	25	25	23	24	23
CO ₂ /Population	80	79	75	76	75
CO ₂ /GDP	63	71	70	71	60
CO ₂ /GDP (purchasing power parity)	81	84	81	81	55

Source: International Energy Agency (IEA), 2001

2-National Activities

In parallel with international activities and agreements, national institutions started coordination on climate change issues.

2.1 The National Wetland Commission

Regulations related to the protection of wetlands have three major components that are:

- 1- Protected area approach
- 2- Management of a specified area approach
- 3- National Commission approach bringing together NGO's, research institutes, individual scientists

Turkey is one of the few countries having a national commission dealing with wetland issues called the ' National Wetland Commission'.

2.2 The National Climate Coordination Group (NCCG)

The National Climate Coordination Group (NCCG) conducted preparatory work regarding climate change and the protection of the atmosphere in the context of the preparations for the 1992 Rio Summit. The State Meteorological Service (SMS) chaired this group and served as its secretariat. The work of the NCCG was compiled in two reports entitled 'Protection of the Atmosphere and Climate Change' and 'Energy and Technology'.

2.3 The Specialised Commission on Climate Change

A Specialised Commission on Climate Change was established in 1999 in the context of the preparations conducted by the State Planning Organisation (SPO) for the Eight Five-Year Development Plan covering the period of (2001-2005). Thus, climate change became officially a national issue in the context of development planning. The report of the Specialised Commission on Climate Change was prepared in consultation with relevant ministries, public organisations and NGO's for the eight planning period in Turkey. This report contains proposals for

- ? national policies, measures and technologies in sectoral investments,
- ? stipulates the existing difficulties related to sectoral, legal and institutional arrangements that are needed
- ? gives a scientific and technical evaluation of climate change

All the above-mentioned issues are discussed in Part C of this report.

2.4 The Coordination Committee on Climate Change

In accordance with a circular issued by the Prime Ministry, a Coordination Committee on Climate Change composed of high-level representatives from relevant institutions and organizations was established in 2001. The Committee is scheduled to meet three times a year. The terms of reference defining the operating rules of the committee are available (*See Annex 2*)

2.5 Other National Activities

The Ministry of Environment (MoE) organized two seminars in April 1999 and 2001 in Ankara and Istanbul respectively with the aim of informing the public in general and the industrial sector, in particular, about the Framework Convention on Climate Change.

The Ministry of Agriculture and Rural Affairs (MARA) organized a panel on the 'Impacts of Climate Change on Agriculture' in 2001 in Ankara.

3-Institutions

Since its establishment in 1923, the Republic of Turkey has been undergoing important and vital changes in its legal and institutional structures. The introduction of five-year plans was the first attempt at the adoption of a long-term and centralized policy-making approach related to public investments, whose planning and programming was entrusted to the State Planning Organization (SPO) operating under the Prime Minister's Office. The SPO is charged with developing economic, social and environmental policies for the five-year development plans, and preparing annual programs and public investment programs that are implemented by the related central and local agencies and institutions that function within their establishment law. Turkey is currently implementing its 8th Five-Year Plan (2001-2005).

More than ten governmental institutions together with their regional directorates and local/municipal agencies operate according to specific laws and regulations in environmental protection issues.

The Ministry of Health (MoH) plays an important role in certain aspects of environmental protection through its responsibilities for public health. Prior to the establishment of the Ministry of Environment, the Ministry of Health was responsible for environmental matters in general. In the water sector, it has particular responsibilities for drinking water and bathing water quality. The Ministry of Health also issues permits to industrial installations with regard to their production and emission and undertakes air quality monitoring with the objective of public health protection.

The Ministry of Forestry has general duties relating to the protection and management of forests with nature protection objectives through its management of National Parks and enforcement of hunting rules.

The Ministry of Agriculture and Rural Affairs is responsible for land use and water resources development in rural areas. The Ministry monitors surface waters in agricultural areas for nitrate and pesticide run-off pollution. It acts as an inspection agency together with the Ministry of Environment for receiving water suitable for fisheries and aquaculture, and for pesticide control.

The Ministry of Public Works and Settlement has an important role in the development of municipal and territorial plans. At the regional level, the SPO is responsible for carrying out the land-use plans, establishing their management rules by providing protection/usage balance. Affiliated to this ministry is the Bank of Provinces, an investment agency in charge of the planning, construction and financing of drinking water and municipal wastewater treatment.

The Ministry of Energy and Natural Resources has two administrations of special importance for environmental issues:

- ? **The General Directorate of State Hydraulic Works (DSI)** established in 1953 is the main investing organization responsible for the development of water and soil resources in general. Its duties are to plan, design and construct works for flood protection, irrigation, drainage, hydropower schemes and water supply. Further responsibilities include carrying out basic investigations, data collection and research related with stream-flow gauging, soil classification, water quality monitoring, river rehabilitation plans and formulation of proposals for construction, financing and subsequent operation and maintenance of the works. It also undertakes the monitoring of surface water in 26 river basins and groundwater. DSI is responsible for the operation and maintenance of the dams.
- ? **The General Directorate of Electricity (EIEI)** is responsible for supplying the energy needs of Turkey, including hydroelectric power stations and large combustion plants.

The State Meteorology Service (DMI) is responsible for building and operating precipitation, climatologic, synoptic and higher atmospheric observation stations, keeping the archives of records of these observations, making weather and sea forecasts based on the evaluation of these observations, and informing the public and the relevant organisations about its forecasts. In addition to weather, climate and sea observations, the SMS has also carried out higher atmospheric ozone observations since 1994 and contributes to the Global Atmospheric Watch Programme of the World Meteorological Organisation (WMO).

The Ministry of Labour and Social Security has joint responsibility with the Ministry of Environment for adopting and implementing legislation aimed at the prevention of industrial accidents at large installations.

The Ministry of Interior has responsibility for local government exercised through the provincial administration. The provincial governors are assigned by the Ministry and are in charge of all local government agencies.

