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İKLİM DEĞİŞİKLİĞİ BAŞKANLIĞI

ADAPTATION STRATEGY AND ACTION PLAN (2024-2030)

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ABBREVIATIONS

Abbreviation	Description
AB	Ministry of Justice
ABÇPM	Directorate of European Union Framework Programs
ABDGM	Directorate General for European Union and Foreign Relations
AEGM	General Directorate of Research and Training
AFAD	Disaster and Emergency Management Presidency
R&D	Research and Development
AR5	IPCC Fifth Assessment Report
ARA	Disaster Risk Reduction
ARAS	Disaster Risk Reduction System
ASHB	Ministry of Family and Social Services
ASHGM	General Directorate of Emergency Health Services
AYDES	Disaster Management and Decision Support System
AYGM	General Directorate of Infrastructure Investments
DGOII	General Directorate of Disaster Management and Climate Change
BB	Metropolitan Municipalities
BRSA	Banking Regulation and Supervision Agency
BEK	Biodiversity and Ecosystem Services
BIDB	Department of Information Processing
BMI	Regional Development Administrations
BOTAS	Petroleum Transportation by Pipelines Joint Stock Company
BSGM	General Directorate of Fisheries and Aquaculture
BTGM	General Directorate of Information Technologies
BTK	Information and Communication Technologies Authority
BÜGEM	General Directorate of Crop Production
CBS	Geographic Information System
CBSGM	General Directorate of Geographic Information Systems
EIA	Environmental Impact Assessment
EIAIDGM	General Directorate of Environmental Impact Assessment, Permitting and Inspection
CEMGM	General Directorate for Combating Desertification and Erosion
EGM	General Directorate of Labor
DGMMU	General Directorate of Child Services
CORINE	Coordination of Information on the Environment (Coordination of Information on the Environment)
MINISTRY OF LABOR AND SOCIAL SECURITY	Ministry of Labor and Social Security
MOEUU	Ministry of Environment, Urbanization and Climate Change
DGMM	General Directorate of Environmental Management
TCIP	Natural Catastrophe Insurance Pool
DB	Ministry of Foreign Affairs
DGDEG	General Directorate of Foreign Economic Relations
DGM	General Directorate of Maritime Affairs
DHDB	Department of Support Services

Abbreviation	Description
DHGM	General Directorate of Support Services
DHMI	General Directorate of State Airports Authority
DKK	Naval Forces Command
DKMPGM	General Directorate of Nature Conservation and National Parks
DSI	General Directorate of State Hydraulic Works
WHO	World Health Organization
EC	European Commission
EÇGM	Directorate General for Energy and Environment
EEC	European Economic Community
EİGM	General Directorate of Energy Affairs
EM-DAT	Emergency Events Database
ENR	Energy
EMRA	Energy Market Regulatory Authority
MENR	Ministry of Energy and Natural Resources
EÜAŞ	Electricity Generation Inc.
EVÇED	Department of Energy Efficiency and Environment
EYDB	Department of Education and Publication
EYHGM	General Directorate of Disabled and Elderly Services
FAO	Food and Agriculture Organization of the United Nations (Food and Agriculture Organization of the United Nations)
GES	Solar Power Plants
GGM	General Directorate of Customs
RA	Directorate of Migration Management
GKGM	General Directorate of Food and Control
GSB	Ministry of Youth and Sports
GDP	Gross Domestic Product
HAYGEM	General Directorate of Animal Husbandry
HLSA	General Directorate of Lifelong Learning
HES	Hydroelectric Power Plants
HGM	General Directorate of Communication
HMB	Ministry of Treasury and Finance
HSGM	General Directorate of Public Health
HYMK	Central Board of Basin Management
IB	Ministry of Interior
ICD	Statistical Organization of Diseases and Health Related Problems Classification
İÇDB	Audit Department
ICOM	International Council of Museums
ICOMOS	International Council on Monuments and Sites (International Council on Monuments and Sites)
IDB	Climate Change Directorate
IDEP	Climate Change Action Plan
IDSADB	Department of Climate Change and Zero Waste

Abbreviation	Description
IDU	Adaptation to Climate Change
IDUKK	Climate Change and Adaptation Coordination Board
IFAD	International Fund for Agricultural Development (International Fund for Agricultural Development)
IGAM	Center for Asylum and Studies
IHDB	Department of Human
DGMM	General Directorate of Provincial Administration
ILBANK	Iller Inc.
IM	Provincial Directorates
PMI	Special Provincial Administrations
IOM Turkey	International Organization for Migration, Turkey Representative Office (International Organization for Migration)
IPCC	Intergovernmental Panel on Climate Change (Intergovernmental Panel on Climate Change)
IRAP	Provincial Disaster Risk Reduction Plans
OHSGM	General Directorate of and Safety
İŞKUR	General Directorate of Turkish Employment Agency
ITGM	General Directorate of Trade
IUCN	International Union for Conservation of Nature and Natural Resources (International Union for Conservation of Nature)
SCOUT	Communicable Diseases Surveillance and Early Warning System
JGK	Gendarmerie General Command
KA	Development Agencies
KAGM	General Directorate of Development Agencies
KDB	Directorate of Urban Transformation
KENTGES	Integrated Urban Development Strategy Document and Action Plan (2010-2023)
KGK	Public Oversight Authority
KGM	General Directorate of Highways
KHGM	General Directorate of Public Hospitals
GCC	Public Procurement Authority
KNT	Kent
KOSGEB	Small and Medium Enterprises Development Organization Presidency
KSGM	General Directorate on the Status of Women
KTB	Ministry of Culture and Tourism
KVKBKM	Regional Directorates for the Protection of Cultural Assets
KVMGM	General Directorate of Cultural Heritage and Museums
LFYDB	Department of Port and Ferry Management
MAKS	Spatial Address Registration System
MAPEG	General Directorate of Mining and Petroleum Affairs
MONE	Ministry of National Education
MGM	General Directorate of Meteorology
MHGM	General Directorate of Vocational Services
MILE	General Directorate of National Real Estate

Abbreviation	Description
MPGM	General Directorate of Spatial Planning
MSB	Ministry of National Defense
MTA	General Directorate of Mineral Research and Exploration
MUSIAD	Independent Industrialists' and Businessmen's Association
MYK	Vocational Qualification Authority
NACE	Statistical Classification of Economic Activities in the European Community (Nomenclature statistique des Activités Économiques dans la Communauté Européenne)
OAE	Forestry Research Institutes
OBM	Regional Directorates of Forestry
OECD	Organization for Economic Co-operationand Development operation and Development)
ÖERHGM	General Directorate of Special Education and Guidance Services
OGM	General Directorate of Forestry
OÖGM	General Directorate of Secondary Education
OSB	Organized Industrial Zone
OSBUK	Supreme Organization of Organized Industrial Zones
ÖRYM	Special Risks Management Center
PCA	Principal Component Analysis
PTT	General Directorate of Post and Telegraph Organization
RCP	Representative Concentration Pathway
RES	Wind Power Plants
RTB	Directorate of Guidance and Inspection
RTÜK	Radio and Television Supreme Council
RIGHT	Public Health
SaHGM	General Directorate of Health Services
SAVGM	General Directorate of Strategic Research and Productivity
SaYGM	General Directorate of Health Investments
SB	Ministry of Health
SBB	Presidency of Strategy and Budget
SBGM	General Directorate of Industrial Zones
SBSGM	General Directorate of Health Information Systems
SED	Health Impact Assessment
SEDDK	Insurance and Private Pension Regulation and Supervision Agency
SEGE	Socio-Economic Development Index
SGB	Presidency of Strategy Development
SGGM	General Directorate of Health Promotion
SSI	Social Security Institution
SGM	General Directorate of Industry
SHF	Federation of Social Work
SHM	Health Services Council
ShGK	Coast Guard Command
DGCA	Directorate General of Civil Aviation

Abbreviation	Description
SKA	Sustainable Development Goals
SKDM	Carbon Regulatory Mechanism at the Border
SKL	Social Development
SKYGM	Directorate General for Sectors and Public Investments
SNY	Industry
SOYGM	General Directorate of Social Assistance
STB	Ministry of Industry and Technology
STIGM	Directorate General for Relations with Civil Society
NGO	Civil Society Organization
SUEN	Turkey Water Institute
SUKI	Water and Sewerage Administration
SUY	Water Resources Management
SYDV	Social Assistance and Solidarity Foundations
SYGM	General Directorate of Water Management
TAE	Agricultural Research Institutes
TAGEM	General Directorate of Agricultural Research and Policies
TAMP	Turkey Disaster Response Plan
TANAP	Trans Anatolian Natural Gas Pipeline Project
TAR	Agriculture and Food Security
TARAP	Turkey Disaster Risk Reduction Plan
TARSIM	Agricultural Insurance Pool
TASIP	Turkey Post Disaster Recovery Plan
TAYS	Turkey Disaster Management Strategy
TB	Ministry of Trade
TBB	Union of Municipalities of Turkey
TCFD	Task on Climate-related Financial Disclosure (Task Force on Climate-related Financial Disclosures)
CBRT	Central Bank of the Republic of Turkey
TDI	General Directorate of Turkish Maritime Enterprises Inc
TEDAŞ	Turkish Electricity Distribution Co.
TEGM	General Directorate of Basic Education
TEIAS	Turkish Electricity Transmission Inc
TEIDSAE	Clean Energy, Climate Change and Sustainability Research Institute
TGA	Turkey Tourism Promotion and Development Agency
TGM	General Directorate of Promotion
TIHEK	Human and Equality Institution of Turkey
TKDB	Department of Natural Resources
TKDK	Directorate of Agriculture and Rural Development Support Institution
TKİ	Turkish Coal Authority
TKYGM	General Directorate of Shipyards and Coastal Structures
TMK	Turkish National Commission
TMMOBOB	Union of Chambers of Turkish Engineers and Architects
TOB	Ministry of Agriculture and Forestry

