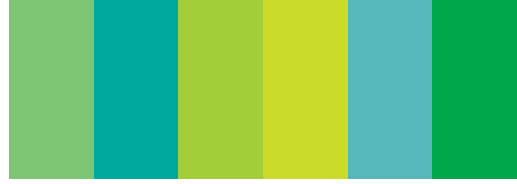


# Turkey's National Climate Change Adaptation Strategy and Action Plan







# Turkey's National Climate Change Adaptation Strategy and Action Plan

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# Abbreviations

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<b>AFD</b>	Agence Française de Développement
<b>ARDSI</b>	Agriculture and Rural Development Support Institution
<b>ARIP</b>	Agricultural Reform Implementation Project
<b>CAE</b>	Chamber of Agriculture Engineers
<b>CATAK</b>	Environmentally Based Agricultural Land Protection
<b>CBCC</b>	Coordination Board on Climate Change
<b>CMB</b>	Capital Market Board ( <i>SPK</i> )
<b>CoHE</b>	Council of Higher Education
<b>CORINE</b>	Coordination of Information on the Environment Project
<b>DA</b>	Development Agencies
<b>DEMP</b>	Disaster and Emergency Management Presidency ( <i>AFAD</i> )
<b>DGAR</b>	General Directorate for Agricultural Reform ( <i>TRGM</i> )
<b>EBRD</b>	European Bank for Reconstruction and Development
<b>EE</b>	Energy Efficiency
<b>EIA</b>	Environmental Impact Assessment
<b>EIB</b>	European Investment Bank
<b>EIE</b>	General Directorate of Electrical Power Resources Survey and Development Administration
<b>EIS</b>	Environmental Information System
<b>EMRA</b>	Energy Market Regulatory Authority ( <i>EPDK</i> )
<b>EU</b>	European Union
<b>FAO</b>	United Nations Food and Agriculture Organization
<b>GAP</b>	Southeastern Anatolia Project Regional Development Administration
<b>GDP</b>	Gross Domestic Product
<b>GDM</b>	General Directorate of Meteorology ( <i>MGM</i> )
<b>GEF</b>	Global Environment Facility
<b>GIS</b>	Geographic Information System
<b>GM</b>	Greater Municipalities
<b>HPP</b>	Hydroelectric Power Plant
<b>ICCAP</b>	Impact of Climate Change on Agricultural Production in Arid Areas
<b>IEA</b>	International Energy Agency
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>KAMAG</b>	Support Program for Research and Development Projects of Public Institutions
<b>KOSGEB</b>	Small and Medium Scaled Enterprises Development Organization
<b>LA</b>	Local Authorities
<b>LC</b>	Land Consolidation
<b>LULUCF</b>	Land Use, Land-Use Change and Forestry
<b>MCT</b>	Ministry of Culture and Tourism
<b>MENR</b>	Ministry of Energy and Natural Resources
<b>METU</b>	Middle East Technical University
<b>MEU</b>	Ministry of Environment and Urbanization

<b>MEUA</b>	Ministry for European Union Affairs
<b>MFA</b>	Ministry of Foreign Affairs
<b>MFAL</b>	Ministry of Food, Agriculture and Livestock
<b>MFWW</b>	Ministry of Forestry and Water Works
<b>MIA</b>	Ministry of Internal Affairs
<b>MoCT</b>	Ministry of Customs and Trade
<b>MoD</b>	Ministry of Development
<b>MoE</b>	Ministry of Economy
<b>MoF</b>	Ministry of Finance
<b>MoH</b>	Ministry of Health
<b>MoNE</b>	Ministry of National Education
<b>MTMAC</b>	Ministry of Transport, Maritime Affairs and Communications
<b>MSIT</b>	Ministry of Science, Industry and Technology
<b>NAMA</b>	Nationally Appropriate Mitigation Action
<b>NCCAP</b>	National Climate Change Action Plan
<b>NCCS</b>	National Climate Change Strategy
<b>NGO</b>	Non-Governmental Organization
<b>NPC</b>	National Productivity Center
<b>OECD</b>	Organization for Economic Co-operation and Development
<b>ORBIS</b>	Forestry Information Systems
<b>OR-KOOP</b>	Central Union of Turkish Forestry Cooperatives
<b>PA</b>	Privatization Administration
<b>PPA</b>	Public Procurement Authority
<b>Pro. Dir.</b>	Provincial Directorates
<b>R&amp;D</b>	Research and Development
<b>RE</b>	Renewable Energy
<b>REC</b>	Regional Environmental Center
<b>REDD+</b>	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
<b>RER</b>	Renewable Energy Resources
<b>RI</b>	Research Institute
<b>SCST</b>	Supreme Council for Science and Technology
<b>SFM</b>	Sustainable Forest Management
<b>SHW</b>	General Directorate of State Hydraulic Works ( <i>DSİ</i> )
<b>SME</b>	Small and Medium Scaled Enterprises
<b>SPA</b>	Special Provincial Administration
<b>SPO</b>	State Planning Organization
<b>TAGEM</b>	General Directorate of Agricultural Research
<b>TAKEP</b>	Turkey Agricultural Drought Action Plan
<b>TARSIM</b>	Agricultural Insurance Pool
<b>TBB</b>	Union of Municipalities of Turkey
<b>TEFER</b>	Turkey Emergency Flood and Earthquake Recovery
<b>TEIEN</b>	Technical Assistance for the Establishment of Turkish Environmental Information Exchange Network
<b>TIGEM</b>	General Directorate of Agricultural Enterprises
<b>TKDK</b>	Support Authority for Agricultural and Rural Development



<b>TOBB</b>	The Union of Chambers and Commodity Exchanges of Turkey
<b>TSE</b>	Turkish Standards Institute
<b>TSKB</b>	Industrial Development Bank of Turkey
<b>TTGV</b>	Technology Development Foundation of Turkey
<b>TUBA</b>	Turkish Academy of Sciences
<b>TUBITAK</b>	The Scientific and Technological Research Council of Turkey
<b>TUBITAK MRC</b>	TUBITAK Marmara Research Center
<b>TUGEM</b>	General Directorate of Agricultural Production and Development
<b>TUOP</b>	Turkey's National Forestry Programme
<b>TURKSTAT</b>	Turkish Statistical Institute
<b>TUSIAD</b>	Turkish Industry and Business Association
<b>UCES</b>	EU Integrated Environmental Approximation Strategy
<b>UCTEA</b>	Union of Chambers of Turkish Engineers and Architects
<b>UN</b>	United Nations
<b>UNCBD</b>	United Nations Convention on Biological Diversity
<b>UNCCD</b>	United Nations Convention to Combat Desertification
<b>UNDP</b>	United Nations Development Programme
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>UNIDO</b>	United Nations Industrial Development Organization
<b>Unv.</b>	Universities
<b>VCM</b>	Voluntary Carbon Market
<b>WHO</b>	World Health Organization
<b>YIGM</b>	General Directorate of Construction Affairs

## Abbreviations in Tables

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<b>US</b>	Adaptation Water Resources
<b>UT</b>	Adaptation Agriculture and Food Security
<b>UO</b>	Adaptation Ecosystems, Biodiversity and Forestry
<b>UA</b>	Adaptation Natural Disaster Risk Management
<b>UİS</b>	Adaptation Public Health
<b>UYK</b>	Adaptation Crosscutting Issues

# Foreword



The universe that shelters human kind as well as all its living and non-living existence has been carefully created in a certain order and balance. But it is globally acknowledged that the life style humankind pursues for his needs in his journey of existence within the rapidly flowing time, causes a disruption in the climate system. Concrete data obtained scientifically prove that greenhouse gases caused by human activities result in global climate change. Even worse is that we will continue to experience for hundreds of years, the effects of climate change caused by human - induced greenhouse gases and that remain in the atmosphere for long years.

The impacts of these changes occurring in our old world affect our country like all other countries. Therefore while measures are being taken to control and reduce human-induced greenhouse gases, the process of strengthening, developing and implementing strategies is crucial for adapting benefiting from and managing the impacts of climate events.

In this context on May 24, 2004 our country became an official party to the United Nations Framework Convention on Climate Change (UNFCCC) which has been in force since 21 March 2004. Turkey highlights the necessity that the policies and measures implemented in combating climate change must be defined according to each country's potential and skills. The fact that Turkey will be one of the most impacted Mediterranean countries that it is an agriculture country, that her water resources are rapidly diminishing, and that tourism is her important income makes it an obligation for us to attach the required importance on adaptation studies.

The fourth report of the Intergovernmental Panel on Climate Change stresses that "the cost of mitigation and adaptation activities in combating climate change will be much lower than the cost of the damage caused by climate change if no measures are taken". Whatever its impact, changing climate conditions will impact many human related areas from natural resources to the socio-economic structure.

Sustainable development will be attained with reducing impact costs if legal regulations are continued through the strengthening of current legislative, technical, political and administrative infrastructure in addressing climate change, and if progress is made in increasing infrastructure investments, water and transportation plans as well as urban and land use plans for adapting to climate change.

Adaptation enables communities to cope with the negative impacts of global climate change, benefit from these impacts where appropriate and manage these impacts. Solutions will generally be possible in line with sustainable development through taking measures that will minimize climate risks.

In reality, climate change adaptation is possible only through a good understanding of its impacts so that the best methods can be established in addressing these impacts. Climate change adaptation is not a one step action but a continuous process.

When infrastructure investments, water and transportation plans, building designs, urban and land use plans are prepared taking into consideration climate change; the costs of impacts will be minimized.

Our nation with its rooted and rich civilization and who perceives the environment as an entrustment will continue to sustain its human life at peace with nature, and continue to develop policies that will show maximum sensitivity in the preparation of urban settlement plans.

Water Resources Management, Agriculture and Food Security, Ecosystem Services, Biodiversity and Forestry, Natural Disaster Risk Management and Public Health sectors which have been acknowledged as vulnerable areas through participatory processes supported by technical and scientific studies as well as by Turkey's National Climate Change Adaptation Strategy and Action Plan will be focused on.

The targets we have identified regarding issues such as the improvement of irrigation methods in agricultural production, food security, development of systems for the reuse of water, preparation of drought action plans, conservation of biodiversity, natural disaster risk management and public health are cited in detail in our Adaptation Strategy.

These studies occupying an important place in many areas of our lives in a climate-rich geography where four seasons are experienced are very promising for a rapidly growing Turkey. Because we believe that the investment we make in the environment is really an investment we make in people and the future.

I hope that this valuable study, which aims to integrate climate change adaptation into national, regional and local policies in line with sustainability and in the framework of Turkey's development goals will set an example to other projects required in this field and will contribute to the development of our country's adaptation capacity. I would like to particularly thank all institutions under our coordination board on climate change as well as our universities, non-governmental organizations and the United Nations Development Programme for the support they have provided.

Erdoğan BAYRAKTAR  
Minister of Environment and Urbanization





# Introduction

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## a. Global Look

The fact that climate change will lead to consequences other than expected natural impacts on the planet's transformation process necessitates urgent measures for lightening the negative impacts we will be facing. Being an issue beyond an environmental problem at the global level, climate change will continue to affect the world in the long term. Today, it is a scientifically proven fact that the planet will face increase in temperatures and changes in precipitation in the coming decades.

In the last 100 years the global climate has gotten 0.5°C warmer due to greenhouse gas emissions partially caused by human activities. The research of English scientist Stern indicates that global temperatures will continue to increase between 0.5° and 1°C even if emissions stop as of today.<sup>1</sup> Climate models prepared within this research envisage a temperature increase between 1.4° and 5.8°C in the next hundred years unless measures are taken to critically reduce emissions. These changes will render the globe's hydrological cycle unstable to a great extent, will cause bigger changes in precipitation and water flow and will increase the intensity of extreme hydrological events.

As a result of increased terrestrial and marine temperatures and changes in precipitation amount and types due to climate change, risks of global average sea level rise and coastal erosion are also increasing and increased intensity in natural disasters linked to weather conditions are being witnessed. Changing water levels, temperatures and flows affect the integrity of the ecosystem as well as affecting food supply, agriculture, health, industry, tourism and transportation sectors. Today communities in certain regions of the world face with the negative impacts of climate change at a greater extent and more frequently.

Extreme climate events cause considerable economic and social impacts. The infrastructure (buildings, transportation, energy and water supply) sector is also affected from climate change in this sense and this poses a threat for densely populated settlements. Sea level rise as a result of climate change brings a new dimension to the impacts on infrastructure. In this sense, plans for terrestrial and marine areas including the

<sup>1</sup> *Nicholas Stern, The Economics of Climate Change, The Stern Review, 2007, Cambridge.*

transportation, regional development, industry, tourism and energy sectors require a more strategic and long-term approach. It is inevitable that the tourism sector will also be negatively affected from decreasing snow cover in mountainous areas and increasing temperatures in the Mediterranean Region.

Measures taken against climate change follow two inter-related methods. The first is lightening negative impacts, in other words reduction of greenhouse gases and the second is adapting<sup>2</sup> to these impacts. It is known that even if the world's greenhouse gas emissions are limited and gradually reduced, it will require time for the planet to eliminate the greenhouse gases that exist in the atmosphere today. This situation shows that even if efforts for reducing global emissions prove to be successful adapting to the impacts of climate change is necessary regardless. Specific scientific projections present that the world will visibly face the impacts of climate change in the next 50 years.

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)<sup>3</sup> states that adaptation efforts carry great importance in managing the impacts of climate change and that climate change adaptation is the only tool for taking measures against the impacts caused by emissions as a result of a historic process. It is stressed that this situation brings taking measures for climate change adaptation on the agenda and that a strategic approach needs to be adopted at the regional and country level as well as ensuring harmony between various sectors and management levels in order to take these measures in a timely and more effective manner. In the present situation, as it is not possible to completely offset the impacts of greenhouse gases, the second method, in other words the need to adapt to the impacts of climate change is becoming increasingly important. In reality, adapting to the impacts of climate change aims for the livelihoods and economies of people and natural systems to be less affected from the changes caused by the climate and in some cases to benefit from adaptation. Among the measures to be taken for adaptation are important issues such as increasing the resistance of the agriculture sector against drought, reducing flood risks through more storage and infrastructure management and integrated management of water resources. Moreover, in certain cases, mitigating the negative consequences of climate change in other words reducing greenhouse gas emissions and adaptation strategies are closely linked and can be complementary.

**The challenge, policy-makers face in terms of combating climate change is; understanding the impacts of climate change, identifying strategies for adapting in the most suitable way and implementing these via rational policies.** In fact, strategies that focus on sustaining the functions of ecosystems in a healthy and effective way, and the management and conservation of water, land and biological resources are important means for coping with the impacts of climate change. In terms of adapting to the impacts in urban and rural areas, even giving importance to physical infrastructure can be effective in adapting to climate change. "Green infrastructure" as the European Union expresses it, can play a vital role in efforts for adapting to climatic conditions within social and economic dimensions.

**Even if solid measures for limiting global greenhouse gas emissions are taken on time, it is no longer possible to completely prevent warming due to the course of the climate.** This situation sufficiently displays the need for measures and strategies for adapting to the impacts of climate change.

In reality, adaptation is a strong defence measure that reduces the size of the possible damage. Adaptation strategies rather provide a complementary approach for decreasing negative results. While the mitigation of negative results is regarded as reducing the possibility of negative conditions to arise; adapting can be seen

<sup>2</sup> Adaptation: Adapting to the impacts of climate change. In the narrow sense, harmony with/adjustment to new and changing environments. In the broad sense, reducing the vulnerability level against climate change and variability that are real or envisaged to occur in natural and human systems; or adjustments that aim to benefit from its opportunities.

<sup>3</sup> IPCC published its first Assessment Report in 1990. Following this report, the Second, Third and Fourth reports were published in 1995, 2001 and 2007 respectively. As of today the IPCC Fourth Assessment Report (2007) is up-to-date. IPCC's Fourth Assessment Report (2007) took 6 years to prepare and 2500 experts from 130 countries, 450 primary authors and 850 supporting authors have contributed to the report.

as reducing the intensity of many impacts given that negative conditions persist. In short, adaptation reduces the level of the possible damage. However, adaptation is not a risk management strategy free of costs and problems. When the benefit of a measure is being evaluated, the estimated value of the harm that will be avoided needs to be carefully compared with the real costs of implementing an adaptation strategy. This is because adaptation is not a step that occurs in on ego but rather a continuous process. Although research on the impacts of climate change provides a support for understanding climate change, steering is needed for identifying appropriate strategies and policies for adaptation. In reality adapting to changes in the environment is a fundamental human character and is not a new concept. For centuries, human communities have shown that they have a strong capacity in adapting to different climates and environmental changes even if they weren't always successful. As the dispersed and climatically different distributions of the settlements in the world have proven; human beings have learned how to show development in various climate regimes ranging from cold to warm and humid to dry air. The flexibility and resistance shown in various settlements proves the inherent will and to some extent the capacity for adapting.

**The success in adapting to climate change in social systems however, depends on the availability of the necessary resources.** These resources are not only made up of financial and natural resources but consist knowledge, technical capacity and institutional resources. The types and levels of necessary resources depend mostly on the nature and speed of the real or expected environmental/climatic change and the measures that are planned to be taken.

Climate change adaptation processes in social and natural systems are complicated and dynamic to a great extent and usually consist dependencies and information feedback flows regarding existing local and financial conditions. The complexity, scope and limited experience on anthropogenic climate change show the limited level of applied research regarding adaptation up-to today, departure from mechanic hypotheses and the common use of scenarios and historical comparisons. Moreover, several social, economic, technological and environmental trends will determine the future capability of social systems o adapt to climate change.

**From the ecosystems point of view, addressing climate change adaptation in terms of the conservation of ecosystems is crucial.** The reason for this is that while biological systems can cope with uninterrupted and continuous small (or slowly occurring) shocks, even small changes in the climate can be irritating for many ecosystems and species. In addition many species in the world are in a difficult situation due to various factors including urban development, pollution, alien species and fragmented (or separated) habitats. When these conditions combine with the rapid realization of envisaged climate change, they can reduce the resistance of many species as well as their chance to adapt.

On the other hand, increasing levels of welfare and developing technology will most probably increase resources and capacity necessary for adapting to climate change. These trends should be taken into consideration when evaluating the character and scope of future adaptation measures as well as their probability of succeeding.

Moreover, telling that the society can “adapt” as a whole does not mean that regions and people will not be harmed. For example the agriculture sector can successfully adapt as a whole but some regions may suffer losses while other regions acquire gains. For example it is envisaged that many regions in the north of USA will adapt to climate change by benefiting from changing climate conditions to increase agricultural production while the agriculture sector in southern regions will downsize due to a more hot and arid climate. Farmers who do not benefit from adaptation measures can lose their livelihoods. Moreover, individuals or groups in these regions or other regions can be under risk as they will be negatively affected from climate change and as they

lack the capacity to adapt. This is especially valid for low-income individuals or groups whose livelihoods are dependent on resources that are under risk due to climate change.<sup>4</sup>

**Climate change is an issue of sustainable development.** Planning on the impacts of climate change and managing risks that arise from these impacts in fact means supporting governments in their sustainable economic growth. Strategies developed for adapting to the impacts of climate change draws more attention to risks and reference to the possible benefits of climate change is not adequately given. However in certain sectors and in the agriculture sector in particular awareness has started to rise lately on the possible benefits of adapting to climate change. Moreover, on the contrary to the efforts for reducing emissions, most measures aimed at adaptation provide local benefits before long.

## b. Turkey and Climate Change

In the case of increases in the global temperature of up-to 2°C; the expected impacts in the Mediterranean Basin of which Turkey is situated in, show the extent to which measures taken against the impacts of climate change need to be programmed.

In the Fourth Assessment Report of the IPCC it is indicated that a 1°C - 2°C increase in temperatures in the Mediterranean basin would be observed, that aridity will be felt in an even wider area, and heat waves and the number of very hot days will increase especially in inland regions. For Turkey, on the other hand, the average increase in temperatures is estimated to be around 2.5°C - 4°C, reaching up to 5°C in inner regions and up to 4°C in the Aegean and Eastern Anatolia. The IPCC report and other national and international scientific modeling studies demonstrate that Turkey in near future will get hotter, more arid and unstable in terms of precipitation patterns.

Turkey's First National Communication on Climate Change prepared in 2007 indicates the impacts of climate change in Turkey as; increasing summer temperatures, decreasing winter precipitation in western provinces, loss of surface water, increased frequency of droughts, land degradation, coastal erosion and floods.

This situation is expected to have; negative impacts on water and soil resources that are necessary for food production and security and therefore on development estimates in rural areas, and; gradual increase of these impacts' severity. For example it is anticipated that 50% of the surface waters in the Gediz and Greater Menderes Basins will be lost by the end of the century and that water scarcity will be faced in agricultural, domestic and industrial water usages.

Although the impacts of climate change in Turkey seem to pose a serious threat in the future, it is also envisaged that these impacts will bring with them some opportunities if planned carefully. It is crucial that this situation is addressed in terms of the pressures on natural resources and water resources in particular and in terms of the bottlenecks or opportunities in the development of climate-dependant sectors.

Diminishing water resources, forest fires, drought, desertification and ecological degradation linked to these are the impacts of climate change that are evident in Turkey. Climatic forecasts that are carried out within the scope of the UN Joint Program on Enhancing the Capacity of Turkey to Adapt to Climate Change also produced similar outputs to support other work, indicating noticeable temperature increases and a precipitation regime that can impact all economic sectors, all settlements and climate-related natural disaster risks. The latter, in other words, is the alteration of the water cycle. An interpretation of this data would only emphasize an obvious impact of changes in temperature and precipitation patterns on closely related areas such as **water resources**,

<sup>4</sup> The "Coping with Global Climate Change, the Role of Adaptation in the United States of America" has been prepared by William E. Easterling III for Pew Global Climate Change Centre. Pennsylvania State University: Brian H. Hurd, New Mexico State University: Joel B. Smith, Stratus Consulting Inc, June 2004.



**agricultural production, public health and natural disaster risks; and ecosystem services** that provides raw materials for economic activities and that directly affect the amount and quality of basic inputs such as water, to manufacturing activities.

National Climate Change Adaptation Strategy and Action Plan have focused on five important fields which are supported by technical and scientific studies and participatory processes.

- Water Resources Management
- Agricultural Sector and Food Security
- Ecosystem Services, Biodiversity and Forestry
- Natural Disaster Risk Management
- Public Health

### **Water Resources Management**

Projections for the year 2100, suggest that precipitation will be observed instead of snowfall during wintertime as a result of increasing temperatures. Also, the snow cover would melt faster and join surface runoff. Also, changes in the annual frequency and impact of precipitation patterns would change. Shifting precipitation patterns from snowfall to rainfall and faster melting snow covers would lead to water shortages in elevated areas where urban and agricultural water requirements and supply are regulated on the basis of 'the snow load' throughout the year. And these shortages would hit at times when water demand is highest.

Such an alteration of the water cycle would lead to considerable changes in the supply and quality of water resources, and impact many climate based sectors, including food production, in which water is vital. Increasing temperatures in Turkey as a result of climate change would lead to increased summer temperatures, reduced winter precipitation (especially in the western provinces), loss of surface waters, more frequent arid seasons, degradation of soil, erosion in coastal regions and floods all of which are direct threats to water resources.

### **Agriculture Sector and Food Security**

As said, climate change will lead to shifts in water cycle and temperatures; and to seasonal alterations. These changes will inevitably have direct impacts on the agriculture sector that is directly linked to and controlled by these systems. As a result of changes in temperature and precipitation patterns, impacted area from agricultural pests will expand and number of species concerned will increase. Climate change will affect production, production sites and stockbreeding activities. The volume and frequency of these changes as well as the possibility of increased occurrence will lead to a higher risk of reduction in agricultural yield. All these are directly related to food safety.

Impact of climate change on agriculture sector is pivotal for food safety because in Turkey agriculture is the priority sector for socio-economic reasons and it is where the population's food supply mostly comes from. As a result of impacts of climate change, amount of water for agriculture will diminish, quality of water will decrease, biodiversity and ecosystem services will be lost, sustainable agricultural production patterns will change, pastures will degrade, stockbreeding activities will be affected and farmers will find themselves incapacitated in terms of adaptation to climate change; and all these will eventually risk food security.

Climate change in Turkey is expected to lead to increasingly negative impacts on water and soil resources and rural development that are vital for food production and food safety. For example, in the Gediz and the Greater Menderes Basins in the Aegean coastline, a 50% reduction in surface waters is expected towards the end of this century, leading to severe water shortages in agriculture, settlement areas and industry. Also, as a result of increasing temperatures and waning water resources in the Mediterranean Region, Tourism sector is expected to be negatively affected.

These are the long-term impacts of climate change. Turkey is already striving to protect its vulnerable coastal regions and water resources and trying to adapt its agricultural activities to the existing climatic conditions.

### **Ecosystem Services, Biodiversity and Forestry**

In addition to ever-growing losses in terrestrial and marine ecosystems, climate change will also result in loss of biodiversity. This will significantly affect species, ecosystems that are crucial for the society and related services. Ecosystems have a direct role in the formation of the carbon-storing topsoil, wetlands and climatic regulations. It is also well known that saline marsh ecosystems and sand dunes provide protection against storms.

Climate change, probably along with other changes in forest health and fertility is already causing alterations in the geographical distribution of some tree species. Climate change, further increases the stress on sectors such as fishing and aqua-production; and as a result of climate change, there will be more coastal erosions and exorbitant impacts on coastal and marine ecosystems.

### **Natural Disaster Risk Management**

The frequency, magnitude and nation-wide geographical distribution of natural disasters like floods and drought triggered by the changes in the water cycle are expected. Surging surface water in winter will necessitate additional measures against floods and improvement of the existing infrastructure. Similarly, there are regions where the impact of precipitation will increase. So, in rural and in urban areas there will be flood risks or existing level of risk will be higher.

According to the IPCC, a possible change in climate in the future will increase the frequency, the scope and duration of forest fires in Turkey, depending on the length and severity of the warm and arid seasons. Adaptation actions for forest fires are based on targets focusing on identification and mitigation of risks. Another dimension of impacts of climate change is forest fires and these are considered as yearlong dangers in the Mediterranean Basin, especially in the south, increasing number of forest fires all year long. This increase is believed to lead to a spread of invasive species, which in return will lead to increased forest fire scope.

### **Public Health**

Changing climatic conditions will also have significant impacts on human health. This process has actually started. The more frequent extreme climate events become, the more diseases that are linked to weather conditions will be observed and deaths will increase. As shown in diagrams above, for example, an increase in the number of consequent very hot days will directly affect the elderly and acute health problems in people with chronic cardiovascular diseases. The increased flood risk as a result of climate-change will also increase the risk of contagious diseases and affect areal distribution of such diseases. Increasing human mobility through migration and tourism will promote disease-causing microorganisms, vectors and other diseases in new environments to where, due to rising temperatures, they will find new areas to live and new risks will arise. Moreover, climate change will also lead to serious risks such as contagious diseases transferred by pests such as zoonoses<sup>5</sup>.

<sup>5</sup> Zoonoses: Infections and diseases which are naturally transferred between human and animals (WHO)



# 2

## The Need for a National Climate Change Adaptation Strategy in Turkey

The information in this section has been taken from the draft report of Turkey's Second National Communication to UNFCCC.

### a. Climate Change Projections for Turkey

Human influence on Earth's climate is now accepted as a well-tested scientific hypothesis; therefore both mitigation and adaptation are imperative for a sustainable future at all levels of social organization. Starting point of any adaptation effort is information concerning what the future will bring; one needs as detailed as possible assessment of how natural and human-built systems will behave under climatic change, and in turn, such an assessment is in desperate need of information on the future of climate at appropriate space scales and for several time horizons. Our climate projections have to make also assumptions on the future of the composition of the Earth's atmosphere: Climate simulations that IPCC AR4 is based upon provide such information assuming several atmospheric greenhouse gas concentration scenarios of SRES Report.

The main shortcoming of the information one can derive from these global climate/earth systems models (hereafter referred as GCM) studies is related to their spatial resolution, which is usually on the order of several hundreds of kilometers. Spatial scale issue can be resolved by 'downscaling' the output of global earth system models to scales useful/meaningful for climate impact assessment studies. This 'downscaling' can be achieved either with the help of a regional climate model (i.e. dynamical downscaling) for a given region, or by relating large-scale information from global models to station data through a statistical model (i.e. statistical downscaling). Most of the 'regionalization' efforts of the last five years in Turkey were concentrated on dynamical downscaling, for a high resolution regional climate model can reproduce many physical aspects of the regional climate phenomena, therefore bringing in a higher level realism along with better spatial information.

There is some substantial climate simulation studies focused on Turkey and its surrounding region in recent years. Regional climate change simulation based on the IPCC A2 scenario over Eastern Mediterranean for the last 30 year of the twenty first century has been investigated by Önoğlu and Semazzi (2009) and some of the highlights from this study have been reported in First National Communication of Turkey on Climate Change (2007). In this study, the highest seasonal temperature increase for entire Turkey has been reported for the summer, 4.3 °C. In addition, very distinctive change in future precipitation of winter season has been noted

for the Black Sea region (increase) and the Mediterranean region (decrease) of Turkey (Önol and Semazzi, 2009). The similar pattern change in precipitation produced by climate projections has also been reported by Gao and Giorgi (2008). Besides, sensitivity simulations (Bozkurt and Sen, 2011) have been carried out to understand climatic effects of surrounding seas of Turkey. They indicated that warmer summer and autumn sea surface temperatures of the surrounding seas of Turkey probably enhance the formation of the flash floods and extreme precipitation events. Also, the significant warming trend of summer temperatures during the last two decades over Turkey has been determined in the model simulation by Önol (2011).

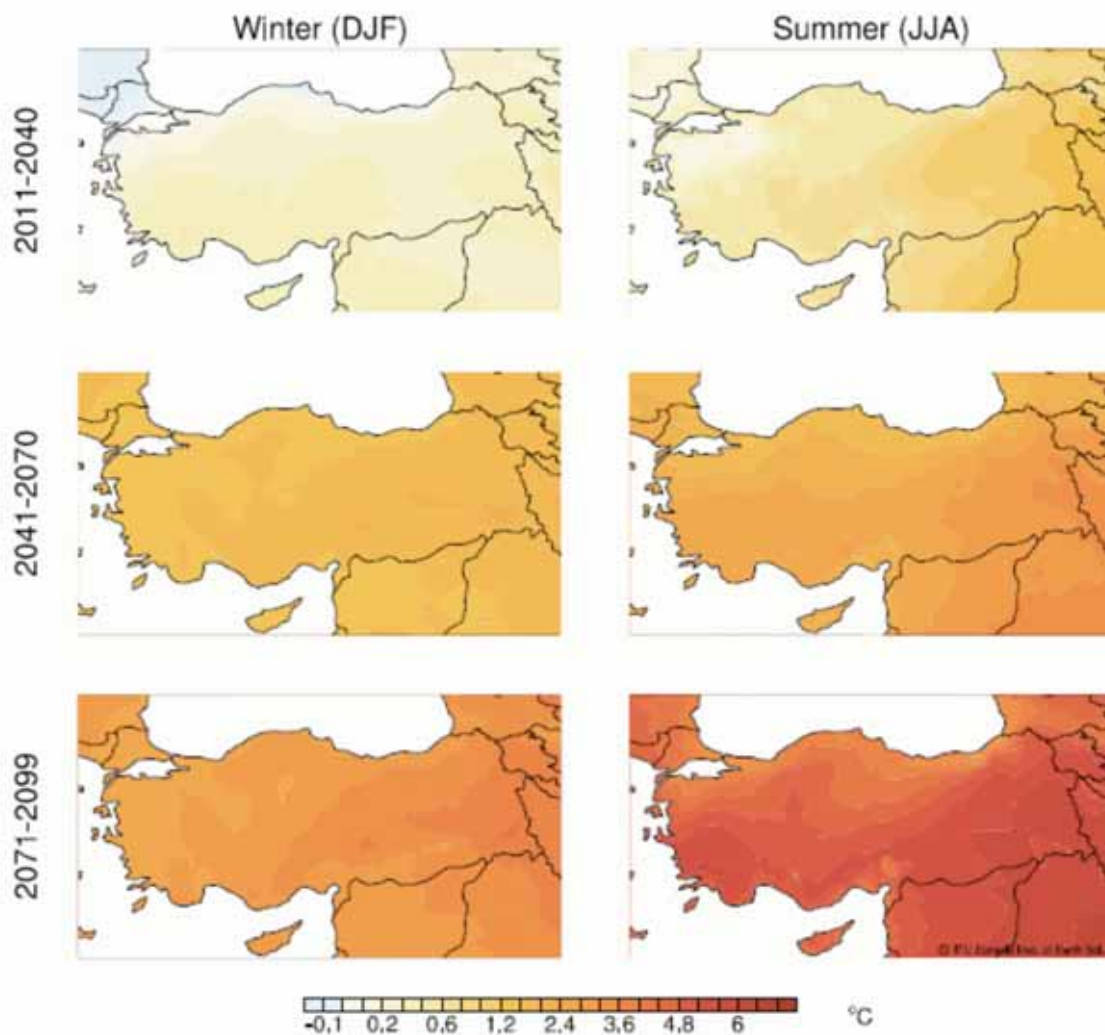
Water availability in future over Middle East countries has been analyzed based on the climate simulations by several studies. Hemming et al. (2010) pointed out that magnitude of precipitation decrease (5%-25%) for all the model ensembles is highly consistent in western coasts of Turkey during the first-half of 21st century. Moreover, projected annual discharges simulated by Kitoh et al. (2008) indicate that substantial decrease for the Euphrates River has been calculated (30-70%) at the end of the 21st century because of the reduction in precipitation over the basin. In addition, detailed hydrological study for Seyhan River Basin has been applied to determine potential impacts of climate change by Fujihara et al. (2008). In terms of this study, annual runoff calculated from precipitation and evapotranspiration variables of two different global climate models decreased in between 50% and 60% for the entire basin. Evans (2009) examined future predictions of 18 GCMs over Middle East and he showed that the largest precipitation decrease (annually more than 25%) caused by less storm track activity over Eastern Mediterranean occurs over South-western Turkey in year 2095.

During the last four years, some momentum has been gained in Turkey in the development of detailed regional climate projections. Two efforts, both conducted at the Istanbul Technical University, must be noted in this context: first one is the TUBITAK funded (KAMAG 105G015) "Climate Change Scenarios for Turkey" Project conducted in conjunction with the General Directorate of Meteorology. Later on, a second effort was carried out to increase reliability of the climate simulation over Turkey; many climate simulations with different scenarios has been produced under the project of UN Joint Programme on Enhancing the Capacity of Turkey to Adapt to Climate Change (MDGF-1680).

### **Temperature**

Downscaled climate change projections obtained by the climate research group of the Eurasia Institute of Earth Sciences involve three GCMs with different scenarios. In this report we only illustrate the projections obtained using the ECHAM5 model's A2 scenario simulation. The seasonal results of all models and scenarios are summarized in Table 1 for the last 30-year period of the twenty first century.

The surface temperature is projected to increase all over Turkey for the 2011-2040 period (Fig. 1), but the increases are usually small (less than 0.5 °C in winter and 1.0 °C in summer). Substantial increases in surface temperature start to appear in the second period (2041-2070) in Turkey. They amount to around 1.5 °C in winter and to about 2.4 °C in summer. By the end of the twenty first century, surface temperature increases are projected to reach to around 3.5 °C in winter and 6 °C in summer. The model simulation suggests that the increase in surface temperature in Turkey will not be uniform. The eastern interior parts will experience more rises in temperatures in winter, and southern and south-eastern parts in summer. It is interesting to see a north-south gradient in surface temperature changes in summer that becomes stronger by the end of the century. For the last period, the summer temperature increases reach to around 6 °C in places in the south-eastern and south-western parts of Turkey while they only rise to around 3 °C in much of the Black Sea and Marmara regions.



**Figure 1. Projected changes (over 1961-1990 period) in surface temperature (°C) for winter (left column) and summer (right column). The projections are based on the A2 scenario simulation of the ECHAM5 general circulation model.**

As Table 1 indicates, there are a total of five downscaled simulations available for Turkey for the period between 2071 and 2099. These are based on the A2 simulations of ECHAM5, HadCM3 and CCSM3, the A1FI simulation of CCSM3 and the B1 simulation of CCSM3. All three models exhibit similar behaviours in the changes of surface temperatures. For instance, the changes are relatively small in winter but they increase in transition seasons and make peak in summer. They mostly indicate larger increases in the eastern Turkey than in the western Turkey. The differences between model simulations arise mostly in the magnitudes of their projections. The magnitude differences are usually pronounced between different scenario simulations of the same GCM or between different GCM simulations of the same scenario. With the combination of the GCMs and scenarios available in Table 1, it is possible to make two comparisons; the first one between three GCMs for the same scenario (A2) and the second one between the three scenario simulations with the same GCM (CCSM3). For the former, it could be said that the increases estimated by all three models are relatively close to each other in all seasons. The noticeable differences to mention are the smaller summer increase (about 5 °C for Turkey) estimated by ECHAM5 compared to the estimations of other models (about 6.5 °C) and relatively larger winter increase (about 3.6 °C for Turkey) estimated by HadCM3 compared to the estimation of CCSM3 particularly (about 2.7 °C for Turkey). The CCSM3's estimation of fall temperature increase for Turkey (about 5.4 °C) is relatively larger than those of the other two models (about 4.2 °C). A1FI simulation of CCSM3 yields 0.5-1.4 °C larger values than A2 simulation of the same model. It produces an average summer increase of

7.3 °C for the eastern Turkey. The projected increases by the B1 scenario simulation of CCSM3 model lie in the range between about 1.4 °C in winter and 3.35 °C in summer for the whole Turkey. These values are, as expected, much smaller than those estimated in the A2 or A1FI scenario simulation by the same model.