The Ministry of Industry and Trade will have important responsibilities with the Ministry of Environment in the implementation of the EU industrial pollution control sector, especially with regard to industrial pollution prevention and control.

Additionally, the **Undersecretariat of Treasury, Undersecretariat of Customs and Undersecretariat of Foreign Trade** cooperate with institutions with regard to financial issues in particular.

The Ministry of Environment is directly associated at present with the accession process together with the General Secretariat for EU Integration, the Undersecretariat of the State Planning Office and the Undersecretariat of the Treasury, all of which carry major responsibilities for the environment.

Institutionalisation in the environmental sector commenced with the establishment of an Undersecretariat of the Environment, under the Prime Minister's Office, which was later transformed into a ministry in 1991. The fundamental object of institutionalisation was to provide a mechanism for implementing the measures envisaged by the Environment Act, undertaking protection and rehabilitation work, and introducing sanctions to ensure that the regulations were complied with. The Ministry of Environment plays an overall coordinating role for the development and implementation of environmental policies, with these specific duties:

- ? developing projects to determine principles of environmental protection,
- ? developing guidelines and protection principles for appropriate urban and rural land-use,
- ? developing standards in cooperation with the Turkish Standards Institute,
- ? developing regional urban and physical plans including the designation of Ramsar sites,
- ? conducting, approving and ensuring the implementation of environmental plans, taking economic and ecological values into consideration,
- ? ensuring the implementation of environmental impact assessment (EIA)
- ? monitoring and controlling of activities which might have negative impacts on the environment,
- ? establishing laboratories

4-Coordination

Coordination exists between local governmental institutions. The Ministry of Environment is entrusted with mainly coordination at local level and also with international cooperation since one of the major task of this ministry is to ensure coordination among various parties. Focal points are responsible for the follow-up of the related activities.

Example: The MoE, Directorate General of Environmental Protection has coordinated and established working groups with the participation of relevant experts and officials from institutions taking part in the 'Technical Working Commission'.

The SMS is in charge of the coordination of the Working Group related to 'Monitoring of Climate Change in Turkey and Research on its Effects'. The working group is composed of five ministries and one administration.

In addition to the above-mentioned issues, since the MoE has an important role in the harmonisation of the existing legislation within the context of the Accession process to the EU, preparatory works related to the UNFCCC for Turkey when she becomes a signatory are also undertaken by the MoE (e.g. issues on reduction of GHG emissions).

PART C- INTEGRATION OF WATER AND WETLAND RESOURCE MANAGEMENT POLICY AND PRACTICES AND CLIMATE CHANGE

1-Management Policies

At present, there is not a national policy taking the climate change impact on water resources management into account in long-term planning. However concerns related to the climate change issues stipulated in the report of the 'Specialised Commission on Climate Change' will take place in the development plans of Turkey for the first time. The report issued by the SCCC in February 2000, has included necessary information and assessment of the national policies, measures and technologies, difficulties on the climate change issue; sectoral, legal and institutional regulations and requirements, anthropogenic greenhouse gas emissions of Turkey and their projections, and a scientific, technical and politic assessment of climate change. (SCCC, 2000)

2-Applied Practices

In general, the applied practices in water resource management and wetland protection have been designed as remedial/emergency measures and in some cases as preventive actions that have been taken as need has arisen. So far management policies were set for short-term planning in accordance with urgent priority projects instead of implementation of long-lasting policies with integrated resource management approach. The following examples give a better insight:

The existing measures that are applied for water resource management are mainly limited to the operation of the dams. As stipulated in Part B, DSI is responsible by law for the O&M of dams, therefore, it can modify the beneficial water use purposes and operation of dams that were set initially at the planning phase, and this in line with emerging new water patterns as a result of climate change after their commissioning. As a pertinent example, in the Gediz River basin the ten-year operation programme is now being revised with the purpose of changing energy production. Also, the safety of dams is rechecked against flooding and appropriate reinforcement measures are reconsidered.

Based on the monitored example of the Keban Dam in the South-eastern Region, evaporation factor, which might have a significant impact, has raised awareness among various stakeholders in EIA studies. (1million m³ water is evaporated increasing the rainy days record by eight/year). (*Interview with DSI, 2002*)

Environmental flow: The regulations on ‘Environmental Impact Assessment’ dictate the preservation of natural ecosystems and implementation of mitigation measures where a facility is planned. In line with this, ‘environmental flow’ has to be allocated so as to safeguard aquatic ecosystems in the water resources where a facility/activity is planned to be implemented and/or if this may have indirect adverse impacts on ecosystems in connection with the related water resource, e.g. a minimum flow that corresponds to the dry-weather flow of the river must be secured in the river bed. (The trend is to secure 10% of the yearly average flow)

Wetland Conservation: One of the major task of DSI was to drain marshes hosting malaria vectors and causing epidemic in the hot regions of Turkey, in particular. In the early 1960s, malaria epidemic was a severe threat to human health, therefore drainage of several hectares of marshes resulted in loss of wetlands. After the 1970s, the successful result of campaigns to eliminate malaria on the one hand, raising environmental awareness on the other, halted the ill-adapted policy of draining marshes. According to DSI’s records, more than 100 000 ha of marshes were dried out between 1955 and 1970 (See Figure 1)