Abbreviation	Description
TOBB	Union of Chambers and Commodity Exchanges of Turkey
TOKI	Housing Development Administration
TPAO	Turkish Petroleum Corporation
TRGM	General Directorate of Agricultural Reform
TRT	Turkish Radio and Television Corporation
TSB	Insurance Association of Turkey
TSE	Turkish Standards Institute
TUA	Turkish National Agency
TUBITAK	Scientific and Technological Research Council of Turkey
TUIK	Turkish Statistical Institute
TUR	Tourism and Cultural Heritage
TÜRSAB	Association of Turkish Travel Agencies
TUSIAD	Turkish Industry and Business Association
TUSKA	Turkish Health Services Quality and Accreditation Institute
TUYSGM	General Directorate of Incentive Implementation and Foreign Investment
TVKGM	General Directorate for the Protection of Natural Assets
UAB	Ministry of Transport and Infrastructure
UDHAM	Transportation, Maritime Affairs and Communication Research Center
UDSEP	National Earthquake Strategy and Action Plan (2012-2023)
UEIMB	Transportation Safety Investigation Center
UHDGM	General Directorate of Transportation Services Regulation
NCCU	Department of International Cooperation
DGMM	Directorate General for International Labor Force
ULŞ	Transportation and Communication
UNDP	United Nations Development Program (United Nations Development Program)
UNESCO	United Nations Educational, Scientific and Cultural Organization (United Nations Educational, Scientific and Cultural Organization)
USKKK	National Sustainable Development Coordination Board
UST	National Health Regulations
VGM	General Directorate of Foundations
YAS	Groundwater
YEĞİTEK	General Directorate of Innovation and Education Technologies

EXECUTIVE SUMMARY

Climate change is one of the most important global problems facing humanity today, caused by human activities such as excessive use of fossil fuels, changes in land use and deforestation since the industrial revolution.

According to the 6th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), global temperatures have increased by around 1.1°C since the pre-industrial revolution period, and if the current processes continue, global warming will increase by around 3°C by 2100.

Climate change has already brought about a series of impacts on ecosystems, economic sectors and human health in different dimensions all over the world. The IPCC Report emphasizes that even if greenhouse gas emissions can be minimized today, we will continue to face the inevitable impacts of climate change for a long time.

While climate change is a globally recognized reality, complementary policies and actions are required to adapt to its impacts. This clearly shows that adaptation to the impacts of climate change is as important as reducing emissions. As a matter of fact, adaptation activities to the impacts of climate change have started to increase day by day all over the world, and adaptation policies are included as an important title together with emission reduction policies in international conventions (Paris Agreement, Article 7).

At this point, the impacts of climate change being experienced much more intensely, it is clear that a balance between adaptation and mitigation should be considered within the framework of global and national policies. Since vulnerability to climate change and the resulting adaptation needs vary according to local, national and regional conditions, local dynamics come to the fore at this point.

Adaptation can be explained as the process of strengthening and implementing strategies and policies to combat and manage the impacts of climate change. Adaptation keeping up with the changing climate, reducing the negative impacts of climate change and turning negative impacts into opportunities as much as possible. Adaptation to climate change is a dynamic process that integrates decision-making processes in many areas (such as agriculture, food, water, public health, tourism, disaster, insurance, infrastructure, biodiversity and ecosystem, energy, finance, urbanization, transportation, industry, migration, social development).

Climate and disaster risks are increasing worldwide, with a significant increase in the severity and number of climate-related disasters over the last 50 years.

According to IPCC reports, one of the regions that will be most affected by climate change is the Mediterranean Basin and Turkey is located in this region. Due to its location, Turkey is already affected by climate change-induced disasters such as drought, floods, extreme weather events and it is predicted that Turkey's vulnerability to these disasters will increase in the future.

Between 2010 and 2021, Turkey experienced 8,274 meteorological disasters. The three most common meteorological disasters in the relevant period were storms (32%), heavy rains/floods (30%) and hail (17%). In addition, extreme temperature events have been frequent in recent years.

According to AFAD Natural Disaster Statistics, 450 floods, 18 avalanches, 859 landslides and 13 sinkholes occurred in 2022. In this context, these disasters spread over a wide area in terms of the areas they affect and their frequency of occurrence.

However, 2,793 forest fires occurred across Turkey in 2021, which was a year in which forest fires were much higher than the annual averages, and 2,793 forest fires occurred in these fires.
139,503 hectares of forests were damaged.

According to the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), floods in Turkey between 1970 and 2021 caused a loss of USD 2.8 billion. On the other hand, 758 people lost their lives in the floods. In addition, the damage caused by drought in Turkey was calculated as 1.2% of GDP.

Again, according to ESCAP data, the annual average loss for climate change-induced disasters constitutes 2.2% of GDP. It is calculated that these losses will be 2.8% and 3.2% of GDP for medium (RCP 4.5) and pessimistic (RCP 8.5) scenarios, respectively. Therefore, it is important to increase our resilience to protect our country from the impacts of climate change-induced disasters and to continue our struggle with determination to design and implement adaptation actions at all levels.

With the awareness that climate change is a multifaceted and complex problem that may lead to serious environmental and socioeconomic consequences and that its impacts have become one of the most important challenges threatening the lives of future generations, Turkey is aware of the necessity to adapt to climate change by reducing greenhouse gas emissions and the importance of international cooperation in combating climate change. In this context, Turkey has submitted its First Updated National Contribution Declaration and 2030 climate targets in order to contribute to global efforts to mitigate the impacts of climate change within the framework of its own specific conditions and opportunities. With this declaration, Turkey announced that it will reduce its greenhouse gas emissions by 41% by 2030 compared to the reference scenario in the declaration submitted in 2015. Turkey has included adaptation as a separate heading in its Updated First National Contribution Statement due to the importance it attaches to climate change adaptation efforts.

Following the announcement of our 2053 Net Zero Emission Target, Turkey's first Climate Council was organized by the Ministry of Environment, Urbanization and Climate Change between February 21-25, 2022 to determine the building blocks of our country's long-term roadmap for climate change with all stakeholders. Around 5,000 people from various stakeholder groups including public and private sectors, universities, NGOs and students attended the Council. After the Council, a roadmap guiding Turkey's long-term climate change policies was determined with a total of 217 recommendations, 76 of which were prioritized. In this context, critical decisions that directly or indirectly support adaptation to climate change were taken, particularly the decisions of the Climate Change Adaptation Commission. These decisions taken at the Council form the basis for Turkey's policy and strategy documents and legislative work on climate change.

Within the scope of the decision "Adaptation actions of sectors at national, regional and local scales should be determined, implemented and monitored by conducting climate change impact, vulnerability and risk analyses.", the preparation of the Climate Change Adaptation Strategy and Action Plan for 2030 has been initiated.

In addition, under the title of "Protection of the Environment" in the 12th Development Plan (2024-2028) Measure No. 865.3 is related to the preparation and implementation of strategies and action plans in order to reduce greenhouse gas emissions in order to achieve the objectives of the "Paris Agreement" and to set out the steps to be taken within the scope of adaptation to climate change and combating climate change.

On the other hand, the Medium Term Program 2024-2026 defines the priority reform area as "activities for reducing greenhouse gas emissions and adaptation to climate change and planning and implementation tools for combating climate change will be regulated in order to realize and sustain the green transformation and the 2053 net zero emission target".

In our country; with the "Presidential Decree on the Organization of the Presidency" dated 29/10/2021 and numbered 85 (Official Gazette 29/10/2021-31643), the duties of "determining policies, strategies and actions at national and international level within the scope of Turkey's efforts to combat and adapt to climate change, carrying out negotiation processes, ensuring coordination with institutions and organizations" were assigned to the Presidency of Climate Change. In this context, the preparation of the Climate Change Adaptation Strategy and Action Plan for 2024-2030 was initiated within the scope of the "Strengthening Climate Change Adaptation Action in Turkey Project" financed by the European Union and the Republic of Turkey and implemented by the Ministry of Environment, Urbanization and Climate Change and the United Nations Development Program (UNDP).

In this direction, Climate Change Adaptation Strategy and Action Plan 2024-2030 was prepared with the vision of "A more resilient, more sustainable and greener Turkey in economic, social and ecological terms to ensure the preparedness and adaptation of Turkey's inhabitants, public and private sector institutions against the impacts of climate change." The Climate Change Adaptation Strategy and Action Plan 2024-2030, which sets out the strategies and actions until 2030.

The strategies and actions in the Plan are defined within the framework of 12 chapters, including 11 sectors listed as Urban, Water Resources Management, Agriculture and Food Security, Biodiversity and Ecosystem Services, Public Health, Energy, Industry, Tourism and Cultural Heritage, Transportation and Communication, Social Development and Disaster Risk Reduction, and a chapter on cross-cutting issues.

In developing the general framework in which the current situation is presented within the framework of the preparations of the Strategy and Action Plan, climate change adaptation studies currently carried out by public, private sector, universities and non-governmental organizations in Turkey were reviewed, national and international legislation, plans, programs and documents in force and national practices were evaluated.

In the second stage, the results of regional climate projection studies produced by different institutions were used to analyze the climate hazards projected for the current and future periods, and in line with the results, Vulnerability and Risk Analyses were carried out for each sector on a national scale. Action options developed based on sectoral vulnerability and risk analyses discussed in stakeholder consultation meetings attended by 180 different public, private, university and non-governmental organizations.

In addition to the meetings, stakeholder views were reflected in the Action Plan through official letters, e-mails and bilateral meetings.