**Table 1. Projected seasonal surface temperature changes (°C) in 2071-2099 period over 1961-1990 period based on different scenario simulations. W indicates the western half of Turkey and E indicates the eastern half of Turkey.**

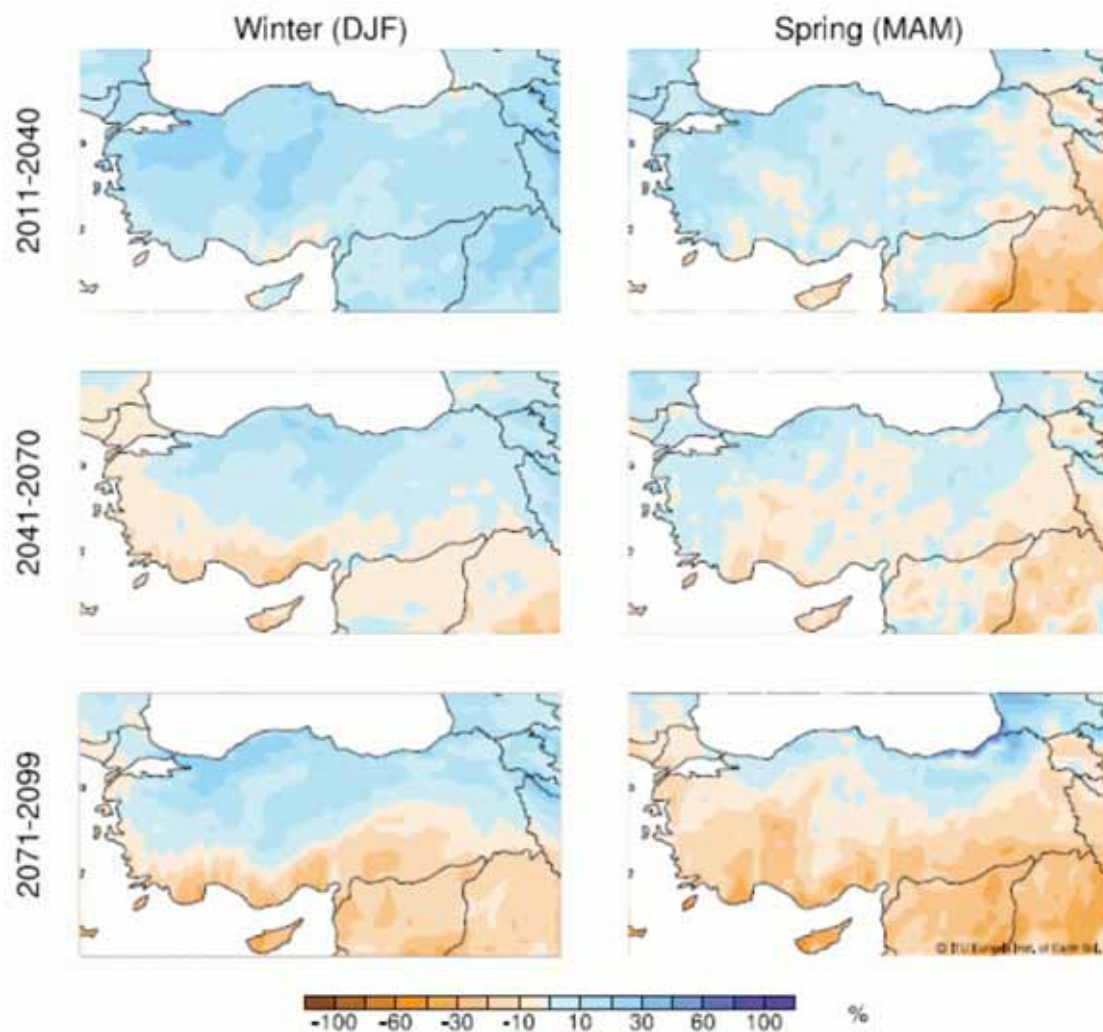
Scenario	GCM	Winter		Spring		Summer		Autumn	
		W	E	W	E	W	E	W	E
A2	ECHAM5	2.9	3.4	3.1	4.1	4.7	5.2	4.0	4.4
	HadCM3	3.4	3.8	3.7	4.1	6.9	6.1	4.0	4.3
	CCSM3	2.5	2.9	3.6	3.5	6.4	6.8	4.9	5.9
A1FI	CCSM3	3.5	4.0	4.8	4.9	6.9	7.3	5.5	6.8
B1	CCSM3	1.3	1.5	1.7	1.7	3.3	3.4	2.5	3.0

### Precipitation

Turkey receives much of the precipitation in winter and spring, therefore; only the projection results of these seasons are illustrated for precipitation in this report. Thus, similar to the way the temperature results are presented, we include a figure (Fig. 2) to show the precipitation changes in space based on the A2 scenario simulation of the ECHAM5 model. The seasonal projection results based on all GCM-scenario simulations are summarized in Table 2 for the last 30-year period of the 21st century.

Figure 2 indicates that ECHAM5 A2 simulation yields up to 30% increases in winter and spring precipitation for much of Turkey for the first 30-year period (i.e., 2011-2040). In the second period, however, winter precipitation is projected to decrease in the southern and western parts of Turkey by up to 20%. Spring precipitation is also simulated to decrease in the southern and central parts of Turkey. Nevertheless, precipitation is simulated to increase in the northern parts in both seasons. The winter precipitation change pattern in the last period is similar to that of the second period. Perhaps the major difference is the strengthening of the changes; i.e., the areas with precipitation reduction become much dryer and the areas with precipitation increase become much wetter in the last period. The areas with precipitation reduction in spring cover much of Turkey in the last period. Only remains the Black Sea region where the precipitation is estimated to increase. It could be said that the ECHAM5 simulation indicates two areas with important changes (they may be called as ‘hot spots’) in precipitation with respect to the increased emissions. These areas are Mediterranean and south-eastern Anatolia regions with significant reductions and Black Sea region with significant increases. Outside of these areas the changes are relatively small.





**Figure 2. Projected changes (over 1961-1990 period) in precipitation (%) for winter (left column) and summer (right column). The projections are based on the A2 scenario simulation of the ECHAM5 general circulation model.**

Table 2 provides the seasonal changes in precipitation from the five different simulations for the 2071-2099 periods. There are broad agreements between the model estimations of the precipitation changes for the same scenario (i.e., A2). However, the magnitude of the changes may not be fully consistent because areas outside of ‘hot spots’ may show different sensitivity to the increased emissions in different models, and this affects the average values. The projected changes in precipitation are usually larger in the CCSM3’s A1FI simulation than those in its A2 simulation. Its B1 simulation, however, yields much lower changes than the other two simulations, as expected. All models broadly agree that Turkey will have less annual precipitation in the last 30-year period of the twenty first century compared to the present times.

**Table 2. Projected seasonal precipitation changes (%) in 2071-2099 period over 1961-1990 period based on different scenario simulations. N indicates the northern half of Turkey and S indicates the southern half of Turkey.**

Scenario	GCM	Winter		Spring		Summer		Autumn	
		N	S	N	S	N	S	N	S
A2	ECHAM5	+ 13	- 17	+ 1.5	- 23	- 23	- 30	- 4	+ 4
	HadCM3	- 2.5	- 26	-1	- 28	- 48	- 61	+ 3	+ 21
	CCSM3	-6	- 32	- 21	- 36	- 33	- 62	-6	- 23
A1FI	CCSM3	- 0.6	- 35	- 30	- 47	- 57	- 70	-1.5	- 10
B1	CCSM3	-0.6	- 14	- 10	- 28	- 19	- 40	- 7	- 16

### Surface Runoff

Turkey has a relatively high topography (about 1,000 m) and the elevation increases towards eastern Anatolia. In the winter, especially eastern parts of Turkey receive much of the precipitation in the form of snow, and therefore, the major rivers originating from these areas are characterized as snow-fed (Sen et al., 2011). Peak flows in these rivers occur in the spring. Because snow cover is sensitive to the temperature increases, the projected temperature increases are expected to shift the peak flows towards winter. Figure 3 illustrates the changes in runoff in the twenty first century as estimated by the ECHAM5 model simulation of A2 scenario. The seasonal results from all simulations for the last 30-year period of twenty first century are given in Table 3.

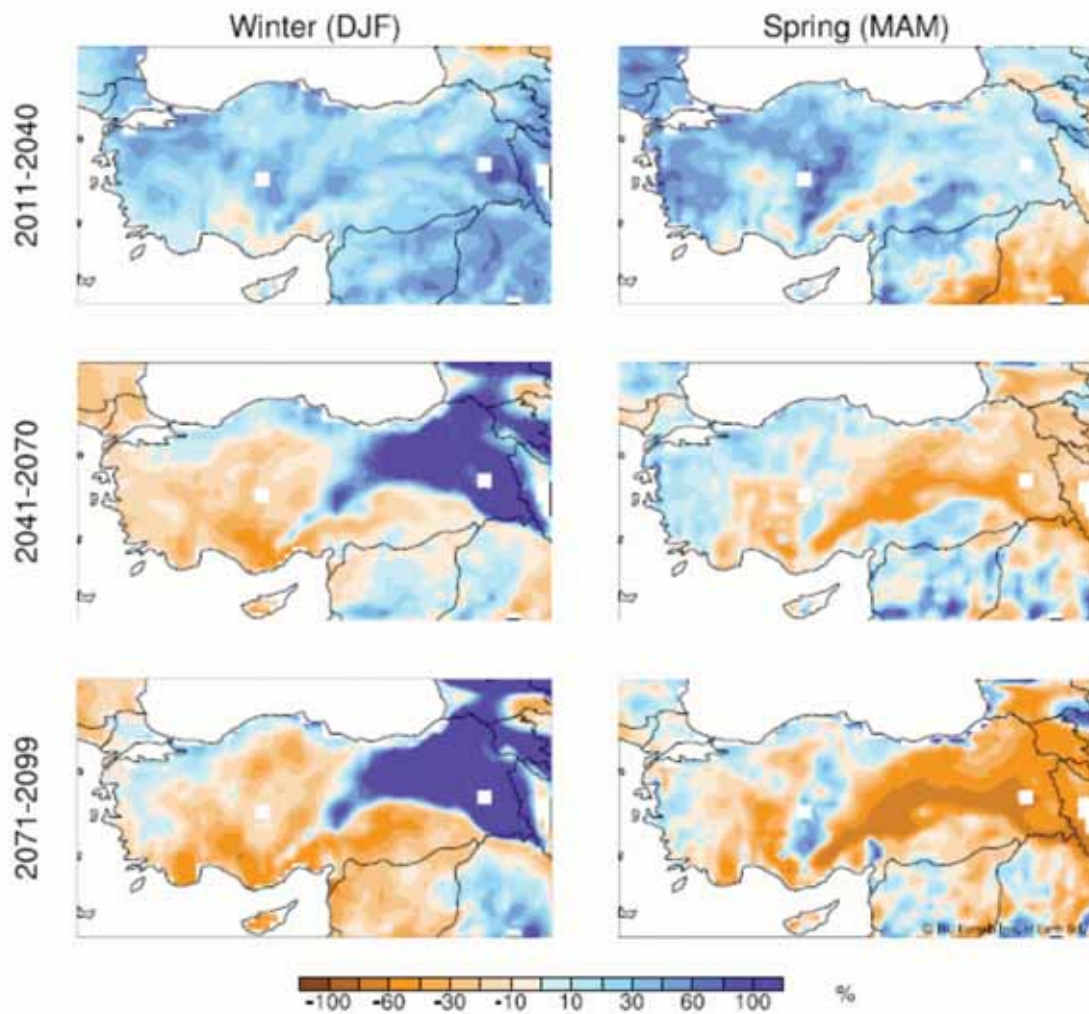
For the first 30-year period, the ECHAM5 A2 simulation predicts increased surface runoff for almost all parts of Turkey for both winter and spring. The pattern starts to change in the second period, however. Surface runoff in this period is projected to increase in winter while it is simulated to decrease in spring in the eastern Anatolia. This is most likely an indication of early melting in response to the increased surface temperatures. In the same period, surface runoff is estimated to increase in the western Black Sea region in both months and in the Aegean and south-eastern Anatolia regions in spring. Mediterranean region is projected to have less runoff in 2041-2070 period compared to the present times. The change patterns in the last period are much of the same as that in the second period.

All simulations indicate substantial reductions in winter and spring runoff for western Turkey (Table 3). They all demonstrate significant reductions in spring runoff for eastern Turkey as well. For the same region, ECHAM5 and HadCM3 A2 simulations show large increases in winter runoff, but CCSM3 simulations do not show large changes in winter runoff. The very large changes in summer runoff are due to very small rates of runoff in summer. Even small changes amount to large percentages.

**Table 3. Projected seasonal surface runoff changes (%) in 2071-2099 period over 1961-1990 period based on different scenario simulations. W indicates the western half of Turkey and E indicates the eastern half of Turkey.**

Scenario	GCM	Winter		Spring		Summer		Autumn	
		W	E	W	E	W	E	W	E
A2	ECHAM5	- 16	+ 27	- 18	- 45	+ 71	- 413	- 15	+7
	HadCM3	- 32	+ 39	- 49	- 48	- 137	- 169	+ 25	+ 6
	CCSM3	- 47	- 1	- 63	- 63	+ 14	+ 18	- 65	- 18
A1FI	CCSM3	- 42	+ 4.5	- 68	- 74	+ 15	+ 22	- 20	- 17
B1	CCSM3	- 24	- 4	- 44	- 42	+ 8	+ 14	- 31	- 48

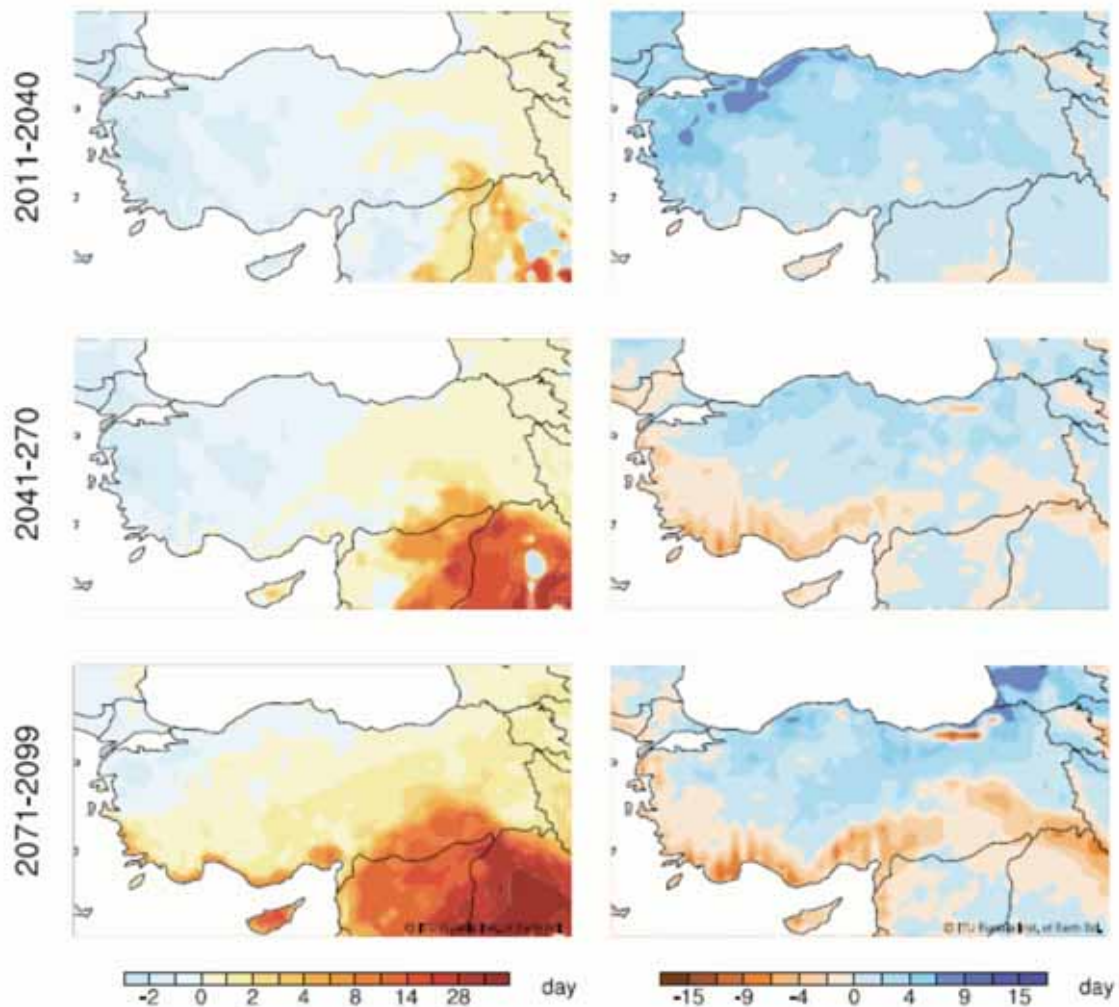




**Figure 3. Projected changes (over 1961-1990 period) in surface runoff (%) for winter (left column) and summer (right column). The projections are based on the A2 scenario simulation of the ECHAM5 general circulation model.**

### Climate Indices

Climate indices provide information about the extreme events that might affect the daily life in a negative way. They are usually calculated using the daily values of the climate variables such as daily maximum and minimum temperatures and daily precipitation. Figure 4 illustrates the annual changes in two of such indices that are based on the estimations of the ECHAM5 A2 simulation. The hot spell index is defined as the largest number of consecutive days where daily maximum temperature is larger than 30 °C. The heavy precipitation days index is defined as the number of days where the daily precipitation is at least 10 kg m<sup>-2</sup>. The changes are relatively small in the hot spell days in the first period (i.e., 2011-2040); however, they increase substantially (up to 10 days) in the south-eastern Anatolia region and coastal areas of the Mediterranean region by the end of the twenty first century (Fig. 4). The changes in the heavy rainy days on annual basis look alike those in the winter precipitation. For the first 30-year period, the number of the heavy precipitation days is projected to increase all over Turkey, but the largest increases (up to 10 days) lie in the north-western parts of the Anatolian Peninsula. In the second and third periods, the number of the heavy rainy days is simulated to decrease (up to 10 days) in the Mediterranean and south-eastern Anatolia regions while it is projected to increase in the Black Sea, central and eastern Anatolia regions.



**Figure 4. Projected annual changes (over 1961-1990 period) in hot spell (left column) and heavy rain (right column) days. The projections are based on the A2 scenario simulation of the ECHAM5 general circulation model.**

### Conclusions

Despite some differences in magnitudes, there are some changes that are agreed by all model simulations. All simulations agree on a temperature increase in Turkey in the twenty first century. They also indicate larger increases towards interior and eastern parts of Turkey. Almost all simulations agree on a precipitation reduction in winter in the Mediterranean region of Turkey. They consistently indicate an increase in the winter precipitation of the Black Sea region. All simulations agree on a reduction of spring runoff and an increase of winter runoff in the eastern Anatolia.

As of the writing of this report, plans are made to continue regional climate projection based studies. Global model outputs prepared for AR5 (CMPI5) efforts will be dynamically (with RegCM4 and WRF-ARW) and statistically downscaled to update the information about the future of the climate for Turkey. These regional simulations will have a higher resolution (< 10 km) and a richer set of statistics will be produced, with special attention given to extreme events. It is expected that in the coming years climate impact analysis community will enlarge and consequently climate data products can be tailored to its specific needs.

## b. Impacts of Climate Change Observed in Turkey

Adaptation can generally be defined as the development of institutional and financial structures, plans, programs, policies and more importantly of a fundamental strategy that guides the uncertainties related to climate and the risk stemming from them. The framework of the National Climate Change Adaptation Strategy was structured by taking into account the direct and indirect objectives of the “National Climate Change Strategy” ratified by the Turkish High Planning Council in May 2010. Under this framework, the combined effects of climate change on socio-economic sectors would be eliminated or alternatively be turned into opportunities in line with the country’s sustainable development policies. The strategic objectives were determined by the identification of national, regional and localized level structural needs and priorities (of varying terms), and by taking into account the potential barriers related to the legal, institutional and financial infrastructure, the planning processes and participatory mechanisms.

Among the current needs and problems that were identified in the current situation are; the lack of high quality data and information, the lack of concordance of available information, the insufficiency of scientific research, difficulties in producing projects, risk management of natural resources, weakness of the relations between health and climate change, absence of correlation between the impacts on the means of subsistence of climate change and human health, the need for comprehensive models to determine the effects of climate change in climate- related sectors, the need to determine these impacts and to make measurements and projections; therefore the necessity arises to clarify the evaluation of the susceptibility to be affected by the impacts of climate change.

Another important factor identified is the insufficiency of financing policies and support mechanisms in the adaptation to the impacts of climate change. This is an issue of primordial importance for the implementation.

To this date, the constantly increasing risks and results stemming from climate change are still not included in the traditional development policies of governments, nor are they included as a factor in the investment decisions of the private sector in Turkey. However, the variable and uncertainty climate conditions bear, make it necessary to include them as a climatic risk factor in investment decisions and even to go further by taking into account the impacts of climate change at the feasibility stage of projects in a standardized manner. That entails the necessity in Turkey to make extensive “impact analyses” to emphasize the impacts of climate change. The realization of climate change impact analyses will enable the determination of climate change impacts on various sectors and social segments, the calculation of benefits and costs of the adaptation to climate change, the reach of an understanding of stakeholders having varying views on climate change policies and will ultimately decrease the uncertainties and bear a significant importance in clarifying the priorities.

Despite the non-realization of direct adaptation planning resulting from findings of studies on climate change impacts in Turkey, some adaptation measures were identified and activities undertaken towards their realization. These measures mostly tackled with issues like the development of modern techniques in the usage of water resources, the multiplication of research on the efficient irrigation management systems due to the increasing needs in water caused by climate change, the development of high quality plant species needing low quality water or the development and cultivation of plant species that are resistant to drought and salinity. For instance if we were to consider the agricultural sector in Turkey, it is possible to note that there has been a transition from traditional irrigation methods to modern irrigation systems where water losses are minimized (through sprinkler and drip irrigation applications). Appropriate financing supports are made available to agricultural producers wishing to use these methods.

The fast growing population in Turkey, the increasing urbanization and the priorities of economic policies result in complicating the realization of efficient adaptation policies and their implementation. Nevertheless, one

should not ignore the fact that the current sustainable development policies and objectives already support the adaptation efforts to climate change. Latest policies applied in several sectors in Turkey support the adaptation to the impacts of climate change. The most important ones entail modern approaches to the management of water resources and rural development policies such as sustainable forest management, wise use of water in agriculture or integrated basin management.

Additionally, despite the fact that more often than not, it was not specified directly, most of the strategic documents prepared recently for the development of several sectors in Turkey (The Agricultural Strategy, TAKEP, The Rural Development Strategy and Action Plan, the Energy Efficiency Strategy etc.), as well as most of the policies and long term policy programs (Rural Development Program/ IPARD, TUBITAK Vision 2023, National Forestry Program, National Program to Combat Desertification in Turkey etc.) and action plans (National Action Plan to Combat Desertification (2005, RG), the Southern Anatolian Project's Action Plan, Biodiversity Strategy and Action Plan, the Campaign for Forestation and Erosion Control Action Plan, the Waste Management Action Plan, the Waste Water Treatment Action Plan etc.) do include alongside emission decrease measures to combat climate change, several activities in the scope of adapting to the impacts of climate change.

However little direct correlations were made between issues in the documents and adaptation to the impacts of climate change and however insufficient inter-sectoral combined effects were accounted for (there are no holistic approaches aiming the adaptation to climate change in soil depletion and food security in the current national policy documents for instance), these activities were brought to attention when preparing the strategy.

The focus was given to water scarcity problems, therefore to the drought problems in Turkey in the adaptation policies against the impacts of climate change. Drought in Turkey figures at the top of the list of climatic disasters. Disaster alert policies and systems and information flow are being developed in this particular field. There are a lot of efforts put towards the constitution of realistic water policies relying on sound strategies, laws and scientific research that need to be rapidly brought to life in order to prevent the serious water scarcity that will have to be faced in the future due to climate change. Despite the existence of an ongoing series of activities to research the potential results of global climate change on a water-basin scale for river basins that are socio-economically important for Turkey (Gediz, Greater Menderes, Seyhan, Konya Basins), there is a need for more scientific studies.

Floods are inevitable in areas of low altitude like coastal areas. There are many coastal areas with low altitude in Turkey and this is why clumps of cities, populations and industrial regions are threatened by the coastal erosion caused by tempests due to the rise of the sea level and are also more prone to face extreme precipitation phenomena. Even though in lesser measures, the mountainous geography of Turkey, the irregular regimes of its rivers, its steep mountain sides and land utilization practices make floods important threats to river basins also. Furthermore the characteristic of arid soil and erosion problem of Turkey also<sup>6</sup> bring together with them natural disasters like floods and excessive precipitation.

It has been foreseen that together with climate change, drought and floods will have negative impacts on key sectors, enterprises and populations. Table 4 depicts major climate change impact examples together with relevant sectors and regions as well as an evaluation of the relative intensity of these impacts specific to the characteristics of the sectors and regions in Turkey subject to climatic effects causing droughts, floods and self-igniting fires:

<sup>6</sup> Parliamentary Report on Climate Change and Water Management, Ankara, April 2008



**Table 4. The Impacts of Climate Change and Susceptible Sector/Regions in Turkey.**

Impacts	Intensity	Susceptible regions	Susceptible Sectors /Themes
Modification of river / basin regimes	Low	All regions	Ecosystem services and biodiversity
Diminishing surface waters	Medium	Western Anatolian region	Agriculture, water distribution infrastructure
Scarcity of exceeding usage water	High	Istanbul, Ankara, Aydın, Nevşehir, Bursa	Urban areas
	Medium	Afyon, İzmir, Kayseri, Muğla, Manisa	Agriculture, industry, energy
Floods	Medium	Black Sea and South-eastern Anatolian Regions	The survival of the agricultural farmer, human health
Soil loss / salinity	Low	Mediterranean, Black Sea and Aegean Regions	Tourism, ecosystem services, biodiversity, marine products
Soil loss / loss of quality of soil	Medium	South-western Anatolia	The survival of the agricultural farmer, human health, shallow lakes and wetlands
Coastal Erosion	Low	Black Sea Region	Fishing, unemployment
Degradation of marine ecosystems	Low	Mediterranean, Black Sea and Aegean Regions	Ecosystem services and biodiversity
Forest fires	Medium	Western Anatolia	Tourism, agriculture
Migration of species to other areas in order to survive	Low	Mediterranean region	Tourism, agriculture, food security
Decreasing agricultural productivity	Medium	Mediterranean and Aegean coastal areas	Agriculture (employment), food security
Lowering Hydro – Energetic potential	Low	Mediterranean region	Energy, industry
Lowering production of sea products	Low	Mediterranean region	Agriculture, food security, water distribution networks

In summary, when looking at Turkey’s above mentioned position towards the impacts of climate change, Turkey figures among the risky group of countries with regards to the potential impacts of climate change consequently revealing the importance of the socio-economic and environmental impacts that climate change can cause.

It has been demonstrated that the current sectoral strategies and joint implementations in the view of adapting to climate change impacts as well as their monitoring were still at a very early stage in Turkey and three main factors were identified as the main reasons underlying this situation:

**1- The refusal to accept or to understand the existence of a series of maladaptation<sup>7</sup> policies and implementations:** Inefficient water management policies, inefficient agricultural practices concerning climate change, allowing important environmental threat-bearing activities like mining in vulnerable water basins, forests and ecological areas, facing water scarcity in metropolitan areas as a result of inaccurate water policies and other realities that illustrate this situation.

<sup>7</sup> Maladaptation: An action or a process that increases susceptibility due to the dangers of climate change (UNDP definition), or a development policy that through its usual application increases the level of susceptibility to climate change (OECD definition).

**2- The insufficient cooperation among public institutions:** Conflicting authorities in land use planning, a multiplicity of modifications made without the necessary foundation in the legislation, conflicts between the laws and the sustainability of ecosystems and insurance regimes that do not reflect sufficiently climate change risks can be cited to illustrate this factor. Issues regarding the long-term negative effects of climate change over the economy in Turkey, like the collaboration between the insurance sector and the government. Besides, activities which have been initiated by TARSİM (Agricultural Insurance Pool) within the scope of state funded agricultural insurances are ongoing.

**3- The insufficiency of institutional and technical capacities needed to ensure the sustainability of the initiatives required:** The lack of definition of potential adaptation projects, the lack of prioritization and in this context, the insufficient capacity to access international adaptation funds figure among the examples that might be cited to illustrate.

Consequently, there are five vulnerability areas that stand out fundamentally when prioritizing specific criteria. These are the following: i) Management of Water Resources, ii) Agricultural Sector and Food Security, iii) Natural Disaster Risk Management, iv) Ecosystem Services, Biodiversity and Forestry, v) Public Health.

In this framework, in order to realize the strategic objectives that have been identified, it has been decided to focus on basically planning policies, the development of legal and institutional structures and the accessibility to the required financial resources and to this end, it has been foreseen to apply the “proactive/anticipatory adaptation” approach<sup>8</sup>. What is important here is that contrary to obtaining short term benefits or to get rid of threats, the risks of climate change will be taken into account from the start in the framework of policy programs.

<sup>8</sup> Proactive/anticipatory adaptation: The act of adaption which is executed before the impacts of climate change occur and hence, which prevents the eventual economic losses .



# 3

## Development Method of the Turkey's National Climate Change Adaptation Strategy and Action Plan

Until recently various discussions, political suggestions and implementations made in Turkey in the framework of combating global climate change were oriented mainly in the decrease or limitation of greenhouse gas emissions, particularly carbon dioxide. The endeavours to cut back on emissions in Turkey are undoubtedly very important; nevertheless it should also be known that if the policies in mitigation and adaptation are not done simultaneously, it will not be possible to combat efficiently climate change.

Besides the long-term impacts of climate change, Turkey is a country that is currently struggling against the vulnerability of its water resources and coastal areas and trying to adapt its agricultural activities to the existing climatic conditions. A considerable part of the population in Turkey is concentrated in the coastal areas with its infrastructure and economic activities. It is a known fact that these areas are facing rising sea levels, salty water mixing with fresh water and more frequently observed meteorological hazards due to the impacts of climate change. In inland regions, when considering demographic and socio-economic tendencies, the pressures on natural resources have also been observed to increase also due to the impacts of climate change. This situation shows the vulnerable position of Turkey concerning the impacts of climate change and demonstrates the need to identify the potential vulnerabilities to climate change impacts not only in all the processes of strategies and policies produced in relation to climate but in all areas in order to ensure afterwards taking adaptation measures.

Dealing with the impacts of climate change in economic growth strategies and national development policies has increased in Turkey in the recent periods. The Ninth Development Plan (2007-2013) currently in effect and the Annual Programs of the Plan, despite doing so indirectly, encompass principles, objectives and measures for various sectoral areas.

In the current situation, the sectors that need to take adaptation measures against the impacts of climate change (agriculture, food, vegetal production, animal production, forestry, energy, industry, health, tourism etc.) do have some actions to this end that are included in their own strategies and policies. In this context, particularly under the heading of the agricultural sector, some legal, institutional and financial implementations are remarking.

Nevertheless, these subjects are not put in relation directly with adaptation to the impacts of climate change and are dealt with in particular only when the necessity occurs to deal with holistic impacts. Looking from this point of view, it has clearly been seen that there is a need to integrate the relevant sectors' strategies and policies when preparing a strategy for the adaptation of Turkey to the impacts of climate change.

These needs are the “soft adaptation”<sup>9</sup> measures; these entail the development of innovative policies in key institutions, the revision of existing ones, the development of capacity and strengthening of coordination, the realization of vulnerability assessments, the realization of modeling for the adaptation to climate change and the integration of the adaptation factor to the existing emission limitation strategies. Furthermore, among the first measures of “soft adaptation” to be taken for the planning of the adaptation to the impacts of climate change, considering in particular the fact that the information available or produced to this date remains general and limited, is the necessity to increase academic studies, research and development activities and the search for innovative technologies in this subject.

Actually, contrary to the negative connotation of climatic risks, the governmental policies and programs when designed better and in a coordinated manner can be adequate instruments to realize “proactive adaptation”. When looking from this perspective, the studies undertaken in Turkey in order to develop its capacity to manage climate change risks as well as all the factors entailing the adaptation to a changing climate need to be integrated in macro-policies with a sustainable approach.

### **a. Development Method of the National Climate Change Adaptation Strategy**

The method which was followed in the preparation process of the National Climate Change Adaptation Strategy has consisted of five phases. These phases are:

1. Revision and synthesis of current situation about the vulnerable areas and impacts of climate change in Turkey (Stocktaking Analysis),
2. Evaluation of the existing infrastructure for the development of necessary education, awareness and capacity for adaptation to climate change,
3. Realization of “Participatory Vulnerability Analysis” at the local level,
4. Realization of a comprehensive modeling activity (the Community-Based Adaptation to Climate Change in the Seyhan River Basin Grants Programme),
5. Development of the strategy.

Implementation of the current policies about the adaptation to climate change in Turkey contains also the developments in the institutional structure and legislation in this field. The policies, legislation and institutional framework have been interlaced and they should be handled simultaneously. Within the scope of the Stocktaking Analysis, relevant policies and implementations have been examined; in addition to this, they have been evaluated comprehensively in order to observe to what extent the legal and institutional structure satisfies the need. One of the main objectives of the strategy is to integrate adaptation to climate change with the legal and institutional framework in Turkey. Thus, it has been assumed that a stocktaking analysis, the scope of which is well determined, will form a rational basis for the development of a national climate change adaptation strategy.

In the course of work, consultations and meetings have been made with many subunits of the institutions including the department of law of relevant institutions and the information which was obtained has been analyzed. Within this period, it has been determined that there is need for legal and institutional changes and essential policies which are required in various thematic fields for the adaptation to climate change.

<sup>9</sup> Soft adaptation measures: Focusing on knowledge and capacity building, identifying policy and strategy and organizational regulations.



The Stocktaking Analysis consists of seven different main parts. These parts are “Food Security and Climate Change Adaptation in Turkey”, “Ecosystem Services and Climate Change Adaptation”, “Towards the Climate Change Adaptation Information Management System in Turkey”, “Participatory Processes and Climate Change Adaptation”, “The Impacts of the Climate Change on Water Resources in Turkey”, “Agricultural Sector and Climate Change Adaptation” and “Natural Disasters and Climate Change Adaptation”. Existing legal and institutional frameworks in these fields have been analyzed separately for each of these parts.

Moreover, prioritized issues which will constitute the framework of the Strategy at the central and local/regional level have been discussed together with all parties, especially with relevant Ministries (the Ministry of Environment and Urbanisation, the Ministry of Forestry and Water Works, the Ministry of Food, Agriculture and Livestock) that carry out the works for adaptation to climate change; the problems have been determined and solution suggestions have been discussed on intersecting themes.

The completed Stocktaking Analysis has been shared with relevant institutions; opinions have been exchanged regarding this analysis and all evaluations that were obtained have been used for the development of the National Climate Change Adaptation Strategy. Besides, in this process, a comprehensive “Knowledge Needs for Adaptation to Climate Change Survey” has been conducted in order to determine the needs related to awareness, education, participation and capacity development in the institutions across the country for adapting to climate change in Turkey. A series of training activities have been realized in line with the results of the above mentioned research in order to support the development of the Strategy. With this process, the adaptation to climate change has become the subject of a university certificate programme for the first time up to now<sup>10</sup>.

## b. Vulnerability Analysis in Turkey

### Vulnerability

Vulnerability is one of the main concepts which are used in the adaptation negotiations related to the climate change and in the literature for adaptation to the impacts of the climate change. Vulnerability is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity<sup>11</sup>. Intergovernmental Panel on Climate Change (IPCC) defines the vulnerability against the climate change as a function of three elements. These elements are i) types and magnitude of exposure to the impacts of the climate change ii) sensitivity of target systems to the exposures at a certain level and iii) adaptation or coping capacity of the target system. The explanations of these terms are given below;

- o **Exposure:** indicates the elements which are out of the system analyzed such as changes in the climate changeability or rate of change in average climatic conditions including excessive weather activities. (In certain conditions, high level of exposure is observed. However, the impacts of this exposure may be eliminated by high level of adaptation capacity. As a result of this, lower vulnerability rates are obtained).
- o **Sensitivity (or susceptibility):** is the level of negative or positive exposure of a system to climate variability or climate change. This exposure may occur directly (for example; change in harvest as a result of another change in average temperature, temperature interval or changeability) or indirectly (for example; damages which arise from increase in frequency of floods in coastal areas because of sea level rise).
- o **Adaptation capacity:** means the capability of a system in adapting to the climate change, variability, and probable damages at excessive or medium levels, in benefiting from the opportunities or in coping with the results of the abovementioned factors.

<sup>10</sup> Middle East Technical University, Continuing Education Center, « Climate Change, Adaptation Policies and Turkey Certificated Education Programme.

<sup>11</sup> Vulnerability= Risk – Adaptation Capacity.

When the studies by which the impacts of the climate change are researched in Turkey are evaluated in general, it is seen that the impacts of the climate change pose danger on the sectors which depend on natural resources and especially water in Turkey. The biggest proportion of water utilization belongs to agricultural sector with 75% utilization throughout country and this situation means that the impacts of the climate change will be mostly seen in this sector. Therefore, many sectors like industry, forestry, energy, tourism and especially agriculture have to adapt to the impacts of the climate change. In this framework, with Turkey's First National Communication on Climate Change which was prepared in 2007, Turkey has determined its' road map for adaptation to the climate change and struggle against it in order to choose the economic programmes which will be applied to all sectors, to decide which productivity criteria will be presented and to define what kind of developments should be realized in the technological field.

One of the main evaluations of Turkey's First National Communication on Climate Change has shown that there is need for intensive and long-term studies at national level on adaptation activities related to the climate change, especially its' impacts. The National Communication within the scope of which the reflections of climate change impacts on Turkey are evaluated on a regional scale in line with Forth Assessment Report of IPCC is a national policy document in which adaptation issues related to the impacts of climate change have been dealt with for the first time.

In Turkey's First National Communication, national and international model studies have demonstrated that Turkey will have a warmer, more arid and more vague climate pattern in terms of precipitation in the near future and it has been foreseen that the new expected climate pattern will cause a decrease in water resources in the future of Turkey. Drought circumstances and water shortage in Turkey have reached a critical point in many sectors not only for agriculture and energy production but also in terms of water resources management which includes irrigation, potable water and other hydraulic systems and activities. In Turkey, adaptation policies which are pursued against the impacts of the climate change have mostly focused on increasing water shortages and drought problems. Disaster warning policies and systems are attempted to be realized. In addition to this, information flow is aimed to be provided. In this aspect, the importance of climate prediction is clearly seen for determination of possible impacts.