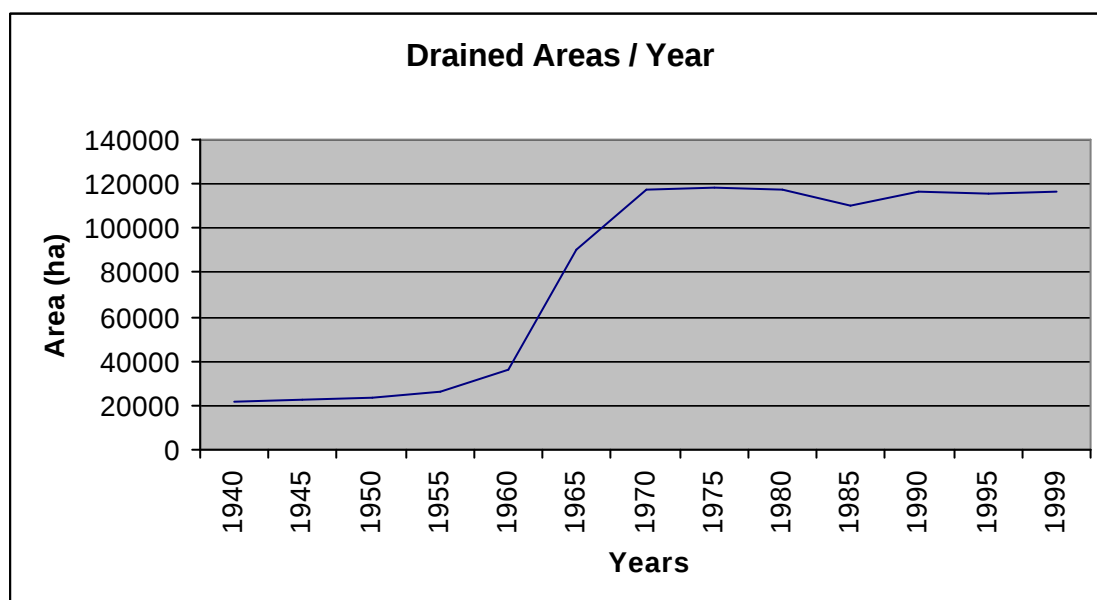


Figure 1. Drained Marshes Between 1955-1999

Land use in flood plains and and/or low land coastal areas: In lowland coastal areas, applied measures are mainly river rehabilitation and/or diversion, implementation of cascade systems to mitigate flood hazard. Terracing method in agriculture in hilly areas is the practice in use as elsewhere to avoid landslides, land loss.

Afforestation to combat erosion is another important activity. The General Directorate of Afforestation and Erosion Control (GDAEC) of the Ministry of Forestry administer Turkey’s afforestation and erosion control activities. By the end of 2001, trees were planted on approximately 2 9001 000 ha of land, including afforestations in and outside the forests, green-belt afforestations, and memorial forest afforestations realised through the contributions of a variety of institutions and organisations.

3-Measures taken in Irrigation

Raising awareness has led stakeholders to some extent to start adopting and investing modern low-water consuming technologies e.g. drip irrigation systems. However this policy is limited to a few cases as pilot study or it is considered within the scope of bilateral financing where utilisation of such techniques is the conditionality of the loan agreement. At present there is no particular measures i.e. incentives and/or economic deterrence by the state to encourage water user associations to initiate such changes although the need for demand management is highlighted at various instances by institutions. The main reason for that is two-fold: The first one is the high capital investment cost; the second is that low water-consuming techniques are not considered as a priority since at present there is no severe water stress experienced in irrigation although warning related to droughts and predicted stress on water resources in various BAU scenarios are given for the near future in the arid regions of Turkey. Different forms of agricultural land use practices in Turkey and changes are given in Table 2.

Different forms of agricultural land use practices and changes are given in Table 2.

Table 2. Agriculture Land Use in Turkey, 1995

Types of Land	1995 (km ²)	Changes from 1970 to 1995 %
Agricultural land	353,640	45% ²
Arable land	243,840	-7.3
Permanent crops land	24,610	-1.5
Permanent grass land	85,190	-5.2
Total Land ¹	779,452	-21.1
		-

Source: Ministry of Agriculture and Rural Affairs (MARA)

¹ Datum area

² Share of agricultural land use in total land

4-Research, data and information systems

The High Committee for Science and Technology of Turkey launched a programme under the auspices of the Scientific and Technical Research Council of Turkey (TÜBİTAK) with the objective of preparing the 'National Energy Technologies Research Programme'. The programme is expected to be fully developed by the end of 2002. In the preliminary report, technical, institutional and financial issues related to R&D have been assessed and strategies to be adopted have been proposed on a phased approach.

Scientific studies on the climatic variability and change that have been carried out after 1990s by universities, research institutes and relevant departments of state institutions are available as most of them are published in Sci. Revues. These studies incorporate mainly researches on:

- ? long-term temperature and solar radiation variations
- ? long-term precipitation trends and variations
- ? water resource development project (energy and irrigation) in the south-eastern region, the GAP Project
- ? marine sciences studies on the neighbouring seas of Turkey

The State Institute of Statistics (SIS) is responsible for the estimation of the greenhouse gas emissions by source and removal by sink. The first comprehensive national greenhouse gas inventory was prepared by using the basic IPCC methodology in 1998 (*MoE, 1998*). SIS has recently carried out a study to re-estimate greenhouse gas emissions resulting directly from agricultural activities (*Türkes, 2000*).

Data is stored by state institutions and is utilised for their project purpose. This data is made available to other institutions either against a fee or within the context of project protocols.

It can be stated that there are constraints with regard to the access to data collected by the institutions, in particular, reluctance for their dissemination on a voluntary and collaborative basis is assessed as an issue. (*Annex 3, list of available studies and institutions involved*)

5- Project Financing

5.1 Options for Foreign Financing

As stipulated in the ‘National Report on Sustainable Development’ issued in October 2002, a detailed study outlining international loan and/or grant programme to finance projects that reduce greenhouse gas emissions does not exist in Turkey at present.

The first effort made on this matter was the study called ‘Energy and Environment’ conducted in 1999 with grant money allocated from the World Bank. Among the issues that were later subject to an in-depth analysis, the ‘Energy Modelling’ and the ‘Energy Demand Estimation’ studies administered by the World Bank with a grant by the Japanese government are expected to outline the extent of Turkey’s investment needs in this field. The World Bank’s Country Assistance Strategy planned to be launched in 2003 will include an item defining loan extension procedures on favourable terms to private sector projects. Public institutions and organisations will serve as intermediaries with the purpose of promoting energy production using renewable resources in Turkey. The estimated amount of the loan is approximately US\$ 200 million.