The Climate Change Adaptation Strategy and Action Plan consists of 40 strategic objectives and 132 actions prepared for 11 main sectors and cross-cutting issues. Accordingly, the strategic objectives of the action plan include;

- Identifying and transforming urban areas and structures at risk of flooding and flooding,
- Increasing the amount of treated wastewater, increasing the reuse rate of treated wastewater to 15% by 2030,
- Updating agricultural policies in a way that is resilient to climate change, uses technology effectively, and takes into account the basin's crop pattern and water budget,
- Contributing to efforts to increase the proportion of marine and terrestrial protected areas to 30% globally,
- Establish a system for developing a list of indicators and health impact chains based on the Turkey Climate and Health Profile,
- Identifying climate change-related risks in the energy sector and strengthening generation, transmission-distribution and storage infrastructure to ensure adaptation to climate change,
- Preparation of guidelines for the identification and management of climate risks to movable and immovable cultural heritage items and sites,
- Identify facilities at risk of major industrial accidents and develop prioritized adaptation actions,
- Making vehicle, bicycle and pedestrian roads and all public transportation infrastructures in cities resilient to climate change-related risks,
- Incorporate social development elements into the 2053 long-term climate change strategy,
- Prioritizing investments in critical sectors to build resilience to climate change-induced disasters,
- In 81 provinces, Local Climate Change Action Plans are

Considering the wide scope of the subject and the necessity to implement many sub-actions in order to realize the actions, detailed "Sectoral Implementation Plans" have also been prepared to guide the implementation of the actions in the Action Plan by the responsible institutions and will be published by the Presidency of Climate Change.

On the other hand, since adaptation to climate change is a cross-cutting issue and deeply affects many sectors, the measures to be taken in these areas are of great importance in terms of making our economy, cities and infrastructure resilient. In addition, the Action Plan will make a significant contribution to the global adaptation target, which is currently being negotiated under the Paris Agreement.

The adverse impacts of climate change necessitates that measures for adaptation to climate change be taken in a timely and effective manner and that cooperation and coordination be ensured between various sectors and levels of government in this context. In this context, it is of great importance that the strategies and actions determined in this context are implemented by the relevant institutions and organizations with sensitivity, taking into account the importance of adaptation for our country.

1. INTRODUCTION

Climate change has brought about a series of impacts on ecosystems, economic sectors and human in different dimensions all over the world. The 6th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) published in 2022 emphasizes that even if greenhouse gas emissions can be minimized today, we will continue to face the inevitable impacts of climate change for a long time.

While climate change is a globally recognized reality, complementary policies and actions are required to adapt to its impacts. This clearly shows that adaptation to the impacts of climate change is as important as reducing emissions. As a matter of fact, adaptation activities to the impacts of climate change have started to increase day by day all over the world, and adaptation policies have been included as an important title together with emission reduction policies in international conventions (Paris Agreement, Article 7).

At this point, with the impacts of climate change being experienced much more intensely, it is clear that a balance between adaptation and mitigation should be considered within the framework of global and national policies. Since vulnerability to climate change and the resulting adaptation needs vary according to local, national and regional conditions, local dynamics come to the fore at this point.

Adaptation can be explained as the process of strengthening and implementing strategies and policies to combat and manage the impacts of climate change. Adaptation means keeping up with the changing climate, mitigating the negative impacts of climate change and turning negative impacts into opportunities as much as possible. Adaptation can be practiced in many areas (agriculture, food, water, public health, tourism, disaster, insurance, infrastructure, biodiversity and ecosystem, energy, finance, urbanization, transportation, industry, migration, social development).

As adaptation involves the integration of needs and measures at different scales of governance (local/national/regional), it requires continuous cooperation and coordination among all relevant stakeholders. In this context, the success of adaptation policies is directly related to the development models of countries. Development models prepared by taking into account important sectors exposed to the impacts of climate change such as urbanization, disaster, agriculture, tourism, ecosystems and water resources management are critical for adaptation to climate change.

With the awareness that climate change is a multifaceted and complex problem that may lead to serious environmental and socio-economic consequences and that its impacts have become one of the most important challenges threatening the lives of future generations, Turkey is of the necessity to adapt to climate change by reducing greenhouse gas emissions and the importance of international cooperation in combating climate change. In this context, Turkey has submitted its National Contribution Declaration and announced its 2030 climate targets in order to contribute to global efforts to mitigate the impacts of climate change within the framework of its own specific conditions and opportunities. Turkey has included adaptation as a separate heading in its National Contribution Statement due to the importance it attaches to adaptation to climate change.

Turkey's first Climate Council was held in Konya between February 21-25, 2022 under the coordination of the Ministry of Environment, Urbanization and Climate Change. Public

Approximately 5,000 people from various stakeholder groups including the private sector, universities, NGOs and students participated. With a total of 217 recommendations, 76 of which were prioritized after the Council, a roadmap was determined to guide Turkey's long-term climate change policies. In this context, Adaptation to Climate Change

Commission decisions, critical decisions were taken that directly or indirectly support adaptation to climate change. These decisions taken at the Council formed the basis for Turkey's policy and strategy documents and legislative work on climate change.

1.1. the international process and the paris treaty

Adaptation has gained momentum in recent years within the scope of international climate negotiations. In 2005, the issue of adaptation to climate change, which gained importance with the establishment of the Nairobi Working Group, gained a strong structure that encourages international cooperation with the Cancun Adaptation Framework and Adaptation Committee adopted in 2010.

In 2015, the United Nations Framework Convention on Climate Change (UNFCCC)
With Article 7 of the Paris Agreement adopted at the 21st Conference of the Parties (COP21), the issue of adaptation was addressed in detail and became one of the most important topics in the negotiations. In particular, Article 7.1 directs Parties to a global harmonization goal: "Parties This Agreement sets a global goal on adaptation to enhance adaptive capacity, strengthen resilience to climate change and reduce vulnerability to climate change, with a view to contributing to sustainable development and ensuring that adaptation responses are adequate in the context of the temperature target set out in Article 2." (UNFCCC, 2015)

With Article 2 of the Paris Agreement, the issue of adaptation to climate change is linked to socio-economically sustainable development and poverty reduction.

efforts to eliminate climate change and strengthen the capacity to respond to climate threats. Particular emphasis was placed on adapting to the adverse impacts of climate change in a way that does not jeopardize food production, increasing climate resilience and ensuring consistent financing flows in this area.

The 2030 United Nations Agenda for Sustainable Development reinforced the adoption of international goals on adaptation. The Sustainable Development Goal "13. Climate Action: Taking urgent action to combat climate change and its impacts" encourages countries to take mitigation and adaptation actions on climate change and sets targets in this context.

The United Nations Sendai Framework for Disaster Risk Reduction (2015-2030) provides an inclusive approach for climate change-induced disaster risks. The Framework introduces a new approach to disaster risk management policies and practices with a focus on not compromising sustainable development (UNDRR, n.d.). This Framework, together with the Paris Agreement and the 2030 Agenda for Sustainable Development will work supported by indicators.

1.2. DECLARATION OF TURKEY'NATIONAL

In September 2015, in accordance with decisions 1/CP.19 and 1/CP.20, the Republic of Turkey submitted its Intended Nationally Determined Contribution (INDC) to the United Nations Climate Change Frame Convention Secretariat. Within the framework of the Paris Agreement, Turkey has set a greenhouse gas reduction target of up to 21% by 2030 compared to the baseline scenario. Subsequently, Turkey signed the Paris Agreement on April 22, 2016 and it was passed by the Parliament on October 7, 2021. by passing (Official Gazette dated 07.11.2021 and numbered 31621). Like all parties to the UNFCCC, Turkey is obliged to submit a Nationally Determined Contribution (NDC) to the UNFCCC Secretariat every five years, each time with more ambitious mitigation targets (and optionally climate change adaptation targets).

The Republic of Turkey submitted its Updated First National Contribution to the UNFCCC on April 13, 2023 and announced that it will reduce its greenhouse gas emissions by 41% by 2030 compared to the baseline scenario. Turkey is committed to sustainable development by taking into account development policies and international developments and addressing economic, social and environmental issues in a balanced manner. on its way to aims to move forward. Turkey, As a country that recognizes the importance of compliance policies, it is acting decisively in this area and continues to work to achieve its goals through a wide range of initiatives, including vulnerability and risk assessments, information systems, legal and policy instruments.

Legislation and policy documents in this area are listed below:

- Environmental Law
- 11th Development Plan (2019-2023)
- Strategic Environmental Evaluation Regulation
- National Climate Amendment Strategy (2010-2023) and Action Plan (2011-2023)
- National Climate Amendment Cohesion Strategy and Action Plan (2011-2023)
- Energy Efficiency Strategy and National Energy Efficiency Action Plan (2017-2023)
- 2053 National Transportation and Logistics Master Plan
- Turkey's Green Deal Action Plan
- Climate Council Final Recommendations
- Turkey National Energy Plan
- Medium Term Program (2024-2026)
- 12th Development Plan 2024-2028

Primary legislation and policy documents that are being prepared to enhance Turkey's climate action and are targeted to be finalized as soon as possible are listed below:

- Climate Law
- Regulation on Local Climate Change Action Plan
- Turkey Spatial Strategy Plan 2053
- Water Law
- Flood Law
- 2053 Long-term Climate Change Strategy
- Cyclical Economy Strategy and Action Plan
- Sustainable Consumption and Production Strategy
- Sustainable Smart Transportation Strategy and Action Plan
- Green Growth Technology Roadmap
- Climate Finance Strategy

1.3. CHANGE ADAPTATION PLAN PROCESS

In Turkey, Turkey's Climate Change Adaptation Strategy and Action Plan for the period 2011-2023 was prepared to identify strategies and actions related to adaptation to climate change. The Action Plan included water resources management, agriculture sector and food security, ecosystem services, biodiversity and forestry, natural disaster risk management and human health sectors.