Turkey started to prepare its Second National Communication on Climate Change in November, 2010; as a result of this process, vulnerability analyses were realized and adaptation measures were updated within the framework of climate change adaptation activities.

### **c. Stocktaking Analysis**

#### **Strategies, Policies and Plans**

Recently, the activities to handle the effects of climate change in economic growth strategies and national development policies have been accelerated. The Ninth Development Plan (2007-2013) and Annual Programs of the plan include principles, objectives and measures concerning some sectors.

In the current situation, there are some actions in this direction in the strategies and plans concerning these sectors (agriculture, food, forestry, energy, industry, health, tourism etc.) in which measures should be taken for adapting to the effects of the climate change. Particularly in the agricultural sector; policies, legal, institutional and financial implementations that will facilitate adaptation regarding vulnerable areas were identified. However, these issues haven't been directly associated with adaptation to the effects of the climate change.

Apart from the fact that there are no clear policies and implementations for adaptation of sectors and resources affected from climate change or the lack of these policies and implementations; institutions determine the

effects on their own and set goals in this direction. This prevents integration between sectors. One of the reasons for which this integration cannot be ensured is organization laws foreseeing that operational mandate of specialized organizations will act independently. For example, it is important that Provincial Directorates of Disaster and Emergency work in integration with field services of other ministries. That is, here it is important to take into account and measure the combined effects.

Some examples from Turkey are mentioned below:

- The policies on food security and land use change regarding food production caused by the changes in erosion patterns and large scale land degradation are not sufficient.
- The effects of desertification in agricultural lands and salinization -environmental degradation- on the GNP of Turkey in terms of production and capital losses are not measured.
- The effects of sea level rise on fish stocks and fish displacement are not examined.
- The “measure effect” of soil loss on tourism sector is not measured.
- Relations between forests and water resources are not studied sufficiently.

Existing strategies, policies, plans and programmes on management of water resources and covering different areas/sectors do not include objectives directly concerning climate change adaptation. In this context, measures such as developing future techniques for unconventional use of water resources, conducting more research for management of estimated increase for the need for water depending on climate change by increasing irrigation efficiency, growing plant species that can produce high-quality crops with low-quality water, developing and growing new plant species resistant to drought and salinity.

Many targeted policies in agricultural sector are activities indirectly supporting adaptation to the effect of climate change. It is seen that modern irrigation techniques (sprinkler and drip irrigation applications), in which there is less water loss, are preferred to conventional irrigation techniques. Initiatives for financial support appropriate for producers desiring to use these techniques have been accelerated.

Especially after the 2000s, a set of strategy documents, policies, programmes and action plans were prepared on ecosystem services, biodiversity and forestry. The most important of these are the Action Plan to Combat Desertification, Biodiversity Strategy and Action Plan, Forestation and Erosion Control Mobilization Action Plan and General Directorate of Forestry Strategic Plan.

In order to minimize the negative effects of climate change on human health and take measures against possible effects, an action plan was prepared by the Ministry of Health with the support of World Health Organization (WHO).

National Capacity Self Assessment Project of Turkey (NCSA) under Rio Conventions has been conducted. The primary objective of the NCSA is to identify country level priorities and needs for capacity building to address global environmental issues, in particular, enhance the capacity of Turkey to meet its existing commitments under the UNCBD, UNCCD, and the UNFCCC. The NCSA process will also aim at reaching the following specific objectives:

- To identify, confirm or review priority global environmental issues for action within the thematic areas of biodiversity, climate change and desertification/land degradation;
- To explore related capacity building needs within and across the three thematic areas;
- To explore targeted and co-ordinated action and requests for future external funding assistance and;
- To link country action to the broader national environmental management and sustainable development framework.

A secondary objective of this project is to establish a long-term co-ordination mechanism, which will facilitate the ongoing assessment of the capacity development needs.

Although not directly mentioned most of the time; strategy documents<sup>12</sup>, long-term policy programmes<sup>13</sup> and action plans<sup>14</sup>, which have been prepared contain various measures in terms of adaptation to the effects of climate change as well as emission reduction in the fight against climate change.

In order to research the possible impacts of global climate change on water basins, there is a set of activities continuing in the socio-economically important river basins of Turkey (Gediz, Greater Menderes, Seyhan and Konya River Basins); besides this, it is important to increase and expand these kinds of activities.

### Legal Framework

Turkey became a party of the United Nations Framework Convention on Climate Change in 2004<sup>15</sup>. In the 7<sup>th</sup> Conferences of the Parties (COP7) meeting held in Marrakech in 2001, the special conditions of Turkey which has a different position than the other countries in the Annex-I<sup>16</sup> list of the Convention, were recognized and it was decided that its name will remain on the Annex-I while it will be removed from the Annex-II<sup>17</sup> list.<sup>18</sup>

The process that is started when Turkey is recognized as an Annex-I country having special conditions different from the other parties of the Convention, has affected and accelerated the country's political decision of being a party of the Kyoto Protocol. Around five years after becoming a part of the Convention, in February 2009, "The law on the convenience of Turkey's entrance to the Kyoto Protocol for the United Nations Framework Convention on Climate Change" came into force<sup>19</sup>, in May 2009, Turkey's entrance to the Kyoto Protocol was documented<sup>20</sup> and sent to the General Secretariat of the United Nations. The whole ratification process of the Protocol was completed in 26 August 2009.

The issues that are related with the adaptation to the effects of the climate change are in the 2nd and the 4th articles of the UNFCCC. According to these;

*Article 2: "The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent **dangerous anthropogenic interference with the climate system**. Such a level should be achieved within a time-frame sufficient to allow ecosystems to **adapt naturally to climate change**, to ensure that **food production is not threatened** and to enable **economic development to proceed in a sustainable manner**."*

*Article 4: "1. All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, shall:*

<sup>12</sup> Agricultural Strategy, Strategy and Action Plan for Fight Against Agricultural Drought, Strategy and Action Plan for Rural Development, Energy Efficiency Strategy etc.

<sup>13</sup> Rural Development Programme (IRPAD), National Science and Technology Policies (2003-2023) Strategy Document (Vision 2023), National Forestry Programme etc.

<sup>14</sup> National Action Plan to Combat Desertification, Southeastern Anatolia Project Action Plan, Biodiversity Strategy and Action Plan, Afforestation and Erosion Control Mobilization Action Plan, Waste Management Action Plan, Wastewater Treatment Action Plan etc.

<sup>15</sup> The law on the convenience of Turkey's entrance to the Kyoto Protocol for the United Nations Framework Convention on Climate Change" Official Gazette, 21 October 2003, Vol.25266 (Enforcement: 24.5.2004)

<sup>16</sup> The 41 countries that are on the UN Framework Convention on Climate Change Annex-I List and directly responsible for emission downgrading, technology transfer and financial support: OECD + EU + countries in transition (Transition to Market economy countries – Eastern Block countries). Note: The countries that are not included to Annex-I and have no responsibility on the Convention are countries like China, India, Pakistan, Mexico, Brazil.

<sup>17</sup> The countries that are on the UN Framework Convention on Climate Change Annex-II List and responsible for technology transfer and financial support: OECD + EU-15 (24 countries).

<sup>18</sup> 26/CP.7 numbered COP7 Decision.

<sup>19</sup> Official Gazette 17 February 2009, vol. 27144 (Enforcement: 26 August 2009).

<sup>20</sup> The process of proposing the depositary instrument that is prepared by the Ministry of Foreign Affairs to the UN Secretariat.

- b) *Formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and measures to facilitate adequate adaptation to climate change;*
- e) *Cooperate in preparing for **adaptation to the impacts of climate change**; develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by **drought and desertification**, as well as **floods**;*
- f) *Take climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions, and employ appropriate methods, for example impact assessments, formulated and determined nationally, with a view to minimizing adverse effects on the economy, on public health and on the quality of the environment, of projects or measures undertaken by them to mitigate or **adapt to climate change**;*
- g) *Promote and cooperate in scientific, technological, technical, socio-economic and other research, systematic observation and **development of data archives** related to the climate system and intended to further the understanding and to reduce or eliminate the remaining uncertainties regarding the causes, effects, magnitude and timing of **climate change** and the economic and social consequences of various response strategies;*
- h) *Promote and cooperate in the full, open and prompt exchange of relevant scientific, technological, technical, socio-economic and legal information related to the climate system and climate change, and to the economic and social consequences of various response strategies;*

*Article 4: “4. The developed country Parties and other developed Parties included in Annex II shall also assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects.”*

*“8. In the implementation of the commitments in this Article, the Parties shall give full consideration to what actions are necessary under the Convention, including actions related to **funding, insurance and the transfer of technology**, to meet the specific needs and concerns of developing country Parties arising from the adverse effects of climate change and/or the impact of the implementation of response measures, especially on:*

- a) *Small island countries;*
- b) *Countries with low-lying coastal areas;*
- c) *Countries with **arid and semi-arid areas, forested areas** and areas liable to forest decay;*
- d) *Countries with areas prone to **natural disasters**;*
- e) *Countries with areas liable to **drought and desertification**;*
- f) *Countries with areas of **high urban atmospheric pollution**;*
- g) *Countries with areas with **fragile ecosystems, including mountainous ecosystems**;*
- h) *Countries whose economies are **highly dependent on income generated from the production, processing and export, and/or on consumption of fossil fuels and associated energy-intensive products**; and*
- i) *Land-locked and transit countries.*

*The issues that are related with the adaptation to the effects of the climate change are in the 3<sup>rd</sup>, 10<sup>th</sup> and 12<sup>th</sup> articles of the Kyoto Protocol are listed below:*

*Article 3: “14. Each Party included in Annex I shall strive to implement the commitments mentioned in paragraph 1 above in such a way as to **minimize adverse social, environmental and economic impacts** on*

developing country Parties, particularly those identified in Article 4, paragraphs 8 and 9, of the Convention. In line with relevant decisions of the Conference of the Parties on the implementation of those paragraphs, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session, consider what actions are necessary to **minimize the adverse effects of climate change and/or the impacts of response measures** on Parties referred to in those paragraphs. Among the issues to be considered shall be the establishment of **funding, insurance and transfer of technology**".

**Article 10:** "All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, without introducing any new commitments for Parties not included in Annex I, but reaffirming existing commitments under Article 4, paragraph 1, of the Convention, and continuing to advance the implementation of these commitments in order to achieve sustainable development, taking into account Article 4, paragraphs 3, 5 and 7, of the Convention, shall:

(b) Formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change and measures to facilitate adequate adaptation to climate change:

(i) Such programmes would, *inter alia*, concern the **energy, transport and industry sectors as well as agriculture, forestry and waste management**. Furthermore, **adaptation technologies and methods for improving spatial planning would improve adaptation to climate change**; and

(ii) Parties included in Annex I shall submit information on action under this Protocol, including national programmes, in accordance with Article 7; and other Parties shall seek to include in their national communications, as appropriate, information on programmes which contain measures that the Party believes contribute to addressing climate change and its adverse impacts, including the abatement of increases in greenhouse gas emissions, and enhancement of and removals by sinks, **capacity building and adaptation measures**;"

**Article 12:** "8. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall ensure that a share of the proceeds from certified project activities is used to cover administrative expenses as well as to assist **developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation**.

As a country that ratified the UN Convention Framework on Climate Change and the Kyoto Protocol, Turkey has taken the responsibilities mentioned above, that are related to the adaptation to the effects of the climate change which are imposed to the parties.

The issues of some of the international UN conventions that Turkey is a party, are also indirectly related with the adaptation to the effects of the climate change. These are; Convention to Combat Desertification, Convention on Biological Diversity, Bern Convention on the Conservation of European Wildlife and Natural Habitats, Conventions for the Protection of Mediterranean Sea and the Black Sea Against Pollution and its additional protocols.

In order to assess Turkey's capabilities and reveal possible challenges in adaptation, national legislation relevant to adaptation were indexed at constitution, law and regulation levels; and reviewed at a provision level.

- Disaster risk management
- Conservation of biodiversity
- Water safety and security
- Food safety and security



Legislation directly related to climate change adaptation has been provided in Table 5. Legislation indirectly and secondarily related to climate change adaptation has been provided in Table 6.

**Table 5. Legislation directly related to climate change adaptation**

Category	Legislation Pertaining to Adaptation
<b>Disaster Risk Management</b>	<ul style="list-style-type: none"> <li>▪ Law pertaining to the Duties and Organization of the Disaster and Emergency Management Presidency (5902):</li> <li>▪ Law pertaining to the Precautions to be taken and Aids regarding Disasters Effective on Public Life (7269)</li> <li>▪ Coast Law (3621):</li> </ul>
<b>Conservation of Biodiversity</b>	<ul style="list-style-type: none"> <li>▪ Environmental Law (2872):</li> <li>▪ Forestry Law (6831), Regulation pertaining to the Implementation of the Forest Cadastre in accordance with the Forestry Law no 6831 (15.07.2004), and Tourism Incentivization Law (2634):</li> <li>▪ Land Hunting Law (4915):</li> <li>▪ Forest Management Regulation (05.02.2008)</li> <li>▪ National Parks Law (2873):</li> <li>▪ Law pertaining to the Precautions to be taken and Aids regarding Disasters Effective on Public Life (7269):</li> <li>▪ Agriculture Law (5488):</li> <li>▪ Pasture Law (4342):</li> <li>▪ Seed Law (5553):</li> <li>▪ Decree Law on Organization and Duties of Ministry of Environment and Urbanization</li> <li>▪ Law No. 5403 on Soil Conservation and Land Use</li> </ul>
<b>Water Safety and Security</b>	<ul style="list-style-type: none"> <li>▪ Environmental Law (2872):</li> <li>▪ Environmental Impact Assessment (EIA) Regulation:</li> <li>▪ Regulation on the Protection of Wetlands (17.05.2005):</li> <li>▪ Regulation on Water Pollution Control (31.12.2004)</li> <li>▪ Zoning Law (3194):</li> <li>▪ Renewable Energy Law (5346):</li> </ul>
<b>Food Safety and Security</b>	<ul style="list-style-type: none"> <li>▪ Law pertaining to the Adoption with Amendments of the Decree Law regarding Food Generation, Consumption and Inspection (5179):</li> <li>▪ Biosafety Law (5977):</li> <li>▪ Agriculture Law (5488) and Agricultural Basins Regulation (07.09.2010)</li> </ul>

**Table 6. Legislation indirectly and secondarily related to climate change adaptation**

Category	Legal Regulations
<b>Disaster Risk Management</b>	<ul style="list-style-type: none"> <li>▪ Regulation pertaining to Emergency Aid Organization and Planning Principles regarding Disasters (Council of Ministers: 88/12777 - 1.4.1988)</li> <li>▪ Regulation pertaining to the Norms, Organization, Standards and Principles of Provincial Disaster and Emergency Directorates and Civil Defense Search and Rescue Unions</li> </ul>
<b>Conservation of Biodiversity</b>	<ul style="list-style-type: none"> <li>▪ The Constitution</li> <li>▪ Law pertaining to the Duties and Organization of the Ministry of Forestry and Water Works</li> <li>▪ Law pertaining to the Duties and Organization of the Ministry of Environment and Urbanization</li> <li>▪ Law pertaining to the Adoption with Amendments of the Decree Law regarding to the Duties and Organization of the General Directorate of Forestry</li> <li>▪ Law on the Mobilization for National Reforestation and Soil Erosion Prevention</li> <li>▪ Regulation with regard to the Implementation of the Forest Cadastre in accordance with the Forestry Law no 6831</li> <li>▪ Circular no 2007/ 28 on the Mobilization of Reforestation</li> <li>▪ Draft Law on the Protection of Nature and Biodiversity</li> <li>▪ Cadastre Law</li> <li>▪ Regulation regarding the Marking of Wood Package Materials in relation with Phytosanitation</li> <li>▪ Regulation pertaining to Rooting out, Generation and Export of Natural Bulbs</li> <li>▪ Beekeeping Regulation</li> <li>▪ Fisheries Law</li> <li>▪ Fisheries Regulation</li> <li>▪ Aquaculture Regulation</li> <li>▪ Fishing Ports Regulation</li> <li>▪ State's Forest Management and Fluid Capital Regulation</li> </ul>
<b>Water Safety and Security</b>	<ul style="list-style-type: none"> <li>▪ The Constitution</li> <li>▪ Communiqué on the Identification of Closed Bay and Gulfs which are of Sensitive Nature Where Fish Farms Shall not be Built</li> <li>▪ Wetlands Communiqués</li> </ul>
<b>Food Safety and Security</b>	<ul style="list-style-type: none"> <li>▪ The Constitution</li> <li>▪ Veterinary Services, Plant Health, Food and Seed Law</li> <li>▪ Organic Agriculture Law</li> <li>▪ Law Pertaining to the Preservation of the Rights of Breeders of New Plant Species</li> <li>▪ Agricultural Insurances Law</li> <li>▪ Law on the Protection of Soil and Land Use</li> <li>▪ Law on Agricultural Reform Pertaining to Land Regulation in Irrigation Fields</li> <li>▪ Law on the Foundation and Duties of Agricultural and Rural Development Institution</li> <li>▪ Law on Agricultural Producer Unions</li> <li>▪ Fodder Law</li> <li>▪ Law on Animal Health and Inspection</li> <li>▪ Animal Breeding Law</li> <li>▪ Statutory Decree on the Foundation and Duties of the Ministry of Agriculture and Rural Affairs</li> <li>▪ Turkish Food Codex Regulation</li> <li>▪ Regulation on the Inspection and Control of Food Safety and Quality</li> <li>▪ Regulation on Good Practices in Agriculture</li> <li>▪ Law on Aids to be Provided to Farmers Affected by Natural Disasters</li> </ul>



## **Institutional Structure**

Since the Ministry of Environment and Urbanization is the National Focal Point of the UNFCCC, this Ministry is also the institution that coordinates activities for adaptation to climate change at first hand. Moreover there are many relevant Ministries, institutions and organizations indirectly responsible for adaptation activities. With the new arrangements made regarding restructuring of Ministries, some Ministries took additional responsibilities in the fight against climate change.<sup>21</sup>

Many important institutions such as, the Ministry of Environment and Urbanization, the Ministry of Forestry and Water Works, the Ministry of Food, Agriculture and Livestock, and the main units of these Ministries (General Directorate of Environmental Management, General Directorate of Water Management, General Directorate of Plant Production, General Directorate of Agricultural Research and Policies and their subordinate organizations (General Directorate of State Hydraulic Works, General Directorate of Meteorology, General Directorate of Forestry etc.) began to strengthen their policies regarding adaptation to climate change and increase projects and activities in this field.

The Climate Change Department was established in 2009 under the General Directorate of Environmental Management, which is subordinate to the Ministry of Environment and Urbanization and it tackles all issues concerning climate change.

First established in 2001 and restructured in 2004 the “Coordination Board on Climate Change (CBCC)”<sup>22</sup> that is responsible to take necessary measures to prevent adverse effects of climate change, ensure coordination and distribution of tasks between public and private sector institutions and organizations, and determine domestic and foreign policies considering the conditions of our country regarding this issue was restructured in 2010.<sup>23</sup>

The Ministry of Environment and Urbanization is responsible for the Secretariat of CBCC. One of the 11 Technical Working Groups functioning under the CBCC is the Working Group on Climate Change Adaptation for which the General Directorate of State Hydraulic Works is responsible. In the context of adaptation to climate change, the General Directorate of State Hydraulic Works holds duties and authorities focusing on the management of water resources and it conducts research on relevant issues and works in cooperation and coordination with other authorized institutions.

A Division on Adaptation to Climate Change has been established under the Ministry of Forestry and Water Works General Directorate of Water Management Department of Flood Planning and has been assigned with the issues of “the impacts of climate change on water resources and floods and necessary precautions”.

**1. Water Resources Management:** Development of strategies focusing on adaptation and sustainable water management (surface waters as well as ground waters); determination of needs in different sectors (potable water, industry, irrigation) to ensure balanced and realistic supply and demand; ensuring effective use

<sup>21</sup> In 2011 the Ministry of Environment and Forestry, the Ministry of Public Works and Settlement, the Ministry of Agriculture and Rural Affairs, the Ministry of Industry and Trade, State Planning Organization, Undersecretariat of Foreign Trade, General Directorate of Forest were restructured and some new Ministries were established. Within this framework; with the Decree Law (DL) No. 633, published in the Official Gazette dated June 8, 2011, numbered 27958 the Ministry of Family and Social Policies; with the DL No. 634 Ministry for European Union Affairs; with the DL No. 635 the Ministry of Science, Industry and Technology; with the DL No. 637 the Ministry of Economy; with the DL No. 638 the Ministry of Youth and Sports; with the DL No. 639 the Ministry of Food, Agriculture and Livestock; with DL No. 640 the Ministry of Customs and Trade and with DL No. 641 Ministry of Development was established. Pursuant to the Decree Law No. 645 Pertaining to the Organization and Tasks of the Ministry of Forestry and Water Works, published in the Official Gazette dated July 4, 2011 and repeated numbered 27984; the Ministry of Environment and Forestry carries on its activities as the Ministry of Forestry and Water Works. Pursuant to the Decree Law No. 644 Pertaining to the Organization and Tasks of the Ministry of Environment and Urbanism, published in the Official Gazette dated July 4, 2011 and repeated numbered 27984; the Ministry of Public Works And Settlement carries on its activities as the Ministry of Environment and Urbanism. Since the ministries have been restructured; in the Report, the relevant institutions are usually referred to by the new names of the institutions; while referring to the works before the date the DLs were published, to the legislation that hasn't been changed yet, and to printed and other sources that were published, the old names of the Ministries/institutions are used.

<sup>22</sup> IDDK was established with the Notice No. 2001/2, which was prepared in 2001 and rearranged in 2004, and was restructured with the Notice No. 2004/13.

<sup>23</sup> The Notice No. 2010/18.

of water resources and to minimize the stress of catchment-based immediate changes (aridity as well as floods) on water quality; improvement of dams (dams for potable water, industrial water, irrigation, hydropower and flood control dams); establishment of irrigation and drainage systems; water supply and improvement of water treatment plants.

- 2. Agriculture and Food Safety:** Using water from catchment-scale agricultural irrigation activities (water economy in agriculture); identification of water resources that will be used for the provision of water within the scope of climate change; and handling agriculture and food safety under the light of the above.
- 3. Natural Disaster Risk Management:** Designing water resources management and operation policies and plans in a way to establish a system/mechanism to ensure an optimal balance for risks from disasters (flood control, future-looking estimations).
- 4. Basin Management:** Within the scope of adaptation to climate change; integrating appraisals and existing as well as future operation policies for a basin-based water resources management to national and regional policies and supporting decision making mechanisms to serve this purpose.
- 5. Natural Resources Management:** Identification and planning of water resources that supply wetlands; putting in place measures to supply water needed by wetlands (reservoirs etc.) in a way to ensure effective management and sustainability of ecosystem services; erosion and deposit (sedimentation) control.

Efforts to improve the resistance of forest ecosystems to climate change that are carried out by the General Directorate of Forestry affiliated institution of Ministry of Forestry and Water Works are considered within the scope of adaptation to climate change. The General Directorate of Meteorology, on the other hand, participates in efforts to clarify obscurities on the issue of adaptation to climate change. Also, the Prime Ministry Disaster and Emergency Management Presidency carries out efforts concerning the likelihood of increasing disaster risks' as a result of climate change and related insurance work. These efforts are directly linked to adaptation.

Many activities carried out by the Ministry of Food, Agriculture and Livestock shall be considered within the framework of adaptation to climate change. Also, other ministerial departments carry out research on soil and water resources as well as other work on efficient use of sources of plant, animal and aqua- products; increasing efficiency; increasing the variety of products; agricultural insurance schemes, aridity action plans, food safety, combating animal and plant pests and diseases and prioritizing support to women farmers. All these efforts, again, are either directly or indirectly linked to climate change.

## **Financing**

Adaptation to climate change has costs. Increasing awareness about economic costs of not taking measures regarding adaptation to climate change is an important part of adaptation policies. One of the most recent researches that stimulate public debate about the costs of not taking measures considering economic dimensions of climate change is the Stern Review (Stern, 2007) on the economics of climate change. The report emphasizes the importance of taking early measures regarding adapting to and mitigating the negative effects to avoid the gravest results of the climate change. The economic costs of the results of climate change and the costs of not taking measures can be regarded as an important principle in mitigating the negative results and creating adaptation policies.

There are indirect financial policies for adaptation to climate change and supporting mechanisms in Turkey. In Turkey, in order to adapt to the effects of the climate change, cost-benefit accountings regarding adaptation at national, regional or sectoral level are not conducted yet. In order to adapt to climate change, which activities would be carried out by national and local efforts and which activities would be carried out with international financial supports are in the assessment phase.

International financial resources promoting projects regarding adaptation have been increasing recently. In order to both include actions identified in the National Climate Change Adaptation Strategy and Action Plan in the national investment plans and to be able to benefit from external financing facilities; the detailed works should be urgently initiated to determine these costs and increase internal/external financing facilities.

Within the scope of funding policies for adaptation activities, Turkey shares her need for financial resources with international community on various occasions. One of the statements within this framework: “...Turkey is of the view that the funds for adaptation should be provided to Parties on the basis of certain criteria including vulnerability to the adverse effects of climate change, level of associated risks and the capacity of the Parties to adapt to climate change. Generation of new, adequate, predictable and sustainable financial resources should be based on the principles of “equity” and “common but differentiated responsibilities” and respective capabilities. Turkey is of the opinion that there is a need for an international, multi-optional insurance mechanism in compensating losses and damages that arise from climate induced extreme events such as droughts, , floods, frost and landslides, as indicated in the Bali Action Plan.”<sup>24</sup> A multiple option insurance mechanism has been developed for all risks except for “drought” within the scope of state funded agricultural insurances. Additional work is needed to insure against drought. When financial resources to be used at national level, the resource to be used via Provincial Bank within the scope of Supporting the Infrastructure of Municipalities Project (BELDES-SUKAP) and the grant transferred from bank profit for drinking water and sewerage works of municipalities the population of which is less than 25.000 are planned to be included.

In recent years, a number of projects which aims at adaption to climate change have been supported by United Nations and its subsidiaries so as to provide technical assistance. Besides, Turkey has a remarkable share from Clean Technology Fund<sup>25</sup> within the scope of Climate Investment Funds<sup>26</sup> composed of two multilateral funds. Although Clean Technology Fund is solely financing reduction investments, it is indirectly a remarkable progress for financing the policies aiming at adaption.

Currently, the funds allocated for scientific research and R&D activities in climate change adaptation activities are not sufficient. There hasn't been research for conducting climate change impact analyses of the climate dependent sectors (agriculture, industry, tourism etc.) and determination of adaptation costs.

It is of great importance to build information on the cost and financing of climate change adaption and to evaluate the road map concerning these issues more comprehensively.

### **Economic Tools**

Climatic conditions with their fast-changing and nebulous nature demand an evaluation of the impacts of climate change. As a matter of fact, these impacts have to be considered as standard factors during the feasibility studies for such projects.

Existing and future investment plans, incentives and other economic tools for the five vulnerability areas that were so far identified and that would shape climate change adaptation efforts from now on will either directly or indirectly prepare the grounds needed for Turkey's adaptation to climate change. Taking the National Climate Change Strategy and Action Plan as one of the sources to be used during the preparation of the 10th Development Plan will further strengthen this process.

It is important to continue planning existing investments that are still implemented and important for adaptation, i.e. closed system irrigation investments, through national and international resources and support infrastructure investments for advanced sprinkler and drip irrigation.

<sup>24</sup> “Turkey's Views on the Fulfillment of the Bali Action Plan and the Components of the Agreed Outcome”, 24 April 2009.

<sup>25</sup> Clean Technology Fund (CTF): <http://www.climateinvestmentfunds.org/cif/node/2>

<sup>26</sup> Clean Technology Fund (CTF): <http://www.climateinvestmentfunds.org/cif/node/2>

Besides, it is essential to encourage increasing treatment of waste water to be used in agriculture and industry through economic tools and support private sector in this regard in terms of rational management of water resources.

### **Research-Development, Data and Information Systems**

Increasing academic initiatives, research and development activities and the research for innovative technologies on the issue of adaptation to climate change would be the very first of the 'soft adaptation measures' to be taken for the planning of climate change adaptation process.

Turkey started working on regional climate projections to set the basis for impact assessment and adaptation efforts for climate change in 2005. Turkey's First National Communication further accelerated these efforts that are mainly carried out by the ITU Eurasia Institute of Earth Sciences. They were supported first by a TUBITAK KAMAG project, and later by another project as a part of the UN Joint Programme on Enhancing the Capacity of Turkey to Adapt to Climate Change. Within the scope of the IPCC 4th Assessment Report the results of some of the global climate models were studied and elaborated in more detail and in the end models with a scale of 150-200 km were downscaled to 27 km-scale. The results are available through a web interface ([www.agora.itu.edu.tr](http://www.agora.itu.edu.tr)).

Within the framework of the same programme, Ministry of Forestry and Water Works, Ministry of Food, Agriculture and Livestock coordinated efforts with METU on the development of an information management system on the impacts of drought and floods. The objective of these efforts was to have access to real-time meteorological data via an integrated system; to collect such data; to develop related software tools to collect and analyze such data and to design software and methods for emergency warning systems.

Within the context of adaptation to climate change activities, though indirectly; research organizations such as TUBITAK Marmara Research Centre (Food Institute, Environment Institute, Energy Institute, etc.) the research institutes of the Ministry of Food, Agriculture and Livestock in provinces, Agricultural Combat Research Institutes, Fisheries Research Institutes, product-based research institutes (Niğde Potato Research Institute, Bornova Olive Research Institute, Çukurova Agricultural Research Institute etc.), Forestry Research Institutes of the Ministry of Forestry and Water Works are active.

It is early to say that scientific studies on fight against climate change are widespread nationwide in the universities in Turkey. Adaptation to climate change issues have started to be dealt with in the scientific research institutes and environmental research centers of some universities such as ITU, Boğaziçi University, Dokuz Eylül University and Çukurova University.

### **Training, Awareness Raising and Capacity Building**

Institutionally, Ministry of Environment and Urbanization was appointed as national focal point for training and raising awareness on climate change as foreseen by article 6 of the UNFCCC. The General Directorate of Environmental Management, the main service unit of the Ministry of Environment and Urbanization, carries out activities in this field in coordination with the Department of Education and Publication.

The Ministry of Environment and Urbanization, the Ministry of Forestry and Water Works, the Ministry of Food, Agriculture and Livestock and the Ministry of National Education have significant roles in raising and creating public awareness on the impacts of the climate change and adaptation.

In recent years, there has been a remarkable increase in the works for capacity building on the subject of climate change. The reason for this is Turkey's active participation in climate change processes and that

negative effects of global warming are discussed in the national media. The fact that some media organs make special programs for climate change issues has an influence on raising public awareness. Moreover; NGOs conduct activities -though limited- in terms of the effects of climate change and adaptation.

Although important projects regarding the effects of climate change on water resources, ecosystem services and agriculture were realized by certain non-governmental organizations and the works continue, there is still a need for strengthening participatory processes for adaptation to climate change.

In this context; through a set of international projects, training programmes for combating against climate change were developed and implemented in cooperation with universities and research organizations, awareness-raising activities on climate change adaptation aiming at public opinion and related public institutions were and are being carried out.

Within the scope of UN Joint Programme on Enhancing the Capacity of Turkey to Adapt to Climate Change carried out by the Ministry of Environment and Urbanization; Climate Change, Adaptation Policies and Turkey Certified Training Programme was realized in cooperation with METU. The training programme aimed to provide training to employees of public and private sector institutions, universities, research institutions and non-governmental organizations on “climate change, the impacts of climate change and adaptation to these impacts, adaptation policies and planning, the understanding of the social, communal and economic dimensions of adaptation, Turkey’s status and the interaction between climate change policies and economic development policies” as well as to build capacity in this field, ensure the implementation of scientific studies, project management and decision-making mechanisms and to establish human resources for implementing agencies.

In recent years, UNDP has been implementing many joint projects with the Ministry of Environment and Urbanization as well as with national institutions and organizations within the scope of enhancing the capacity of relevant parties on climate change adaptation and effective implementation of UNFCCC.

#### **d. Model Implementation for Supporting Strategy Development: Seyhan River Basin**

One of the most important activities carried out during the preparation of National Climate Change Adaption Strategy is Community Based Adaption to Climate Change in the Seyhan River Basin Grants Programme.

The “Community-Based Adaptation to Climate Change in the Seyhan River Basin Grants Programme” which was realized between 2009 and 2010 was a program which supported the preparation of National Climate Change Adaptation Strategy and Action Plan and which was designed and developed as a model programme in order to demonstrate the approaches on climate change and adaptation. This Grant Programme has been a guide in developing the strategy through its model applications.

The aim of this programme is to reduce the adverse effects of climate change, and increase the benefits of its’ positive impacts at maximum level and to secure the achievement of Millennium Development Goals. While adaptation capacity of communities and institutions in the Seyhan River Basin is being enhanced, innovative adaptation activities have also been supported by bringing new approaches to people who live in the region.

Local pilot implementations have been realized on adaptation to climate change within the scope of the programme. Each of the aforesaid local implementations has aimed to develop the adaptation capacity and to make contributions to the achievement of Millennium Development Goals. These implementations have been handled under different titles such as agriculture (including irrigation applications, crop production, animal husbandry and fishery), management of water and national resources, sea level rise level, public health and

## **“Community-Based Climate Change Adaptation in the Seyhan River Basin” Grants Programme**

### **A systematic approach to adaptation applications**

#### *Area of the Programme*

Seyhan River Basin is part of the Eastern Mediterranean Basin and it is identified by the UNFCCC as one of the extremely vulnerable regions that would be affected the most by climate change. The basin covers an area of 20,000 km<sup>2</sup> and is one of the world’s richest regions in terms of biodiversity. It comprises one of the most productive agricultural regions in Turkey and Europe and hosts a wide range of agricultural systems, including dry agriculture, irrigated agriculture, cattle breeding, forestry and fisheries. Different types of geographical terrains leads to diversification of landscapes, ecosystems, livelihoods, communities and hence the diversification of adaptive capacities and climate related risks. From north to south highland steppes, mountainous areas, lowland plains and associated socio-economic dynamics give the area a unique character.

According to the population census in 2008, the basin hosts almost 2.5 million inhabitants in which 25% living in rural areas. Based on the socio-economic development ranking survey of State Planning Organization in 2004, agriculture including animal husbandry is the main economic sector in the basin (72% of the labor force). This is followed by services and industry sectors by 22% and 6% respectively.<sup>27</sup>

#### *Making use of existing knowledge and experience*

The project titled “The Impact of Climate Change on Agricultural Production Systems in Arid Areas (ICCAP)”<sup>28</sup> implemented in the Seyhan Basin between 2001-2007 is an unique example for Turkey<sup>29</sup>. Within the context of this project, an extensive assessment and examination on the approach of the agricultural production system on land and water management was done and relations between the regional climate, hydrology and agricultural economy were examined. Also, a comprehensive assessment is done on the sensitivity of the system to climate change in order to identify the motives behind agricultural productivity. The outcomes of this project have been used as a scientific basis during the climate change adaptation strategy preparation and for the activities done in the context of the “Community-Based Adaptation to Climate Change in the Seyhan River Basin” Grants Programme.

#### *The predicted changes in the basin's climate*

According to the ICCAP projections, temperatures are expected to rise 2-3.5° C in the Seyhan Basin and precipitation to drop 25-35% until 2070. Also the water resources that are used for irrigation and for other purposes will decrease dramatically. A decrease in the volume and a downfall in the quality are also expected in the ground water resources. The decrease in the volume of the ground water will lead to salt water intrusion from the sea up to 10 km inland. The changes in temperatures and precipitation will bring changes in the economic activities and sources of incomes like changes in the location of crop types, agricultural practices.

<sup>27</sup> Ministry of Development data.

<sup>28</sup> Impacts of Climate Change on Agricultural Production System in Arid Areas-ICCAP

<sup>29</sup> Project has been executed by Çukurova University, TUBITAK, SHW and RIHN

### *Filling the gaps with complementary works*

In order to enhance and complete the works that have been done before, the initiatives listed below were taken:

- Stakeholder Analysis: Perception, existing and possible future perceptions of institutions on the climate change.
- Livelihood Analysis: The effects of the risks of climate change on the sources of income (since the more livelihoods depend on natural resources, the more the communities are under risk of changing climatic conditions)
- Ecosystem Analysis: The effects of climate change risks on ecosystem services like ecosystem and natural structures.

### *Merging experiences and making the “complex” understandable and usable: Application of Systems Approach for Climate Change Adaptation in Seyhan River Basin*

To make clear the complex and interrelated issues in climate change such as climate-soil-water-agriculture-livelihood-health relations as well as to identify region specific root-causes of barriers to adaptation and possible site specific adaptation opportunities, it was essential to analyze the local dynamics/conditions in a systematic and holistic way. This will help to identify root-causes to solve a It is unavoidable to analyze the local dynamics and conditions systematically and holistically for clarifying the interrelated and complex issues like climate, soil, water, agriculture, livelihood, health and also for identifying the region specific root-causes of barriers to adaptation and possible site specific adaptation opportunities. This approach that is applied in the context of Community-Based Adaptation to climate Change in Seyhan River Basin Grant Programme will ensure to identify the fundamental underlying root-causes while resolving a specific problem, better understanding of a complex structure, developing coping policies, strategies and measures used by the decision makers and other stakeholders. Starting from this point, it was decided to apply system approach with a participatory understanding in the region. Thus, in the region, it was aimed to identify the prioritized themes and subjects within the frame of the community-based program, to convey the holistic thinking approach to local specialists and public officers to use in their daily planning and decision making.