Additionally, within the context of the accession process to the EU, Turkey made commitments for short-term and medium-term for the adoption of the EU acquis for the ‘Air Quality’ sub-sector. The short-term commitments comprise the preparation of inventories of air pollutants and greenhouse gas emissions whereas the medium-term commitments, the development of programs that reduce greenhouse gas emissions. Table 3 shows CO₂ emissions from fuel combustion.

Table 3. CO2 Emissions from fuel combustion of Energy Sector

Emission sources	1975	1980	1985	1990	1992	1995	1997
Energy and transformation	16,496	20,437	33,279	51,094	56,288	61,271	71,056
Industry	17,673	20,864	24,573	37,385	39,181	41,560	50,303
Transport	15,967	16,024	18,885	26,443	25,871	33,665	34,307
Other (e.g. Residential, agriculture, forestry)	15,072	18,361	24,531	27,805	30,603	32,686	35,982
Total	65,208	75,687	101,267	147,727	151,943	169,181	191,650

Source: SIS

5.2 Joint Implementation

As mentioned in the ‘National Report on Sustainable Development’ after Turkey becomes a party to the UNFCCC as an Annex 1 country, activities implemented jointly can be undertaken in cooperation with one or several of the other Parties included in Annex 1, in accordance with Article 4 of the UNFCCC defining the commitments of the Parties. In this regard, the institutions and organisations, which will carry the full responsibility of these, should urgently be identified and the necessary legal framework established (*National Report on Sustainable Development, 2002*)

The priority areas and corresponding proposed project topics in line with the technology transfer and joint implementation projects mechanisms of the UNFCCC are identified as follows for greenhouse gases reduction and/or limitation in Turkey:

- ? land-use, land-use change and forestry (LULUCF),
- ? high efficiency boiler technologies,
- ? co-generation technologies,
- ? application of advanced technology to heat regeneration systems,
- ? advanced technologies for energy efficiency in buildings,
- ? energy management systems,
- ? increasing energy efficiency in industry,
- ? energy conservation in residential and commercial sectors,
- ? energy efficient production technologies,
- ? reduction of loss in electricity transmission and distribution,
- ? burning technologies in fluidised bed,
- ? advanced energy transformation systems such as fuel cells,
- ? projects and R&D studies on renewable energy resources (*National Report on Sustainable Development, 2002*)

PART D- TOWARD ADAPTIVE STRATEGIES

1-Projections and Effects of Policies and Measures

Major threats to climate change in Turkey due to mainly:

- ? Precipitation (increase in winter, decrease in summer rainfall with increase of evaporation)
- ? Snow cover (decrease)
- ? Seasonal distribution of precipitation and intensity (change)

- ? Flow peak (change)
- ? Sea water level (rise) (*Özgüler, H. 2002 DSI Bulletin*)

would be in the mid-term on:

- ? water resources, (adverse impact on all water uses, e.g. Istanbul has experienced a severe drought in 1990 which has resulted in drastic water shortage in utility water, in particular) local and central institutions have decided to implement new onerous water supply projects and launched enhanced leak detection campaign
- ? decrease in water table level with pollution risk of the aquifers
- ? wetlands (Lagoons and deltas that are very likely to be affected by the rise of the sea water level by approximately 10-20cm resulting in destruction of lagoon systems)
- ? increase in water infrastructure capital costs due to uncertainty

2-Mitigation of Adverse Impacts on Climate Change

Three major strategies should be implemented at the same time so as to mitigate the adverse impacts of climate change:

- A) Emergency measures e.g. flood and drought management and emergency project implementation
- B) Adaptive strategies: Measures to mitigate temporary and/or permanent impact on climate change (Sink Projects)
- C) Long-term strategy: Reduction of greenhouse gas emissions

A) Emergency measures: The Government of Turkey (GOT) assumes full financial responsibilities for disaster recovery, including highways, infrastructure at all levels, telecommunications, electric power transmission, housing, crop and animal loss and agricultural damage. Although there are disaster mitigation activities being implemented by the GOT, there is no national strategy for disaster mitigation. Although the GOT recognises that floodplain mapping and landslide-prone area mapping will mitigate disaster damage, such maps are not being applied to land-use management in most regions of Turkey and enforcement of land-use management is inconsistent. There is no element of government responsible for providing flood or landslide warnings to provinces and municipalities in Turkey.

The technical agencies DMI, DSI and EIE are aware of the warning technologies available, but have not been directed to provide warnings of the type needed, and consequently have never developed the required technical capability to do so. Their current budgets do not include funds needed for the collection of real-time data and their analysis. Furthermore, there is no secure and reliable communications system to deliver disaster warnings to the provinces or municipalities, and the local response plans are not designed to respond to specific, localised warnings.

Example: Flood Damages in the Western Black Sea Region (WBSR)

As a result of extreme rain on May 21, 1998, a flood affected the WBSR with recurrence intervals estimated to range from 200 to 1000 years, several landslides occurred on May 21 and for several weeks thereafter. In WBSR, an area of about

37 000 km² with a population of 2.2 million suffered the worst flooding of the last century. Some 151 rivers overrun their beds and embankments, 478 settlements were left wholly or partially under water.