Due to the completion of the said plan period in 2023, the preparation of the Climate Change Adaptation Strategy and Action Plan for the years 2024-2030 was carried out within the scope of the "Strengthening Climate Change Adaptation Action in Turkey Project" financed by the European Union and the Republic of Turkey through the Ministry of Environment, Urbanization and Climate Change and the United Nations Development Program (UNDP).

In the Climate Change Adaptation Strategy and Action Plan (2024-2030), the sectoral scope was expanded to include Urban, Energy, Tourism and Cultural Heritage, Industry, Transport and Communication, Social Development in addition to the sectors included in the previous plan.

Thus, adaptation strategy and action plan studies were carried out in 12 sectors including agriculture and food security, ecosystem services and biodiversity, water resources management, tourism and cultural heritage, industry, urban, social development, public health, transport and communication, energy, disaster risk reduction and cross-cutting issues for 2024-2030.

Within the scope of the preparatory work, firstly, climate change adaptation studies currently conducted by public, private sector, universities and civil society organizations in Turkey were reviewed and compiled.

The most important issues that need to be addressed before the Adaptation Action Plan is created vulnerability and risk analysis. In order to determine the right adaptation actions, it is critical to identify the problems correctly. As discussed in detail in the "Vulnerability and Risk Analyses" section, regional climate projections produced by different institutions using, The projected future climate hazards of climate change were analyzed and the results were evaluated.

Using the results obtained, vulnerability and risk analyses were conducted for the sectors identified under the Plan using internationally accepted risk analysis methodology. The initial findings of the vulnerability and risk analyses were shared with the relevant public and private sectors, academia and civil society organizations in consultation meetings and their opinions were received. Following the evaluations, the national vulnerability and risk analyses were finalized. As a result of the vulnerability and risk analyses, the gap analyses recommended in the international literature and preliminary work on identifying actions have been completed.

Action options developed based on sectoral vulnerability and risk analyses were discussed in consultation meetings with the participation of relevant stakeholders and draft action lists were developed.

In the following process, meetings and workshops were held with relevant stakeholders and detailed studies were carried out on action options. During the meetings, actions were prioritized based on criteria such as urgency, importance, co-benefits, economic benefits, robustness and resilience, environmental and social consequences.

In the consultation meetings held in the last phase before the finalization of the Action Plan, strategic objectives for adaptation to climate change, interactions between sectors, overlapping action areas, institutional structuring and work opportunities for cooperation, data and information infrastructure, monitoring systems and financing were discussed, as well as what could be done in terms of communication, awareness and training. In light of the discussions, it was decided to add "Cross Cutting Issues" as the twelfth area to the Action Plan.

More than 25 meetings were held with stakeholders during the preparation of the Climate Change Adaptation Strategy and Action Plan. Over 2000 people from 180 different public, private sector, universities and civil society organizations participated in the meetings. Gender balance was observed among the participants. Cooperation with responsible and relevant institutions and organizations under the Action Plan

129 actions were identified in unity. These actions responsible Sectoral Implementation Plans were prepared to guide the implementation by institutions.

Finally, Adaptation Working Group under the Climate Change and Adaptation Coordination Board was held and the Action Plan was presented to the Working Group and finalized.

Following these studies, the Climate Change Adaptation Strategy and Action Plan was submitted to the Climate Change and Adaptation Coordination Board, approved and published.

Table 1 Strategic objectives, actions and number of responsible and relevant institutions identified in the Action Plan

Sector	Strategic Target	Complia nce Action	Responsible and Relevant Institution
Kent	3	12	13
Water Resources Management	2	14	18
Agriculture and Food Security	3	12	18
Biodiversity and Ecosystem Services	4	12	29
Public Health	2	12	31
Energy	2	11	12
Tourism and Cultural Heritage	3	11	19
Industry	6	8	14
Transportation and Communication	4	12	15
Social Development	4	6	26
Disaster Risk Reduction	4	8	27
Cross Cutting Topics	3	11	29
Total	**40**	**129**	

Table 2 Sectoral Strategic Objectives

SECTOR	OBJECTIVES
KENT	Enhancing the adaptive capacity and resilience of cities and urban dwellers.
	Implementation of legislation and plans to increase adaptation capacity to climate change revision
	Ensuring sustainable urbanization that is balanced with nature and climate resilient.
WATER RESOURCES MANAGEMENT	Improving the political and legal framework in the field of Water Resources management, Increasing the production and sharing of data and information,
	Protection, improvement and efficient use of water resources Ensuring
AGRICULTURE AND FOOD SECURITY	policy and legal for the adaptation of the agriculture sector to climate change framework, strengthening institutional capacity, cooperation and awareness-raising
	Protection of ecosystems and natural resources in agricultural production, development and ensuring sustainable use
	Increasing R&D studies on the impact of climate change on agriculture and adaptation, developing database, information technologies and innovation practices in agriculture and improving agricultural activities accordingly to be carried out in accordance with
BIOLOGICAL AND ECOSYSTEM SERVICES	Increasing awareness and capacity on biodiversity, ecosystem services, nature-based solutions, ecosystem-based adaptation, ensuring data and information sharing between all stakeholders , authorization avoiding confusion and strengthening cooperation
	Biological Diversity and ecosystem services Threat the one that did it, the pressure of factors such as habitat fragmentation and change, pollution, overuse Reduction of
	The impact of climate change on biodiversity and ecosystem services research, monitoring and evaluation of their impact
	Increasing the amount of protected areas for effective nature conservation, increasing has been ecosystems restoration and Management to their plansintegrating climate change adaptation
PUBLIC HEALTH	Strengthening the infrastructure for evidence-based analysis, assessment and reporting on climate change in the field of health, increasing R&D studies
	Strengthening capacity, cooperation and awareness on climate change and health perspective in all institutions and organizations at national and local level
ENERGY	Developing the political and legal framework for the adaptation of Turkey's energy sector to climate change, strengthening institutional capacity and cooperation, increasing information and data production and sharing
	Strengthening the generation, transmission-distribution and storage infrastructure in energy resources, taking into account the necessary designs and increasing the flexibility of the electricity energy system to ensure adaptation to climate change

TOURISM AND HERITAGE	Capacity of tourism investments and enterprises to adapt to climate change increasing for infrastructure
	Capacity to adapt to climate change in the tourism and cultural heritage sector Improving the social infrastructure to develop
	Climate in strategic and spatial decisions related to tourism and cultural heritage taking into account the issue of adaptation to change and ensuring coordination between authorized institutions
INDUSTRY	Triggered technological risks and at risk of major industrial accidents identify facilities and develop adaptation actions as a priority
	Prior to investment projects, it is important to identify climate change impacts on investment and climate change impacts on investment. joint assessment and monitoring of their impact
	To increase insurabilityclimate change impacts making the necessary updates as a result of the review of insurance legislation
	National projections and data for industrial sector studies Providing fast and practical access to databases
	Encouraging business collaborations within the sector (mentoring system and training of trainers)
	Inclusion of climate change adaptation elements in green purchasing criteria encouraging the adoption of
TRANSPORTATION AND COMMUNICATION	Ensuring resilience of critical infrastructures in transportation and communication
	Assurance of transportation and passenger health by reducing the level of vulnerability to be taken under
	Climate sourced from disasters duringaccessibility, Communication and evacuation possibilities with the development of urgent situation management and intervention increasing capacity
	In line with the goal of adaptation to climate change in the field of transportation and communication improving the capacity for planning
SOCIAL DEVELOPMENT	Incorporating the impacts of climate change on social life and measures into socio-economic development and ecosystem protection strategies at all levels (national, regional, local) and integrating social development into each sector's climate change adaptation policyplanning and implementation processes incorporation of the component
	Social protection policies should be designed to protect society against actual/potential climate hazards. resilience and harmony to strengthen for as development of
	Moving away from the crisis management approach to a risk management model for the adaptation of society to climate change and building the necessary legal, institutional, administrative, scientific, human and financial capacity in this context strengthening
	Ensure that national adaptation policies on climate change are developed and implemented by all segments of society. Implementation of a rights and interests-based approach for well-being, with a focus on equal opportunities
DISASTER RISK REDUCTION	Understanding climate change and disaster risk for sustainable and resilient development and strengthening the information infrastructure
	Climate change and transformative risk for strengthening disaster resilience ensuring governance
	To achieve inclusive and responsive climate change and disaster resilience improving institutional capacity and raising awareness
	Stable and sustainable in the context of climate change and disaster resilience making investments

HORIZONTAL CUTTING ACTIONS	Integrating climate change adaptation into all policies and strategies to be
	Increasing knowledge to support decision-making processes and climate Developing institutional capacities to increase expertise, training, knowledge base, monitoring and R&D activities related to change
	Increasing knowledgeandawareness on climate change adaptation in a way to ensurecitizens part of the solutiondecision-making Ensuring participation in decision-making mechanisms

1.4. EVALUATION

Monitoring and evaluation is a critical step in ensuring the long-term success of climate change adaptation action plans. The monitoring process plays two important roles.

- Monitoring the performance of the actions in the plan
- Determine whether planned outputs and outcomes from adaptation actions have been achieved

A successful monitoring and evaluation process plays an important role in improving the effectiveness of actions and accountability. A proper monitoring system can also help to ensure continued support for actions and any additional funding that may be required.

In this context, an online monitoring and evaluation system will be established to monitor the Climate Change Adaptation Strategy and Action Plan.