The system approach for gathering different specialities from different institutions within the basin and for adaptation to the climate change, the themes listed below were considered:

- *Agriculture and food security*
- *Water resources and quality*
- *Public health*
- *Disaster risk management*
- *Natural resources management*
- *Infrastructure*
- *Basin and coastal areas management*

<sup>30</sup> Participatory Vulnerability Analysis (PVA) is a systematic process that includes a rapid assessment of the vulnerabilities of local stakeholders against climate change, their existing coping methods with the increasing climatic disasters and possible activities to build future resilience against the impacts of climate change.



### *Identifying the urgent measures and priorities*

The most important outcome of the system approach in climate change is the “casual loop diagram” that is made by gathering similar diagrams done by each working group. The diagrams (especially the points where threats and opportunities intersect) revealed which themes require urgent measures and what are their priorities.

Within the frame of the program, in the Seyhan basin, a series of information and education meetings were held in Kayseri, Niğde and Adana provinces. Information on climate change in general and its effects on the Seyhan River Basin were given to local authorities, NGOs and academic staff.

The experiences gained at the end of the Seyhan project became an important example and a baseline not only for the National Climate Change Adaptation Strategy and Action Plan but also for region/basin scale regional strategies possible to be prepared for adapting to the effects of climate change in Turkey.

Seyhan program at the same time played a complementary role by ensuring the information flow from bottom (application level) to top (national policy level) to identify the effects of the activities realized in the process of strategy development for adapting to the effects of climate change and especially to Participatory Vulnerability Analyses (PVA)<sup>30</sup> conducted in 11 provinces.

### *Pilot Schemes for Eco-Efficiency and Clean Production in Seyhan Basin*

Adaptation in industry necessitates giving priorities to the precautions that are going to be taken against the elements which are expected to be seen because of climate change and which will negatively affect production and competitiveness. Expected decrease especially in the production inputs (water, raw materials, energy, etc.) (and as a consequence of this, increase in costs) poses great risk for industrialists.

This risk which the industrialists are faced with has also been emphasized within the scope of Joint Programme, and UNIDO Eco-Efficiency (Clean Production) Programme has been carried out under the coordination of United Nations Industrial Development Organization (UNIDO) and under the consultancy of Middle East Technical University (METU) by the Technology Development Foundation of Turkey (TTGV).

Within the scope of UNIDO Eco-Efficiency (Clean Production) Programme, it has been aimed to develop the capacity in clean production and eco-efficiency, to implement pilot schemes in Seyhan Basin (Adana, Niğde, Kayseri) and to make these schemes widespread on the national scale. Since “decrease in available water supply” is foreseen to be the most significant impact of climate change which will directly affect the industrialists in many regions of Turkey and in Seyhan Basin, UNIDO Eco-Efficiency Programme has focused on “decreasing water utilization in production”.

Based on Seyhan Basin, “food and drinks”, “textile and leather”, “chemical materials and products” and “metal coating and machine part production” have been determined as privileged industry sectors in line with economic and environmental criteria (water consumption and others).

Pilot projects were realized on water saving and clean production have been conducted in 6 firms operating in these sectors. With the help of these pilot projects, 784,550 m<sup>3</sup> water, 207.8 ton chemicals and 4,946,970 kWh energy consumptions have been annually economized. Annual financial gain which has been obtained by these implementations is \$1.35 million. See: [www.ekoverimlilik.org](http://www.ekoverimlilik.org)

<sup>30</sup> Participatory Vulnerability Analysis (PVA) is a systematic process that includes a rapid assessment of the vulnerabilities of local stakeholders against climate change, their existing coping methods with the increasing climatic disasters and possible activities to build future resilience against the impacts of climate change.

## e. Participatory Vulnerability Analysis

“Participatory Vulnerability Analysis – PVA” has been carried out at local level as one of the main activities which have been realized in order to determine the impacts of the climate change and to put forward the vulnerable areas in Turkey. The fact that Turkey is a notably broad country in geographic aspect and has many environmental and climatic varieties has necessitated that certain studies are carried out at the local level in order to make effective contributions to the preparation process of “National Climate Change Adaptation Strategy and Action Plan”. Provinces have been chosen in limited number in order to determine the impacts of the climate change and vulnerability at the local level; selection criteria of the provinces have been carefully identified in order to make the sampling safe and by this way, the problems and gaps that may occur have been minimized. In the PVA process; identification of vulnerability areas related to the climate change at the local level with the help of a participatory approach has offered a considerable insight to the development of the strategy and to the determination of the privileged objectives and actions.

In the process of the “Participatory Vulnerability Analysis” which was realized in four months within 2009 and 2010, vulnerabilities against the impacts of climate change were determined at local level in 11 provinces that were chosen; the impacts on relevant sectors or themes in changing climate conditions were analyzed; sustainability levels of ecosystem services and natural resources were examined as much as possible and preparedness level against natural disasters originating from the climate was observed.

Thus, it has been understood that i) changes which have occurred because of the climate ii) people who were affected from these changes and information about where, how and how often they were affected iii) types of measures which were taken by certain institutions and iv) existing capacities and needs (needs related to policies, legislation and implementations etc.) of local institutions (all of the abovementioned elements were determined in all provinces at local level) have guided the general principles, priorities and measures (as strict and light adaptation measures) of the National Climate Change Adaptation Strategy.

The PVA showed that adaptation to climate change is a new topic in Turkey. Nevertheless, vulnerable communities engaged in spirited stakeholder discussions that have led to the elements of national adaptation strategy proposed in the previous section. In conclusion, there are a number of key observations from the process that are offered below relative to implementation aspects of the national strategy.

- **Urgency:** *Since climate change is understood as a slow process, public institutions in the provinces do not necessarily yet see the urgency in taking adaptive action. Prioritizing institutional cooperation and coordination at the outset of the national adaptation implementation process will enhance the Strategy itself. Not only is coordination needed in the development of the policy, but in the implementation as well.*
- **Coordination:** *The PVA workshops revealed that the Ministry of Food, Agriculture and Livestock is a strategic partner for the Ministry of Environment and Urbanization (MoEU) at the provincial level. Ideally, these two ministries will work closely in the implementation of the national climate change adaptation strategy. The MoEU will need to involve, cooperate, coordinate and convince other ministries and public institutions to contribute to the implementation of the National Climate Change Adaptation Strategy.*
- **Cooperation:** *Improved cooperation is needed between institutions e.g. public, private, NGOs, etc. because bureaucracy has been shown to be a road block to the implementation of effective actions. Moreover, effective regional partnerships with EU countries, international cooperation, and private sector engagement are essential building blocks.*
- **Awareness:** *There is limited local awareness of the impacts of climate change. Effective implementation of a national climate change adaptation strategy will need to enhance the capacity of local stakeholders to manage risks associated with future climate change. Deeper engagement on the part of local organizations, particularly local universities and research institutes, will be essential in the process.*

- **Representation:** Local ownership/commitment should be sought through the ongoing inclusion of representatives of key public institutional actors from the specific provinces where PVAs have been undertaken. This inclusion should help ensure that community-scale project requirements are taken into consideration in implementation decisions with regard to adaptation to climate change by the central level.
- **Mandate:** It will be important for there to be a central mandate on adaptation in the form of national legislation. The workshops relayed the positive effects of national legislative action through the introduction of agricultural insurance. A robust implementation of a national climate change adaptation strategy will require similar actions.



# 4 Road to the National Climate Change Adaptation Strategy

Stocktaking analyses and evaluations in the process of PVA have been used as a base in the development of “National Climate Change Adaptation Strategy and Action Plan”. In addition to this, the needs and priorities which have been indicated by all other activities summarized above have guided the preparation of the National Climate Change Adaptation Strategy and its’ actions.

## **a. What’s National Climate Change Adaptation Strategy?**

Adaptation strategies at the national level are important in that they contribute to the coordination of adaptation activities. In the “National Adaptation Programmes of Action (NAPAs)” documents prepared in least developed countries and “National Adaptation Strategies (NAS)” documents prepared in developing countries; issues such as determining specific impacts on countries, including different institutions and administrative levels, as well as adaptation to climate change at local and regional level with broad participation of business world and civil society actors are handled.

As a matter of fact, adapting successfully to climate change at the national level is possible by ensuring some conditions. The conditions determining the elements of a national strategy are as follows:

- o A systematic planning capacity in a collaborative institutional atmosphere;
- o Sufficient institutional arrangements including coherent policies, measures and regulatory frameworks;
- o Effective coordination of continuous activities at the regional and local level that are carried out under the leadership of NGOs, research institutions, private sector, and regional authorities;
- o Scientific and technical capacity to develop measures and adaptation strategies in accordance with understanding of the problem and its effects at national and local/regional level, modelling of long-term effects and level of implementation;
- o Capacity to develop programmes and projects;
- o Awareness and participation of citizens sustaining climate change adaptation measures and identifying priorities.

The factors that determine the capacity to adapt to the effects of climate change in countries are listed below:

- Availability of resources and expansion of these resources to the population
- Infrastructure of critical institutions and coordination of decision-making authorities
- Stages of risk assessment methods and management (risk expansion methods)
- Economic effects of climate change
- Investment programmes based on effect analyses
- Associating the impacts of climate and adaptation with financial policies (For instance, associating tax/incentive policies with insurance regime)
- Technology options/innovations for adaptation
- Using adaptation funds and capacity to develop projects so that these funds are demanded rather than being supplied

The most important difficulty in developing strategies for adapting to the effects of climate change is the existence of obstacles in determining impacts, vulnerabilities and uncertainties. Scientifically, main obstacles are that effects and uncertainties for nearly all sectors are not known sufficiently, these uncertainties and effects can not be measured and there are no comprehensive models. There are no vulnerability assessments or they are very unspecific. The lack of awareness brings about the lack of adaptation at sectoral/thematic basis. However while identifying the impacts; they should be differentiated as the impacts on the growth of dominant sectors (the impacts arising from the responsibilities of reduction and control of greenhouse gases), the ones on social life and on the environment.

Apart from the fact that there are no clear policies and implementations for adaptation of sectors and resources affected from the climate change to climate change or the lack of these policies and implementations; institutions determine the effects on their own and set goals in this direction. This prevents integration between sectors. Here it is important to take into account and measure the combined effects.

The process of adaptation to the effects of climate change includes integration of options, costs and risks by private and public decision-makers in different places and at different times. Consequently, it is important to develop a climate change adaptation strategy that can lead many decision-making processes in time. This strategy should be a sustainable approach that makes societies stronger, ensure the long-term wealth of the environment and the economy. It is important that a sustainable approach regarding adaptation to climate change supports basic “strategic principles” summarized below:

1. Adaptation should be performed through measures providing resistance. Adaptation measures should ensure strong societies, sustainable economic development and a healthy environment.
2. Adaptation should be continuous and based on new information. Adaptation measures should take into account uncertainties about climate forecasts through systematic observation and review. This, identifies successful measures, increases accumulation of knowledge and enables including new information regarding risks.
3. Adaptation should be integrated with normal development and implementation processes. Climate resistance and risk management should be integrated into existing management processes and decisions in order to extend the scope of development implementations.
4. Adaptation should be integrated at a proper scale and contain relevant decision-making levels. Here, governments have a strategic role to play. However, the problem doesn't only belong to governments; because the effects of climate change require many organizations and individual actors in society to decide. Adaptation to climate change sometimes requires making efforts at a large scale; sometimes requires an integrated approach aiming to handle it in geographically different areas, basins or at smaller scales.
5. Adaptation should be tackled together with actions for reducing greenhouse gas emissions. Activities for

the management of changing climate effects should also be appropriate in line with existing conditions regarding reduction of greenhouse gas emissions. Similarly, works carried out to reduce emissions should be in accordance with adaptation principles (specified here).

6. The adaptation of a sector shouldn't restrict the adaptation of another sector. The decisions made by an organization, an enterprise or an individual to manage climate change risks should aim to provide resistance to relevant parties by promoting strong societies, sustainable economic development and conservation of biodiversity.

The "strategically prioritized" activities that will be selected for adapting to the effects of climate change may directly reduce the level of vulnerability from climate risks or ensure to benefit from opportunities. Alternatively, the activities may include improving skills and capacity to create adaptation measures. Governments should identify some strategic priorities and take some measures stated below so as to encourage the climate change adaptation:

**Taking action immediately if possible:** Since climate change is an issue that will occur in the future, it is not usually regarded as a priority by decision makers. On the other hand; it is witnessed that while usual implementations are carried out, the costs increase due to the climate changes. At this point, although lack of knowledge poses an obstacle, climate risk management plans should be prepared and these plans should be combined with the planning of existing applications. The priority is to obtain more reliable and sufficient information.

**The leading role of governments and ensuring coordination:** Governments should include adaptation to climate change principles in development plans, policies and programmes, be pioneers in this respect and coordinate with relevant parties.

**Creating adaptation capacity:** It is important to provide more access to information and encourage building capacity to use this information. Moreover; in order to take effective adaptation measures, there should be effective communication between key decision makers.

**Elimination and management of uncertainties:** It is necessary to increase the accumulation of knowledge by adopting a strategic approach aimed at research, understanding what kind of planning will be done and how it will be managed, and joining partnerships that share information. At this point, "precautionary principle" may be used as a good guide for making decisions before uncertainties.

**Training public and other groups on characteristics of climate risks and how to manage them:** In order to adapt to the impacts of climate change, active participation of households, enterprises, other segments of the society, NGOs, volunteers and the private and public sector is required. Governments should support enhancing the adaptation capacity of these actors by raising the level of consciousness and awareness regarding the characteristics and risks of climate change, and how they can better manage these risks. The more public awareness increases, the easier it will be to eliminate the risks; moreover, the benefits of adaptation will come out.

**The need to review administrative structures for adaptation to climate change:** Active participation of nearly all sectors and administrative structures is necessary for adapting to the effects of climate change. Governments should support developing adaptation capacities of these actors. At this point institutional appropriation is important. In many countries general responsibility for climate change is undertaken by Ministries of Environment. In addition to the participation of environmental ministries; it is essential that Ministries of Planning, Economy, Agriculture and Trade, which play key roles in development, participate in developing

climate change adaptation strategies. For instance, the fact that important ministries such as Ministries of Public Works, Economy and Trade in the governments of the countries located in the Pacific region which are more affected from natural disasters have insufficient capacity to adapt to the effects of climate change caused many measures taken for adaptation to be affected negatively.

In brief, institutional structure may increase or reduce the level of public exposure to climate risks. Radical institutions such as disaster relief payments and insurance programmes influence adaptation capacity. Coastal zoning, construction plans and construction regulation are institutional examples that will be able to contribute to (or reduce) resist effectively against climate change.

**Using certain planning tools for adaptation to climate change:** It is important to use certain environmental management and planning tools for adaptation to climate change. At this point, Environmental Impact Assessment (EIA), one of the environmental management tools, can be regarded as a possible access point. As in Turkey, in many countries for investment suggestions conducting EIA is subject to the legislation. Therefore, EIA may form a frame for the identification of routine issues regarding climate change at the project level. Principally, in EIA implementations, an important deficiency in including problems concerning adaptation to climate change is that EIAs aim at determining the impacts of projects on the environment instead of the impacts of the change in the environment on projects.

The first phase of an EIA is to identify the activities that may probably have important effects on the environment. That's why; even though "environmentally harmless" activities may be affected from the results of climate change; unfortunately they are not taken into consideration. Combining climate risk analyses and climate change adaptation with EIA actions will require determining vulnerability of project screening process against climate change and project's level or potential of being affected from climate change, and that the project is expanded in such a way as to include all these.

## **b. Principles of a National Climate Change Adaptation Strategy**

The up-scaling of baseline studies to the national level has identified the following eight (8) key elements of a national adaptation strategy for Turkey in the short-, mid-, and long-term.

- **Introduction of enhanced planning practices:** This should include improved planning frameworks such as stronger integrated water basin management and integrated coastal zone management, expansion of rain-fed agricultural areas to irrigation, use of enhanced ploughing techniques for soil moisture retention, new plant rotation schemes, and water harvesting systems;
- **New research and data systems:** This should involve the development of new areas of climate change impacts research (e.g., links between sea level rise and coastal erosion, thermal ocean characteristics and fisheries, efficacy of new vaccinations, impact of reduced snowfall), as well as new data/information systems (e.g., institutionalization of information for easy access);
- **New infrastructure and restrictions:** This should include the construction of new infrastructure (e.g., forest belts, vegetating stream slopes, transportation routes, diversion of rivers), as well as new restrictions on infrastructural development in vulnerable areas (e.g., no construction in stream beds);
- **New technology:** This should involve development and/or the import of new products that are capable of mitigating worst impacts of extreme weather events in fields, parks, and gardens and introduction of higher efficiency technologies (e.g., thermal insulation in buildings).
- **Awareness raising and training:** This should include the development of public awareness campaigns to inform citizens on measures that should be taken, particularly public health related. It also involved the strengthening capacity of vulnerable groups (poor, women, children, youth, elderly, disabled) to take advantage of new adaptation strategies (e.g., insurance);
- **Early warning systems:** This should involve meteorological modelling and implementation strategies to



ensure that rainfall projections are accounted for in agricultural planning and programming in rural areas;

- **Insurance and precautionary plans:** This should include the development of mandatory insurance for certain types of agricultural production activities (e.g., flood insurance for agricultural production in flood prone areas) and the development of precautionary plans to offset new risks (e.g., water storage structures such as dams and ponds). (Flood risk in agricultural lands has been added into the scope since 2010 by TARSIM within the context of state funded agricultural insurance.)
- **Emergency planning:** This involves the requirement that municipalities should develop and implement protocols and systems to deal with the increased frequency of climate change-related disasters (e.g., more first aid personnel, coordination among relevant rescue agencies), as well as the establishment of disaster funds.

### c. Framework of National Climate Change Adaptation Strategy

While developing “National Climate Change Adaptation Strategy and Action Plan” stocktaking analysis and assessments in the PVA process were used as a base. Moreover, all other activities summarized above, specified needs and priorities served as a guide to preparing the National Climate Change Adaptation Strategy and its actions. In this respect, basically five vulnerability fields were focused on. These are:

1. Water Resources Management<sup>31</sup>
2. Agricultural Sector and Food Security<sup>32</sup>
3. Ecosystem Services, Biodiversity and Forestry
4. Natural Disaster Risk Management
5. Public Health

The common/crossing points of these vulnerability themes are; Finance; Economic Tools; Research and Development; Data and Information Systems; Education, Raising Awareness and Capacity Building; Governance; Coordination, Monitoring and Evaluation, and Gender Mainstreaming.

In the process of developing strategies and actions; pre-assessments and priority planning regarding thematic/vulnerable areas and obstacles were performed through workshops conducted consecutively with all relevant segments (at central and local/regional levels).

The first step in developing a “National Climate Change Adaptation Strategy and Action Plan” was to draw a “Framework” covering the main objectives and principles of the Strategy. This Framework was drawn in line with sustainable development policies by establishing combined relationships of the possible effects of climate change on sectors and it formed a facilitator basis for the determination of structural needs at regional/local level and priorities (in different terms) necessary for adaptation. Within the scope of the “Strategy Framework”, existing political initiatives were emphasized and potential barriers concerning legal/institutional infrastructure, planning processes and participatory mechanism for adapting to the impacts of climate change were pointed out.

Each of the cross-cutting common issues in the context of climate change adaptation and five thematic areas specified above, and constituting the scope of the “National Climate Change Adaptation Strategy and Action Plan”, adopted by all organizations, included their own strategic objectives and goals<sup>33</sup>.

While identifying goals and actions in line with the determined objectives and goals that are directly or indirectly concerned with climate change adaptation of “Turkey’s Climate Change Strategy” which is in force were taken into account and relations with other existing plans and programmes, and priorities were maintained.

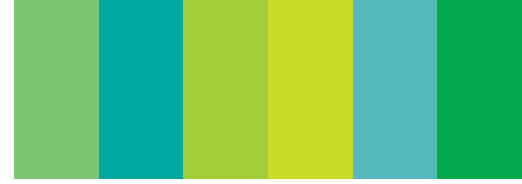
<sup>31</sup> Including marine and coastal areas.

<sup>32</sup> This area includes plant production and animal husbandry.

<sup>33</sup> Each theme has one or more strategic purposes and objectives.

Objective/objectives and actions under each strategic goal were determined by identifying time, outputs and performance indicators, responsible/coordinating agency and relevant agencies. Strategy and action plan chapters prepared for each thematic area were submitted for assessment and approval of all relevant segments through meetings organized separately.

The next process aimed at an assessment of public opinion with broad participation via web environment. National Climate Change Adaptation Strategy was offered for the consideration of all segments of the society during one month. National Climate Change Adaptation Strategy and Action Plan took its final form with the contributions obtained through this process.



# 5

# Turkey's National Climate Change Adaptation Strategy and Action Plan

## I. WATER RESOURCES MANAGEMENT

### **PURPOSE 1. Integrating Adaptation to the Impacts of Climate Change into Water Resource Management Policies**

Turkey's annual potential for consumable surface and ground waters is approximately 112 billion m<sup>3</sup>.<sup>34</sup> It is planned to develop this amount which is the economic and consumable potential under the coordination of the General Directorate of State Hydraulic Works (DSİ) thus making it ready by 2023, the founding year of the Turkish Republic.<sup>35</sup>

It has been stated in "Water and DSİ" Report of DSİ (General Directorate of State Hydraulic Works) that the water consumption amounts has been foreseen as follows in 2023; 72 billion m<sup>3</sup> for irrigation, 18 billion m<sup>3</sup> for drinking and human consumption and 22 billion m<sup>3</sup> for industry which makes 112 billion m<sup>3</sup> in total.

It is scientifically anticipated that the most important impact of climate change will be on the water cycle and that climate change will cause a decrease in Turkey's overall water resources in the future. It is indicated that there will be a decrease in precipitation and a notable increase in temperatures and a corresponding decrease trend in flows in certain basins. For example, it is estimated that 50% of surface waters in the Gediz and Greater Menderes Basins may perish within this century and that water scarcities will occur for the water users in agriculture, in households and in industry.<sup>36</sup>

<sup>34</sup> National Rural Development Strategy, State Planning Organisation, page: 37.

<sup>35</sup> In future water consumption calculations, it has been accepted that the 2% annual population growth as of today will slow down and that population in 2023 will be approximately 100 million. With the increase in life standards, activities for reaching European standards and lowering the daily water consumption per person to 150 liters from 270 litres through the reduction of water loss and savings need to be increased.

<sup>36</sup> T.R. Climate Change First National Communication, January 2007 (in the context of the United Nations Framework Convention on Climate Change).

Although climatic conditions are the leading causes of this situation; excessive use of water in irrigation, illegal ground water use, problems caused by the operations of current facilities, leakages and loss of water within the water network, administrative and institutional problems, delays in investments and water pollution caused by various reasons are the main issues that need to be addressed in order to adapt to the impacts of climate change.

Impacts in Turkey caused by climate change such as increase in summer temperatures, decrease in winter precipitation (in western provinces in particular), loss of surface waters, increase in the frequency of droughts, land degradation, coastal erosion and floods threaten water resources needed for food production and rural development. Due to the impacts of climate change, a reduction of up to 30% is estimated in Turkey's surface water resources, snow storage and ground water potential. This reduction in water reserves compared to the increased need of natural and agricultural water of plants, show that a more effective management of water resources in the future will be unavoidable. In this context, a need for integrating adaptation to climate change impacts approach into water resources management policies has been identified and issues such as water management at the basin scale, distribution of water among sectors, water savings, management of demands, control of water use, enhancement of the monitoring network and increase of large volume artificial storage structures have started to be evaluated as priority areas.

It is considered to benefit from the "uncertainty" theory which has been progressively gaining popularity in recent years in the impact of global climate change and in planning and managing of water resources. Besides, it is highly needed to identify the land use and changes in flora more comprehensively so as to predict the future condition of water resources in a better way. In this frame, attention should be paid to the surveys conducted in these fields by using Geographical Information Systems and Remote Detection technologies should be used.

Although the impact of climate change on water resources has not been directly addressed in the Ninth Development Plan, targets for effective and integrated management of water resources indirectly aim to reduce the vulnerability of water resources against the impacts of climate change. The targets pertaining to water management in Turkey in the Ninth Development Plan have been generally listed below:

- o Efforts initiated for making legal regulations and establishing administrative structures for the allocation, use, development and protection of water resources against pollution will be completed.
- o Protection of surface and ground waters against pollution will be ensured.
- o The effective use of the country's water resources will be ensured through decreasing the loss and leakages in the current water supply facilities.
- o The most appropriate system and technologies will be preferred in the establishment, maintenance and operation of infrastructural facilities aimed at protecting the environment such as water, waste water and solid waste facilities.
- o In order to identify urban infrastructure needs aimed at environmental protection throughout the country; an urban infrastructure master plan and financing strategy will be prepared that will identify the infrastructural needs of municipalities such as drinking water, sewage and waste water treatment facilities.
- o Financial and technical consultancy services provided to municipalities for the realization of urban infrastructure investments will be activated.
- o Use of treated waste waters in the agriculture and industry sector will be encouraged.
- o New finance methods including the participation of the private sector will be developed for the realization and operation of environmental investments (water investments and others).

Besides, other methods which can be handled within the scope of climate change adaptation are determination of alternative water resources so as to plan more flexible water and waste water systems (rain water harvest, flood water, grey water, refined waste water) and creating plans for involving in main resources.

In this framework, efforts to legally and institutionally regulate integrated water resources management in a

way that will include surface and ground water resources are continuing by all institutions. Moreover, the issue of combating climate change have started to be taken into consideration in the context of the preparations for a strategy and action plan on the effective and integrated management of water resources by relevant institutions and in particular by the Ministry of Environment and Urbanization, Ministry of Forestry and Water Works, Ministry of Foreign Affairs, Ministry of Health, Ministry of Food, Agriculture and Livestock, Ministry of Development, General Directorate of State Hydraulic Works and the General Directorate of Provincial Bank.

### **Objective 1.1. Ensuring the integration of climate change adaptation issue into existing strategies, plans and legislation**

The impacts of climate change are directly or indirectly taken into consideration in decisional documents such as Turkey's Combating Agricultural Drought Strategy and Action Plan (2008-2012), Electrical Energy Market and Security of Supply Strategy Document<sup>37</sup> as well as in DSI Water Action Plan (2008-2013) and DSI Strategic Plan (2010-2014) in particular and in the strategic plans of other relevant institutions; and activities are being implemented accordingly. In this regard, the revision of institutional and sectoral strategy plans (industry, agriculture, energy, tourism, urban) of institutions partaking in water management will be made in terms of combating climate change.

Legislation directly related to water management in Turkey are Decree Law No. 645 of 29.06.2011 on Organization and Duties of Ministry of Forestry and Water Affairs. the Organic Law referenced 6200 (1953), Law Pertaining to Ground Waters referenced 167 (1960), Law Pertaining to the Supply of Drinking, Utility and Industrial Water in Settlements of Municipal Organization referenced 1053 (1968), Municipality Law referenced 5393 (2005) Law Pertaining to the Amendment of Certain Laws referenced 5625 that regulates SHW's services on drinking, utility and industrial water in settlements of municipal organization and investment services on waste water treatment (2007) and the Environmental Law referenced 2872 (2006) are the fundamental laws that form the basis for DSI's activities. Moreover, in the context of every Ministry's responsibilities; legislation pertaining to water and international conventions Turkey is a party to are in effect. The mentioned legislations show that many institutions assume responsibility in the management of water when relevant parties and their roles are taken into consideration. In the context of EU legislation, efforts for harmonization with EU directives in the field of preventing water pollution and protecting water resources are ongoing.

There are conflicts and overlap in the duties, authorities and responsibilities of institutions regarding the implementation of water legislation (such as defining of bodies authorized to ensure water services and clear identification of the boundaries of service providing institutions' duties, authorities and responsibilities). Therefore the distribution of institutions' tasks have started to be revised taking into account new legal regulations as well as EU structures and acquis. Assessing that there is a need for developing Turkey's current water legislation to adapt to climate change; the identification of conflicts and overlaps as well as the deficiencies of authorized and relevant institutions' duties, authorities and responsibilities in terms of climate change, will ensure that the necessary revisions are made. In this sense it is aimed to entrust a legally and institutionally integrated water resources management under the umbrella of a single institution responsible for water allocation and quality including surface and ground waters. This integrity will be provided by means of duty and competence of General Directorate of Water Management, central organization of recently founded Ministry of Forestry and Water Works and General Directorate of State Hydraulic Works, which is a subsidiary of the Ministry.

There is a need for re-addressing and developing financing resources and tools necessary for the better management of water resources, in terms of adaptation to the impacts of climate change. In this context, in the allocation of financial resources in the central or local level that has been made or will be made for water management; priority measures (for example steering the service areas of KÖYDES – Supporting the Infrastructure of Villages Project – towards irrigation services) will be taken into account and economic tools will be determined by showing regard to user pays & polluter pays principles in accordance with water use purposes and socio-economic conditions.

<sup>37</sup> With this Strategy Document, special importance has been given to renewable energy resources in Turkey and using all the hydroelectrical potential until 2023 has been aimed (Adoption Date: 21 May 2009).

The Law on Irrigation Unions referenced 6172, that aims to eliminate the deficiencies of irrigation unions which are the most important civil formations in adapting to the impacts of climate change at the local level and to restructure these unions, went into effect in March 2011.<sup>38</sup> The objective of this Law is to ensure the rational use of the country's water assets and resources by using and operating the irrigation facilities that have been constructed, that are being constructed and that are planned to be constructed by the General Directorate of State Hydraulic Works according to their purposes; operating and assuming the responsibility for the maintenance, repair and management of these facilities with the approval of the General Directorate of State Hydraulic Works; implementing projects and having projects implemented for developing these facilities; and regulating the duties and authorities of irrigation unions responsible for renewing these facilities. When the Law on Irrigation Unions referenced 6172 is assessed in terms of adaptation to the impacts of climate change; one of the liabilities of union members is the liability for abiding to plantation planning of unions due to water scarcity, water planning and participating into water distribution and alternation programmes which are indirectly related with adaptation. With the studies implemented taking into consideration the impacts of climate change, enhancement of the authorities of irrigation unions will be ensured in the context of irrigation management which will in turn increase the capacity of unions at the local level.

When it comes to the use of water in different areas within the management of water resources; ensuring the management of water resources in the industry sector is important. Even though industrial water use in Turkey is lower<sup>39</sup> compared to the agricultural water and drinking water uses, the fact that it creates more pollution necessitates a special focus. In order to manage water use in the industry sector in Turkey in a healthy way; water saving at the beginning of processes, recycling waste water and realizing priority policies in industrial sub-sectors (such as reduction of water in paper industry) which consume excessive water are first and foremost needs. In this framework; the National Industry Strategy Document (2014-2020) that envisages the reduction of energy and fuel consumption at a larger scale and that focuses on ensuring the treatment of waste waters caused by industries within the context of environmental legislation, is aimed to be revised in terms of water efficiency in industry, taking into consideration the impacts of climate change.<sup>40</sup>

Concerning cleaner production (eco-efficiency) implementations, one of the most important tools of climate change adaptation in industry; Ministry of Environment and Forestry realized "Determination of Environment Conditions and R&D Needs for Expanding Cleaner Production Implementations in Turkey" in 2009 in order to set up the infrastructure of a road map for expanding cleaner production.

The project was conducted by TTGV on behalf of The Ministry of Environment and Forestry with counseling of METU. In the Project, the current status of "cleaner (sustainable) production" in Turkey was assessed with the context of "capacity, resource, legal regulation, incentive mechanisms and the works undertaken", comparisons with international practices was conducted and a report consisting of advices in line with the needs and conditions in Turkey was prepared<sup>41</sup>.

The aim of Integrated Urban Development Strategy and Action Plan (KENTGES) carried out under the coordination of Ministry of Environment and Urbanization is to enhance the habitability level of cities and settlements and it includes action plans and strategies in a number of areas such as spatial planning, transport and infrastructure, housing, urban transformation, disaster preparedness, protection of natural and cultural heritages, climate change, energy efficiency, renewable resources, settlement and environmental science, strengthening the economic structure through immigration and social policies and participation.

<sup>38</sup> Official Gazette no 27882 and dated 22.03.2011.

<sup>39</sup> As of the year 2008, it has been calculated that a total of 46 billion m<sup>3</sup> water has been consumed: 34 billion m<sup>3</sup> in the irrigation sector, 7 billion m<sup>3</sup> in drinking water sector and 5 billion m<sup>3</sup> in the industry sector.

<sup>40</sup> Taking into account the negative impacts of climate change, pilot projects on water saving have been implemented in priority sectors (metal processing, fisheries processing and fruit juices) in the Seyhan Basin in 2010 in order to re-evaluate water consumption in industry. Domestic technologies and designs have been used in these projects implemented using different methods such as improvement of water refrigerating systems, waste water recycling, equipment replacement and process improvement.

<sup>41</sup> <http://www.ttgv.org.tr/tr/temiz-uretim>

By means of KENTGES, it is aimed to ensure a sustainable spatial development by creating a habitat sensitive to environment, to produce sustainable and diversified lands and housings, to set up a sustainable urban transport system, to ensure the integration of open and green areas, to protect natural and cultural heritages, to use natural resources in a sustainable way, to plan the effective use of water in cities, to protect urban ecosystems and forests, to prevent pollution, to encourage the approaches paying attention to energy efficiency and environment sensitivity and to reduce the risk of disaster and settlement.

KENTGES links spatial development strategies with water management, risk management and integrated coastal areas management thus bringing actions that support the climate change adaptation process.

## **PURPOSE 2. Strengthening Water Resources Management Capacity, Interagency Cooperation and Coordination with regard to Adaptation to Climate Change**

In order to adapt to the impacts of climate change, the establishment of a strong administrative and institutional structure on water management is a necessity to eliminate the threat posed on clean water resources in Turkey. The strengthening of the administrative capacities of institutions at the regional, basin and provincial level for the protection of drinking water resources, monitoring of their quality, supply of drinking water, treatment of drinking water and elimination and treatment of waste water is predicated on.

The main objective of the Ninth Development Plan regarding this issue is; giving importance and priority to the effective use of water resources through the economic use of water in the framework of a revised and comprehensive mechanism that ensures strong and structural coordination among relevant institutions and planning studies aimed at developing water resources with an integrated approach primarily at the basin scale and in a way that ensures flexibility in meeting changing consumption demands.

### **Objective 2.1. Increasing the institutional capacities of agencies and organizations that are authorized and related institutions in the management of water resources**

Many institutions responsible for the management of water resources need to increase their institutional capacities and galvanize their activities in order to adapt to the impacts of climate change. In this regard, the following will be ensured: i) strengthening the water quality monitoring and evaluation capacity of institutions, establishing database and strengthening institutional structure, ii) building the capacities of relevant institutions in order to conduct detailed studies to identify water potential, using purposes, consumption and categorization and iii) training and informing irrigation unions and farmers on the wise and sufficient use of water.

### **Objective 2.2. Developing financing policies and practices**

Financially and technically supporting agricultural producers to take measures that enable savings in their irrigation water uses and reduce costs in irrigation investments and the instalment of in-field modern pressurized irrigation systems (drip and sprinkler irrigation systems) should be encouraged in order to adapt to the impacts of climate change. In this regard; continuing the planning of investments for closed irrigation systems using sprinkler and drip irrigation methods through national and international resources and the instalment of drip irrigation system manufacturing facilities throughout the country and in priority regions will be encouraged.

Encouraging the participation of the private sector, as well as the public sector, into irrigation investments (construction and operation of facilities) has been aimed in order to adapt to the impacts of climate change on water resources and the treatment of waste waters, by the private sector, for their re-use in the agriculture and industry sectors will be encouraged through economic tools. Finance policies will be developed in order to support projects that aim to recycle processing and cooling waters in sectors identified as a priority and



that have excessive water consumption, increase pilot implementations, prepare guidelines on “sectoral eco-efficiency (clean production)” towards water efficiency in the industry sector and to encourage best practices. Moreover encouraging the production and use of domestic and industrial equipment that consume less water in industry has also been targeted in terms of water savings.

### **PURPOSE 3. Developing and Expanding R&D and Scientific Studies to Ensure Adaptation to the Impacts of Climate Change in Water Resources Management**

Monitoring and projecting the changes in climatic parameters in the management of water resources in Turkey constitute the basis of climate change studies. For this reason developing the monitoring network in which meteorological and hydrological observations will be conducted is important for acquiring data at certain volumes. Therefore developing R&D and scientific studies that will be a benefit for the impacts of climate change on water resources is required.

#### **Objective 3.1. Strengthening existing systems and establishing new systems for monitoring the effects of climate change**

Establishing new systems for the continuous monitoring of climate change impacts as well as developing existing systems is also essential. In this regard; the collection, control, evaluation and archiving of data related to drought within the hydrological observation and monitoring system will be ensured through conducting observation, research and evaluations for integrating climate change impacts into studies for planning water resources. Preparation of projections aimed at sectoral water needs in basins, taking into consideration climate scenarios is targeted along with the support of R&D studies for the re-use of water from agricultural irrigation.

#### **Objective 3.2. Identifying the vulnerabilities of water resources and coastal management against climate change, developing alternative adaptation options, making periodical revisions based on monitoring results**

A “Waste Water Treatment Action Plan (2008-2012)” has been prepared by the Ministry of Environment and Forestry. In the plans made, the rate of population for which service is provided with waste water treatment facilities to the rate of the total municipal population is targeted to reach 73% in 2010 and 80% in 2012. In order to reach these goals, planning of waste water treatment facilities according to water basins have been initiated and Basin Protection Action Plans and Special Provision Determination studies have been prepared in this framework in 20 havza ve alt havzada (Gediz Basin, Meriç –Ergene Basin, Van Lake, Akarçay Basin, Burdur Basin, Gretaer Menderes Basin, Ceyhan Basin, Kızılırmak Basin, Konya Closed Basin, Northern Aegean Basin, Lesser Menderes Basin, Marmara Basin, Seyhan Basin, Susurluk Basin, Yeşilırmak Basin, Atatürk Dam, Eğirdir Lake, Kartalkaya Dam, Gökçe Dam ve Alibey Dam ) based on waste water treatment targets. In these plans, the water potential and water pollution status of basins according to agricultural, domestic and industrial pollutants have been analyzed, pressures on existing protected areas have been determined investment and renovation needs for waste water treatment facilities within the basin have been identified for the future.