The TEFER Project (Turkey Emergency Flood and Earthquake Recovery): This project responds to the urgent needs in the flood-affected region. It covers the repair and reconstruction to water and wastewater systems, municipal, rural and forest roads and bridges, irrigation facilities in more than 100 municipalities and villages including mitigation measures comprising flood management and hazard reduction that are:

- ? Basin flood protection planning
- ? Monitoring, forecasting and warning
- ? Investment in flood protection infrastructure
- ? Flood hazard reduction

The project cost is US\$ 369 million and covers the WBSR and three pilot river basins namely, the Simav, Gediz and Büyük Menderes. (*See Annex4Map*)
(*The WB Project Appraisal Report for the TEFER Project, 1998*)

B) Adaptive strategies: In the ‘National Report on Sustainable Development’, it is stipulated that Turkey is able to cooperate particularly with the EU member states and/or undertake joint activities to mitigate the possible adverse impacts of climate change on forest ecosystems, develop adaptive policies and techniques, take counteractive measures and protect forest assets, land and water resources. The decision concerning agriculture, meadows/pastures and forestry of the Bonn Agreement dated July 2001 of the UNFCCC may be of particular use for Turkey
(*National Report on Sustainable Development, 2002*)

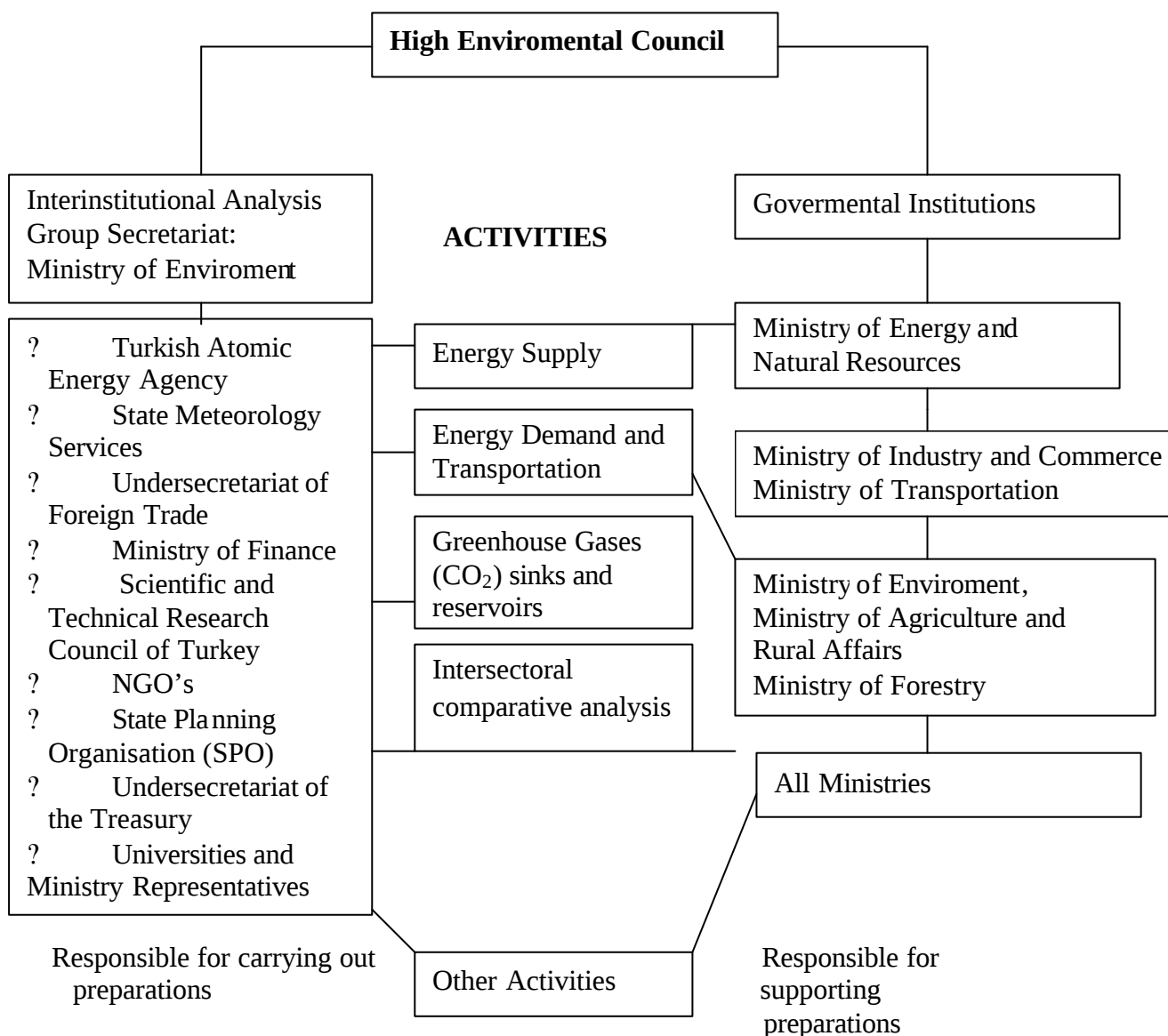
In this regard, participation of Turkey to the R&D studies conducted in these countries and complementary support should be made possible.

Sink Projects: Turkey may seek international cooperation, joint projects and financial resources through ‘joint implementation projects’ under the UNFCCC and the flexibility mechanisms of the Kyoto Protocol such as ‘Clean Development Mechanism’ and ‘Joint Implementation Projects’.

C)Long-term Strategies-Reduction of greenhouse gas emissions: An overview of Turkey’s actions aiming at reducing and/or limiting the levels of greenhouse gases caused by different sectors shows that energy conservation proved to be the most successful means of mitigation measures that have been taken so far. Projects to be developed on joint implementation are enumerated in Section 4.2 of Part C.

Within the framework of the ‘Proposal for Green House Gas Emissions Reduction National Program and Action Plan’ made at the Strategic Committee on Climate Change of the eight five-year development plan, the following flow chart was designed to be made operational:

Flowchart of the Proposal for Green House Gas Emissions Reduction National Program and Action Plan



(Ref. Report of the Specialized Commission on Climate Change, 1999)

In the SCCC report, it is stipulated that prior to any action to be taken related to UNFCCC, the Ministry of Environment should be strengthened so as to be able to apply the required environmental policies with efficiency and sustainability. In order to formulate a 'National Strategy on Climate Change' or a 'National Climate (Change) Programme', and ensure coordination among scientific studies and activities within the existing institutional structure, it is of utmost importance to delegate this task through a regulation and/or legislative tool.