From each action under the National Climate Change Adaptation Strategy and Action responsible institutions will enter the developments of the previous year into the online monitoring system that will be activated for data entry between January 1 and March 31 each year. In line with the information entered into the system, annual monitoring and evaluation reports will be prepared by the Ministry of Environment, Urbanization and Climate Change, Climate Change Directorate with the contributions of the main responsible institutions from the sectors by June 30th of each year at the latest. The recommendations to be included in the monitoring and evaluation report and the steps to be taken will be discussed in the Working Groups of the Climate Change and Adaptation Coordination Board. Climate Amendment The annual evaluation report prepared under the coordination of the Presidency will be submitted to the Climate Change and Adaptation Coordination Board by December 31st of the monitoring year. It may be possible to make individual revisions to the action plan in line with the needs.

1.5. ADAPTATION VISION

The Climate Change Adaptation Strategy and Action Plan and the work undertaken during the preparation of this action plan provide an approach to adapt nature, human development and healthy living conditions to a changing climate, together with key sectors of the Turkish economy. The strategy, which is a reference document outlining the strategic framework and priorities for climate change adaptation until 2030, is supported by vulnerability and risk assessments and highlights key priority areas and regions for action. Strategy; The strategy is complemented by an action plan that sets targets and priorities for building adaptive capacity, formulates climate change adaptation measures per sector, provides a timeline for their implementation, and points to the necessary resources and responsible institutions.

Turkey's vision for adaptation to climate change is as follows.

A more economically, socially and ecologically resilient, more sustainable, greener Turkey to ensure that Turkey's residents, public and private sector institutions are prepared for and adapt to the impacts of climate change.

The ultimate goal is to ensure that nature, infrastructure, health and emergency services, as well as key economic sectors, are not only resilient to risks, but also able to maximize opportunities.

In order to achieve this goal, the Climate Change and Adaptation Coordination Board aims to reduce the vulnerability of natural, social and economic systems in Turkey and to protect and enhance their capacity to adapt to the inevitable impacts of global climate change.

will lead actions at the national level.

Adaptation actions aim to increase the resilience of society and institutions capable of making timely and well-informed decisions to address the challenges and opportunities presented by a changing climate. The vision, set of strategic objectives and awareness raising to trigger a mental transformation for such a society, institutional capacity building and the inclusion of climate change adaptation in sectoral policies have been instrumental in determining the selection of relevant adaptation actions.

Based on this vision, in line with this Strategy and Action Plan, it will be ensured that climate change adaptation actions are mainstreamed in current and future policy cycles and included in the planning developed under the responsibility of relevant ministries and local governments.

1.6. ADAPTATION AND PRINCIPLES

During the consultation meetings for the preparation of the Strategy and Action Plan, the following key principles were identified together with all stakeholders to be taken into account in the development of the national adaptation strategy for Turkey.

Evidence-Based Decision Making: This is an approach that aims to ensure that decisions concerning the society are taken in a rational and transparent manner. By increasing research and development and field studies in different sectors on the impacts of climate change, the work of decision-makers becomes easier when the extent of the impacts, the systems and regions affected by them are determined based on scientific data, and in line with the findings obtained sources prioritization can be carried out in order to use it efficiently. Evidence can also have the effect of increasing coherence and coordination in public practice.

Sustainability: The principle of sustainability focuses on making societies prosper without harming the environment. The concept of sustainability is important for nature to regenerate itself and to improve the quality of economy, health, life and education. In particular, slowing down rapid consumption by allowing nature's resources to renew themselves is one of the principles necessary to minimize the threat of globalization on the environment.

Risk Based Approach: Risk-focused approach or risk-based thinking an approach or way of thinking that has been added to draw attention to the need to take into account the risks that may arise when making a decision and to make preparations, if any, accordingly. When identifying and prioritizing climate change adaptation actions, the potential risks posed by climate change hazards should be well analyzed. Risk-based approach is also closely related to the principle of evidence-based decision-making.

Awareness raising and training: It covers issues such as training, capacity building programs and development of awareness raising campaigns to raise awareness of public employees, private sector, citizens, especially decision makers, on issues such as the dangers of climate change and the impacts of decisions taken on other sectors/areas.

Integrated approach: Many sectors and systems, especially the eleven priority sectors addressed under the action plan, have interdependencies not only on climate change but also in many other areas. For example, water resources within a certain water basin are important for many sectors (drinking-utilization, energy, tourism, etc.), especially agriculture. A decision on energy policy can have an impact on meeting the water demand of other sectors. Therefore, all decisions made with increasing resolution, starting from policy decisions wide one should be considered across the spectrum.

Prioritization: Prioritization is the process of implementing certain adaptation actions more urgently than others according to agreed criteria. Prioritizing adaptation actions usually takes into account the projected geographical distribution of climate change impacts and the different vulnerabilities to impacts among the country's population.

Inclusiveness: All actors affected by climate change (e.g. public institutions, NGOs, NGOs, business, local communities and individuals) need to be identified and engaged, and their participation should be ensured through accurate and regular information for them to work on adaptation. Ensuring the participation of especially disadvantaged groups in adaptation actions from the design stage is important in terms of ownership of the actions and even their implementation.

REFERENCES: Introduction

Das, S., Ghosh, A., Hazra, S., Ghosha, T., Safra de Campos, R., & Samanta, S. (2020a). Linking IPCC AR4 & AR5 Frameworks for Assessing Vulnerability and Risk to Climate Change in the Indian Bengal Delta. Progress in Disaster Science, 7, 100110. DOI: 10.1016/j.pdisas.2

IPCC (2012). Managing the Risk of Extreme Events and Disasters to Advance Climate Change Adaptation. Geneva: Intergovernmental Panel on Climate Change. https://www.ipcc.ch/report/managing-the-risks-of-extreme-events-and-disasters-to- Retrieved from advance-climate-change-adaptation/.

IPCC (2014). Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge and New York: Cambridge University Press. Retrieved from https://www.ipcc.ch/report/ar5/wg2/.

IPCC (2014). IPCC Fifth Assessment Report: Climate Change 2014. Geneva: Intergovernmental Panel on Climate Change. Retrieved from https://www.ipcc.ch/report/ar5/syr/.

Johnson, K., Depietri, Y., & Breil, M. (2016). Multi-hazard risk assessment of two Hong Kong districts. International Journal of Disaster Risk Reduction, 19, 311-323. DOI: https://doi.org/10.1016/j.ijdrr.2016.08.023

MGM (2022, January). 2021 Climate Assessment. Republic of Turkey Environment, Urbanization and Climate Change Ministry of Meteorology General Retrieved from: https://mgm.gov.tr/FILES/iklim/yillikiklim/2021-iklim-raporu.pdf

Nguyen, C. (2015). Development and application of a social vulnerability index at the local scale. Melbourne: RMIT University. https://www.semanticscholar.org/paper/Development-and-application-of-a-social- index-at-Nguyen/a9d16d9857d92978c87adc81ea11a0c73cde3e01 Retrieved from

Wiseman, V. (2016). Part I: Supporting Implementation of Sustainable Development Goal (SDG) Target 13.1 on Climate Change Adaptation. International Institute for Sustainable Development: https://sdg.iisd.org/commentary/policy-briefs/the-unfccc- national-adaptation-planning-model-a-foundation-for-fulfilling-post-2015- commitments/ Retrieved from https://sdg.iisd.org/commentary/policy-briefs/the-unfccc-national- adaptation-planning-model-a-foundation-for-fulfilling-post-2015- commitments/.

KENT

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2.1. GENERAL FRAMEWORK

Carbon-intensive urbanization that destroys natural areas and does not take into account climate parameters, changing climate risks, leaving our cities and their inhabitants vulnerable.

Home to more than half of the world's population and responsible for around 70% of global greenhouse gas emissions, cities are at the center of the climate change crisis. Moreover, many modern cities are destroying natural ecosystems through urban expansion.

Beyond causing climate change, cities are also highly vulnerable to its impacts. Cities are already feeling the impact of climate hazards such as floods, extreme heat, heat waves, floods, droughts, etc.

Cities at the points where impacts and risks are intense on climate change can also be an important of the solution. Because cities also provide opportunities for climate action. Sustainable and resilient urban design and planning, smart city practices, nature-based solutions, effective water management, urban agriculture practices, zero waste practices, green transportation practices can all provide more inclusive and fairer life (UNEP, 2022b).

Cities can reduce their emissions by 2050 using technically feasible measures.
As infrastructure hubs at risk of being impacted by climate change, with the potential to mitigate up to 90%, they also play an important role in climate adaptation.

In Turkey, the prominent impacts of climate change in urban areas are floods and inundations caused by heat waves, cold waves and heavy rainfall with a significant increase in temperatures in summer months. Areas prone to flooding and inundation due to rapid urbanization,

Climate change is increasing its impacts in cities and making them felt severely. Although rainfall regimes have changed, urbanization processes such as changes in land use and occupation of flood lines have increased the destructive effects of floods. On the other hand, drought is also an important climate hazard for our cities. During the great drought of 2007-2008, some of Turkey's major cities experienced significant water shortages. Therefore, cities should pay attention to the protection of water catchment basins (Krellenberg & Turhan, 2017).

Climate change impacts such as increasing temperatures and the urban heat island effect need to be related to urbanization processes. Establishing these relationships will ensure that the right decisions are made in design and planning actions and the right actions are taken in the two-way relationship between climate change and the city (Cities change the climate, while changing climatic conditions cause various damages in cities). Land use change is one of the biggest urban variables in the relationship with climate. These changes, which we can summarize as urban sprawl with the decrease in forests and agricultural areas, can affect the climate at both macro and micro levels.

Ongoing urbanization negatively affects climate and is affected by climate change. The physical characteristics of built areas are decisive in this interrelationship. The characteristics of the built environment affect the urban climate, energy flow and water cycle, thereby determining the quality of life and the risks arising from climate change.

The scarcity of natural surfaces and green areas and the increase in paved surfaces increase the impact of extreme heat in urban areas. Light-colored materials absorb less light, making the effect of extreme heat in urban areas less noticeable.