A holistic management approach has been used during the preparation of the Basin Protection Action Plan by ensuring the active participation of institutions and NGO representatives. These “Basin Protection Action Plans” are also important in terms of Turkey’s EU environmental harmonization studies and are good starting points for the “River Basin Management Plans” that needs to be prepared within the framework of EU Water Directive<sup>42</sup>. In this regard identifying the hydrological, social, economic and environmental vulnerabilities (including natural disasters) in river basins and sub-basins through monitoring and developing adaptation options will be ensured.

<sup>42</sup> It is important that Turkey meets her commitments regarding the directives under the “Water Quality Sector” that is the most important and expensive sector within the sectors of EU Environment Chapter.

The problems faced in Turkey regarding ground waters will increase incrementally in the near future with the challenges currently caused and will be caused by climate change. Drought and lack of precipitation will decrease ground waters to be fed. Main problems such as the illegal use of ground waters, mixing of wastes (domestic and industrial wastes) with ground waters as a result of their uncontrolled discharge to the surface,

decrease in ground water levels due to excessive water extraction, granting use of ground water to settlements and industries in an unplanned manner thus leading ground water to excessive environmental pollution exposure, existence of more than one institution working on ground waters and the lack of coordination among these institutions, insufficient quality data of ground water resources and the lack of importance on ground water in scientific studies also need to be solved in the process of adapting to the impacts of climate change. In the light of these evaluations; identification of the vulnerabilities of ground water resources against climate change, development and implementation of adaptation options and allocation of current ground water reserves in Turkey taking into account the impacts of climate change will be ensured.

As an initial step, risk assessment studies will be conducted in order to identify the vulnerabilities of coasts (including rivers and natural and artificial lake coasts) against climate change and to develop adaptation measures. Innovative solutions that will increase adaptation capacity will be established and applied following the identification of risks (including natural disasters) pertaining to the vulnerability of coasts against climate change.

#### **PURPOSE 4. Integrated Management of Water Resources in Water Basins for Adaptation to Climate Change**

As the administrative boundaries in Turkey do not overlap with hydrological and hydrogeological basin boundaries; benefit is seen in taking the “basin dimension”<sup>43</sup> as the main scale in the management of water resources against the impacts of climate change. It is important to plan and adapt the economic and social benefits of water resources within a certain basin as well as sectoral needs through an integrated approach taking into consideration the impacts of climate change.

In the context of the integrated management of water resources in water basins, the Department of Basin Planning has been established under the Ministry of Forestry and Water Works General Directorate of Water Management and has been assigned with the issues of “*preparing River Basin Management Plans and Basin Conservation Plans as well as following their implementation and inspection*”.

The General Directorate of State Hydraulic Works has prepared its 2010-2014 Strategic Plan. The master plan of 10 basins will be revised in order to identify and implement the sustainable water management policies of river basins in the context of developing, protecting and the efficient use of our country’s water resources.

Revision of the General Directorate of State Hydraulic Works’s existing database in this framework would be a first step in minimizing climate risks. Secondly, re-evaluation of existing and planned databases, identification of reserve systems and irrigation areas as well as storage amounts bring with it countrywide comprehensive studies. Data pertaining to reserve systems and agricultural irrigation areas within basins are recorded by DSI; however, it is known that these records show differences due to the implementations in basins. In this sense updating these data in a comparable manner carries importance. In this framework, DSI has intensified its activities at the central

<sup>43</sup> Moving from the standpoint that a majority of threats on fresh water systems arise as a result of land use applications in the river basins; integration at the basin level means that it should be merged with land use at the basin scale, water use planning and management.

<sup>44</sup> National Climate Change Strategy Document (2010-2020), Higher Planning Council Decision No: 2010/8, 3.5.2010.

<sup>45</sup> Example: – In the context of the grants provided within the framework of the UN Joint Programme on Enhancing the Capacity of Turkey to Adapt to Climate Change implemented under the coordination of the Ministry of Environment and Forestry; a Project on Development of Water Management Policies for Identifying Seyhan River Basin Surface Water Potential, Risks and their Management in the framework of Adaptation to Climate Change has been implemented by the DSI VI. Regional Directorate (Adana) and DSI XII. Regional Directorate (Kayseri) between 2009-2010.

and local levels<sup>44</sup>. Necessary scientific studies in order to determine the changes in climate change parameters will also determine the categorization of precipitation-flow relations in river basins. This in turn will enable to identify the water budget at the basin scale in a healthier manner and therefore basin-scale water operating policies will be developed at the basin scale. It is envisaged to adapt to climate change in the long run through the pricing of water according to volume, improvement of water networks and transition into modern systems.<sup>45</sup>

Calculation of the water budget at the basin scale is also an important input for identifying flood risks operation levels. There new operating policies can be identified through ensuring flood planning against the impacts of climate change.

Moreover, as the National Climate Change Strategy also aims; forest areas and forestry activities that carry great importance in terms of the protection of water resources and their management within sustainability principles will be planned in line with upper basin management principles and their implementation will be ensured. All these studies will be evaluated as a base for River Basin Management Plans to be prepared.

#### **Objective 4.1. Planning basin-based development of water resources with a holistic approach that offers flexibility in meeting the changing consumption demands**

Integrated River Basin Management Plans are aimed to be prepared taking into consideration ecosystem services and the impacts of climate change. Integration of draft River Basin Management Plans that have been prepared today for some basins and that are super scale plans with other low scale physical plans (such as Environmental Plans) will be ensured. In this framework, it is also aimed that current and planned “Basin Protection Action Plans” and “Protection Areas Maps” take into consideration the impacts of climate change and make necessary revisions.

Moreover accelerating projects on erosion and sediment control in all basins and in dam and pond basins in particular are important for adapting to the impacts of climate change.

Prevention of illegal ground water use in water basins and raising public awareness on this matter will be important studies for developing water resources at the basin scale.

#### **Objective 4.2. Addressing urban water management from the perspective of adaptation to climate change**

Cities are elements that are most affected by water crisis but they are also factors that cause this crisis the most due to the population they host and the way water is used. Changing consumption patterns that change depending on rapid population growth and economic development in large urban settlements in particular increase the demand for water. On the other hand, cities also turn into structures that create pollution on water resources and increase the pressure on ecosystems as a result of their uncontrolled, physical distribution trends that are not in harmonization with the nature. The primary negative impacts of urban sprawl in Turkey on the environment, natural life and resource consumption are on soil and water resources. The impact of urban and sectoral development on water resources and on water pollution in particular requires addressing the issue as a priority policy area. In this context, as part of Turkey’s targets pertaining to water management, the Ninth Development Plan envisages the preparation of urban infrastructure master plan and financing strategy that will identify the infrastructure needs of municipalities aimed at environmental protection within the country, such as drinking water, sewage and waste water treatment facilities.

<sup>44</sup> National Climate Change Strategy Document (2010-2020), Higher Planning Council Decision No: 2010/8, 3.5.2010.

<sup>45</sup> Example: – In the context of the grants provided within the framework of the UN Joint Programme on Enhancing the Capacity of Turkey to Adapt to Climate Change implemented under the coordination of the Ministry of Environment and Forestry; a Project on Development of Water Management Policies for Identifying Seyhan River Basin Surface Water Potential, Risks and their Management in the framework of Adaptation to Climate Change has been implemented by the DSI VI. Regional Directorate (Adana) and DSI XII. Regional Directorate (Kayseri) between 2009-2010.

Revision of spatial planning concepts, in order to ensure cities to address water management with a climate change adaptation approach, and realizing up-scaling plans, especially in the management of metropolitan areas (large cities, metropolitan municipality), taking into account climate change is being targeted.

The “2008-2012 Action Plan for the Supply of Drinking, Utility and Industrial Water of 81 Provinces” has been prepared with the objective of meeting provinces’ drinking, utility and industrial water needs while prioritizing the provinces that are in urgent need of drinking water.

In Spatial Strategy Plans and Environment Plans prepared for ensuring the economical, social and cultural development of the country within the context of sustainable development principles, it is aimed to take ecological decisions, to pay attention to the balance between protection and use and to take the climate change adaption capacity into consideration ( water resources management, waste management, protection of the air quality etc.) and to conduct the urban development in an efficient way. In order to realize integrated water management and planning in settlements in a healthy way; activities such as; the separation of sewage and rain water harvesting systems, reuse of collected and treated water (such as the target in the National Climate Change Strategy on the effective use of waste water in urban green areas), development of pricing policies taking into account socio-economic conditions for increasing water use efficiency in cities, making legal regulations, detection of water loss and illegal water use in cities and taking precautions for reducing loss-leakage ratio, spreading of the SCADA system (Databased Control and Observation System) at the national scale and ensuring access of network water to consumers as a potable water in order to reduce the pressures on water resources, need to be realized.

## **PURPOSE 5. Planning Renewable Energy Resources taking into consideration the Impacts of Climate Change and the Sustainability of the Ecosystem Services Oriented to Increase Resilience to Climate Change**

The National Climate Change Strategy aims to increase the share of renewable energy in the total production of electrical energy in Turkey by the year 2023 to 30%. Turkey should benefit from its various energy resources, particularly coal, hydroelectric, wind, geothermal and solar energy at the maximum level in line with energy supply security and climate change objectives.

When the pressure of climate change on water resources and natural systems are taken into consideration, hydroelectric power plants need to be planned in a way that will not destruct the nature and in a way that will enable the rational use of water resources.

### **Objective 5.1. Planning of hydraulic and geothermal energy resources from climate change adaptation perspective**

The management of climate risks requires the balance of several factors in terms of policies, implementation and investments. For example, even though a hydroelectric power plant project is a renewable energy source; the location selection and its construction may have negative impacts in terms of the environment, natural life and social aspects.

Increasing the share of hydroelectric energy in the total energy production in Turkey appears as an important policy. Compared to wind and solar power; hydroelectric energy production are evaluated as priority investments in the development of renewable energy policies, due to their use of domestic natural resources, lower operation and maintenance costs, technical feasibility, longer physical working life, less negative environmental impacts and as they revive economic and social structure in rural areas.

Hydroelectric Power Plants (HPPs), which have a remarkable place in renewable energy policies in Turkey, should definitely take the climate risk policies into consideration. In this context, the evaluation of the country's technical and economic hydraulic potential will be ensured. In the context of combating climate change, the Strategy envisages a more effective operation of hydroelectric power plants using clean production technologies and the best available methods. Moreover, economic and socio-cultural impacts of hydroelectric power plants as well as the impacts of climate change will also be taken into consideration in location selection and planning.

The Electrical Energy Market and Supply Security Strategy Document sets various targets for increasing the electricity production capacity of geothermal resources to 600 MW. This will ensure the revision of the Geothermal Resources and Natural Mineral Water Law referenced 5686 according to the impacts of climate change and with an adaptation approach.

It has been considered that regional heating implementations with geothermal energy and expanding use of geothermal heat pumps are important tools in climate change adaptation.

## II. AGRICULTURE SECTOR AND FOOD SECURITY

### **PURPOSE 1. Integrating Climate Change Adaptation into the Agriculture and Food Security Policies**

Today, it is already known that the agriculture sector is not only a victim of climate change but also one of the reasons of this phenomenon. The destructive impacts of climate change on agriculture should be dealt through the development, food security<sup>46</sup>, environmental, biodiversity and sustainability of the ecosystem services.

Adaptation to the impacts of climate change should be one of the primary strategies of production oriented policies in the agriculture sector in Turkey. For this reason, it is necessary that the action plans and national and regional development strategies regarding the aforesaid sector are revised and/or adaptation strategies specific to the sector are prepared. Indeed, many current policies which are carried out for the activation of the agricultural structure in Turkey contain the necessary activities which will support the direct or indirect adaptation to the impacts of the climate change.

In order to adapt to the impacts of the climate change on agriculture sector, certain issues such as notably food security, production, consumption, price, insurance systems, farmer support and market policies, productivity and competition, drought and desertification, conservation of biodiversity, plant and animal health, production of plant and animal husbandry should be dealt with together. In addition to this, by the integration of the issues that have been mentioned above with current legal and institutional arrangements, the strategic plans, various policies and programmes, it is aimed to provide sustainable use of natural resources in agriculture and to create an organized and competitive structure for adapting to the impacts of climate change.

In the Ninth Development Plan, it has been stated that there is need for legal grounds devoted to accurate and safe determination of agricultural areas and production pattern. By this way, 2013 vision of Turkey regarding food safety and security, plant and animal health has been identified. In this vision, *“producing the necessary materials within the framework of the traceability and ‘From Farm to Table’ approach, which is compatible with the EU legislation by increasing the value of the current biodiversity and richness of the raw materials with the help of the strong production and labour force potential; transforming the establishments into the organizations which have the necessary structure and equipments in order to meet the requirements of the food safety legislations; conducting efficiently the public control/inspection systems by means of a strong structuring where the authorities gather in a single centre; developing the education and publication services;*

<sup>46</sup> Access of all people to the sufficient, safe and nutritious foods which supply with their nutrition needs and food preferences for an active and healthy life.

*releasing safe foods which satisfy the expectations of consumers to the domestic and foreign markets by creating the sustainable food safety system based on scientific data that are obtained from R&D activities”* have been identified as the strategic purpose. At this point, the impacts of climate change have not been directly connected with the food security. However, it should be understood that many applications which are envisaged to be realized in plant production and animal husbandry in order to increase the quality based production within the framework of the principle of sustainability and to provide the food safety and security are necessary for adaptation to climate change. For example; in Turkey, in vegetative production, the subjects such as good agriculture practices, organic agriculture practices, provision of the traceability in each phase of the production, struggle against plant diseases and harmful organisms, irrigation and in-field services, land consolidation, non-formal education/publication and raising awareness of the consumers are effective practices which make contributions to the issue of adapting to climate changes.

### **Objective 1.1. Reviewing existing strategy and action plans as well as legal arrangements from a perspective of adaptation to climate change**

In Turkey, the legislation on the issues related to adapting to the impacts of the climate change in the agriculture sector is mainly in the area of responsibility and authority of the Ministry of Food, Agriculture and Livestock. The legal arrangements which are in question contain the issues such as the quality and quantity of water resources, food safety and security, protection of agricultural biodiversity, irrigation infrastructure in agriculture and in-field services, fishing activities, drought and desertification and natural disaster risk management. In the recent period, in the agriculture sector, new legal and institutional arrangements were made in order to strengthen the administrative and institutional infrastructure related to food, feed, food hygiene, veterinary services and plant health for the purpose of the provision of food safety and security arrangements are still ongoing. It has been aimed that necessary revisions are realized in the Agriculture Strategy, National Rural Development Strategy, Combating Agricultural Drought Strategy and Action Plan by establishing a direct and integrated connection between the policy of adaptation to climate change and agricultural production policies.

When sustainable rural development policies are analyzed, for example; within the framework of the strategic purpose of “Protection and Development of the Rural Environment” of the National Rural Development Strategy; it was mentioned that some problems such as drought, forest fires, floods, landslide, decrease in biodiversity and desertification because of unsuitable agricultural techniques in water and soil resources have increased; it was envisaged that the relations between agriculture and environment should be redefined for the sustainability of forestry and agricultural activities in rural areas and the development of the ecological agricultural practices that has taken part as precautions/priorities<sup>47</sup>.

In this framework, development of the agricultural activities together with the precautions of environmental protection, protection and development of the characteristics of agricultural and pasture areas which have natural or local richness, or which are at risk and expansion of the agricultural product planning which is suitable for the local ecology constitute the strategic purpose. With the help of the aforesaid purpose, necessary precautions will be taken for the development of integrated agricultural basin programmes, the expansion of the organic agricultural and good agricultural practices, the application and diversification of the environment-friendly production methods, the monitoring of the environmental pollution caused by agricultural activities, the effortst for the improvement of the agricultural and pasture areas and protection measures against natural disasters, sustainable utilization of production resources in aqua-cultural activities; the efforts that have been put in the aforesaid issues will be supported. Another important purpose of National Rural Development Strategy regarding the impacts of the climate changes is “Development of Rural Areas Infrastructure Services and Improvement of Life Quality”; certain measures about the disaster risks management as well as the new arrangements that are envisaged in spatial planning in rural areas under the title of “Development and Protection of Rural Settlements” are considered among the priorities of the abovementioned strategy. In this context, in the strategy, it has been stated that it is necessary to reduce the risks which arise from the disasters in certain rural settlements where the disasters such as earthquake, landslide and flood pose a threat and to increase the efficiency of the activities which are held in order to ensure safe settlement conditions.

It is required to review and develop the measures that are taken for adapting to the impacts of the climate

<sup>47</sup> National Rural Development Strategy, State Planning Organization, Ankara.



change and which are implicitly mentioned in the strategic plans of the relevant institutions. Within this scope, the integration of the impacts of climate changes into “Combating Agricultural Drought Strategy and Action Plan” will be provided in terms of water resources, food safety, natural disaster risks, ecosystem services and human health. In addition to this, it has been also aimed that support for agricultural producers’ activities (including agricultural basin production and support) are implemented by taking the impacts of the climate changes into account.

The main titles of the works that are planned to be realized in Turkey for climate change adaptation and which have been mentioned in General Directorate of Meteorology’s Strategic Plan that is taken into consideration within the scope of climate change adaptation strategy and which has been applied between 2009 and 2013 by the General Directorate of Meteorology that is one of the most important institutions for adaptation to the impacts of the climate changes are as follows:

- To issue early warning in case of meteorological natural disasters (to finalize the development of regional forecast and early warning units, to develop the meteorological early warning system, to develop the forecast system against the avalanche risks)
- To improve the diversity of products and sectoral implementations (the studies on the impacts of Sahara dust on living beings within the process of climatic changes in Turkey and in its own region etc.)
- To develop the atmosphere modeling and data simulation practices
- To monitor the global warming and climate change (to monitor the impacts of the global warming and climate change on agriculture and to develop the utilization of meteorological forecasts for agricultural purposes; to support the minimization of the negative impacts of potential climate changes with the help of the actions to be taken.

The above stated headings will be the most important bases in climate change adaptation works of Ministry of Food, Agriculture and Livestock.

### **Objective 1.2. Reviewing signed protocols between institutions from a perspective of adaptation to climate change**

The activities related to adaptation to the impacts of the climate change are not limited to the scope of duty and authority of a single ministry or institution. In many fields where sustainable development in agriculture is aimed, cooperation protocols which the Ministry of Food, Agriculture and Livestock signed with certain institutions and agencies are directly related to the adaptation activities to climate change. In Organic Agriculture Protocol which was signed by the Ministry of Food, Agriculture and Livestock, the General Directorate of Agricultural Production and Development (TUGEM) and the General Directorate of State Hydraulic Works, it has been aimed that organic agriculture could be made in the basins allocated for drinking water and utility water supply throughout the country, and that the pollution of the land and water resources which arise from agricultural production could be avoided with the expansion of organic agriculture.

It is also aimed to spread good agricultural practices through Good Agricultural Practices in Specially Protected Areas Protocol, which was signed by the General Directorate for the Protection of Cultural and Natural Property, the General Directorate of Agricultural Production and Development (TUGEM) and the Ministry of Food, Agriculture and Livestock; aims for agricultural production which does not pose a danger for the environment, human and animal health; protection of natural resources; and ensuring food security with the help of traceability and sustainability in agriculture. With this protocol, it has been decided that the works will be conducted for the spread of good agricultural practices in management plans which were prepared for 14 specially protected areas. For this reason, it is necessary to review the practices which have been done and will be done in these fields and the adaptation alternatives by taking the impacts of the climate changes into account. It has been aimed that certain revisions that will include adaptation activities to the impacts of the climate change are made in all these protocols.

It has also been aimed that the implementations which are realized in accordance with the Forestation Protocol within the scope of Action Plan for Combating Erosion which was signed by the Ministry of Environment and Urbanization and TUGEM and the Cooperation Protocol that was signed by the General Directorate of State Hydraulic Works, the General Directorate of Forestry and the General Directorate of Forestation and Erosion Control in order to prolong the life of the reservoirs with the forestation of the dam basins, to control erosion,



to increase the number of the green fields and to provide the balance between water, plant and earth are reviewed in the context of adaptation to climate change.

It has been aimed that the Protocol for Detection and Prevention of Drought which was signed by the General Directorate of Meteorology, the Ministry of Food, Agriculture and Livestock and the General Directorate of Agricultural Research (TAGEM), the Protocol on Turkey Emergency Flood and Earthquake Recovery (TEFER) Project which was signed by the Ministry of Food, Agriculture and Livestock by TUGEM and the General Directorate of Land Registry and Cadastre in order to determine the application ways of the provisions of the Pasturelands Law about the registry and cadastre are reviewed or renewed in accordance with adaptation to the climate change.

## **PURPOSE 2. Developing and Expanding R&D and Scientific Studies to Identify the Impacts of Climate Change on Agriculture and to Ensure Adaptation to Climate Change**

Up to now, many researches and development activities aimed at increasing the productivity of vegetative and animal production in agricultural sector have mostly been based on economic development goals, as a result of this; the issue of adaptation to the climate change has been ignored. However, it has been aimed that the researches which are carried out for the protection of especially soil and water resources are supposed to be developed for climate change adaptation. When the drought impacts of the climate change are taken into consideration, it would be necessary to develop irrigation activities with the help of different methods and through researches at regional and basin level, to change the production patterns, to increase the diversity and to develop disaster management policies against agricultural drought throughout the country.

Since serious drought problems have been faced in certain regions during the works conducted so as to lessen the impact of climate change on agriculture in Turkey, relevant research institutes of General Directorate for Agricultural Research and Policies have started to develop products resistant to drought and farmers implementations have begun.

In the Strategy, it has been aimed that socio-economic researches and scientific studies on agriculture, food, environment and rural development at the national level are conducted considering the impacts of the climate change and innovative policies are developed in order to make contributions to the development of the country's agriculture in accordance with the climate change and to assure the future of some populations such as women farmers who make their livings through agriculture.

Sustainable food security system which is based on the scientific data obtained from R&D studies will be formed considering the impacts of the climate change and the expectations of the consumers will be satisfied.

Besides, it has been aimed that a safe database and information system are developed in regional or basin scale throughout the country in order to determine and monitor the impact ratio of climate change on agricultural lands and are revised by taking the impacts of the climate change into consideration.

### **Objective 2.1. Developing and expanding R&D activities for effective crop, soil and water management**

The vulnerability analysis on climate change in agricultural areas is important for monitoring possible changes in agricultural productivity, production and knowledge of area and for determining necessary policies regarding this issue. The identification of various accounts such as moisture and salinity stress on agricultural products is also substantial for effective management of product, soil and water. In addition to this, the development of the R&D activities about this matter especially at regional or basin level has been aimed.

The adaptation policies prepared for climate change have also importance for the reinforcement of agricultural product markets so as to increase the competitiveness in the sector. For this reason, the determination of the productivity and current genetic diversity of the products will be provided at the local level and in accordance with climate change adaptation. It has been envisaged that these studies would be carried out with the new opportunities that biotechnology offers. In this context, change in product pattern for adapting to climate, R&D studies and scientific activities will be made widespread. Besides, first and foremost, the vulnerability analysis of agricultural irrigation areas will be realized regarding climate change issue.

## **Objective 2.2. Increasing the capacities and numbers of organizations carrying out R&D and scientific studies**

There are a large number of research institutes which have been established across the country within the scope of the Ministry of Food, Agriculture and Livestock in order to work at different levels (central, basin-scale) and on different subjects for the purpose of increasing the productivity in agricultural production. General Directorate for Agricultural Research and Policies (TAGEM) have been monitoring, assessing and coordinating the research projects deemed to be necessary to support in 47 research institutes, consisting of 10 central research institutes on Arable Crops, Garden Plants, Agricultural Protection, Livestock, Animal Health, Water Products, Soil and Water Resources and Food, 10 regional research institute, and 26 domain based research institutes working on different subjects and disciplines.

Following the closure of the General Directorate of Rural Services and given under the responsibility of TAGEM, the research studies of the aforesaid institutions on the fields of Land and Water Resources have been counted among the duties of TAGEM. Many research projects which have been carried out by TAGEM may be correlated with adaptation activities on the impacts of the climate change. These researches are vegetative biodiversity protection project, agricultural Geographical Information Systems and remote detecting research, research on soil and water resources, territorial food and feed researches, in-situ protection of endangered plant species and irrigation techniques and mechanization activities in irrigated farming areas in certain regions (such as South-eastern Anatolia).

In the context of the General Directorate of Agricultural Enterprises' (TİGEM) activities under its fundamental status is the production and research of seeds, saplings, seedlings in order to increase and diversify plant and animal production as well improve their qualities. In addition to the mentioned activities the "Ceylanpınar TİM Irrigation (GAP) Project" has been realized with the aim of ensuring effective water management in agricultural practices in particular. The project was implemented during 2009-2011 and aimed to convert 500 thousand decares of dry farming areas into irrigated farming areas.

In order to make researches on the impacts of climate change and to determine adaptation measures, it may be necessary to expand the activity areas of Agricultural Economics and Policy Development Institute (TEAE)<sup>48</sup> which has continued its' works since 1996 so as to inform mainly the Ministry of Food, Agriculture and Livestock and decision maker units in public and private sectors by conducting economic researches on agriculture, food, environment and rural development in Turkey and/or by having these researches conducted and to make contribution to the development of the country's agriculture with the policies and decisions based on the results of the abovementioned researches.

The emphasis on R&D studies which are necessary for combating agricultural drought regarding climate change has been seen in many policy documents of ministry of Food, Agriculture and Livestock<sup>49</sup>. Establishment of climate change research centers has been aimed in all regions as well as the development of the capacity of current research and science institutions in this direction and the modernization of laboratory infrastructures. In the new settlement process of the Ministry, "determining the possible effects of climate change on soil,

<sup>48</sup> The studies within the framework of OECD Committee for Agriculture are carried out by TEAE.

<sup>49</sup> Example: the Parliamentary Research Commission Report no: (10/1,4,5,7,9,10,11,13,14,15,16,17) about the Grand National Assembly of Turkey Sustainable Management of Water Resources and the Impacts of Global Warming, 23. Session, 2. Legislative year, S. number: 138, April 2008, Ankara.

water and plant and define appropriate adaptation strategies” have become one of the duties of research institutes working under TAGEM. Beside, Soil, Water and Agricultural Meteorology Research Station in Trakya and Research Stations on Soil, Water and Fighting against Against Desertification in Konya are directly related to the subject. By this way, the capacity of plant production forecast studies which are carried out by using the data of vegetation density, land use and climate especially for the purpose of monitoring the impacts of the drought will be improved.

Various national and international research projects on reducing the effects of desertification have been initiated by Ministry of Food, Agriculture and Livestock. One of these projects is the project titled “Agricultural Crop Monitoring and Prediction System” by means of Distant Detection and Geographical Information System realized with the cooperation of General Directorate for Agricultural Research and Policies and Istanbul Technical University in 2008. The objective of the project is to make seasonal and inter-season predictions on products, collect data for monitoring of agricultural drought and to support related units with the help of these data. With the pilot schemes of the project, stations have been set up in such cities as Şanlıurfa, Diyarbakır, Mardin and Gaziantep, where the effect of drought is more prevalent. Predictions have been made for those specific regions based on the data gathered from stations. Another project carried out within this context is Product Monitoring and Yield Prediction Project, carried out with the help of agro meteorological model of FAO in cooperation of General Directorate for Agricultural Research and Policies and FAO in 2004-2006. Drought monitoring and prediction for winter wheat by using the outputs of this project still continue and five prediction bulletins are issued every year. Besides, a “Drought Test Center” in Konya Bahri Dağdaş International Research Institute has been set up and started to operate. Another project which has been implemented since 2008 is “Advanced Producing Techniques in Drought Conditions Project”. The Ministry aims at enhancing and developing similar projects.

### **Objective 2.3. Developing a “Soil and Land Database and Land Information System” taking into consideration the effects of climate change**

The climatologic impacts of the climate change on agriculture are identified within the framework of the activities of the General Directorate of Meteorology. Automation has started to be used within the scope of modernization works which was started by the General Directorate of Meteorology in 2001 and a lot of automatic meteorological observation stations have been founded. Some of these stations are located in the areas which have high agricultural potentials in Turkey. 14 of those stations were established in the institutions of the General Directorate of Agricultural Enterprises (TIGEM) in 2005. In addition to this, it has been planned that agricultural meteorological observation network becomes widespread across Turkey with 14 separate stations which have been envisaged to be established in the institutes of TAGEM as of 2010.

It has been aimed that the establishment of Drought and Flood Information System is accelerated within the framework of the works conducted for current technical capacity and needs determination for early flood and drought warnings.

The activities of the Ministry of Food, Agriculture and Livestock related to monitoring and early warning are supported by UN Food and Agriculture Organization (FAO). Situation analysis is carried out by FAO for the works of Monitoring and Early Warning Projections Committee and Risk Assessment Committee which work within the framework of TAKEP (Turkey Agricultural Drought Action Plan). These studies will contribute to the development of national information systems which monitor the changes in land use types, revision of the data which are compiled and identification, collection, register and retention to the database of new data which are needed within the framework of international processes. FAO also carries out the development activities of an “environmental information management system” focused on flood, inundation and drought in Turkey. These activities support current works of land information system and soil and land database.

It will be provided that the data about land asset, water resources and climate which are gathered by Provincial Crisis Centers for Agricultural Drought, which work within the scope of Agricultural Drought Management Coordination Council of ministry of food, Agriculture and Livestock in Provinces are incorporated in climate change information management system by updating. Additionally, a pilot survey will be initiated in Ankara in 2012 within the scope of National Geographical Soil Data Base Project conducted by the General Directorate of Agricultural Research and Policies in an attempt to create a data base for soil and land which is highly needed in our country. It is planned to expand this project in other regions, as well. In addition, "Fertility of Turkish Soil and Soil Organic Carbon Data Base and Chemical Fertilizer Consumption in Turkish Land Data Base" Project will be initiated next year and these studies are considered to provide great support to climate change adaptation activities.

### **Objective 2.4. Conducting and monitoring disaster analysis for agricultural droughts**

Drought, flood, forest fires and storms have started to be seen more occasionally than the past and to drop the agricultural capacity in many countries. First and foremost, it is necessary to develop the land and water management at national level in order to prevent the climate change disasters from causing the loss of agricultural lands in Turkey.

The meaning of drought is different in agricultural sector than other sectors, since the water existing at the roots of plants during the period of growing is more important for plants than annual areal precipitation. Therefore; if plants cannot find necessary water in the earth during the period of pullulating and growing, this situation is defined as a natural disaster and is entitled as "agricultural drought"<sup>50</sup>. Law No. 2090<sup>51</sup> on Aids to be Provided to the Farmers Affected by Natural Disasters which deals with support for farmers influenced from agricultural drought and which has been in force since 1977 is a legal arrangement which arranges the aids for the farmers who have been influenced from disasters in animal and plant production. Recently, certain legal and institutional arrangements have been realized in order to retrieve the losses which arise from agricultural drought in the production of the farmer in Turkey. In addition to this it has been targeted that the assurance regime is handled by taking the impacts of the climate change into account.

"Combating Agricultural Drought Strategy and Action Plan" which has been carried out effectively under the responsibility of the Ministry of Food, Agriculture and Livestock is not a plan that is put into practice in case of drought and which is forgotten in rain years; it is a plan which envisages the implementation of the mid and long term precautions in order to be prepared against future droughts and their impacts even in rain years. Moreover, some works which take the impacts of the climate change into consideration have also been conducted in the implementation of the plan.

When the population growth is considered, decrease in agricultural production because of drought also causes many risks in the provision of the food security and fulfilment of need. For this reason, it is important to evaluate the struggle against agricultural drought in this aspect. By incorporating the agricultural drought into natural disaster definition, it would be possible to realize the necessary analysis in this context. By this way, this subject will be incorporated into the management of early warning system in the first place.

When the situation is considered from an institutional perspective, the organizational law of the Prime Ministry Disaster and Emergency Management Presidency which was established in the recent period will be ensured to be changed in order that the Ministry of Food, Agriculture and Livestock can be represented as authority and member in advisory commission.

<sup>50</sup> Agricultural Drought Action Plan, the Ministry of Agriculture and Rural Affairs, Ankara.

<sup>51</sup> Official Gazette no. 15987 and under date of 5.7.1977.

Combating Agricultural Drought Strategy and Action Plan envisages that “Provincial Drought Action Plan” is prepared for each province as an effective mechanism for struggle against drought at local level according to the dynamics and special conditions of the aforesaid provinces. The legal ground in preparation of Drought Action Plan in Province is “the Decision Pertaining to the Procedures and Principles of Combating Agricultural Drought and Drought Management Activities<sup>52</sup>” and “the Regulations Pertaining to the Duties and Operation Procedures and Principles of Agricultural Drought Management”<sup>53</sup>. “Drought Action Plans in Province” of many provinces have been prepared. Besides, it has been aimed that Drought Province Crisis Centers are strengthened in the legal, administrative and financial aspects in order to implement effectively the aforesaid action plans and crisis plans.

## **Objective 2.5. Determining the socio-economic impacts of climate change on the agriculture sector**

Especially all of the rights to food, water, sheltering and health of poor people are under the danger of impairment because of the climate change. The groups which will be influenced at the very most by the impacts of the climate change are local people, farmers and women since these people are poor and vulnerable.

For this reason, the state will be supposed to take the opinions of the most fragile sections of the sector about the adaptation to the impacts of the climate change into account.

It has been envisaged that the reason and the economic, social and environmental impacts of the climate change in the regions which will be mostly affected by agricultural drought are primarily determined as soon as possible. It has been aimed that the poor farmers who have worked in agricultural sector and who have been affected by the climate change are going to be identified at regional and basin level and the necessary measures are going to be taken in this aspect. It is essential to implement the measures which deal with the impacts of the climate change and gender elements.

It has been envisaged that the reason and the economic, social and environmental impacts of the climate change in the regions which will be mostly affected by agricultural drought are primarily determined as soon as possible. It has been aimed that the poor farmers who have worked in agricultural sector and who have been affected by the climate change are going to be identified at regional and basin level and the necessary measures are going to be taken in this aspect. It is essential to implement the measures which deal with the impacts of the climate change and gender elements.

Women are mostly affected by the climate change and the number of the women who lost their lives because of natural disasters that occurred is more than the number of men in the same category. Women are also exposed mostly to the indirect impacts of the climate change on human health such as nutrition, the diseases caused by the vectors, respiratory system diseases and other diseases caused by water. The impacts of the climate change on agriculture have negative results economically for female farmers who work in the sector. The studies which deal with this issue are so limited in Turkey and they are mostly at academic level.

Considerable part of the agricultural enterprises in Turkey is small enterprises which are run by family members and where the labour force from outside is never used or little used. In addition to this, the researches have shown that 70% of women work in agricultural sector while this rate is only 30% for men. In rural areas, this rate is higher for women and it contains 92.7% of women. Coproduction forms of women vary by the type of the agricultural activity and income state of the family. However, women work in those activities in every phase. These evaluations show that women are important enough in the context of impacts of the climate change on agricultural production in Turkey.

<sup>52</sup> The Decree of the Council of Ministers: 2007/12477, Article 7.

<sup>53</sup> Official Gazette no. 26804 and under date of 02.03.2008, Article 12.

Periodical trainings for female farmers have been organized so as to provide necessary equipments, to teach the new technologies and have them applied, to improve their abilities, to inform them about the subjects which include the sustainable agriculture (such as diversifying the rural economy, management of water resources and ecological agriculture implementations). It has been aimed that in these trainings which have been arranged by the alternative means of livelihood, gene sources and their sustainable utilization. In this context, consciousness raising and informing activities will be arranged about certain subjects such as training for disasters and access to micro assurance opportunities.

Training and publication services will be provided for female farmers in order to develop their abilities and give them the necessary information and techniques about agricultural subjects for the purpose of teaching the technologies and having them used so as to provide the female farmers with information, methods and equipments for more efficient agricultural production compliant with the climate change, to manage and use effectively the resources.

Moreover, if the reason and the economic, social and environmental impacts of the climate change are primarily determined in the regions which will be mostly affected by agricultural drought because of the climate change, the socio-economic impacts of the climate change on agricultural sector will also be determined.

### **PURPOSE 3. Sustainable Planning of Water Utilization in Agriculture**

One of the primary sectors which will be mostly affected by the inadequacy in water supply across the country is agricultural sector. In Turkey, the adaptation precautions about the impacts of the climate change will only be successful with effective management of water resources in basin and field base within the framework of agricultural production policies. In order to ameliorate the water management in basin base in agricultural sector, it is important to develop agricultural support policies, to develop hard infrastructure services (channel excavation for floods, alternative water collection mechanisms etc.) to reduce the transmission losses, to realize consciousness raising activities on water harvesting in the upper basins and water saving. Effective adaptation to the climate change may be realized with the help of proper irrigation methods, plantation of durable plant types and varieties, measures for preventing soil moisture and utilization qualified water for modern irrigation.

Some of these precautions may reach the solution in short term; however, certain precautions will be realized for mid and long term. When the agricultural sector is taken into consideration about the impacts of the climate change, in the short term, it has been aimed that the institutional effectiveness of certain institutions such as the Ministry of Food, Agriculture and Livestock, the General Directorate of State Hydraulic Works and the General Directorate of Meteorology which are the most important actors in water management. In addition to this, the expectations in mid and long term will be higher policies such as an effective water code in the base of participant platforms, the integration of adaptation strategy and higher policies of the agricultural sector within the framework of macroeconomic grown and macro targets about the climate change.

As of today, 75% of the water amount which is consumed as 46 billion m<sup>3</sup> annually is used for agricultural irrigation purposes. The total of the cultivated areas is 28 million hectares; the irrigable areas are approximately 25.8 million hectares. In Turkey, it has been envisaged that the areas of 8.5 million hectares in total which can be irrigated technically and economically with current water potential will be equipped with irrigation facilities until 2023. The main purpose of this activity has been determined as decreasing the 75% consumption rate of irrigation water to 65% with the help of modern irrigation techniques. It has been also planned that 72 billion m<sup>3</sup> water is annually used in agriculture.