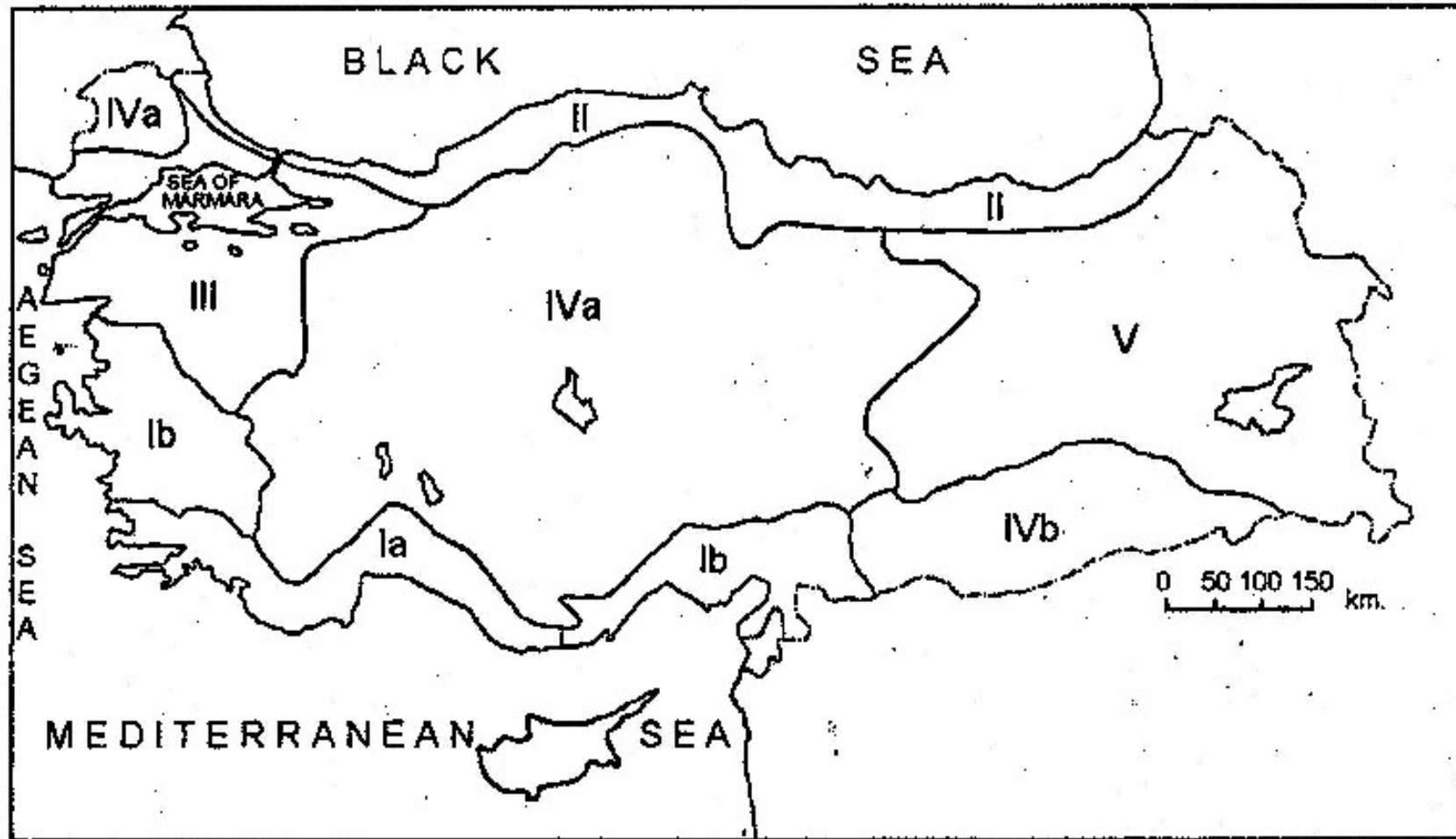
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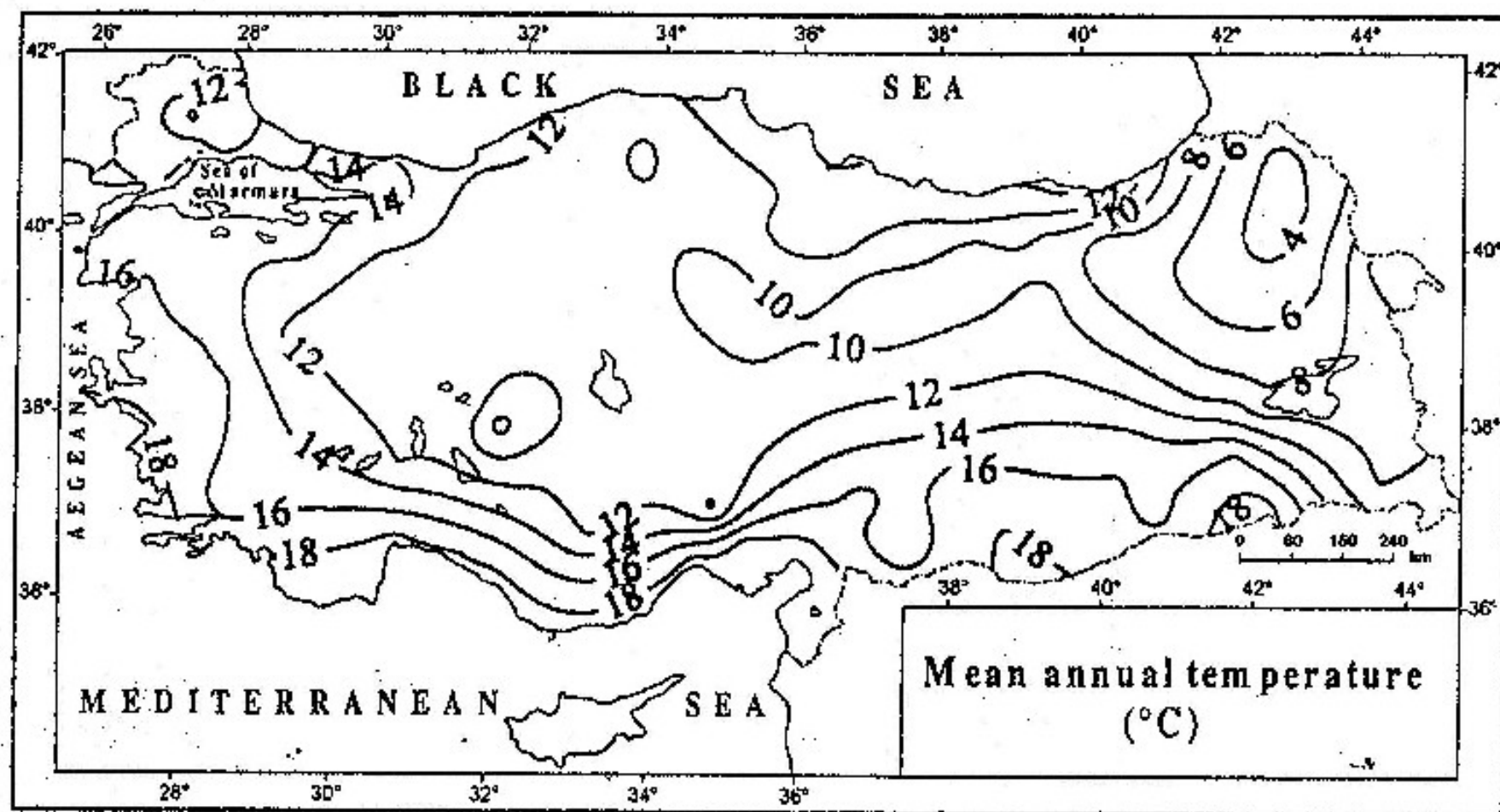
- 1-National Report on Climate Change, (Ministry of Environment November 1998)**
- 2-National Report on Sustainable Development, (Ministry of Environment, UNDP, July 2002)**
- 3-Özgüler, H., (Global Climate Change and Possible Impacts on Turkey's Water Resources-DSI Bulletin, June 2002)**
- 4-Report of the Specialized Commission on Climate Change, 1999)**
- 5-The WB Project Appraisal Report for the TEFER Project, 1998)**
- 6-Türkes, M.; Possible Impacts of Global Climate Change on Agriculture and Water Resources-Panel on the Impacts of Climate Change on Agriculture, June 2001)**
- 7-Türkes M.,(Climatic Change Studies and Activities in Turkey ; Advanced Seminar on Climate Effects on Agriculture in the Mediterranean Region, Zaragoza, 25-29 September 2000)**
- 8-Interview with officials, experts and scientists from the Ministry of Environment, State Hydraulic Works, State Meteorological Service, Technical University of Istanbul**