Therefore, the color of materials preferred for surfaces in urban areas may be important. Strategies on the characteristics of blue and green infrastructure and its enhancement in urban areas are among the prominent actions to create a climate resilient urban model and adapt to changing climate conditions. Creation of open and green space systems and green corridors in urban areas this in this context. Such design strategies stand out in terms of mitigating the effects of heat waves and providing ease of drainage in cases of heavy rainfall (Sass; Gartland, 2008; Givoni, 1998; Emmanuel, 2005). In the process of planning and designing urban areas, the contributions of these parameters may be limited. In addition, street orientations and urban form and geometry (Givoni, 1998; Emmanuel, 2005; Herrmann & Matzarakis, 2010) are factors that determine ambient temperatures in built-up areas. On the other hand, wind corridors are also related to climate within urban built-up areas is an important spatial design parameter. At the building scale, green facades and roofs stand out with similar contributions. The reality that emerges from the studies on urban climate and design parameters is that a single solution and application will not be sufficient in the relationship between climate and the city and will not provide climate resilience. Therefore, detailed analyses should be made in cities and locally specific actions should be considered based on these analyses. It is of great importance to identify the physical characteristics of the local context and the problematic regions in relation to climate. Social as well as physical issues should be included in this process. For example, it is a great necessity to identify the disabled, elderly and child population, who are most vulnerable to climate change-induced disasters, and their living spaces. At this point, the biggest action is to continuously and regularly monitor the developments in urban areas and to envisage arrangements for this population in the light of inclusive design principles.

2.2. SECTORAL LEGAL FRAMEWORK AND RESPONSIBLE INSTITUTIONS

Climate change adaptation urban areas actions, international climate agreements and national legislation set the basic policy and legal framework, and centralized institutions/organizations, municipalities and provincial organizations of ministries responsible institutions.

When the issues that increase vulnerability and risks and improve adaptation to climate change in urban areas and the laws related to these issues are examined, "Zoning Law", "Soil Conservation and Land Use Law", "Cadastral Law", "National Parks Law", "Law on the Protection of Cultural and Natural Assets" are considered, "Laws on Wetlands and Water Resources", "Coastal Law", "Law on Protection against Floodwaters and Floods", "Environmental Law", "Law on Building Inspection" and "Law on Transformation of Areas under Disaster Risk" stand out.

With the Zoning Law, the formation of settlements and constructions in accordance with the plan, science, health and environmental conditions; with the Law on Soil Conservation and Land Use, the protection/development of soil, sustainable development with environmental priority development appropriate planned/balanced/efficient use and management; determination of the legal status of immovable properties by indicating their boundaries on the land/map with the Cadastral Law; land and water resources management and land use planning; determination and protection of national parks, nature parks, nature monuments and nature conservation areas with the Law on National Parks; protection and use of movable and immovable cultural and natural assets with the Law on the Protection of Cultural and Natural Assets; protectionregistrationplanning and management of wetlands with the Law on Wetlands and Water Resources;

The Coastal Law provides for the protection of the natural and cultural characteristics of the sea, natural and artificial lakes, river coasts and coastlines and the utilization of these areas; the Law on Protection against Floodwaters and Floods provides for the identification and declaration of areas that are under water or that may be subject to flooding; the Law on Building Inspection provides for project and building inspection for the construction of quality buildings in accordance with the zoning plan, science, art, health rules and standards for the safety of life and property; and to ensure that the technical and standard specifications of the materials are heat insulated and low energy; The Law on the Transformation of Areas under Disaster Risk (Urban Transformation) provides for the transformation of urban areas at risk of disaster to create healthy and safe living environments; and the Environmental Law provides for the use of mandatory standards and economic instruments and incentives for the protection of the environment in line with the principles of sustainable environment and development, the evaluation of land and resource use and economic activities within the framework of sustainable development, the efficient use of natural resources and energy, the protection of the environment, the prevention and elimination of environmental pollution (Talu and Kocaman, 2022; Talu, 2019).

Climate change, which ensures law enforcement and climate change against There are many institutions involved in vulnerability, risk and adaptation in cities. Both the organizational structures and legislation of these institutions, which have the right of disposition over the city in different aspects, are changing. The two prominent institutions related to urban areas are the Ministry of Environment, Urbanization and Climate Change (MoEUCC) and municipalities. The Ministry is responsible for carrying out works and procedures related to climate change, determining plans and policies for global climate change and taking necessary measures, global climate change and the ozone layer.

To provide coordination for taking measures related to thinning, to encourage renewable energy sources, clean energy, to ensure that fuels can be used in a way that does not cause air pollution, to determine the procedures and principles and standards for the control of exhaust emissions of motor vehicles, to determine climate change policies, Conducting climate negotiations, monitoring greenhouse gas emissions, ensuring the development of local climate change policies, supporting climate change R&D and applications, monitoring/controlling emissions, discharges and wastes, treatment and disposal systems of activities and facilities that cause environmental pollution; to monitor/regulate emissions, discharges, wastes, treatment and disposal systems of activities and facilities that cause environmental pollution; to make/enforce settlement, construction and land use, spatial strategy plans, environmental layout plans, zoning plans, sectoral plans; and integrated coastal area management and planning.

Municipalities are divided into two groups: metropolitan municipalities and other municipalities. The Metropolitan Municipality Law and the Municipal Law define the work to be carried out at both levels. The Law on Metropolitan Municipalities and the Law on Municipalities define tasks, each of which may indicate an action in the face of changing climatic conditions. These include planning, regulating, approving, regulating, approving, planning, regulating, approving, planning, regulating, regulating, approving, planning in areas such as zoning, transportation, urban traffic and public transportation, water and sewerage, river rehabilitation, natural assets, natural disasters, regional parks, etc. planning, regulation, approval, implementation, supervision, protection of agricultural areas and water basins; afforestation; solid waste management; establishment of central heating systems, licensing and supervision of workplaces, protection of natural assets, environment and environmental health; waste water and storm water removal; emergency aid, rescue; afforestation, parks and green areas; development of economy and trade; production of land plots and construction of housing.

Considering the powers of the municipalities and central government, a governance structure in which the central and local governments will set targets together is important for successful implementation of adaptation to climate change in cities. In this context, establishing the legal framework of a governance model that will enable the participation and contribution of all relevant stakeholders in order for cities to realize their planning by considering climate change adaptation while becoming resilient to disasters; and Harmony will contribute to accelerating the process.

Policy support, responsible institutions and support issues for local governments' fight against climate change can be summarized as follows:

Regional plans prepared by Development Agencies with the contributions of institutions and organizations in their regions provide a framework for planning and implementation activities carried out by local governments. In addition, development agencies provide financial and technical support to activities and projects that ensure the implementation of regional plans and programs.

The Southeastern Anatolia Project Regional Development Administration, Eastern Anatolia Project Regional Development Administration, Eastern Black Sea Project Regional Development Administration and Konya Plain Project Regional Development Administration work with local governments in regional/local climate change prevention and adaptation. Iller Bank of Provinces (İLBANK) provides technical and financial support to projects of special provincial administrations and municipalities in the field of sustainable urban development (renewable energy, urban planning architecture, engineering, consultancy, infrastructure, superstructure, urban transformation practices). Furthermore, ILBANK supports the preparation process of local climate action plans of local governments. For cities, in addition to the MoEU and municipalities, the Ministry of Transport and Infrastructure's climate

The Ministry of Transport and Infrastructure has areas of responsibility that can be related. The Ministry of Transport and Infrastructure's General Directorate of European Union and Foreign Relations monitors and evaluates studies on environment, energy, greenhouse gases and climate change; the General Directorate of Aviation and Space Technologies works on the protection of human health and the environment, mitigation of climate change-induced disasters by detecting them in advance, and the utilization of natural resources. Ministry of InteriorDisaster and Emergency

The Presidency of Disaster and Emergency Management Presidency (AFAD) is another institution concerned with actions in urban areas in a changing climate. In order to prevent the damages caused by disasters and emergencies, it carries out activities on the issues of identifying hazards and risks in advance, taking measures to prevent or minimize the damages that may occur before the disaster occurs, ensuring effective response and coordination, and carrying out post-disaster recovery works in an integrity.

2.3. EFFECTS OF CHANGE

The Black Sea is the most at-risk city for heavy rainfall in Turkey, Mediterranean and Southeastern cities; Mediterranean and Southeastern cities are the most at risk for heat waves.

In order to plan and implement adaptation actions against climate change on a city basis, vulnerability and risk analyses should be conducted at the local level. While making a national assessment for the cities of our country, the prominent hazards are heavy rainfall and heat waves. Within the scope of this study, risk analyses were conducted for built-up areas according to both hazard types. In the analyses, urban centers of 81 provinces were considered. The exposure of these areas was analyzed, sensitivity, adaptive capacity and vulnerability were examined and risk analysis was conducted. Provincial level maps were produced for each risk component.

Urban Sector Risk Analysis: Heavy Rainfall

An impact chain was prepared for urban built-up areas according to the hazard of heavy rainfall (Figure 1). While determining the impact chain, the indicators necessary to analyze the risk of built-up areas were selected and . It is not possible to conduct national scale analyses according to the spatial issues highlighted in the first section in the context of the relationship between climate change and the city due to data infrastructure and human resources. However, with the support of central units and the inclusion of relevant local actors in the studies, urban risk analyses can be conducted for each province and this problem can be eliminated. Analyses have been conducted that reveal the situation of cities in the face of identified risks, albeit at a general level, and can identify prominent cities and regions. It should not be forgotten that lack of access to the data required by urban infrastructure variables weakens risk outcomes. Therefore, for accurate and precise information that can guide policies, first of all, there is a need for data infrastructure. Studies Making is required. Water depth and spreading areas should be determined and taken into consideration within the scope of flood maps in hazard analysis within urban built-up areas.