Most of the water which is used for irrigation in agriculture is provided from dams and reservoirs while 35% of it is obtained from ground water resources. However, some of these projects have not been implemented with efficient consideration on environmental impacts; they have caused the losses of valuable ecosystems and certain problems such as soil salinity, leakage and spread of agriculture based chemicals because of over-irrigation.



In 2009, a new initiative was launched by the Ministry of Food, Agriculture and Livestock in order to do cross domain production planning for the purpose of decreasing the water utilization in agricultural sector activities. For this reason, in Turkey, the production areas have been determined as “agricultural basins” by taking the climate, soil, topography and field grades into account within the framework of “Agricultural Basins Production and Support Model in Turkey”. The main purpose in cross domain production planning is to do an effective production planning in agricultural sector, to protect the agricultural biological diversity and land and water resources and to reduce the utilization of water in agriculture.

In this context, the process changes which are environment friendly and compliant with the climate will be provided in agricultural basins which have been determined in order to do rational production planning in agriculture and to implement the most appropriate production pattern. It has been aimed that the most appropriate habitats for agricultural products are determined by taking the water resources into consideration within the framework of adaptation works for the climate change and by this way, the use of water in agriculture is decreased. The modern and alternative irrigation techniques will become widespread across the country in order to provide water saving at the basin and agricultural land scale.

The peak utilization area of ground water is irrigation activities in agriculture in Turkey. It is necessary to strengthen the control mechanisms (the control of illegal wells etc.) about the utilization of ground water in agricultural irrigation in institutional and administrative context. Today, approximately 60% of the total potential of ground water which is consumed is used for irrigation and industry.

### **Objective 3.1. Increasing the effectiveness of water management in agriculture**

Technical and technological innovations will be encouraged for the process changes which will assure that the agricultural production process and the agriculture-based industry will be responsive to the environment and climate.

It is necessary to develop the varieties which are resistant to drought and salination in agriculture for the adaptation to the climate change. In Turkey, seed growing sector generally markets the imported hybrid seeds in the country. These seeds can be productive if there is enough water. The product ranges which are resistant to the drought in agricultural basins and which will adapt to the climate change will be developed and encouraged under the leadership of the public.

Sprinkler irrigation method or drip irrigation method will be used in all areas where the conditions of climate, soil and topography are convenient in order to adapt to the climate change in agriculture and to use more efficiently the irrigation water. With the utilization of water saved in the arid areas, increase in production and income will be much greater in total.

In modern irrigation, the quality of the irrigation water is also important as well as the water amount, irrigation time and irrigation method. Even though the soil is so productive and the modern irrigation methods are applied very well, if the quality of the water used is not appropriate for that land, the amount and the quality of the products decrease and salination-desertification problems occur in the land in a short time. For this reason, before using the irrigation water, the water should be definitely analyzed in terms of certain elements (boron, copper, zinc etc.) which cause intoxication and salination in the soil. Salination and desertification and misuse of water in agriculture cause great decrease in production speed-up which was obtained by the irrigation of the land<sup>54</sup>. Therefore, cropping from each drop of the water will be aimed and irrigation and water management systems will be developed considering the conditions of the regions<sup>55</sup>. By this way, water losses will be decreased in agricultural sector.

<sup>54</sup> Today, the amount of irrigable areas is 1.8 million hectares in Southeastern Anatolia Project. Up to present, the areas of approximately 230 000 hectares have started to be irrigated with the help of the works of the General Directorate of State Hydraulic Works. Salination has been observed in almost half of these areas where the drainage system is not established. Even the qualified water of Firat River leaves annually 1.1 tone salt on an area of 10 deceres.

<sup>55</sup> Irrigation methods can be divided into three categories: surface irrigation, pressure irrigation and corrugation. Surface irrigation method contains check flooding, ponding and row irrigation; pressure irrigation method includes sprinkler irrigation and drip irrigation.

<sup>56</sup> Example; Drip Irrigation Method: Peper, cucumber, marrow. Sprinkler Irrigation Method: Clover, wheat, barley

<sup>57</sup> For example; 0.2 m<sup>3</sup> water for potatos, 0.5 m<sup>3</sup> for corn, 1.2 m<sup>3</sup> for wheat, 2.3 m<sup>3</sup> for soybean and 2.7 m<sup>3</sup> for rice plant is needed while 0.9 m<sup>3</sup> water for 1 kg milk, 2.8 m<sup>3</sup> for meat of poultry, 4.7 m<sup>3</sup> for egg, 5.3 for cheese and 16 m<sup>3</sup> for red meat is needed.



Flooding (wild) method is unfavourable for water saving; however, one of the most important elements which should be considered in choosing the economical irrigation method is the type of the plant. In this context, methods such as product based drip irrigation, sprinkler irrigation, row irrigation and ponding will be selected by taking the impacts of climate change into account<sup>56</sup>. In the regions where there is water shortage, irrigation interval and irrigation number will be optimized according to the type of the plant.

Investments which are made in order to change gradually the classical irrigation methods such as flooding method which causes desertification of the soil and overconsumption of water, to use modern irrigation techniques for water saving such as sprinkler irrigation and drip irrigation with the utilization of closed system will be encouraged.

Throughout the country, the most appropriate regional production pattern will be formed according to water assets. Savings about the utilization of water in agriculture will be handled not only for the vegetative production but also for the animal production since more water consumption is needed for the production of animal products<sup>57</sup>.

## **PURPOSE 4. Protecting Soil and Agricultural Biodiversity Against the Impacts of Climate Change**

It is through the acceptance of biodiversity as one of the important regulating functions of the agricultural ecosystem that one can better understand the necessity of agricultural biodiversity. The real issue here is to make the management in a healthy manner, for instance by decreasing the external inputs, increasing productivity and developing the sustainability of the ecosystem.

The degradation of soil and agricultural biodiversity, of the steppes' ecosystems (due to causes like droughts, desertification, and erosion) constricts agriculture and livestock, decreases plant production. Also, effects and pressures on drinking water ecosystems may result in the deterioration of hydrological systems. This situation is affecting agricultural productivity and food security.

When considering agricultural biodiversity and resources, Turkey is one of the most important countries in the world. The majority of wild and woody plants growing in mild agricultural systems and that are used in an annual or multi annual basis in the Mediterranean originate from Turkey. Among the important products originating from Turkey are wheat, barley, oat, peas and lentils; there are also many varieties of fruits such as cherries, apricots, almonds and figs that are cultivated. Turkey hosts at the same time many bulbous plants of which tulips are the most renowned. In addition to that, there are two other important aspects of Turkey being a genetic resource variety centre; firstly, Turkey possesses the wild relatives of many agricultural products and there are five "micro gene centers" where these varieties can be found. Secondly, this wide genetic variety still figures in the products cultivated in agriculture. Contrary to the concentrated agriculture realized in the Anatolian Plain or the coastal areas, these varieties are mostly produced in marginal and mountainous areas where ancestral methods of agriculture are still in use. Rural farmers that work under more marginal conditions act in accordance with local circumstances and know the value of local varieties that grow in steep slopes, higher altitudes and poorer soils. Nevertheless, the abandonment of rural areas and the preference of high productivity varieties in those areas where agriculture is continued cause genetic erosion.

Despite not knowing the exact effects of Turkey's agricultural activities on its biodiversity, some vegetal varieties disappeared with agricultural activities (natural habitat losses due to dams for agricultural irrigation and intensive grazing). There have been several projects and programs (such as the National Plant Genetic Sources Program) in Turkey since the 1960s aiming the protection and usage of agricultural genetic resources, with in-situ protection programs developed and a priority given to varieties carrying global importance

<sup>56</sup> Example; Drip Irrigation Method: Peper, cucumber, marrow. Sprinkler Irrigation Method: Clover, wheat, barley

<sup>57</sup> For example; 0.2 m<sup>3</sup> water for potatoes, 0.5 m<sup>3</sup> for corn, 1.2 m<sup>3</sup> for wheat, 2.3 m<sup>3</sup> for soybean and 2.7 m<sup>3</sup> for rice plant is needed while 0.9 m<sup>3</sup> water for 1 kg milk, 2.8 m<sup>3</sup> for meat of poultry, 4.7 m<sup>3</sup> for egg, 5.3 for cheese and 16 m<sup>3</sup> for red meat is needed.

such as herbaceous varieties like wild wheat, barley, chickpeas and lentils and woody varieties like pears, walnuts, chestnuts, olives, apples and pistachios that have a global scale importance. But, due to insufficient research made on animal genetic diversity, there are very limited data on the characteristics of indigenous races. According to some studies, 20 indigenous cattle races, 19 sheep races and five goat races have been identified; among these, 14 cattle, two sheep and two goat races have completely been lost.

In Turkey, the direct and indirect causes listed below created a tremendous damage on biodiversity and ecosystems, particularly on pasture areas and wetlands:

- o Ploughing pasture areas and other semi natural habitats (meadow and maquis);
- o Excessive grazing from an increasing number of farm animals on narrowing grazing areas;
- o The drying of wetlands to convert them into agricultural lands;
- o The reorientation of water streams from wetlands to dam and irrigation projects;
- o Excessive usage of subterranean water for irrigation causing the decrease of water streaming to wetlands;
- o The inundation of vulnerable habitats due to the construction of irrigation dams;
- o Agricultural run-off water containing nutrients and pesticides.

Solving these problems will result in protecting soil and agricultural biodiversity against the impacts of climate change.

#### **Objective 4.1. Protecting the physical, chemical and biological efficiency of soil against climate change impacts**

It is necessary in agriculture to use techniques that allow for soil to conserve its moisture in order to take into account the impacts of climate change. The usage of commercial fertilizers that destroy soil's physical, chemical and biological structure and decrease its capacity to preserve moisture should be replaced by green fertilizing and through the use of animal manure as a fertilizer, efforts aiming to increase soil's capacity to hold water should be made widespread.

So as to enable the soil moisture regimes to work in accordance with the effects of climate change, researches all over the country will be conducted based on projects and implementation carried out by Soil and Water Resources Research Institutes such as soil and moisture conservation and operation techniques and the implementations will be conducted accordingly. Researches on soil-plant-water relation, water saving, irrigation techniques and irrigation programmes have been conducted by Soil and Water Resources Research Institutes and studies will continue to conduct these activities in accordance with adaptation to climate change effects.

The protection of soil and lands, its improvements and productive usage should be realized through the development of classification standards and the traceability of these applications should be made according to the land quality categories. Analysis for fertilizer use based on soil analysis have been carried out in laboratories of Soil and Water Resources Research Institutes and so as to expand these studies and to enhance the carbon absorption capacity of soil, product varying policies should be conducted in accordance with climate change and the physical, chemical and biological fertility of soil should be protected against the effects of climate change.

Through the widespread usage of appropriate techniques and equipment in soil cultivation, the usage of new and technological systems in irrigation and water management will be promoted.

Furthermore, advanced harvest systems, agricultural forestry as well as fallowing applications according to climate change impacts will be applied.

## Objective 4.2. Protecting agricultural biodiversity and resources for adaptation to the impacts of climate change

The development of innovative and appropriate agricultural techniques regarding to sustainable use of natural resources and adaptation to climate change, the research of climate change impacts on agricultural products having Turkey as genetic origin and the research on product pattern will enable the conservation of biodiversity and resources in order to adapt to the impacts of climate change.

## Objective 4.3. Completing land consolidation activities for the purpose of increasing agricultural efficiency in efforts to adapt to climate change

Land consolidation is an important means to increase agricultural productivity, protect soil quality and therefore realize sustainable development by preventing excessive usage of energy and water. Initially started as a means to gather dispersed plots of land and its main component being land organization, land consolidation is today a multifaceted development instrument in integrated rural planning. Land consolidation can also be used in solving environmental problems. There is a necessity for instance, to implement protective measures for the environment in order to protect threatened lake basins, lake basins used as drinking water reservoirs or regions like Edirne where there is a risk of flood. In these types of approaches, land parcels belonging to farmers and land parcels belonging to the Turkish treasury will be rearranged in order to form conservation belts around the lakes. These types of work directly relate to the adaptation to the impacts of climate change.

Furthermore, there is also a decrease in agricultural energy usage through land consolidation. This situation has also the advantage to contribute to the policy to decrease greenhouse gas emissions. As land parcels in Turkey consist of small and dispersed pieces of land, there is a considerable amount of energy spent on the means of transportation from village centers to the parcels.

The General Directorate of State Hydraulic Works (DSİ) made it compulsory to monitor the usage of water and to use water economically in irrigation areas, to have a regulated distribution of water, to increase the irrigation level and efficiency, to decrease construction costs of irrigation networks, to eliminate costs of expropriation through land consolidation in irrigation projects.

As per the Article 17 of Law no. 5403 on Soil Conservation and Land Use, the principles of land consolidation projects and its applications have been regulated. The by-law, pertaining to “The Protection, Use of Lands and Land Consolidation” in effect since 2009<sup>58</sup> will need to be revised in view of adapting to the impacts of climate change for lands that will be irrigated in order for these to go through land consolidation. Consequently, services to develop in-parcel irrigation efficiency, including land consolidation have been planned.

During the completion process of land consolidation works to increase agricultural efficiency, the necessary technical and financial studies will be realized in order to take into account the proper indicators for the adaptation to climate change impacts and priority will be given to high overflow risk areas for land consolidation applications.

In order to provide for sustainable water management in agriculture, land consolidation and in-field development works shall be simultaneously constructed with irrigation systems.

## PURPOSE 5. Developing Institutional Capacity and Improving Interagency Cooperation in Turkey with regard to Adaptation Alternatives in Agriculture

When considering the relation between climate change and agriculture, there are in Turkey nearly 40 responsible ministries and agencies among which figure at the top of the list the Ministry of Food, Agriculture and Livestock, the Ministry of Environment and Urbanization, the General Directorate of State Hydraulic Works, the General

<sup>58</sup> Official Gazette no. 27298 and under date 28.8.2009

Directorate of Meteorology, the General Directorate of Forestry, the Ministry of Development, the Prime Ministry Disaster and Emergency Management Presidency.

The Meteorological Early Warning System (MEUS) was developed by the General Directorate of Meteorology in order to identify areas prone to forest fire risks and the data obtained from this system is being shared with the General Directorate of Forestry, affiliated institution of the Ministry of Forestry and Water Works.

The Ministry of Food, Agriculture and Livestock has currently a series of ongoing works for the adaptation to the impacts of climate change that are being undertaken in a parallel to developing the legislation for the EU harmonization program; the Ministry also focuses on the development of drought resistant species, the application of appropriate techniques to measure soil moisture and the appropriate usage of agricultural lands. The Turkey Agricultural Drought Action Plan aims at monitoring agricultural drought for the various regions and provinces, making risk assessments and decreasing accordingly the negative impacts of drought. The implementations that have been initiated in provinces are still ongoing. In the scope of the implementation of the Agricultural Drought Action Plan, forestation and erosion control works are undertaken in order to have the precipitations that fall in basins be fed by the ground waters and penetrate in soil; the duties of the Ministry of Forestry and Water Works include the prevention of pollution for the already scarce water quantities in agricultural droughts as well as the works necessary to prevent the deterioration of environmental and ecological systems. The General Directorate of Meteorology has the responsibility to provide the meteorological data regarding agricultural drought. The Ministry of Food, Agriculture and Livestock in cooperation with the General Directorate of Meteorology has the responsibility to provide besides meteorological data, the monitoring and organization of early warning systems based on the measurements of soil moisture in the whole territory through a centralized system of information networks.

The General Directorate of Meteorology under the Ministry of Forestry and Water Works is the agency that is directly responsible of the adaptation works to the impacts of climate change. But in Turkey, regarding the adaptation to the impacts of climate change, there is an important need to develop capacity building for collaboration and cooperation among all the relevant institutions, and this, in practically all sectors. To this effect and in order to achieve that adaptation, the basic information and data base need to be developed, the varying effects, uncertainties and vulnerabilities need to be better determined.

Additionally, the “Agricultural Crop Monitoring and Tracking Systems” and “the Drought Test Centre” at the Konya Bahri Dağdaş International Research Institute were founded. The “Advanced Cultivation Methods in Arid Conditions” project has been implemented since 2008.

### **Objective 5.1. Strengthening interagency cooperation and developing the capacities of MFAL and its attached and affiliated organizations with regard to combating climate change and adaptation**

It is very important to increase the capacity of agencies and committees responsible for agricultural drought management and trainings and research programs to this effect. It will then be possible for TAKEP (Turkey Agricultural Drought Action Plan) to be applied with an understanding that takes into account local and regional effects of climatic changes. Furthermore, it will also be necessary for the Ministry of Food, Agriculture and Livestock and its related relevant institutions to form in their provincial organization an additional unit specifically responsible for climate change issues.

In the field of adaptation to the impacts of climate change over the agricultural sector all the institutions of the Ministry of Food, Agriculture and Livestock will need also to increase their capacity of collaboration with international institutions. It has further been planned for these institutions to develop their existing technical capacity and potential regarding their early alert systems for floods and droughts.

## Objective 5.2. Increasing the awareness of the civil society on the effects of climate change on the agriculture sector and on the adaptation approaches

As Turkey's one of the major objectives, it has been stipulated in the National Climate Change Strategy Document that "With the aim of ensuring effective coordination activities for adapting to and combating climate change, to establish a coordination mechanism which could develop a decision making mechanism based on transparent, participatory and scientific-analytic studies in line with the governance principle," and "to adopt a sound information management system in order to ensure the information flow and dissemination within an integrated system". This objective applies to all the sectors.

The Meteorological Early Warning System (MEUS) was developed by the General Directorate of Meteorology in order to identify areas prone to forest fire risks and the data obtained from this system is being shared with the General Directorate of Forestry, affiliated institution of the Ministry of Forestry and Water Works.

The Ministry of Food, Agriculture and Livestock carries out education and awareness raising activities targeting farmers on the effects of climate change on agriculture and livelihoods. Awareness raising and education activities, which are directly related to climate change, are performed in accordance with the provisions of Regulation on Good Agricultural Practices. In order to ensure the effective use of water resources; education programs aiming to promote the adoption of modern irrigation techniques and plant irrigation methods are provided to farmers. The farmers are also encouraged to be members of cooperatives so as to increase their knowledge. In the local level, these activities are performed by provincial directorates of Ministry of Food, Agriculture and Livestock and occasionally, various broadcasting companies and channels also contribute to the informing and awareness raising campaigns about the impact of climate change on agricultural sector.

Non-participatory adaptation efforts to climate change in the agricultural sector shall only pave the way for an increase in the negative effects experienced by already fragile parties. Although the awareness raising activities carried out by NGOs in Turkey have increased recently, the NGOs working in this field are not efficient. A great proportion of the NGOs are involved in mitigation activities whereas those working in the field of climate change adaptation have been active in the field of ecosystem services management yet the number of these NGOs is still insufficient. The important fact is that when it comes to struggling against the climate change, most of the NGOs perceive the issue from "mitigation" point of view; therefore they should be informed about the "adaptation".

Regarding the adaptation, it is stated in the National Climate Change Strategy that in the mid/long term (1-3 years) "in order to prevent the increase in the amount of sodium and salinization of the irrigated parts of the earth where the temperature and hence the evaporation shall increase, projects including measures such as soil cultivation, drainage, irrigation and mulching must be developed and the farmers must be educated in that sense".

During the preparation of National Climate Change Adaptation Strategy, especially during the activities held in the local level (Participatory Vulnerability Analysis held in various cities as well as the climate arena activity) through the participation of NGOs which are working in the agricultural sector, the consultation with the stakeholders has been realized efficiently.

In National Climate Change Strategy, it is emphasized that i) particularly for the implementation of TAKEP in the village level, to develop and expand the activities of the irrigation associations and cooperatives, ii) to raise the awareness of unions and cooperatives and increase their capacity in adaptation to climate change; iii) to inform the local shareholders in the agricultural sector about the alternative products; iv) to develop projects so as to take measures against salinization in the irrigated regions where temperature and hence evaporation shall increase due to climate change and to provide education to farmers in that sense. Moreover, all the segments of the society must be able to access information on climate and early warning system.

It is aimed that continuous education shall be provided to NGOs who are members of Provincial Drought Damage Assessment Commissions, Provincial Crisis Centers and Provincial Drought Assessment Commissions, associations, cooperatives and local administrators on the impacts of climate change and adaptation methods.

### III. ECOSYSTEM SERVICES, BIOLOGICAL DIVERSITY AND FORESTRY

#### **PURPOSE 1. Integration of Climate Change Adaptation Approach to Ecosystem Services, Biodiversity and Forestry Policies**

The most important factors determining the type of an ecosystem are temperature and precipitation regime therefore climate change causes an alteration in the structure and functioning of the ecosystems. The impact of climate change on species and ecosystems has become much more evident lately. It is assumed that species with a narrow life space as well as the vulnerable ecosystems shall be more influenced by the climate change. The protected areas in the world with rich biodiversity and vulnerable ecosystems protecting rare species shall become the home of many species during climate change. It is not known for sure how the climate change will affect the expansion of ecosystems in the present protected areas. Within the context of climate change, the protected areas are significant in terms of<sup>59</sup>:

- Reduction of the emissions, sustaining the protected areas such as forests and peat lands with ecosystems which enable carbon emission and declaration of new protected areas,
- Adaptation to climate change; ecosystem services, conservation of the distribution of species and ecosystems within the protected areas,
- Thanks to the present network of protected areas, building resilient for the ecosystems and species against climate change.

Once we take into consideration the protected areas, ecosystem assets and sustainability of these assets, it becomes evident that the most important natural assets we have are the forests, wetlands, steppes, marine and coasts. If we are to make an evaluation based on the species in Turkey, it would be convenient to claim that Turkey's geographical position, that it lies at the intersection of three continents, has enabled different species of Asia, Europe and Africa reach Anatolia easily.

Sudden changes in the altitude of the land as well as the glacial periods have contributed to the natural wealth of Turkey. Out of 34 biodiversity hot spots in the world where the plant species and terrestrial vertebrae are abundant, three of these spots are meet in Turkey.

It is known that the "Key Biodiversity Areas" comprise 26% of Turkey and there are 305 important nature zones throughout the country. The protection of those zones means the continuation of many species which are in danger of extinction. Turkey is a country which has the richest flora of Europe, North Africa and Near East with 11,000 types of flowering plants and ferns one third of which are endemic.

In Turkey, 17 protection statutes have been created with the legal arrangements related to the site protection in nature conservation activities. In the fields which those statutes comprise, management plans or secular development plans have been applied by different institutions on the basis of different legal grounds.

After Turkey became a party to the United Nations Convention on Biological Diversity in 1996, "National Biodiversity Strategy and Action Plan" has been prepared as the responsibility of Turkey according to the Article 6 of this Convention. This strategic plan has been updated by taking the necessity of harmony between the activities of Turkey in this field and the arrangements within the scope of nature protection sector of European Union into account<sup>60</sup> and six thematic working areas which are essential for adaptation to the impacts of climate change have been established in this framework. These areas are the thematic areas of agricultural biodiversity, forestry biodiversity, steppe biodiversity, mountain biodiversity, inland waters biodiversity and coast – marine biodiversity thematic.

<sup>59</sup> Resource: Report on Preserved Areas and Climate Change Strategy, Strengthening the Management of Forest Protection Areas, Ministry of Environment and Forestry, UNDP-Turkey, WWF-Turkey, Workshop held in February, 2010.  
<sup>60</sup> National Biodiversity Strategy and Action Plan of Turkey was prepared in 2001 and updated in 2008.



Introduction of a framework law related to the protection of nature and biodiversity was guaranteed as of “the end of 2011” in Turkey in conformity with the Directives no. 92/43/AET and 79/409/AET in “Turkey National Programme concerning Undertaking European Union Acquis” and on the basis of National Biodiversity Strategy and Action Plan and the “Draft Law on the Protection of Nature and Biodiversity” has been prepared.

In Turkey, detailed works about the impacts on biodiversity values of the protected areas and ecosystem services which are provided for humans are not sufficient. However, in the short term, certain works have been started about the impacts of the climate change and the risky areas. In this framework, “Turkey’s National Strategy of Protected Areas and Climate Change” is in the preparation process under the leadership of the Ministry of Forestry and Water Works. In this strategy, primary issues within the scope of protected areas and climate change are the establishment of a “protected areas system”, the policy formulation related to the planning and management of protected areas, multiplication of the researches, awareness raising and information sharing. The aforesaid strategy is handled in three main categories. These categories are forest ecosystem, wetland and steppe ecosystem and coastal ecosystem.

The strategies and policies which are dealt with in forestry sector in Turkey conform to the principles which are internationally agreed in terms of objective and principles. Especially after the preparation of the National Forestry Programme, the objectives of national forestry have conformed to the international norms and this situation has been reflected to the Development Plans.

The purpose, the objective and the strategies of the Strategic Plan of the General Directorate of Forestry (2010-2014) have been prepared in accordance with Ninth Development Plan (2007-2013), Forestry Specialization Commission Report, National Forestry Programme, Medium Term Program (2009-2011), Medium Term Financial Plan (2009-2011) and other plans and programs of forestry sector. In the Strategic Plan of the General Directorate of Forestry, seven main strategic purposes have been determined for sustainable forest management in Turkey and each of them is directly or indirectly related to the adaptation purposes about climate change. The above mentioned purposes are;

- Protection of the forest, the areas considered as forests and the biodiversity in those areas against any kind of biotic or abiotic pests;
- Improvement of the existing forests, enhancement of their fertility and enlargement of their areas;
- Formation of the ecosystem based and multipurpose forest management plans in line with sustainable forest management principles;
- Satisfaction of developing and changing expectations of the people from the forest based goods and services at highest level, utilization of forests in a multi dimensional and sustainable way;
- Provision of institutional development for sustainable forest management and in order to render rapid and qualified services;
- Reinforcement of the image of the General Directorate of Forestry at national and international level.

Protective and environmental services that forests provide in Turkey such as: the protection of soil resources and agricultural lands, the protection and regulation of water resources, the prevention of desertification, floods and other natural disasters, the accumulation of carbon and air cleaning, all make in sort to increase social consciousness and expectations. It has been planned through these activities to determine the economic values of protective and environmental services, to distinguish functional basin-based management areas and to prepare their respective plans, to re-establish the ecological equilibrium that was destroyed through industrialization and to evaluate more rationally the economic value of carbon captured by the forests through its offer to the markets.

The ecological conditions in Turkey offer vitally important opportunities due to the extensive nature of the areas that are considered as “forests”, the capacity of the existing forestry system to enable the forests ecosystems to resist to the potentially harming effects of climate change and to fulfil their function as carbon sinks. These opportunities need to be managed consciously. Otherwise, comparatively speaking, forests in Turkey will be among the ecosystems that are the most prone to be harmed by the potentially negative impacts of climate change.



To summarize, the protection, sustainable management and increase of forest areas that play a key role in combating climate change figure as a priority in policies and strategies related to forestry. Other issues that figure in the forefront of policies for forestry and climate are the protection of biodiversity, the development and inclusion in all the activities that are undertaken of the local population (forest villagers) that make a living out of the forests, the usage of the forest biomass in the production of heat and energy together with the necessity to have all activities measurable, reportable and justifiable through the foundation of the “National Forest Monitoring System”.

### **Objective 1.1. Reviewing the existing strategies in terms of adaptation to the impacts of climate change**

The existing strategies that indirectly tackle the impacts of climate change on ecosystem services shall be revised in accordance with the adaptation policies. In this scope, the National Forestry Program (2004–2023) and the General Directorate of Forests Strategic Plan (2010–2014) shall be revised in terms of adaptation to climate change impacts.

The generalization of the adaptation to climate change will start by integrating within the current planning the adaptation to climate change in chosen or priority given protected areas; additionally, regional strategies and plans will be prepared according to the regional characteristics of the protected areas regarding the adaptation to climate change.

The wetlands of Turkey are protected through the national legislation and also within the framework of commitments to international treaties. Wetlands figure among the ecosystems as important carbon sink areas and will go through constant monitoring by erosion and sediment control to ensure that their functions, efficiency and sustainability are fully realized. The determination of all the water resources that feed these wetlands and the generalization of planning works will be undertaken to this end.

## **PURPOSE 2: Identifying and Monitoring the Impacts of Climate Change on Biodiversity and Ecosystem Services**

The in-situ protection activities were initiated in Turkey in the 1950s. Today, the totality of protected areas amounts to 4.6 million hectares, which corresponds to 6% of the country’s total surface area. Protected areas have been classified as such under various statutes listed below:

- 41 National Parks
- 42 Natural Parks
- 31 Nature Protection Areas
- 14 Special Environmental Protected Area
- 135 Wetlands Bearing International Importance.

The climate change adaptation strategies need to be taken into account in biodiversity and the functioning systematic of ecosystems. New management approaches have started to be put forward in Turkey with the objective of providing for the resistance of existing ecosystems against the negative impacts of climate change and for conserving biodiversity.

Priority protection areas will be determined through overlapping the results of climate change model studies at national level with key biodiversity areas.

## Objective 2.1. Identifying and monitoring the effects of climate change on the species in forest land

Forests directly and indirectly provide a wide range of benefits including the conservation of soil, the prevention of erosion, the regulation of water regimes, the decrease of the effects of desertification and droughts, the prevention of floods, the decrease of productivity losses in agricultural lands in lower basins enabling food security, the prevention of infrastructural degradation in urban areas, the reduction of sedimentation in dams, through which irrigation, energy production, usage and drinking water can be provided. Both direct and indirect contributions are so important that the economic value of forests amount to a much higher value than the mere value of the output that is the production of wood. In these respects and due to the fact that forests are a very important ecosystem and that it is necessary to ensure the continuity of the goods and services provided by this ecosystem, it is truly inevitable for Turkey to adapt to the impacts of climate change. The effects of climate change over the forests in Turkey manifest themselves particularly in the Mediterranean Region where the season of forest fires starts earlier and lasts for longer. It has further been noticed that the dry forest soil, trees and insects have become more vulnerable to fires.

In order to adapt to these types of impacts, it will be necessary to start by determining and monitoring the impacts of climate change on forestry activities, forest ecosystems and forest species. The General Directorate of Forests will undertake impact analyses throughout the country to this effect. The impacts stemming from climate change of an increase in temperatures and changes in precipitation regime over the forests' ecosystem and species will be evaluated.

In order to be able to determine and monitor accurately the effects of climate change over the species in forest lands, the data regarding natural disasters like overflows, floods, avalanches and landslides will be integrated in the Forests Inventory and Monitoring System. R&D studies will be undertaken in order to minimize climatic risks in agricultural forestry. The constitution of an early alert system integrated with the National Land Monitoring System will be made possible as well as the integration in the "Forests Inventory and Monitoring System" of natural disasters caused by climate change such as overflows, floods, avalanches and landslides.

Furthermore, with a priority for R&D support mechanisms of the Ministry of Forestry and Water Works, all other institutions and organizations will need to allocate from their existing R&D financial resources more to projects dealing with climate change and forest – pasture – agriculture ecosystems.

## Objective 2.2. Identifying land use changes due to the impacts of climate change in forest land

Within the context of LULUCF<sup>61</sup>, under the coordination OGM and with the support of TUBITAK; activities have been initiated in order to improve the data quality, develop mathematical models that will be used, and forest management plans (forestry plans) in a way that these models are included and develop carbon management strategies to delay climate change. Within the framework of the strategic goals that have been set, following points will be ensured:

- Identifying the land transformed into meadows, pastures and grasslands in forest land;
- Identifying sites transformed from forest land into settlement land (housing areas);
- Identifying sites transformed from forest land into wetlands;
- Identifying sites transformed from forest land into agricultural lands;
- Identifying sites transformed from forest land into other land types.

Moreover; in order to contribute to the sustainable management of water resources that may be affected from climate change, forest management planning and application methods will be developed by considering hydraulic function more.

<sup>61</sup> LULUCF: Land Use, Land Use-Change and Forestry

### **Objective 2.3 Monitoring the health of forest ecosystems**

In order to manage forest ecosystems in Turkey in a climate-sensitive way; within the scope of the activities carried out on both national and international level by the Ministry of Forestry and Water Works, General Directorate of Forestry; the effects of atmospheric pollution, climate change and other factors on forests will be assessed by the end of 2014. The effects of forestation activities carried out in the properties that don't have forest characteristics and belong to the Undersecretariat of Treasury, and the degraded forest areas in the properties that have forest characteristics and are allocated to the General Directorate of Forestry, on the natural environment will be analyzed and evaluated. Forestation activities conducted within the scope of a nation-wide campaign will be integrated with activities carried out to adapt to the effects of climate change. The findings of International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) will be integrated with Forestry Inventory and Monitoring System by the support of universities. The implementation of Monitoring Forest Ecosystems Level 1 and Level 2 Programme in Europe will be carried out with National Forest Inventory in an integrated way.

### **Objective 2.4. Carrying out R&D activities oriented to identify and monitor the effects of climate changes in protected areas**

Turkey has very different climate types, rich ecological zones under the effect of edaphic factors and various forest ecosystems and habitats in these zones. Turkey is rich in biodiversity with its three bio-geographical regions. Turkey is located on two main bird migration routes and hosts 11,000 plant species one third of which is endemic. Turkey, which has five micro gene centers and more than 100 cereal products in these centers, is also rich in animal gene resources and many animal species are of Anatolian origin.

Identifying the species, ecosystems and processes that will be affected from climate change in protected areas is among the high-priority objectives. In this respect, the impacts will be analyzed and a system will be developed in order to monitor constantly the effects of climate.

Effective management of protected areas system against climate change will be ensured. Moreover; climate adaptation strategy and actions will be determined in order to support the livelihoods of the local people in protected areas; relevant cost-benefit and cost-effectiveness analyses will be conducted and means of livelihood will be diversified in the light of these findings.

### **Target.2.5. Taking into consideration the climate adaptation activities in the socio-economic development of forest villagers, and thereby supporting rural development**

Restrictions are being imposed to some practices (exploitations) in forests and in the areas which should be protected strictly due to the resource values they have. The restricted exploitation action of the local people in the preserved areas should be overcome by providing alternative income producing activities or diversifying the income producing activities. Efforts are being made to ensure that local people know well the resources, participate actively in the preservation activities, and gain awareness and to train them in order to solve these problems. While preparing long-term development plans, the natural resource values in these areas and the problems caused by external effects (here possible effects of the climate change should be emphasized) should be identified; these values and problems should be evaluated and monitored properly. This will provide opportunity for financial sustainability and new alternative income-generating producing practices.

Since forests are the most important ecosystems for climate change adaptation activities, the villagers who make a living from the forests should both protect forests and sustain the socio-economic development. With this, it is targeted to ensure that climate change adaptation activities are taken into consideration for the socio-economic development of the approximately 7.5 million forest villagers populating in Turkey and support rural development by this way. That's why; at first the socio-economic effects of the climate change on the forest

villagers will be identified in cooperation with the Ministry of Forestry and Water Works and Governorates. In order to minimize the risks of climate change effects on the forest villagers' means of existence, incentives will be provided and measures will be taken to diversify the livelihood activities of the villagers.

As a next step, the risks of climate change effects on the forest villagers' livelihoods will be minimized; for this purpose the livelihood activities of the forest villagers will be diversified and different activities will be tried if necessary.

### **Objective 2.6. Identifying and monitoring the effects of climate change on the mountain, steppe, inland water and marine ecosystems and on the ecosystem services they provide, and developing measures for adaptation to climate change**

Within the scope of protection of the mountain, steppe, inland water and marine-coastal ecosystems and the ecosystem services they provide, the effects of climate change should be identified and monitored constantly. In this respect; in order to sustain the resistance of the above-mentioned ecosystems to the climate change, the consumer sectors that have direct negative effects on these ecosystems will be analyzed and assessed. It has been found out that there is a need for R&D activities in many fields and following activities will be carried out within this framework:

- Identifying and monitoring the effects of climate change on the mountain ecosystems (indicator: species, sensitive ecosystems);
- Identifying and monitoring the effects of climate change on the steppe ecosystems (indicator: species, sensitive ecosystems);
- Identifying and monitoring the effects of climate change on the inland water ecosystems (wetlands, peat lands, lakes, rivers) (indicator: species, sensitive ecosystems);
- Identifying and monitoring the effects of climate change on the marine-coastal ecosystems (indicator: species, sensitive ecosystems);
- Identifying and monitoring the effects of climate change on the natural, cultural and visual landscape.

Moreover; the assessment activities of the HPPs which are planned to be built on small streams will ensure that the effects of climate change as well as the ecosystem integrity of the area and biological diversity will be taken into account.

Sustainable integrated peat land management and pilot implementations of rehabilitation will be carried out.

### **Objective 2.7. Integrating climate change adaptation into the marine and coastal zone management framework**

The effects of human consumptions on the coastal zones where tourism activities increase due to their climatic, geographic and morphological features are combined with the negative conditions caused by global climate changes and create a constant pressure.

The changes that should be made in the tourism model, products and geographical site use of the sector should be determined and a new management model for coastal zones should be created.

In the strategy, researching the effects of climate change on sea level rise and adaptation activities was identified as the main objective. In this context it is necessary to; i) ensure the sustainability of marine and coastal protected areas, ii) analyze the lagoon fishery in terms of the effects of climate change (extinction risk), iii) research the possible causes of salinization of drinking and domestic water and rise of seawater level, iv) map the agricultural lands with inundation risk, v) map the settlements and coastal zones that may probably be submerged, vi) integrate the research on the effects on and adaptation to the sea level rise with wetland conservation policies.

- Integrating marine and integrated coastal zone management activities into the climate change adaptation;
- Monitoring the events that will reduce the resistance of marine ecosystems to climate change while planning coastal settlements;
- Taking into consideration the effects of climate change in ballast water management.

### Objective 2.8. Protection of forests against fires

12 million hectares of the forest lands which correspond to 60% of all the forest lands in Turkey are located in fire prone areas. According to Intergovernmental Panel on Climate Change, a probable climate change in Turkey may increase the frequency, impact area and duration of forest fires depending on the increase in the length and severity of dry and hot period.

The forests ecosystems in Turkey have a structure vulnerable to forest fires. 120 million hectares of land, which constitutes 58% of the lands considered as “forest”, is in Aegean and Mediterranean Regions which have the highest probability of fire occurrence. A total of 96 million hectares of land, which constitutes 45.5% of forests, is calabrian and black pine forests. Approximately 45 million hectares of forests are composed of the forests which reach the age of 30- 40 and have the highest rate of accumulation of inflammable material thus leading the highest probability of fire occurrence.