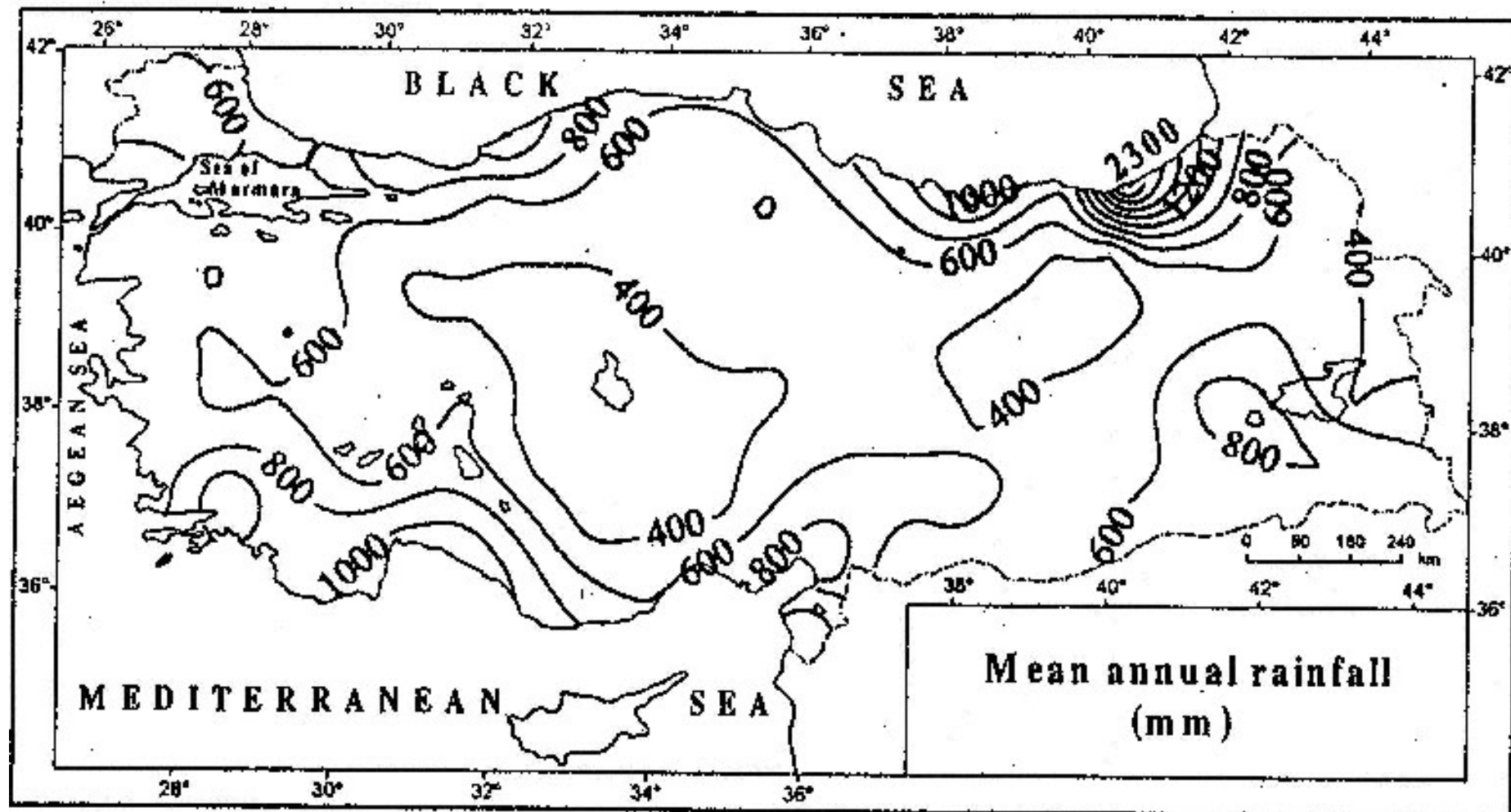
ANNEXES
ANNEX 1
Geographic Regions of Turkey