In the analyses made, population size, building surfaces and continuous urban areas[1] in urban built-up areas for heavy rainfall hazard constitute the data group showing the level of exposure to climate change. The priority stage in all projects to be established against climate change is the establishment of a database. It is an action that should be prioritized for all institutions to produce and share separate data on the basis of urban and rural areas. For the data groups identified in terms of exposure within the scope of this study, the CORINE Project database of the Ministry of Agriculture and Forestry and TURKSTAT database were examined, evaluated and various calculations (such as the size of the built-up area and housing areas with building use permits) were made.

As vulnerability indicators, the discontinuous urban structure [2], the number of people in vulnerable age groups, the total number of floods and overflows experienced, the type of settlement and the concentration of sectors with high risk against heavy rainfall were evaluated on a provincial basis. In order to determine the settlement types, the settlement characteristics of the central areas of 81 provinces were scanned from satellite images and various sources, and 12 different settlement types were identified. These are riverside settlements (e.g. Eskişehir), coastal settlements (e.g. Mersin), hillside settlements (e.g. Artvin), plain (e.g. Iğdır) and plateau settlements (e.g. Gaziantep), hillside and plain (e.g. Denizli), hillside and plateau (e.g. Erzurum), coastal and hillside (e.g. Trabzon), river and hillside (e.g. Amasya), coastal and plain (e.g. Amasya):

[1] Areas where most of the land is covered by transportation networks and structures, with buildings, roads and artificial surfaces constituting more than 80% of the total surface.
[2] Areas where most of the land is covered with structures, buildings, roads, artificial surfaces and scattered mixtures of bare soil and vegetation. 30-80% of the surface should be impermeable

Burdur), river and plateau (e.g. Kars) and river and plain (Aksaray) settlements. Different settlement types have different sensitivities to heavy rainfall. River and slope settlements, coastal and slope settlements, hillside settlements and riparian settlements were identified as types that increase sensitivity. Lowland and plateau settlements are identified as those with relatively low sensitivity. Another sensitivity data was determined for the sectors that have a weight in the city's economy and will be affected by heavy rainfall. In this context, 18 different categories (building and non-building constructions and landscaping activities, private construction activities, sewerage, accommodation, waterway and airway transportation, food and beverage services activities, fishing and aquaculture, food products manufacturing, insurance and financial activities, human health services, travel agency, water collection, treatment and distribution activities) were analyzed according to the number of firms and employees. Cities were grouped according to the number of activities with an LQ value of 1 and above. In this way, cities with higher risk could be identified.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Yağış miktarı ve sıklığında artış	Şiddetli yağışlı gün sayısında artış	**Kentsel altyapı**	Süreksiz şehir alanı oranı	Kişi başına GSYİH	Ulaşım ve iletim altyapısının zarar görmesi
	Sel ve taşkın	Su ve kanalizasyon altyapısı*	Kentsel yerleşim türü	GINI katsayısı	Ticari işletmelerin maddi zarar görmesi
		Ulaşım altyapısı*	Bağımlı nüfus oranı	Lise ve üzeri eğitim oranı	Yerleşim alanlarının zarar görmesi
		İletim altyapısı*	Kayıtlı işsiz sayısı oranı	Ar-Ge merkezleri sayısı	İnsan sağlığının zarar görmesi
		Enerji altyapısı*	Şiddetli yağış karşısında riski yüksek sektör yoğunlaşması	Faal dernek sayısı	
		Kentsel üstyapı	Altyapı yaşı ve kapasitesi*	Bin kişi başına düşen hekim sayısı	
		Nüfus yoğunluğu	Zarar gören yol hattı, ulaşım bağlantısı*	Yüz bin kişi başına düşen yatak sayısı	
		Bina yüzölçümü	Yaşanan toplam sel ve taşkın sayısı	Yeşil şehir alanları oranı	
		Karayolu, demiryolu, havaalanı ve liman alanları toplamı	Kentsel yayılma eğilimi*	Sigortacılık sistemi*	
		Sürekli şehir alanı oranı	Riskli alanlardaki bina sayısı*	Korunan yeşil alanlar*	
		Kent makroform büyüklüğü*	Kentin formu*	Afet yönetim planları varlığı*	
		Arkeolojik ve kentsel sit alanları*	Mevcut çevre yolu varlığı*	Kontrollü kentsel yayılma hedefinde planların varlığı*	
		Tescilli yapılar*	Su yüzeyleri oranı*	İklim ve çevre duyarlı dernek sayıları*	
		Kent içi veya yakını hassas ekosistemler varlığı*	Yoksul mahalleler*	Sosyal hizmetler uzmanı sayıları*	
			Sosyal yardım alanların sayısı*	Kentsel büyüme projeksiyonları*	
			Düşük gelirli nüfus oranı*	Kentsel yayılma oranı*	
			Göçmen nüfus*	Yeşil sistem sürekliliği*	
			Taşkın riskinden etkilenen nüfus ve ekonomik hasar*	Kişi başı yeşil alan miktarı*	
				Çevre yolu projeleri*	
				Taşkın yönetim planlarında önerilen tedbirlerin uygulanma durumu*	

Figure 1 Impact Chain: Urban Sector and Heavy Rainfall Relationship

*The * symbol indicators not used in risk analyses.*

Regarding adaptive capacity, an assessment was made based on the number of active associations, gross domestic product per capita, GINI coefficient, high school and higher education rates, number of R&D centers, number of physicians per capita, number of beds per 100,000 people and green urban areas.

In the study, cities were first analyzed with exposure indicators. Accordingly, coastal cities in the Marmara, Aegean, Mediterranean and Black Sea Regions were analyzed with very high and high are cities exposed to heavy rainfall hazards. Cities in Central Anatolia with high population and urban areas such as Ankara, Konya and Kayseri are also highly exposed to heavy rainfall. According to the characteristics of urban areas, Northeastern and Eastern Anatolian cities have very low exposure levels. It should be kept in mind the exposure levels of cities differ relatively from each other.

It should be kept in mind that cities with low exposure levels have such a value compared to other cities, but other cities are also at risk in the face of heavy rainfall. This can be explained by the trends in Turkey's urbanization history. These trends sprawling cities, high density, limited green space, automobile-dependent transportation system, energy consumption, incompatible material choices, non-localized architecture and public spaces with low accessibility. These characteristics increase the potential negative impacts of heavy rainfall. In order to make clearer statements about each city, they need to be analyzed separately in the context of these characteristics. Cities such as Antalya, Mersin, Istanbul and Izmir are risky due to geographical structure, sprawl tendency, impervious surfaces, high density urban areas, closed or channelized streams and insufficient green areas. Depending on the studies conducted on urban areas, it may be misleading to comment on the whole city. Therefore, zoning should be done and separate actions should be developed according to risk levels. As a method, data should be processed on high-resolution satellite images on the basis of grids (grid) as close to reality as possible, so that the distinctions within the urban area can be defined. When data such as urban geometry, form, street orientations, sky visibility ratios and the amount of permeable surfaces are processed into these grids, a more accurate final product will be possible.

When the results of the sensitivity analysis are analyzed, it is seen that the Mediterranean, Aegean and Black Sea coastal cities have very high and high sensitivity in terms of urban built-up areas. Cities with high population, more developed economies, settlement types that increase the risk, tend to fringe and have a high number of people in vulnerable age groups cities have a very high sensitivity. The characteristics observed in the cities that stand out here are high density, development in the services and industrial sectors, an excess of paved surfaces and a tendency to spread in all directions with a fringed urban form.

Cities Harmony capacities, metropolitan cities such as Ankara, Istanbul and Izmir stand out with very high adaptive capacity values due to their human resources and developed economies. Southeastern Anatolian cities, on the other hand, were found to have low and very low adaptive capacity. In general, cities with high per capita income, a large educated population, a high number of associations, developed health infrastructure and green urban areas have very high adaptive capacity, while cities with low adaptive capacity have the opposite characteristics.

In the vulnerability assessment made by analyzing the sensitivity and adaptive capacity components Central Black Sea and Southeastern Anatolia cities stand out with very high and high values. Cities in Central Anatolia and the Aegean Region also stand out as highly and moderately vulnerable cities. In cities with high vulnerability, sensitivity is very high, while adaptive capacities are very low. Urban development practices in the form of fringing, settlement types that increase the risk in the face of heavy rainfall, high dependent population, high number of floods and overflows, and the concentration of high-risk economic activities are factors that increase the sensitivity of these cities to climate change. In addition to these characteristics, cities with high vulnerability are also characterized by low income levels, low educated populations, weak social capital and health infrastructure, and a settlement structure that is not in balance with nature.

Risk analyses were completed according to the risk of heavy rainfall. Accordingly, the risk of heavy rainfall in urban built-up areas in Mersin, Adana, Hatay, Osmaniye, Samsun, Ordu, Kayseri, Kahramanmaraş, Şırnak, Batman The Black Sea, Aegean, Mediterranean and Southeastern Anatolia cities were found to be high and medium risk cities (Figure 2).

Figure 2 Current Period Risk Map: Urban Sector and Heavy Rainfall Relationship

Adaptive capacities are low and exposure and vulnerability are relatively high in prominent cities. Although the urbanization trend observed in each risky city is not suitable for the climate, the high level of danger in these cities has led to this result. Revision and implementation of the spatial plans of these cities with an urban planning approach that is resilient to climate change and has high adaptive capacity will be an important adaptation action. The features that increase the risk and make these cities stand out are the narrowing and closure of stream beds in coastal cities through construction, the presence of roads and structures that act as dykes at the points where water courses meet the sea, and the rapid urbanization and sprawl process observed in sloping geography and high slope areas. In cities without coastal such as Diyarbakır and Kayseri, transportation demands Urbanization processes that increase urbanization processes, high densities, opening agricultural lands to construction and fringed form increase the risk of being affected by heavy rainfall hazards in the face of climate change. Therefore, a total of 32 cities, 11 very high-risk and 21 high-risk, need to be prioritized for adaptation actions.