Ninth Development Plan has specified in the 2011 Programme that priority will be given to fire fighting and forestation works in forestry activities while particularly aiming at effective protection of the ecosystem. Within this framework, necessary machines and equipment will be bought for more effective fire fighting; beginning from the fire prone areas, forest maintenance activities will be intensified and protection activities including building fire resistant forests and fire lines will be generalized. Forestation works and research about this issue will be planned and sustained in accordance with changing climate conditions.

In the fight against forest fires, General Directorate of Meteorology works in cooperation with General Directorate of Forestry (GDF) and use sudden fire risk maps prepared according to meteorological data obtained in works performed on action plans level. In order to identify and monitor the effects of climate change on forest fires, the findings will be recorded on these fire risk maps.

It will be ensured that risk preparation and prevention issues necessary for forest fires caused by climate change are taken into the scope of local and regional planning works.

It will be ensured that preventive measures are increased by GDF service fields for fight against forest fires on local level and existing early warning systems will be improved.

## IV. NATURAL DISASTER RISK MANAGEMENT

### PURPOSE 1. Identifying Threats and Risks for Management of Natural Disasters Caused by Climate Change

Today in many countries, adaptation activities are being conducted to reduce and manage natural disaster risks caused by climate change. In Turkey natural disaster and risk management policies don't still give priority to risk reduction. Disaster legislation and institutions predominantly focus on post-disaster risk management; therefore, preparation activities for prevention of risks and reduction of probable effects are not prioritized.

In Turkey for disaster management, National Disaster Management Strategy and Action Plan is being prepared to introduce basic approaches and strategies taking into consideration particularly international affairs. At this stage it will be important to take into account climate change adaptation activities for this strategy.

Threats and risks should be identified for the management of natural disasters caused by climate change; for this, natural disaster risks such as floods, overflows, avalanches and landslides should be determined first. As a matter of fact in the National Climate Change Strategy it was foreseen that necessary measures would be taken to determine the natural disasters that might increase due to climate change such as floods, avalanches, and landslides and minimize the effects of disasters by using early warning systems.

Department of Flood Planning affiliated to the General Directorate of Water Management of Ministry of Forestry and Water Works has been set up and this office has been charged to develop “Draft Flood Management Plan”. In this context; a project titled “Enhancing the Capacity for Implementation of Flood Directive in Turkey” so as to implement the Directive 2007/60/EC on “Assessment and Management of Flood Risks” which was put into effect on November 26, 2007 by EU has been initiated by DSİ and other relevant institutions and a National Implementation Plan will be drafted to harmonize the Flood Directive into our legislation, to carry out an initial flood risk assessment in a pilot basin, to prepare flood risk and danger maps, to draft flood risk management plans and to implement the directive in all river basins of the country.

### **Objective 1.1. Identifying risks of natural disasters caused by climate change, such as floods, overflows, avalanches, landslides etc**

In order to properly determine the risks of floods overflows, avalanches, landslides etc. caused by climate change; it will be ensured that risk maps, dangers and disasters such as floods, landslides are prepared and these maps are integrated into land use plans, which will form a basis for risk management processes against the effects of climate change. In the medium run, preparing implementation and control guidelines regarding risk reduction and management plans for floods and avalanches will minimize the risks of climate change. Moreover, monitoring, forecast and early warning systems for the natural disasters caused by climate change will be established and spread. Systematic research will be conducted to identify the social, economic and environmental effects of the natural disaster caused by climate change.

In the long run, it will be ensured that disaster management plans are prepared separately for each sector affected by the natural disasters caused by climate change.

Preparation of a guideline on a micro zoning work to be carried out to prepare integrated risk maps, to determine the integrated disaster risks and to identify all the hazards related to regions planned to be opened to settlement has been undertaken by the Prime Ministry Disaster and Emergency Management Presidency and Ministry of Environment and Urbanization.

### **Objective 1.2. Reviewing the legislation on natural disasters caused by climate change, and determining implementation principles**

In order to provide an effective integrated institutional and legal structure for disaster management in Turkey, Prime Ministry Disaster and Emergency Management Presidency, in charge of disaster management was established and activities were initiated to prepare National Disaster Management Strategy and Action Plan, which will introduce Turkey’s basic approaches and strategies in disaster management considering particularly international affairs. On the other hand; disaster management and relevant central–local organization relation is needed to be strengthened in terms of the risks of climate change. When considered from a legal point of view, it will be ensured that Law No. 7269 pertaining to the Precautions to Be Taken and Aids regarding Disasters Effective on Public Life is reviewed so that it also includes risk management. Legislation on the structural effects of natural disasters caused by climate change will be developed.

Moreover, it is necessary to ensure development and implementation of the legislation required for protection of ecosystems and determining natural structures reducing the effects of natural disasters caused by climate change.

Private and public insurance mechanisms regarding natural disasters caused by climate change should be disseminated among all sectors and citizens. Thus; while insurance mechanisms will be used more often, protection will be provided against climate risks.

Necessary legal regulations for planning of risk prevention and determining disaster risks will be carried out with the cooperation of Prime Ministry Disaster and Emergency Management Presidency Ministry of Environment and Urbanization.

In the medium term, the legislation on urbanization and planning will be regulated in a way to cover risk analysis and prevention plans to reduce the risks of disasters and settlement.

## **PURPOSE 2. Strengthening Response Mechanisms for Natural Disasters Caused by Climate Change**

Uncertainties caused by climate change also induce sudden disasters (especially overflows and droughts). In this respect, especially water resources management and operation policies and planning should be also made in a way that they ensure the risks arising from disasters (flood control and future forecasts) are balanced with an optimal mechanism. Therefore it is important to strengthen intervention mechanisms for natural disasters caused by climate change.

### **Objective 2.1. Strengthening the capacities of local public organizations with regard to responding to natural disasters caused by climate change, and reaching the level of being able to make field exercises**

When considered from an institutional point of view, a new institution named Prime Ministry Disaster and Emergency Management Presidency (AFAD) was created with regard to disasters in Turkey<sup>62</sup>. Three different institutions in charge of disaster affairs to date; the Prime Ministry General Directorate of Emergency Management, the Ministry of Interior General Directorate of Civil Defence and the Ministry of Public Works and Settlement General Directorate of Disaster Affairs were abolished and integrated under one roof as Disaster and Emergency Management Presidency thus enabling to provide service more effectively with respect to disaster management in Turkey<sup>63</sup>. Disaster and Emergency Management Presidency was organized on local level by means of Provincial Directorates of Disaster and Emergency. Provincial Directorates of Disaster and Emergency are obliged to make and implement provincial disaster plans and emergency prevention and response plans in cooperation and coordination with local administrations and field services of state institutions and organizations. One of the local organizations of Disaster and Emergency Management Presidency is Civil Defence Search and Rescue Unit Directorates; these units work upon the instructions of governors in provinces.

### **Objective 2.2. Establishing a community-based disaster management in combating disaster risks that may arise due to climate change**

In order to establish a community-based disaster management in combating disaster risks that may arise due to climate change, it will be ensured that the capacities of relevant institutions and organizations on a local scale covering all administrative levels including mukhtar offices regarding risk reduction, emergency response, long term and short term post-disaster recovery approaches and practices are identified and developed. These activities will be carried out jointly by AFAD, NGOs, mukhtar offices, municipalities, Village Services Unions and other relevant local government units; education need analyses will be conducted together.

<sup>62</sup> Law on Organization and Tasks of Disaster and Emergency Management Presidency N°5902, (Official Gazette Dated 6.17.2009 and N°27261).

<sup>63</sup> Pursuant to the decision dated 12.16.2009 and numbered 1 of Disaster and Emergency High Council; General Directorate of Civil Defense, General Directorate of Disaster Affairs, Prime Ministry Emergency Management General Directorate and, Provincial and District Directorates of Civil Defense were abolished as of 12.17.2009.



Taking into consideration all disaster types including climate changes that may affect settlements; standards and guidelines regarding preparing integrated disaster hazard maps should be developed. Consequently, it will be ensured that implementation guidelines and procedures regarding reduction of risks that may arise due to climate change, emergency response, short term and long term post-disaster recovery approaches and practices are developed, distributed and relevant trainings are provided.

Moreover, knowledge, experience and background sharing will be enhanced by ensuring coordination among institutions at the local level.

### **Objective 2.3. Continuing the training activities that will increase public awareness and participation with regard to the disaster and risk impacts that may arise due to climate change**

The principle is to continue the training activities that will increase public awareness and participation with regard to the disaster and risk impacts that may arise due to climate change and carry out awareness-raising activities aimed at every segment of society. Within this framework, it will be ensured that public institutions on national and local level collaborate with relevant NGOs.

## **V. PUBLIC HEALTH**

### **PURPOSE 1. Identifying the Existing and Future Effects and Risks of Climate Change on Public Health**

In order to minimize the negative effects of climate change on human health and take proper measures against possible effects, activities were initiated by the Ministry of Health. Existing and planned activities by the ministry against the negative effects of climate change on human health are being carried out in three different fields; i) effects of warm air and extreme heat waves, ii) effects of extreme weather events and iii) communicable diseases.

In addition, “National Climate Change and Health Adaptation Strategies Development Project” covering 2010 and 2011 is being implemented by the Ministry of Health with the support of World Health Organization (WHO).

In Turkey; especially during heat waves, many deaths occur due to heart attack, cardiovascular diseases, kidney diseases, respiratory tract diseases and metabolic diseases. Public information activities about warm air and heat waves are being continued especially in summer by the Ministry of Health and, deaths and diseases caused by heat are watched. In May 2010, a new “Temperature and Heat Waves Action Plan”, which contains issues such as proper and timely warning system for heat-health, heat-related health information plans, reducing exposure to indoor heat, special care for high-risk groups, availability of health and social care services, real-time monitoring and assessment was put into practice.

In the strategies, programs and action plans regarding chronic diseases implemented by the Ministry of Health, possible effects of climate change on chronic diseases are also being evaluated. For instance; within the scope of Turkey Chronic Respiratory Diseases (ASTHMA - COPD) Prevention and Control Program (2009-2013) Action Plan activities, Indoor and Outdoor Air Pollution and Climate Change Report Commission was established. The commission carries out activities covering basic information, problems and solution suggestions on national and local level for assessment of indoor and outdoor air pollution and climate change in terms of chronic airway diseases control.

Moreover, studies regarding the effects of extreme heat caused by climate change on risks for cancer are being performed by the Ministry of Health<sup>64</sup>. In this context, screening programs are being conducted for particularly high-risk groups and groups at risk of skin cancer in Cancer Early Diagnosis and Screening Centers (KETEM).

Besides, information activities are being carried out for proper sunbathing and protection from heat. It is known that climate change also has an effect on colorectal and gastric cancers. National screening standards were published regarding screening of these cancers and within the scope of these standards, for all women and men between the ages of 50 and 70, stool occult blood test and decennial colonoscopy are done.

Another health problem which has a negative effect on human health is nutrition and food security. In order to raise individual awareness about nutrition and create a public awareness about this issue; various programmes and trainings for public and health personnel are being conducted by the Ministry of Health.

Within the scope of water resources protection, raising public awareness about water consumption, providing safe water and sanitation works; following activities are performed by the Ministry of Health:

- Measures are taken to protect water resources and reduce pollution; necessary research and development activities are being conducted to supply enough and healthy drinking water to settlements.
- In order to assure water protection and healthy water consumption, physical and quality controls of water and water plants are performed.
- Supplied drinking and domestic water is disinfected.
- Activities are performed to raise public awareness about saving measures and individual disinfection. Works still continue to set up water monitoring system and an information system which will enable public to get information about water quality.
- Efforts are made to develop sanitation operation.

## Objective 1.1. Researching the effects of extreme weather events on public health

National Medical Rescue Teams (NMRT) was formed in order to intervene in natural disasters caused by extreme weather events occurring due to climate change. Regionally coordinated and composed of five-man teams, NMRTs are being structured in 11 areas, 81 provinces. The teams have necessary tools, equipment, mobile hospital, materials and personnel as well as air ambulances for probable disasters.

A disaster coordination centre was formed under the Ministry of Health; constant surveillance is performed against probable disasters with the computer system set up in this centre.

It was foreseen that the Ministry of Health works in coordination with institutions such as the Ministry of Food, Agriculture and Livestock, Ministry of Environment and Urbanization, Ministry of Forestry and Water Works, and NGOs for solution-focused measures and to prevent probable chaoses and psychological problems that may arise among public during drought crisis periods<sup>65</sup>.

Emergency health services of the Ministry of Health have enough capacity for the possible effects of climate change. However, it is necessary to set up an early warning system in cooperation with other institutions, warn public in earthquake prone areas and respond in a more effective and rapid way. For this reason, it was aimed to build and generalize early warning systems and warn of emergencies in order to reduce the effects of extreme weather events on human health.

<sup>64</sup> Extreme heat poses risks in terms of skin cancers. Particularly construction workers, agricultural workers, tourism workers and people living in coastal areas are high-risk groups.

<sup>65</sup> The Report of the TBMM Parliamentary Commission on the Effects of Climate Change and Sustainable Management of Water Resources, N° (10/1,4,5,7,9,10,11,13,14,15,16,17), 23rd Semester, 2nd Legislative Year, No:138, April 2008, Ankara.

Furthermore; based on the existing and future climate projections, in the strategy it was aimed to monitor and evaluate the risks and effects of the extreme weather events such as heat waves, hurricane, floods and drought on human health.

Also, health personnel and public information activities will be carried out by the Ministry of Health about the possible effects of climate change and actions to be taken in order to ensure to develop proper action in disasters.

## **Objective 1.2. Researching and monitoring the link between climate change, communicable diseases and health risks, and determining possible measures**

Many diseases and pathogens have to be monitored in terms of the changes occurring in these diseases and pathogens due to climate changes. In Turkey, all communicable diseases are monitored and immunization programmes are implemented regularly. Waterborne and food-borne diseases which are thought that climate change may affect are monitored and feedbacks of the data analysis are provided. For the last four years, “water and food-borne diseases weekly surveillance” have been conducted from May to October in 81 provinces.

In addition to the weekly Acute Enteric Infections (AEI) surveillance conducted in 81 provinces since 2009, daily surveillance was initiated in ten provinces. These data are entered into the program EARS\_X and thus AEI cases are monitored. In AEI cases “Early Warning and Response System” is operated by the use of this program. Since 2010, AEI surveillance has been conducted in 81 provinces on a weekly basis during the whole year.

Within the scope of “Strengthening Epidemiological Surveillance and Control System of Communicable Diseases Project” carried out by the Ministry of Health in coordination with WHO, it is aimed to develop “Early Warning and Response System” in accordance with International Health Regulations (IHR-2005) and European Union containing determination, evaluation, information and response of infectious, chemical, radio-nuclear diseases or diseases of unknown origin and risks for public health.

One of the tick-borne infectious diseases, Crimean-Congo Hemorrhagic Fever (CCHF) and a rat related disease, tularaemia have a link with meteorological data and climate change. Since taking individual protection measures is very important in CCHF disease; in order to inform public about CCHF disease and ways to avoid from this disease, and raise the awareness of the public; public training activities and household visits, and face-to-face interviews are being conducted by the Ministry of Health. In order to raise the awareness of the public throughout the country, education activities are being carried out in cooperation with relevant public institutions and organizations, non-governmental organizations and the Ministry of Food, Agriculture and Livestock, the Ministry of Forestry and Water Works, the Presidency of Religious Affairs and the Ministry of Defence in particular. Moreover; in-service training meetings regarding both CCHF and tularaemia diseases for health personnel are being conducted on central and local level. For quicker and more effective response to CCHF disease, district hospitals have been established and these hospitals have been strengthened in terms of personnel and infrastructure.

One of the diseases that will be affected by climate change is malaria. In recent years, malaria is seen in provinces in the Southern Eastern Region, particularly in Diyarbakır and Şanlıurfa provinces; however, the frequency of occurrence of this disease has significantly decreased. In the fight against malaria, efforts are being made for medical fight against parasite (treatment of the patient) and vector fly (taking action against vector flies between May and October when mosquito population reaches the peak due to temperatures). While planning the fight against malaria, the effects of climate change on malaria are taken into account.

Considering the increase that may occur in tropical diseases due to climate change, clinics for tropical diseases have been opened in the state hospitals of 11 provinces (Antalya, Samsun, Diyarbakır, Erzurum, Adana, Mersin, Ankara, Trabzon, İstanbul, İzmir) by the Ministry of Health.

The first project that builds a connection between climate change and public health is “Contagious Diseases Monitoring and Control System Project” which is implemented in Adana and was developed by Çukurova Tropical Diseases Research and Application Centre (THAUM). The project aimed to diagnose and treat communicable diseases, and determine vectors (such as insects, animals) by reaching 3,600 of 12,000 seasonal agricultural workers coming from Eastern and South-eastern Anatolia regions and settled in the tents and hovels set up around canals and canalettes around Karataş County, Tuzla and Yunusoğlu Towns and Seyhan River in the District of Yumurtalık.

It is foreseen that there will be an increase in vector–human diseases such as cutaneous leishmaniasis, malaria, CCHF, West Nile fever as well as tuberculosis and trachoma.

In the areas in Sarıhamzalı, Karataş and Ali Hocalı counties where migrant workers live, communicable disease screenings were performed and trainings were provided concerning supplying fresh water and hygiene.

The existing and future relationship between communicable diseases and climate change should be researched and constantly monitored. In the medium-run, it was targeted to determine risky areas for public health and measures to be taken, and regionally form Tropical Diseases Diagnosis Laboratories or strengthen Public Health Laboratories in some provinces in accordance with this purpose.

## **PURPOSE 2. Developing the Capacity to Combat Risks Originating from Climate Change in the National Healthcare System**

The Ministry of Health has started to evaluate public health problems caused by climate change all together in health policies and applications it carries out throughout the country. In this framework, the effects of warm weather, extreme heat waves, extreme weather events and communicable disease are monitored and measures are taken.

### **Objective 2.1. Developing emergency response action plans in risky areas, and supplying the necessary infrastructure**

In order to strengthen the capacity for combating risks induced by climate change in Turkey, following objectives have been set to develop emergency intervention action plans and build the necessary infrastructure:

- Developing and implementing pilot programmes concerning epidemic and emergency health risk,
- Making “National Medical Rescue Teams (NMRT)” conscious of adaptation to the effects of climate change,
- Increase the power and application skills of mobile health teams subordinate to Provincial Directorates of Health in terms of infection (communicable diseases) in risky areas,
- Cooperating with countries and international organizations working on the effects of climate change on human health,
- Preparing and popularizing guides explaining citizens and institutions what to do in case of possible communicable diseases and extreme weather events, and providing periodical trainings.

### **Objective 2.2. Strengthening the capacities of health sector organizations arising health risks arising due to climate change**

In order to strengthen the capacities of health sector organizations against climate-sensitive health risks following objectives have been set:

- Carrying out capacity-building activities on health risks arising from climate change, for health professionals working at protective health services /family health system
- Announcing the “Ministry of Health Climate Change Adaptation Programme” throughout the country
- Establishing Ministry of Health “Disaster Coordination Centers” in areas that may be affected from climate,

- Ensuring coordination and cooperation between relevant institutions and organizations with regard to climate-sensitive disasters and the health risks they will create,
- Strengthening the treatment and control (including vaccination programmes and vector control) and evidence-based protection, including integrated health monitoring and surveillance of vector-borne (transmitted by a carrier) and zoonose (transmitted from animals to humans) diseases, and infectious diseases,
- Researching/monitoring the effectiveness of possible adaptation measures to be taken in the health sector for protection against the impacts of climate change, including early warning, strengthened disease observation, information systems and other public health measures,
- Researching/monitoring the common benefits of mitigation/adaptation measures as well as negative effects and the adaptation costs,
- Strengthening observation and preparedness level in terms of water availability, water quality and hygiene in urban and rural areas,
- Identifying the health risks that may occur due to population increase in the areas vulnerable to climate change and in the areas located on migration routes, and increasing the capacities of health organizations in these areas,
- Cooperating with countries and national and international organizations working in areas that may affect human health due to climate change such as migration movements, international trade and tourism.

## VI. CROSSCUTTING ISSUES IN ADAPTATION

### PURPOSE 1. Ensuring Adaptation to Climate Change on Crosscutting Issues

In order to adapt to the effects of climate change in Turkey, the highly vulnerable fields determined are; i) water resources management, ii) agriculture and food security, iii) natural disasters risk management, iv) ecosystem services, biodiversity and forests, and v) public health. In order to adapt to climate change, some points should be handled and implemented especially in the short- and medium-run. These points are as follows:

- o Education, Awareness Raising and Capacity Building
- o Research and Development, Data and Information Systems
- o Finance and Economic Tools
- o Governance, Coordination, Monitoring and Evaluation
- o Gender Mainstreaming

#### Objective 1.1. Integration of adaptation to climate change into national development plans, programmes and policies

When national development plans, programmes and policies are analyzed, it is seen that there are direct targets in the National Climate Change Strategy document and indirect targets in the strategies of many sectors and institutions. The issues such as water resources management, eco-efficiency, prevention of desertification and food security mentioned in decision documents such as regional planning policies, Agriculture Strategy, Rural Development Strategy, Forest Strategy, Biodiversity Strategy, Energy Strategy, Industry Strategy are also related to climate change adaptation. However, the integrated effects of the targets, actions and sectors mentioned in these strategies should be developed to adapt to direct effects of climate change. In this context, the possible sectoral effects of climate change on general macroeconomic variables (growth, income, employment etc.) will be examined separately and when necessary, all together dynamically; and activities that will be included in national strategies/policies/plans will be carried out. Thus, the advantages or problems that will arise due to climate change will be identified on a sectoral basis, and integrated into sectoral policies and development plans.

At the same time; the activities carried out for adaptation to climate change will encourage sectors active in the fight against climate change to invest in environmental technologies and other fields (nature protection, disaster risk management, administrative capacity etc.) and will provide opportunity to create employment by increasing environmental products and services.

Moreover, it has been foreseen to establish a “Climate Change Regional Center” in Turkey at international or regional level, which will ensure to share the experience in this field in Turkey with other countries and other international organizations.

### **Objective 1.2. Developing and putting in practice information, monitoring and evaluation systems that support decision-making processes**

The existence of reliable and updated environmental information in the implementation of sustainable development policies, will facilitate the proper functioning of institutions and decision mechanisms, and will accelerate the activities for fight against climate change, which is a multi-disciplinary field.

The activities performed to date and experience in existing environmental activities can be regarded as important advances for creating an environmental database in Turkey. However in current situation; comprehensive and reliable environmental information or environmental data observation systems across the country (environmental analysis reports etc. that take into consideration sufficiently environmental information network and database, inventory, environmental and sustainable development indicators and inter-sectoral integration throughout the country) are not available. Consequently, these problems also arise in the fight against climate change activities.

Data collection for the impacts of climate change requires conducting scientific research with a systematic and integrated approach in various fields (flora and fauna, agricultural data, soil research, flood/overflow, drought etc. data for prevention of natural disasters) and building a strong observation network infrastructure. The fact that climate change is a multi-disciplinary issue, many organizations have authority and responsibility in terms of mitigation and adaptation, and that the information is produced in this way causes existing data to be in different formats and standards, which requires managing data and information systematically by taking into consideration the effects of climate change.

Both scientific problems encountered in environmental data collection activities and not being able to bring existing information together are important bottlenecks in Turkey. That’s why; managing systematically existing data is important.

The same situation applies to data and information regarding climate change and while creating a climate information system, the first step will be to develop the technical capacities of related institutions. This will be possible by building technical capacity in data management, analyzing and interpreting the data, preparedness of end users for early warnings and capacity building for this purpose; these points are main issues to cope with climate change risks in Turkey.

As a matter of fact, in the United Nations Joint Programme on Enhancing the Capacity of Turkey to Adapt to Climate Change developed under the leadership of the Ministry of Environment and Urbanization, building a climate information management system was identified as a necessity in the process of collecting and storing the data about climate change and distributing it to end users via early warning systems.

On the one hand forecasting climate risks and reduction of risks necessitate making future projections by developing scientific studies in every field and increasing R&D activities; on the other hand they require effective and constant cooperation and coordination between organizations producing and/or using data and

information and end users. Another important point is to assess the capacity of the current environmental data and information management system for data and information flow in terms of standardization, integration, and administrative (sharing of responsibility etc.) and technical/technological infrastructure (quality control, feedback cycles etc.) of relevant organizations.

The institution that produces the most comprehensive data is Turkish Statistical Institute (TURKSTAT). Within the scope of Official Statistics Programme prepared by TURKSTAT; official statistics were standardized, the responsible and relevant institutions were identified, and points regarding which data will be collected by which institution, through which method, for which periods and when it will be published were clarified. In this respect including indicators on the effects of climate change in the Official Statistical Programme is important and necessary technical infrastructure will be supplied.

Moreover, necessary infrastructure will be built in order to include climate change data in Technical Assistance for the Establishment of Turkish Environmental Information Exchange Network (TEIEN<sup>66</sup>) Project, which is implemented as an EU project by the Ministry of Forestry and Water Works. TEIEN project will ensure to build a system that will enable easy access and environmental data sharing between institutions and organizations concerned with environmental issues in Turkey through a single electronic network.

### **Objective 1.3. Identifying the required amount of financing for the implementation of the National Climate Change Strategy**

For the measures to be taken and future activities to adapt to the effects of climate change; financing policies in this field should be identified clearly and innovative financing mechanisms should also be developed. Within the framework of Turkey's global partnership approach; it will be important to take steps to be funded by technology transfer funds and build capacity in terms of conforming to international organizations, as well as collaborate with countries whose socio-economic structure and development trend are similar to those of Turkey. At this point; a systematic method will be followed for access to international sources and various financial incentive mechanisms will be developed to ensure technology transfer. These activities should be supported on both national and local level. Therefore; it will be ensured that the capacities of Development Agencies in the regions are strengthened so that they finance climate change adaptation projects and adaptation to climate change issues that will emerge in line with local need are included in support programmes of Development Agencies.

Furthermore, conducting integrated cost/benefit analyses that take into consideration the mitigation-adaptation synergy in each relevant sector; particularly in climate dependent sectors such as agriculture, energy, tourism, water, fishery, industry. The analyses on the impacts of climate change on these sectors will be conducted and adaptation costs will be determined. Besides, government subsidies and support for climate change adaptation will be improved and implemented on sectoral level.

### **Objective 1.4. Organizing training, awareness-raising and informative activities to develop the capacity to combat and adapt to climate change**

In order to reduce the effects of climate change and adapt to the process, the awareness of Turkish public should be raised and the capacities of the institutions should be strengthened.

In the "National Climate Change Strategy Document", among short-term (1 year) adaptation to climate change objectives, realizing following awareness-raising activities was aimed:

*"With regard to adaptation to climate change; activities will be continued to support raising the awareness of the public, professionals and local authorities, and their training, scientific and social efforts; to develop international communication and information transfer, policies and strategies.*

<sup>66</sup> TEIEN: Technical Assistance for the Establishment of a Turkish Environmental Information Exchange Network.



*Training activities concerning particularly disasters and risks that will occur due to climate changes will be carried out to raise public awareness and participation.*

*Activities such as local meetings, broadcasts and television programs etc. will be planned on possible results and risks of disasters on human health, environment, historical and natural protected areas (SIT), economic activities and being ready to these risks.”*

In the strategy there is the objective; “*projects will be developed regarding the measures such as soil cultivation, drainage, irrigation techniques, mulching to prevent the increase of salinity and sodium in the irrigated places in the areas where temperature and evaporation will increase due to climate change and the farmers will be trained*” for adaptation in the medium-long run.

Many direct and indirect activities are being carried out on national and local level by the Ministry of Environment and Urbanization, which is the primary responsible public institution for coordination for climate change in Turkey, to raise awareness about this issue. Moreover, committees and bodies established under public institutions on local level also work for fight against climate change; decisions regarding mitigation and adaption are made in these committees and bodies. The activities of bodies such as Local Wetland Commissions, Provincial Hunting Commissions, and Provincial Soil Counsels are directly related to adaptation to the effects of climate change. Within this framework; the capacities of all relevant Ministries, local organizations and relevant committees will be developed with basic in-service trainings about adaptation to the effects of climate change and the situation in Turkey.

In order to create public awareness about climate change in Turkey, the activities of NGOs also increase. However, most of the NGOs are focused on emission reduction activities, few NGOs work for adaptation to the effects of climate change. Basically, some of the NGOs have been active in ecosystem services management activities for a long time. Therefore, in order to ensure participation throughout the country and create awareness with regard to climate change adaptation; it has been aimed that programmes will be developed by primarily NGOs and all other sectors to raise public awareness.

### **Objective 1.5. Developing R&D capacity with regard to climate change adaptation**

Considering climate change is basically a risk assessment issue, the importance of scientific predictions and R&D activities is more evident. Even though, in some universities in Turkey, climate modelling projections are carried out in earth sciences units (i.e. Eurasia Earth Sciences), most of the time these works are not enough. There is a constant need for comprehensive works in the fields such as climate models, extreme and sudden weather and climate events, vulnerability analyses and climate change adaptation. In this respect; financial, technical and human resources are not sufficient to develop scientific research. A lot of data regarding climate change produced by TUBITAK , universities, institutes, various public institutions and the research institutions of these organizations are not sufficient and reliable most of the time; more importantly, these data are not used in coordination between institutions.

This situation requires developing both climate science and scientific studies and research in mitigation and adaptation fields on national level, keeping up with international affairs and bringing them together with an integrated approach in the fight against climate change. In this respect; increasing debate forums and certificate programmes, adding relevant graduate and post graduate courses to the curriculum and creating research/post graduate programmes in universities, with regard to climate change adaptation will be encouraged.

Necessary infrastructure will be developed for R&D activities, which will provide great benefits in foreseeing the effects of climate change in Turkey.

In the Ninth Development Plan, climate change activities within the scope on R&D policies have not been directly mentioned; but rather it has been stated that “mitigation” and R&D activities for sectors concerned with this field will be supported. For instance; new generation nuclear technologies, hydrogen and fuel cell technologies, clean coal technologies etc. are among R&D support programs of Turkey as research in the sectors that industry policy will give priority to. In order to activate the R&D support provided to SMEs, ensure university-industry cooperation and support R&D activities; founding and disseminating Technology Development Centers in universities are among the objectives of the Ninth Development Plan and annual programmes.

Supporting scientific works and R&D activities through strategies determined on local level is important for completing route maps to develop particularly public institutions, research institutes and centre across the country with an innovative approach and for climate change adaptation activities too. Activating local/regional research institutions of some ministries which are in the existing institutional structure and regarded as important institutions for adaptation to the effects of climate change especially on agriculture sector and water resources should be taken into consideration. At this point; it is known that there is a need for scientific studies on the effects of climate change particularly on water resources and agriculture sector.

In this context; supporting capacity building activities to modernize and develop laboratory infrastructures in public institutions in Turkey and/or build new research centers in order to adapt to the effects of climate change has been aimed in the strategy.

Developing “Climate Detection and Projection National Research Area”, which will provide support and infrastructure for climate change adaptation has been targeted; hydrologic, physical and chemical changes due to climate change will be monitored, necessary data will be collected and long-term observations will be conducted in order to determine how ecosystems are affected from climate change and determine physico-chemical structures of flora and fauna. At this point it is also important to determine changes in the ecosystem structure and living creatures during the adaptation processes due to previous climate change conditions. It will be ensured to control predictions regarding changes caused by climate-related changes of living creatures groups such as fish, aquatic plants through laboratory and mesocosm trials.

In addition to the growing need for R&D scientific studies of public institutions on the effects of climate change; private sector will be active in this field and initiatives concerning adaptation to climate change in the R&D activities of private sector will be supported.

The private sector will be encouraged to carry out activities to meet the needs of farmers and to produce seeds of plant species which are found out to be resistant to drought, in needed amounts within the shortest time. Moreover, it was aimed to determine plant species used for bio-energy production and support private sector in order to increase cultivation areas and develop species appropriate to the areas which enable more efficient production.





# Turkey's National Climate Change Adaptation Strategy and Action Plan Tables

## I. WATER RESOURCES MANAGEMENT

<b>PURPOSE US1. Integrating adaptation to the impacts of climate change into water resource management policies</b>				
<b>Objective US1.1.</b>	<b>Ensure integration of adaptation to climate change into existing strategies, plans and legislation</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>US1.1.1.</b> Incorporating measures to tackle the impact of climate change on water resources in the Development Plans and Programmes	2011-2014 (Preparation of Tenth Development Plan)	Development of plans and programmes including the measures	MoD	Relevant public institutions and organizations
<b>US1.1.2.</b> Establishing an institution for holistic management of water resources, which will have sole responsibility on underground and surface water allocation and quality	2011-2013	Making the institutional arrangements	Prime Ministry (completed)	MENR, MFAL, MFWW, MoD, SHW, GAP, MTA, Provincial Bank, Municipalities
<b>US1.1.3.</b> Enhancing the institutional structure and understanding of combating climate change of authorized/relevant institutions under the water legislation in line with their duties, mandates and responsibilities	2011-2014	Entering into force of the water law	MFWW, SHW	MENR, MSIT, MEU, MFAL, MCT, SHW, MoH, Provincial Bank, LA
<b>US1.1.4.</b> Integrating the issue of combating climate change into the corporate and sectoral strategy plans (industry, agriculture, energy, tourism, urban, drinking water etc.) of institutions related to water management	2011-2014	Inclusion of impacts of climate change in sector strategies	MFWW, SHW	MENR, MSIT, MEU, MFAL, MCT, SHW, Provincial Bank, LA
<b>US1.1.5.</b> Revising the Industry Strategy Document of Turkey in terms of water efficiency practices in the industry	2014-2020	Increased water efficiency	MSIT	MoD, TTGV, TOBB
<b>US1.1.6.</b> Identifying economic instruments, in accordance with water utilization purposes, in consideration of socioeconomic conditions and the principles of user pays- polluter pays so as to ensure effective and efficient utilization of water	2011-2015	Economical use of water	MoD, MFWW	MFAL, MoF, SHW, LA, MEU
<b>US1.1.7.</b> Orientation of water user organizations by relevant institutions within the framework of irrigation businesses taking into account the impacts of climate change	2011-2014	Improvement of local capacity	SHW	MFAL, SPA, LA, Water User Organizations, NGOs
<b>US1.1.8.</b> Orienting KÖY-DES service areas to irrigation services	2011-2013	Strengthening practices at local level	Governorships	SPA

<b>PURPOSE US2. Strengthening water resources management capacity, interagency cooperation and coordination with regard to adaptation to climate change</b>				
<b>Objective US2.1.</b>	<b>Increasing the institutional capacities of agencies and organizations that are authorized and related to management of water resources</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>US2.1.1.</b> Strengthening the capacity of the Water Management Coordination Committee	2012-2015	Alignment with the EU acquis	MFWW	MEU, MIA, MFA, MoH, MFAL, MSIT, MENR, MCT, MoD, MEUA, SHW, GDM, SUEN
<b>US2.1.2.</b> Strengthening institutional structure with regards to the protection of water quality and quantity, capacity development of monitoring and evaluation and establishment of database	2011-2015	Ensuring sustainability for the management of water resources	MFWW, SHW	MoH, MFAL, MEU
<b>US2.1.3.</b> Strengthening the capacities of relevant institutions to enable conducting detailed surveys to identify water potentials, utilization purposes, consumptions and classifications	2011-2015	Ensuring sustainability for the management of water resources	MFWW, SHW	MFAL, MEU, SPA, LA, TURKSTAT
<b>US2.1.4.</b> Training and informing irrigation unions and farmers about conscious and sufficient water use	2011-2013	Improvement of local capacity	Governorships (Provincial Directorates of MFAL)	SPA, LA, Unions, Cooperatives, NGOs
<b>Objective US2.2.</b>	<b>Develop financing policies and practices</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>US2.2.1.</b> Activating irrigation investments, continuing the planning of necessary closed irrigation system where appropriate	2011-2014	Enhanced sprinkler and drip irrigation infrastructure	SHW	MFAL, SPA, Water User Organizations
<b>US2.2.2.</b> Improving functionality of build-operate model in irrigation projects, encouraging the private sector to invest in irrigation	2012-2014	Implementation of the build-operate model	SHW	MFAL, MoF, MoD, MoE, UoT, TOBB
<b>US2.2.3.</b> Ensuring sustainability and effectiveness in operation and maintenance activities, rehabilitating irrigation networks that cause excess water consumption and/or converting them into modern systems	2012-2014	Ensuring savings in irrigation water	SHW	MFAL, SPA
<b>US2.2.4.</b> Encouraging the treatment of waste waters through economic tools in order to be used again in agriculture and industry sectors	2011-2020	Adaptation to increased water demand, rising prices of alternative natural water resources, and developing clean production technologies	MoE	MoD, MoF, MSIT, UoT

<b>US2.2.5.</b> Promoting the manufacturing and the use of household and industry equipment with low water consumption	2014-2020	Increased market share of low water consuming equipment	MSIT	MoF, TOBB
<b>US2.2.6.</b> Supporting projects aiming at recycling of process and cooling waters in priority sectors with high water consumption; increasing pilot implementations	2014-2020	Amount of water saved	MSIT	MoD, TTGV, TOBB
<b>US2.2.7.</b> Preparing “sectoral eco-efficiency (clean production)” guides for water efficiency in the industry, promoting pilot practices	2012-2014	Guides	NPC	MSIT, TTGV, TOBB