Climatic Regions of Turkey







ANNEX 2

Terms of References of the Coordination Committee on Climate Change

The TOR are available in Turkish and define mainly the:

1-Tasks, Duties and Objectives of the Committee

2-Operational Procedures

3-Secretariat Services

4-Technical Working Commission

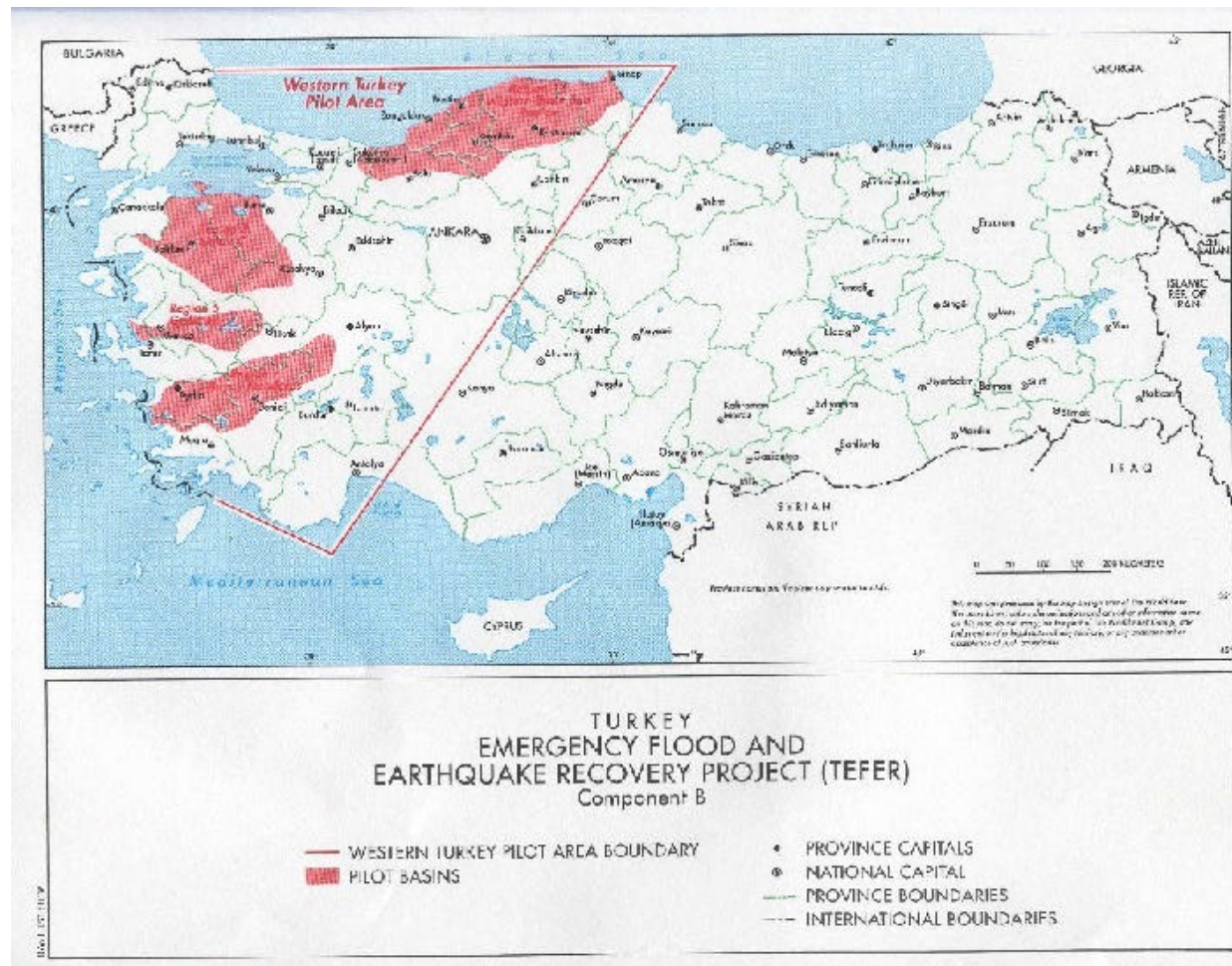
ANNEXE 3

List of Institutions Involved in Climate Change Studies

Scientific studies on climatic variability and change have been carried out since ten years, the previous ones being mostly based on climatologic, aridity and humidity conditions of Turkey. The State Meteorology Service (DMI), meteorology, geography departments and marine research institutes of Turkish Universities have mainly conducted these studies. These institutions are listed as follows:

- ? Research Department of Turkish State Meteorology Service, Kalaba, Ankara
- ? Department of Geography of Istanbul University, Vefa-Istanbul
- ? Department of Geography of Ankara University, Sıhhiye-Ankara
- ? Department of Geography of Aegean University, Bornova-Izmir
- ? Department of Meteorology, Istanbul Technical University, Maslak-Istanbul
- ? Institute of Marine Sciences, Middle East Technical University, Erdemli-Içel
- ? Institute of Marine Sciences and Management, Istanbul University, Vefa-Istanbul
- ? Institute of Environmental Sciences, Bosphorus University, Bebek-Istanbul
- ? Department of General Geology and Eurasia Institute of Earth Sciences, Istanbul Technical University, Maslak-Istanbul

ANNEX 4



The TEFER Project location map.