<b>PURPOSE US3. Develop and expand R&amp;D and scientific studies to ensure adaptation to the impacts of climate change in water resources management</b>				
<b>Objective US3.1.</b>		<b>Strengthening existing systems and establishing new systems to monitor the effects of climate change</b>		
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>US3.1.1.</b> Developing hydrological drought assessment and impact studies	2014-2020	Hydrological drought assessment system	MFWW, SHW	MFAL, GDM
<b>US3.1.2.</b> Conducting research and assessment for identifying the impacts of climate change on water resources and integrating the results into water resource planning studies	2011-2015	Impact assessment reports	MFWW, SHW	MFAL, SPA, GDM
<b>US3.1.3.</b> Making projections of sectoral water demand in basins taking climate scenarios into account	2011-2020	Projections taking into account the climate change scenarios	MFWW, SHW, TUBITAK	Universities, RI
<b>Objective US3.2.</b>		<b>Identify the vulnerability of management of water resources and coastal management against climate change, develop alternative adaptation options, making periodical revisions based on monitoring results</b>		
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>US3.2.1.</b> Identifying the vulnerability of river basins against climate change, development and implementation of adaptation options	2011-2020	Assessment reports	MFWW, SHW	MFAL, MoD, DEMP, LA, SPA, DA
<b>US3.2.2.</b> Identifying the vulnerability of underground water resources to climate change, developing and implementing adaptation actions	2011-2020	Assessment reports	MFWW, SHW	LA, SPA, DA, Water User Organizations
<b>US3.2.3.</b> Identifying the vulnerability risks (including natural disasters) of coastal areas (including banks of rivers, natural and man-made lakes) to climate change, developing and implementing adaptation actions	2011-2020	Vulnerability reports, adaptation action plans	MFWW, MEU	MFAL, MTMAC, LA
<b>US3.2.4.</b> Formulating, developing and disseminating innovative alternative solutions that increase adaptation capacity to climate change	2011-2020	Innovative solution models	MFWW, SHW	MEU, MSIT, MFAL, TUBITAK, TTGV



<b>PURPOSE US4. Integrated management of water resources in water basins for adaptation to climate change</b>				
<b>Objective US4.1.</b>	<b>Planning basin-based development of water resources with a holistic approach that offers flexibility in meeting the changing consumption demands</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>US4.1.1.</b> Developing River Basin Management plans taking into account ecosystem services and impacts of climate change	2012-2020	Adaptation to climate change in management of water resources	MFWW	MFAL, GDF, SHW, LA
<b>US4.1.2.</b> Taking the impacts of climate change into consideration in existing and planned “Basin Protection Action Plans” and “Maps of Protected Areas”, and making the necessary revisions	2012-2020	More efficient protection of basins	MFWW	MEU, SHW
<b>US4.1.3.</b> Accelerating erosion and sedimentation control projects in all basins particularly in dam and small lake basins	2012-2020	Prolonging the life of water storage facilities	SHW	MFWW, GDF
<b>US4.1.4.</b> Protecting and preventing illicit use of underground water resources in basins, and raising public awareness on this matter	2012 and onwards	Awareness raising activities, protection of water resources	MFWW, SHW	MFA, Governorships, MoNE, LA, NGOs
<b>Objective US4.2.</b>	<b>Addressing urban water management from the perspective of adaptation to climate change</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>US4.2.1.</b> Planning up-scaling in management of metropolitan areas (big cities, greater city municipalities) taking into consideration of climate change	2012 and onwards	Climate-adapted urban management	MoD	MEU, LA
<b>US4.2.2.</b> Conducting integrated water management and planning in settlement areas, meeting the drinking-utility and industrial water needs of municipalities with sufficient amount and quality	2011-2023	Rational management of water resources in settlements	SHW	MFWW, MEU, LA, Provincial Bank, SPA, Local organizations of the ministries
<b>US4.2.3.</b> Separating sewage and rainwater collection systems in settlements	2011-2017	Efficient use of water resources in the cities	LA	MEU, MFWW, SHW, Provincial Bank
<b>US4.2.4.</b> Reuse of water collected and treated in settlements	2011-2020	Efficient use of water resources in the cities	LA	MEU; MFWW, SHW, Provincial Bank, MFAL
<b>US4.2.5.</b> Developing a pricing policy taking of socioeconomic conditions into consideration so as to increase efficient water use in cities, making legislative arrangements	2011-2020	Efficient use of water resources in the cities	MFWW, LA	MEU, Provincial Bank
<b>US4.2.6.</b> Identifying water losses and illicit water use in cities and taking measures to reduce the loss-illicit use rate, expanding the SCADA system nationwide	2011-2023	Considerable reduction in water losses	LA	MEU, MFWW, Provincial Bank, Governorships, Local organizations of the ministries

<b>US4.2.7.</b> Ensuring that the consumers are provided with potable tap water	2011-2023	Efficient water consumption	LA	MEU, MFWW, Provincial Bank, Governorships, Local organizations of the ministries
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**PURPOSE US5. Planning renewable energy resources taking into consideration the impacts of climate change and the sustainability of the ecosystem services oriented to increase resilience to climate change**

<b>Objective US 5.1.</b>	<b>Planning and operation of hydraulic and geothermal energy resources with a climate change adaptation perspective</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>US5.1.1.</b> Taking into consideration the impacts of climate change in planning and operation of HPPs	2011 and onwards	Establishment of a healthy operation system in terms of water supply and water rights, Cumulative Impact Assessment Report	SHW	MENR, MFWW, MEU, GDM, EMRA, TUBITAK, Universities, TOBB
<b>US5.1.2.</b> Reviewing the Law no. 5686 on Geothermal Resources and Natural Mineral Waters in line with the impacts of climate change and the adaptation approach	2011-2015	Prevention of loss of surface water quality	MTA	MENR, Governorships, SPA, Provincial Bank, LA

## II. AGRICULTURE SECTOR AND FOOD SECURITY

<b>PURPOSE UT1. Integrating climate change adaptation into the agriculture and food security policies</b>				
<b>Objective UT1.1.</b>	<b>Reviewing existing strategy and action plans as well as legal arrangements from a perspective of adaptation to climate change</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UT1.1.1.</b> Reviewing the Rural Development Strategy and Plan in line with the Climate Change Strategy and Action Plan	2012-2013	Revised plan and strategy	MFAL	MFWW, MoD
<b>UT1.1.2.</b> Integration of the impacts of climate change into the “Strategy and Action Plan for Combating Agricultural Drought” in terms of water resources, food security, natural disaster risks, ecosystem services and public health	2011-2015	Integrated strategy and plan	MFAL	MFWW, LA, SPA, Governorships
<b>UT1.1.3.</b> Reviewing existing legal to ensure adaptation to climate change, and preparing new legislation	2011-2015	Revision of relevant legislation, preparation of new legislation	MFAL	MFWW, MEU, SHW, GDM
<b>UT1.1.4.</b> Integrating producer support activities (including agricultural basins production and support model) into climate change adaptation strategies	2012-2013	Revision of relevant strategies	MFAL	MoD
<b>Objective UT1.2.</b>	<b>Reviewing signed protocols between institutions from a perspective of adaptation to climate change</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UT1.2.1.</b> Revising the Afforestation Cooperation protocol signed between MFWW, SHW and GDF within the framework of climatic impacts	2011-2012	Revised cooperation protocol	GDF	SHW, MFWW
<b>UT1.2.2.</b> Revising the Afforestation Protocol under the Action Plan for Combating Erosion between MFWW and MFAL, within the context of the impacts of climate change	2011-2012	Revised cooperation protocol	MFAL	MFWW

<b>PURPOSE UT2. Developing and expanding R&amp;D and scientific studies to identify the impacts of climate change on agriculture and to ensure adaptation to climate change</b>				
<b>Objective UT2.1.</b>	<b>Developing and expanding R&amp;D activities for effective crop, soil and water management</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UT2.1.1.</b> Conducting analysis on the impacts of climate change on the agriculture sector	2013-2015	Impact analysis reports	MFAL	TUBITAK, Universities, RI
<b>UT2.1.2.</b> Carrying out research and applications to ensure adaptation of plants to climate change, with the help of new possibilities offered by biotechnology and the existing genetic diversity	2011-2015	Model practices	MFAL	TUBITAK, Universities, RI
<b>UT2.1.3.</b> Identifying and monitoring the possible changes in agricultural yield, production and area information due to climate change,	2011-2015	Complete and up to date database	MFAL	TUBITAK, Universities, RI
<b>UT2.1.4.</b> Reassessment of the local value and efficiency of genetic diversity existing within cultivate crops in terms of livelihoods of farmer, within the context of adaptation to climate change	2011-2015	Model practices	MFAL	TUBITAK, Universities, RI
<b>Objective UT2.2.</b>	<b>Increasing the capacities and numbers of organizations carrying out R&amp;D and scientific studies</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UT2.2.1.</b> Developing the capacities of research institutes and other scientific institutions under MFAL, modernizing laboratory infrastructures	2011-2015	Modern and adequate laboratory network	MFAL	
<b>UT2.2.2.</b> Establishing climate change research centres in vulnerable regions	2011-2015	Establishment of research centres	MFAL	MoD, SHW, GAP, RI
<b>UT2.2.3.</b> Updating all the data collected by Agricultural Drought Crisis Centre on land assets, water resources and climate and incorporating it into the climate change information management system	2011-2015	Up to date data	MFAL	SPA, Governorships
<b>UT2.2.4.</b> Improving the capacity in crop production estimation studies carried out by using climate, land use and vegetation density data for the purpose monitoring the impacts of drought	2011-2015	Improved technical infrastructure and human resources	MFAL	

<b>Objective UT2.3.</b>	<b>Developing a 'Soil and Land Database and Land Information System' taking into consideration the effects of climate change</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UT2.3.1.</b> Addressing climate change impacts in existing Soil and Land Database and Land Information System studies	2011-2013	Complete and up to date data base	MFAL	MFWW, MEU, GDF
<b>UT2.3.2.</b> Completing soil survey, inventory and mapping studies while taking the effects of climate change into consideration	2011-2015	Soil inventory and maps	MFAL	MFWW, MEU, GDF
<b>UT2.3.3.</b> Carrying out activities for building a Drought and Flood Information System	2011-2015	Complete and up to date information management system	MFAL	MFWW, MEU, SHW, GDM
<b>UT2.3.4.</b> Reviewing the national information systems monitoring the changes in land use types and the compiled data, and identifying, collecting, recording and registering into the database any new data required within the framework of international processes	2011-2013	Complete and up to date data base	GDF	MFAL, MFWW, MEU
<b>Objective UT2.4.</b>	<b>Conducting and monitoring disaster analysis for agricultural droughts</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UT2.4.1.</b> Including agricultural drought in disaster management activities and making the necessary analyses	2013-2014	Defining agricultural drought as a disaster	MFAL	DEMP
<b>UT2.4.2.</b> Strengthening the capacities of provincial drought crisis centres, and developing crisis management plans	2011-2013	Crisis plans established in provinces	MFAL	Governorships, SPA
<b>Objective UT2.5.</b>	<b>Determining the socioeconomic impacts of climate change on the agriculture sector</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UT2.5.1.</b> Identifying the disparities between poverty levels in agricultural basins	2012-2015	Assessment report	MFAL	TURKSTAT
<b>UT2.5.2.</b> Delivering training on agricultural production techniques for adapting to the effects of climate change to women farmers and/or incorporating these trainings into the already existing training activities	2011-2015	Training of female farmers	MFAL	Governorships, SPA
<b>UT2.5.3.</b> Identifying with priority the economic, social and environmental effects in regions that will be more heavily affected from agricultural drought due to climate change	2011-2013	Situation analysis reports	MFAL	MoD

<b>PURPOSE UT3. Sustainable planning of water utilization in agriculture</b>				
<b>Objective UT3.1.</b>	<b>Increasing the effectiveness of water management in agriculture</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UT3.1.1.</b> Promoting water efficient processes in agricultural industry	2011-2015	Development of efficient processes	MFAL	MSIT
<b>UT3.1.2.</b> Promoting crop types suitable for climate and water availability in agricultural basins	2011-2015	Using appropriate crop types	MFAL	LA, GDM, Water User Organizations
<b>UT3.1.3.</b> Reducing water losses in the agriculture sector	2011-2015	Decrease in water losses	MFAL	Water User Organizations
<b>UT3.1.4.</b> Developing irrigation and water management systems specific to the local conditions	2011-2015	Water management systems specific to localities	MFAL	SHW, Irrigation unions

<b>PURPOSE UT4. Protecting soil and agricultural biodiversity against the impacts of climate change</b>				
<b>Objective UT4.1.</b>	<b>Protecting the physical, chemical and biological efficiency of soil against climate change impacts</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UT4.1.1.</b> Developing classification standards for protection, improvement and efficient use of soil and lands, monitoring such practices and ensuring land use in consideration of capability classes	2011-2013	Standards developed, model practices	MFAL	
<b>UT4.1.2.</b> Studying soil humidity regimes according to climate change impacts	2012-2015	Impact assessment reports	MFAL	
<b>UT4.1.3.</b> Implementation of advanced harvesting systems, and development of agricultural forestry	2012 and onwards	Model practices	MFAL	
<b>UT4.1.4.</b> Ensuring use of new and technological systems in irrigation and water management	2011-2015	Water saving, model practices	MFAL	

<b>Objective UT4.2.</b>	<b>Protecting agricultural biodiversity and resources for adaptation to the impacts of climate change</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UT4.2.1.</b> Developing innovative and appropriate agriculture techniques oriented to ensure adaptation to climate change and sustainability of natural resources	2011-2015	Model practices	MFAL	MFWW, Water User Organizations
<b>UT4.2.2.</b> Researching the climate change impacts on agricultural products the gene resources of Turkey	2012-2015	Research reports	MFAL	RI
<b>UT4.2.3.</b> Carrying out R&D studies to determine and monitor the effects of climate change on cattle, sheep and goat husbandry	2013-2015	Research reports	MFAL	TUBITAK, RI, Universities
<b>UT4.2.4.</b> Carrying out R&D studies to determine and monitor the effects of climate change on aqua-farming	2013-2015	Research reports	MFAL	TUBITAK, RI, Universities
<b>Objective UT4.3.</b>	<b>Completing land consolidation activities for the purpose of increasing agricultural efficiency in efforts to adapt to climate change</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UT4.3.1.</b> Prioritizing land consolidation practices in regions with flood risk	2011-2013	Records on land consolidations, increase in average parcel sizes	MFAL	SHW
<b>UT4.3.2.</b> Conduct technical and financial studies to integrate climate change adaptation indicators in land consolidations	2011-2013	Relevant technical reports	MFAL	MFWW, GDF, SHW
<b>UT4.3.3.</b> Completing land consolidation and other in-field development services to increase in-parcel irrigation efficiency	2011-2013	model practices	MFAL	SHW,SPA, NGOs, Farmer organizations, Irrigation unions



<b>PURPOSE UT5. Developing institutional capacity and improving interagency cooperation in Turkey with regard to adaptation alternatives in agriculture</b>				
<b>Objective UT5.1.</b>	<b>Strengthening interagency cooperation and developing the capacities of MFAL and its attached and affiliated organizations with regard to combating climate change and adaptation</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UT5.1.1.</b> Increasing the climate change adaptation capacities and effectiveness of boards and committees responsible for agricultural drought management	2011-2015	Trainings, Institutional structure with defined job descriptions and responsibilities	MFAL	CBCC, ARDSI
<b>UT5.1.2.</b> Setting up a climate change unit within MFAL and its attached and affiliated organizations	2011-2012	Institutional infrastructure with defined job descriptions and responsibilities	MFAL	
<b>UT5.1.3.</b> Developing and implementing capacity building programmes for climate change in MFAL and provincial offices	2011-2015	Training needs analysis Training programs Capacity building programs	MFAL	
<b>UT5.1.4.</b> Carrying out cooperation activities with international organizations in the area of adaptation to the impacts of climate change on the agriculture sector	2011-2015	Cooperation agreements	MFAL	
<b>UT5.1.5.</b> Increasing existing capacity for flood and drought early warning systems	2011-2013	Effective early warning systems	MFAL, SHW, GDM	GDF, MFWW
<b>Objective UT5.2.</b>	<b>Increasing the awareness of the civil society on the effects of climate change on the agriculture sector and on the adaptation approaches</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UT5.2.1.</b> Informing the local stakeholders in the agriculture sector about alternative crop patterns	2011-2013	Capacity building programs	MFAL	LA, NGOs, Unions, Cooperatives
<b>UT5.2.2.</b> Increasing the awareness and capacities of unions and cooperatives with regard to climate change impacts and adaptation	2011-2013	Capacity building programs	MFAL	LA, NGOs, Unions, Cooperatives
<b>UT5.2.3.</b> Raising the awareness of Provincial/District Drought Damage Assessment Commissions, Provincial Crisis Centres and Provincial Drought Investigation Commissions on adaptation to climate change impacts	2011-2013	Awareness programs	MFAL	
<b>UT5.2.4.</b> Increasing the accessibility of early warning and climate information	2012-2015	Accessible early warning and information system	MFAL, GDM	SHW, Farmer Organizations, Water User Organizations

### III. ECOSYSTEM SERVICES, BIODIVERSITY AND FORESTRY

<b>PURPOSE UO1. Integration of the climate change adaptation approach to ecosystem services, biodiversity and forestry policies</b>				
<b>Objective UO1.1.</b>	<b>Reviewing the existing strategies in terms of adaptation to the impacts of climate change</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UO1.1.1.</b> Revising the National Forestry Programme (2004–2023) and DGF Strategic Plan (2010–2014) for adaptation to climate change impacts	2011-2013	Revised plan and program	GDF	MFWW, MoD, NGOs
<b>UO1.1.2.</b> Preparing regional strategies on adaptation to climate change in protected areas	2011-2015	Regional strategies	MFWW	MCT, MEU, GDF
<b>UO1.1.3.</b> Integrating and spreading adaptation to climate change into the existing planning for selected/priority protected areas	2011-2015	Plans for protected areas including adaptation to climate change	MFWW	
<b>UO1.1.4.</b> Determination of water resources feeding wetlands, and developing planning studies	2012-2015	Effective and sustainable water resources planning	MFWW	
<b>UO1.1.5.</b> Preparing regional strategies for natural and cultural heritage areas with regard to adaptation to climate change	2012-2015	Regional strategies	MFWW, MCT	

<b>PURPOSE UO2. Identifying and monitoring the impacts of climate change on biodiversity and ecosystem services</b>				
<b>Objective UO2.1.</b>	<b>Identifying and monitoring the effects of climate change on the species in forest land</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UO2.1.1.</b> Identifying and monitoring the impacts of climate change on forestry activities, forest ecosystems and species	2011-2013	Impact assessment reports	GDF	MFWW
<b>UO2.1.2.</b> Conducting research in order to reduce disaster risks that can be induced by climate change in agro-forestry activities	2011-2015	Research reports	MFAL	GDF
<b>UO2.1.3.</b> Integration of data related to natural disasters such as floods, overflows, avalanches, landslides etc, into the Forest Inventory and Monitoring system	2011-2015	Early warning system integrated to Land Monitoring System	GDF	MFAL, MFWW, MEU, GDM
<b>UO2.1.4.</b> Allocation of more funds to projects on climate change and forest-pasture-agriculture ecosystems, from existing R&D funding sources, and mainly from the R&D support mechanisms of the DGF	2011-2015	final Project reports, number and size of financed projects	GDF	MFWW, MFAL, SHW, TUBITAK, Municipalities, Universities

<b>Objective UO2.2.</b>	<b>Identifying the land use changes due to the impacts of climate change in forest land</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UO2.2.1.</b> Identifying the land transformed into meadows, pastures and grasslands in forests	2012-2015	Stocktaking reports	MFWW, GDF	MFAL, Governorships, SPA
<b>UO2.2.2.</b> Identifying sites transformed from forest lands into settlement areas (housing areas)	2011-2015	Stocktaking reports	GDF	MFWW, MEU, Governorships, SPA, LA
<b>UO2.2.3.</b> Identifying sites transformed from forest land into wetlands	2012-2015	Stocktaking reports	GDF	MFWW, MFAL
<b>UO2.2.4.</b> Identifying sites transformed from forests into agricultural lands	2012-2015	Stocktaking reports	GDF	MFAL
<b>UO2.2.5.</b> Identifying sites transformed from forest land into other land types	2012-2015	Stocktaking reports	GDF	MFAL, Governorships, SPA
<b>Objective UO2.3.</b>	<b>Monitoring the health of forest ecosystems</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UO2.3.1.</b> Measuring the effects of atmospheric pollution, climate change and other factors on forests and evaluating the findings by 2014	2011-2014	Impact analysis and assessment reports	GDF	MFWW, Universities
<b>UO2.3.2.</b> Identifying the effect of the afforestation activities carried out on the degraded forests classified as forest and allocated to GDF, and on properties of the Ministry of Finance that are not classified as forests, on natural environment	2011-2015	Impact analysis and assessment reports	GDF	MoF
<b>UO2.3.3.</b> Ensuring that European applications on the Forest Ecosystems monitoring Tier I and Tier 2 Programme are carried out in an integrated way with the National Forest Inventory	2011-2013	Integrated system	GDF	Universities

<b>Objective UO2.4.</b>		<b>Carrying out R&amp;D activities oriented to identify and monitor the effects of climate changes in protected areas</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/Coordinating Organization</b>	<b>Relevant Organizations</b>	
<b>UO2.4.1.</b> Identifying the species, ecosystems and processes that will be affected from climate change in protected areas	2011-2013	Vulnerability analysis	MFWW	Universities	
<b>UO2.4.2.</b> Ensuring effective management against the impacts of climate change on protected areas systems	2012-2015	Effective management	MFWW	MoF, MoD, TUBITAK	
<b>UO2.4.3.</b> Identifying climate adaptation strategy and actions in order to support the livelihoods of the local people in protected areas; conducting relevant cost/benefit and cost-effectiveness analyses, and diversification of livelihoods	2012-2015	Assessment reports, livelihood work plans	MFWW	MoF, GDF	
<b>UO2.4.4.</b> Developing monitoring systems on the impacts of climate change in protected areas	2011-2015	Monitoring system	MFWW	GDM, SHW, RI, Universities	
<b>Objective UO2.5.</b>		<b>Taking into consideration the climate adaptation activities in the socio-economic development of forest villagers, and thereby supporting rural development</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/Coordinating Organization</b>	<b>Relevant Organizations</b>	
<b>UO2.5.1.</b> Determining the socioeconomic effects of climate change on forest villagers	2011-2013	Assessment report	GDF	MFWW, Governorships	
<b>UO2.5.2.</b> Diversifying the livelihood activities of forest villagers, and shifting to other activities if necessary, so as to ensure minimization of the risks of climate change on their livelihoods	2011-2015	Livelihood work plans	GDF	MFWW, Governorships	

Objective UO2.6.	Identifying and monitoring the effects of climate change on the mountain, steppe, inland water and marine ecosystems and on the ecosystem services they provide, and developing measures for adaptation to climate change			
Actions	Time Period	Outputs and Performance Indicators	Responsible/ Coordinating Organization	Relevant Organizations
<b>UO2.6.1.</b> Assessing the effects of user sectors, which have direct negative effects on ecosystems, so as to ensure the sustainability of the resilience of ecosystems to climate change	2012-2015	Impact assessment analyses	MFWW	MEU, MFAL
<b>UO2.6.2.</b> Conducting R&D studies to identify and monitor the effects of climate change on mountain ecosystems (indicative species, sensitive ecosystems)	2012-2015	Research reports	MFWW	GDF
<b>UO2.6.3.</b> Conducting R&D studies to identify and monitor the effects of climate change on steppe ecosystems (indicative species, sensitive ecosystems)	2012-2015	Research reports	MFWW	GDF, MFAL
<b>UO2.6.4.</b> Conducting R&D studies to identify and monitor the effects of climate change on inland water ecosystems (wetlands, peat lands, lakes, rivers) (indicative species, sensitive ecosystems)	2012-2015	Research reports	DGF	MFAL, SHW, GDF
<b>UO2.6.5.</b> Conducting R&D studies to identify and monitor the effects of climate change on marine and coastal ecosystems (indicative species, sensitive ecosystems)	2012-2015	Research reports	MFWW	GDF
<b>UO2.6.6.</b> Conducting R&D studies to identify and monitor the effects of climate change on natural, cultural and visual landscapes	2012-2015	Research reports	MFWW	GDF, MTC
<b>UO2.6.7.</b> Taking climate change into consideration in addition to the ecosystem integrity and biodiversity of the localities, in ecosystem assessment studies of HEPPs planned on small rivers	2012-2015	Research reports	MFWW	MENR, EMRA, MEU, GDM, SHW, TUBITAK, Universities
<b>UO2.6.8.</b> Realizing peat extraction plans	2012-2015	Research reports	MFWW	
<b>UO2.6.9.</b> Identifying priority protected areas by matching the results of the climate change model studies carried out at national level, with key biodiversity areas	2012-2015	Research reports	MFWW	TUBITAK, NGOs, Universities
<b>UO2.6.10.</b> Conducting research in the selection of forest tree species, origins and clones resistant to drought, salinity and frost	2012-2015	Research reports	GDF	Forestry Research Institutes

<b>Objective UO2.7.</b>		<b>Integrating climate change adaptation into the marine and coastal zone management framework</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/Coordinating Organization</b>	<b>Relevant Organizations</b>	
<b>UO2.7.1.</b> Taking the climate change impacts into consideration in ballast water management	2012-2015	Revised regulation	MEU	MTMAC, LA	
<b>UO2.7.2.</b> Integrating adaptation to climate change in studies on integrated marine and coastal areas	2012 and onwards	Integrated management plans	MEU	LA	
<b>UO2.7.3.</b> Realizing all coastal area activities (on terrestrial and coastal waters) in a way that will effect marine and coastal ecosystems at the minimum and preparing plans that will not disrupt these ecosystems' adaptation to climate change	2012 and onwards	Coastal settlements zoning plan, Other planning documents	MEU	MFWW, LA	
<b>Objective UO2.8.</b>		<b>Protection of forests against fires</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/Coordinating Organization</b>	<b>Relevant Organizations</b>	
<b>UO2.8.1.</b> Identifying and monitoring the impacts of climate change on forest fires, and incorporating the data onto fire risk maps	2011-2013	Assessment reports, fire risk maps, monitoring system	GDF	GDF Provincial organizations, Governorships	
<b>UO2.8.2.</b> Including necessary risk preparation/prevention against forest fires caused by climate change within the scope of local/regional planning activities	2011-2013	Revised planning processes	GDF	GDF Provincial organizations, Governorships	
<b>UO2.8.3.</b> Increasing preventive measures in combating forest fires, improving existing early warning systems	2011-2013	Effective early warning systems	GDF	GDF Provincial organizations, Governorships	

## IV. NATURAL DISASTER RISK MANAGEMENT

<b>PURPOSE UA1. Identifying threats and risks for management of natural disasters caused by climate change</b>				
<b>Objective UA1.1.</b>	<b>Identifying risks of natural disasters caused by climate change, such as floods, overflows, avalanches, landslides etc</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UA1.1.1.</b> Preparing disaster, hazard and risk maps for floods, landslides, etc., that will be the basis for risk management processes against the impacts of climate change, and integrating these maps into land use plans	2011-2015	Risk maps	MEU, MFWW, SHW, DEMP	GDF, LA, Governorships
<b>UA1.1.2.</b> Preparing implementation and audit guides related to flood, landslide risk mitigation and management plans	2011-2015	Relevant plans and guides	MFWW, DEMP	SHW
<b>UA1.1.3.</b> Developing disaster management plans for sectors affected from natural disasters caused by climate change	2011-2020	Management plans	DEMP	MFAL, MFWW, MEU, SHW, GDM, Universities
<b>UA1.1.4.</b> Establishing, spreading and developing monitoring, forecast and early warning systems for natural disasters caused by climate change	2011-2013	Installing relevant systems (flood, overflow, early warning etc), Making early warnings, risk maps	SHW, GDM, DEMP	MFWW, MEU, Governorships, Universities, Municipalities
<b>UA1.1.5.</b> Identifying the social, economic and environmental impacts of natural disasters caused by climate change	2011-2015	Impact analysis reports	DEMP	MFWW, MEU, MFAL, GDF, Universities
<b>Objective UA1.2.</b>	<b>Reviewing the legislation on natural disasters caused by climate change, and determining implementation principles</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UA1.2.1.</b> Developing and ensuring the enforcement of the necessary legislation to protect ecosystems and to identify the natural structures that reduce the effects of natural disasters occurring due to climate change,	2013-2015	Relevant legal arrangements	MFWW	MEU, MFAL, GDF, DEMP
<b>UA1.2.2.</b> Carrying out studies to disseminate private and public insurance mechanisms across all economic sectors and citizens	2013-2015	Increase in the use of insurance mechanisms	UoT	MoF, MoE
<b>UA1.2.3.</b> Developing and ensuring the enforcement of the legislation on the structural effects of natural disasters caused by climate change	2013-2015	Legal arrangements	UoT	MEU, SHW, DEMP



<b>PURPOSE UA2. Strengthening response mechanisms for natural disasters caused by climate change</b>				
<b>Objective UA2.1.</b>	<b>Strengthening the capacities of local public organizations with regard to responding to natural disasters caused by climate change, and reaching the level of being able to make field exercises</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UA2.1.1.</b> Developing the workforce/ technical capacities of the local organizations of relevant authorities	2011-2015	Training and infrastructure	Governorships	LA, NGOs
<b>UA2.1.2.</b> Developing coordination between provincial offices at the local level	2011-2015	Carrying out joint projects	DEMP	Governorships, LA, NGOs
<b>Objective UA2.2.</b>	<b>Establishing a community-based disaster management in combating disaster risks that may arise due to climate change</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UA2.2.1.</b> Identifying and developing the capacities of relevant agencies and organizations covering all administrative levels at the local level, including mukhtar offices, with regard to risk mitigation, emergency response and post-disaster short and long term recovery approaches and practices	2011-2015	Training needs analysis, trainings, capacity building programs	Governorships	DEMP, LA, NGOs, Village Service Unions
<b>UA2.2.2.</b> Developing and distributing implementation guides and procedures on disaster risk reduction, emergency response and post-disaster short and long term recovery approaches and practices; and delivering the related trainings	2011-2015	Disaster management guides and procedures, training programs	Governorships	DEMP, LA, NGOs, Village Service Unions
<b>UA2.2.3.</b> Improving exchange of information, experience and infrastructure through ensuring interagency coordination at the local level	2011-2015	Partnerships, joint projects	DEMP	Governorships, LA, NGOs, Village Service Unions
<b>Objective UA2.3.</b>	<b>Continuing the training activities that will increase public awareness and participation with regard to the disaster and risk impacts that may arise due to climate change</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UA2.3.1.</b> Carrying out awareness-raising activities for all segments of the society	2011-2020	Awareness raising activities	DEMP	Governorships, LA, NGOs, Village Service Unions
<b>UA2.3.2.</b> Carrying out joint activities with relevant NGOs	2011-2020	Joint projects	DEMP	Governorships, LA, NGOs, Village Service Unions

## V. PUBLIC HEALTH

<b>PURPOSE UİS1. Identifying the existing and future effects and risks of climate change on public health</b>				
<b>Objective UİS1.1.</b>	<b>Researching the effects of extreme weather events on public health</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UİS1.1.1.</b> Monitoring and evaluating the present and future effects on public health of extreme weather events such as heat waves, hurricanes, floods and drought, based on climate projections	2011-2020	Impact assessment reports and monitoring systems	MoH	Governorships
<b>Objective UİS 1.2.</b>	<b>Researching and monitoring the link between climate change, communicable diseases and health risks, and determining possible measures</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UİS1.2.1.</b> Researching and following up the existing and future relationship between communicable diseases and climate change	2011-2015	Research reports	MoH	MFAL, MFWW, Governorships
<b>UİS1.2.2.</b> Identifying the risky areas in terms of public health, and determining the measures to be taken	2011-2015	Map of public health risks arising due to climate change	MoH	LA
<b>UİS1.2.3.</b> Establishing Tropical Diseases Diagnosis Laboratories at the regional level, or strengthening the infrastructures of some of the public health laboratories to this end in some provinces	2011-2015	Strengthened diagnosis and response infrastructure	MoH	Governorships

**PURPOSE UİS2. Developing the capacity to combat risks originating from climate change in the national healthcare system**

**Objective UİS2.1. Developing emergency response action plans in risky areas, and supplying the necessary infrastructure**

<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UİS2.1.1.</b> Establishment and spread of early warning systems in order to reduce the effects of extreme weather events on human health, conducting emergency situation warnings	2011-2020	Emergency situation warning reports Early warning systems	Governorships	MoH, Universities
<b>UİS2.1.2.</b> Developing and implementing pilot programmes in the areas of epidemics and emergency health risks	2011-2015	Repeatable and scalable model studies	MoH	Governorships
<b>UİS2.1.3.</b> Raising the awareness of “National Medical Rescue Teams (UMKE)” on adaptation to the impacts of climate change	2011-2013	Emergency response teams strengthened in the area of climate change risks, including disasters and communicable diseases	MoH	Governorships
<b>UİS2.1.4.</b> Increasing the competence and practical capabilities of mobile health teams of Provincial Health Directorates in risky areas, with regard to infectious (communicable) diseases	2011-2015	Reduction of communicable disease risks at the local scale	MoH	Governorships
<b>UİS2.1.5.</b> Cooperating with international organizations and countries working on the effects of climate change on public health	2011-2015	Exchange of knowledge and experience through joint projects/ activities	MoH	International organizations
<b>UİS2.1.6.</b> Preparing and disseminating guides describing what citizens and agencies should do in the event of possible infectious diseases, during extreme weather events, and delivering periodic trainings	2011 and onwards	Public health guides	MoH	Governorships, LA, Universities, public and private hospitals, university hospitals

Objective UIS2.2.	Strengthening the capacities of health sector organizations against health risks arising due to climate change			
Actions	Time Period	Outputs and Performance Indicators	Responsible/ Coordinating Organization	Relevant Organizations
<b>UIS2.2.1.</b> Carrying out capacity-building activities on health risks arising from climate change, for health professionals working at protective health services / family health system	2011-2015	Capacity building activities	MoH	MFWW, GDF, Governorships
<b>UIS2.2.2.</b> Announcing the “Ministry of Health - Climate Change Adaptation Programme” nationwide	2011-2013	Communication campaigns	MoH	MFWW, GDF, Governorships
<b>UIS2.2.3.</b> Establishing Ministry of Health “Disaster Coordination Centres” in areas that may be affected from climate	2011-2015	Effective health coordination infrastructure	MoH	Governorships
<b>UIS2.2.4.</b> Ensuring coordination and cooperation between related agencies and organizations with regard to climate-sensitive disasters and the health risks they will create	2011-2015	Partnerships, joint projects	MoH	DEMP, Governorships, Universities, NGOs, Public and private hospitals, University hospitals
<b>UIS2.2.5.</b> Strengthening the treatment and control (including vaccination programmes and vector control) and evidence-based protection, including integrated health observation and surveillance of vector-borne (transmitted by a carrier) and zoonose (transmitted from animals to humans) diseases, and infectious diseases,	2011-2020	Strengthened public health monitoring and decision system	MoH	Public and private hospitals, University hospitals
<b>UIS2.2.6.</b> Researching/monitoring the effectiveness of possible adaptation measures to be taken in the health sector for the protection from the effects of climate change, including early warning, strengthened disease observation, information systems and other public health measures	2011-2020	Strengthened public health monitoring and decision-making system	MoH	Public and private hospitals, University hospitals
<b>UIS2.2.7.</b> Researching/monitoring the common benefits of mitigation/adaptation measures, negative impacts and the adaptation costs	2011-2020	Strengthened public health monitoring and decision-making system	MoH	MEU, Universities
<b>UIS2.2.8.</b> Strengthening observation and preparedness level with regard to water availability, water quality and hygiene in urban and rural areas	2011-2015	Water and hygiene monitoring system and measures and information guides	MoH	Governorships, Municipalities
<b>UIS2.2.9.</b> Identifying the health risks that may occur due to population increase in climate-vulnerable zones and in areas located on migration routes, and increasing the capacities of health organizations in these areas	2011-2015	Research reports, capacity development activities	MoH	Governorships, Universities, International organizations
<b>UIS2.2.10.</b> Cooperating with countries and national and international organizations working in areas that may affect public health due to climate change such as migration movements, international trade and tourism	2011-2015	Possible disease prevalence at regional scale with exchange of knowledge and experience,	MoH	Governorships, Universities, International organizations

## VI. CROSSCUTTING ISSUES IN ADAPTATION

<b>PURPOSE UYK1. Ensuring adaptation to climate change on crosscutting issues</b>				
<b>Objective UYK1.1.</b>	<b>Integration of adaptation to climate change into national development plans, programs and policies</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UYK1.1.1.</b> Integrating the data related to climate change into TEIEN	2012-2015	Updated system	MEU	MFAL, GDM, SHW, GDF
<b>Objective UYK1.2.</b>	<b>Identifying the required amount of financing for implementing the Climate Change Adaptation Strategy</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UYK1.2.1.</b> Identifying finance need for climate change adaptation	2012-2013		MEU	MFWW, Relevant institutions/ organizations
<b>UYK1.2.2.</b> Identifying external finance alternatives for climate change adaptation	2012-2013		UoT	Relevant institutions/ organizations

<b>Objective UYK1.3.</b>	<b>Organizing training, awareness-raising and informative activities to develop the capacity to combat and adapt to climate change</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UYK1.3.1</b> Delivering basic training on Turkey's situation and adaptation to the impacts of climate change in the in-service trainings of all ministries	2011-2014	In-service training programs	Relevant ministries	
<b>UYK1.3.2</b> Ensuring participation in the climate change adaptation process, and preparing programmes to raise public awareness	2011-2014	Programmes	MEU	CBCC, Universities
<b>Objective UYK1.4.</b>	<b>Developing R&amp;D capacity with regard to climate change adaptation</b>			
<b>Actions</b>	<b>Time Period</b>	<b>Outputs and Performance Indicators</b>	<b>Responsible/ Coordinating Organization</b>	<b>Relevant Organizations</b>
<b>UYK1.4.1.</b> Carrying out projects to identify the "national research area" that will provide support and infrastructure for climate change adaptation	2011-2015	Research reports	SHW, TUBITAK	MEU, MFWW, GDF, SHW, Universities
<b>UYK1.4.2.</b> Increasing debate forum and certification programmes on climate change adaptation in universities, adding relevant courses to undergraduate and graduate programmes, and encouraging research/doctorate programmes	2011-2015	Courses and programmes	CoHE	Universities
<b>UYK1.4.3.</b> Supporting initiatives concerning adaptation to climate change in the industrial R&D activities of the private sector	2011-2020	Model studies	MSIT	TUBITAK



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