Urban Sector Risk Analysis: Heat Wave

The second major threat to urban built-up areas in the face of climate change is the heat wave. For the heat wave, an impact chain was created based on indicators that determine exposure, express sensitivity and define adaptive capacity in urban areas (Figure 3).

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Ortalama sıcaklık artışı	Sıcak hava dalgası	**Kentsel altyapı**	Süreksiz şehir alanı oranı	Kişi başına GSYİH	Enerji ve su altyapısında yük
Aşırı sıcak gün sayısında artış	Ardışık sıcak gün sayısında artış	Su altyapısı*	İçme ve kullanma suyu arıtma tesisi ile hizmet veren belediyelerin oranı	Lise ve üstü eğitim oranı	Sağlık koşullarında bozulma, yaşam konforunda düşüş
		Enerji altyapısı*	İçme ve kullanma suyu şebekesi için çekilen su miktarı	GINI katsayısı	Yüksek kentsel ısı adası etkisi
		Kentsel üstyapı	Kişi başı elektrik tüketimi	Ar-Ge merkezleri sayısı	İşgücü verimliliğinde azalma
		Nüfus yoğunluğu	Sıcak hava dalgası karşısında riski yüksek sektör yoğunlaşması	Faal dernek sayısı	Hastalık ve salgınlar
		Bina yüzölçümü	Kentsel yerleşim rakımı	Bin kişi başına düşen hekim sayısı	İnşaat faaliyetlerinde aksamalar
		Devlet yolu, il yolu ve bölünmüş yol oranları	Kentsel yerleşim türü	Yüz bin kişi başına düşen yatak sayısı	
		İşyeri sayıları	Bağımlı nüfus oranı	Yeşil şehir alanları oranı	
		Sürekli şehir alanı oranı	Nüfus artış hızı	Sıcak hava dalgası yönetim planı*	
		Karayolu, demiryolu, havaalanı ve liman alanları*	Atık su, yağmur suyu altyapıları*	Yerleşik alanlar içi doğal alanlar oranı*	
		Kent çevresi hassas ekosistemler*	Gecekondu veya kaçak yapı alanları*	Yeşil sistem sürekliliği*	
		Kent makroform büyüklüğü*	Kentin formu/ geometrisi*	Planlarda yeşil alanlar oranı*	
		Arkeolojik ve kentsel sit alanları*	Su yüzeyleri oranı*	Sıcaklık duyarlı kent planlarının varlığı*	
		Tescilli kültür varlıkları*	Sağlık tesisleri kapasiteleri ve erişilebilirlikleri*	Erken uyarı sistemleri*	
			Düşük gelirli grup oranı, Sosyal yardım alanlar oranı*	Çevre yolu projeleri*	
			Göçmen nüfus*	Kentsel büyüme projeksiyonları*	
			Kentsel yayılma*	Sosyal hizmetler uzman sayıları*	
			Kentsel alanda kaplamalı yüzey miktarı*	Tabiat parkı, doğal sit alanı varlığı*	
			Mevcut çevre yolu varlığı*	Koruma bölgeleri*	
			Yeşil alan miktarı*	Bisiklet yolu uzunluğu*	
			Sokak yönlenmeleri*	Kırsal bisiklet yolu uzunluğu*	
			Gökyüzü görünürlük oranları*	Ağaçlık alan oranı*	

Figure 3 Impact Chain: Urban Sector and Heatwave Relationship

*The * symbol indicators not used in risk analyses.*

Most of the information specified in the impact chain is not available on a city basis in Turkey. However, it is important to produce and maintain this information in order to obtain more accurate results. Characteristics of urban infrastructure and superstructure for heat waves, population size, building areas, continuous city structure, road lengths and number of workplaces are defined as exposure components.

Discontinuous urban structure, settlement type, electricity consumption, amount of water withdrawn from springs and wells, population growth rate, dependent population and concentration in sectors with high risk against heat waves were as sensitivity components. 81 provinces

12 settlement types were identified as a result of the examination of central areas. These are riverside settlements (e.g. Eskişehir), coastal settlements (e.g. Mersin), hillside settlements (e.g. Artvin), plain (e.g. Iğdır) and plateau settlements (e.g. Gaziantep), hillside and plain (e.g. Denizli), hillside and plateau (e.g. Erzurum), coastal and hillside (e.g. Trabzon), river and hillside (e.g. Amasya), river and hillside (e.g. Amasya).Denizli), slope and plateau (e.g. Erzurum), coastal and slope (e.g. Trabzon), river and slope (e.g. Amasya), coastal and plain (e.g. Burdur); river and plateau (e.g. Kars) and river and plain (e.g. Aksaray) settlements. The identified settlement types also have different sensitivities to heat waves. Lowland settlements, hillside and plain settlements, and hillside and plateau settlements were identified as types that increase sensitivity. Those with relatively low sensitivity are defined as coastal and hillside settlements. As another variable, a location quotient (LQ-Location Quotient) analysis was conducted according to the number of companies and employees in 19 different categories (building and non-building constructions, wood and wood products production, plant and animal production, forestry, accommodation, fishing and aquaculture, food products manufacturing, residential care activities, mining, insurance and financial activities, human health services and travel agency activities) regarding the sectors that have weight in the city's economy and will be affected by the heat wave. Cities were grouped according to the number of activities with LQ values of 1 and above. In this way, cities with higher risk could be identified. Regarding adaptive capacity, an assessment was made based on the number of active associations, gross domestic product per capita, high school and higher education rates, number of R&D centers, number of physicians per capita, number of beds per 100,000 people and green areas.

First, exposure indicators were assessed and it was found that cities in the western part of the country have very high and high levels of exposure to heatwave hazards. Southeast

Cities in the Anatolian Region are generally exposed to high and medium levels of exposure. Exposure is high due to the high population size, lack of green areas, continuous urban structure, amount of road and building surface area and number of workplaces. Cities with more advantageous exposure (low exposure) are seen as settlements with small populations and relatively small macroforms. Cities with low exposure levels have such a value compared to other cities, but their urban characteristics indicate that these cities are also at risk in the face of a possible heat wave. In order to make clearer statements about each city, they need to be analyzed separately.

Cities such as Antalya, Mersin, IstanbulBursa and Izmir are risky due to geographical structure, sprawl, impervious surfaces, high density urban areas, closed or channelized streams and insufficient green areas. It can be misleading to comment on urban areas for the whole city. Therefore, zoning should be done and separate interpretations should be made according to risk levels.

When the sensitivity of the cities is analyzed, the Southeastern Anatolian cities between Osmaniye and Batman, the coastal cities of the Aegean Region Izmirand the cities of Kayseri and Konya in Central Anatolia have very high sensitivity. Other cities in inland areas are also found to have high levels of sensitivity. The characteristics of the cities that stand out in this map are poorly ventilated settlements, highly vulnerable economic activities, population growth rate, dependent population and high water and electricity consumption.

Looking at the adaptive capacity of cities, Malatya and Trabzon stand out in eastern Turkey, while large settlements such as Antalya, Izmir and Istanbul in the Marmara, Aegean and Mediterranean Regions stand out with very high levels of adaptive capacity. On the other hand

On the other hand, cities in the southeastern part of Turkey have very low adaptive capacity. When the analysis data and maps are analyzed, it is seen that cities with high income and education levels, developed social capital, good health infrastructure and R&D centers have high adaptive capacity.

In the vulnerability assessment, Kahramanmaraş, Adıyaman, Şanlıurfa, Diyarbakır, Mardin, Batman, Osmaniye, Karaman, Çorum, Nevşehir and Afyonkarahisar stand out with very high levels. High vulnerability was observed in Aegean and Southeast Anatolian cities. Very high and

What is also observed in cities with high vulnerability is high sensitivity and low adaptive capacity.

In the assessments made for urban built-up areas, all risk components were evaluated by considering the heat wave hazard map and heat wave risk analysis was made in urban built-up areas. Accordingly, a very high risk situation has emerged between Manisa and Şırnak in a line from west to east (Figure 4).

Figure 4 Current Period Risk Map: Urban Sector and Heat Wave Relationship

The prominence of cities in this area is due to their low adaptive capacity and high exposure and vulnerability. The fact that the spatial development trends observed in cities are not suitable for the climate and the level of danger is high in these areas has led to this result. An urban planning approach that is resilient to climate change and has a high adaptive capacity and spatial development of these cities

Revision and implementation of plans will be an important adaptation action. Cities at high and medium risk of being affected by heat waves in the face of climate change are concentrated in the southern half of Turkey.

When the cities of our country are reviewed in the light of the findings of both analyses, it is seen that although the physical and geographical characteristics of the cities are changing due to climate change

Although it is known to increase risk levels in the face of emerging hazards, it is seen that the characteristics and development processes of cities regarding construction also have an important place in determining risk levels. Coastal It is seen that a significant part of our cities in the coastal areas are at risk against disasters that may develop due to climate change due to low altitude. There are high and very high risk areas along the coast, especially in the Black Sea and the Mediterranean. Stream beds also play a very important role in the emergence of risk areas in the inner parts of the city. It is a fact that the covering of streams and all kinds of unauthorized interventions to streams increase floods. In this way, in addition to damaging the blue infrastructure in settlements, it is also a major factor in urbanization processes. construction Reducing the permeability by means of the lowering of the permeability causes high runoff and increases floods. Another point to be considered is that the effects of increasing floods in the upper basins is not calculated sufficiently. On the other hand, urban settlements developed on lowland lands are also high-risk areas. When the relationship between risk-bearing areas in cities and urban land uses (central business areas, residential areas, industrial areas, etc.) is considered, it is seen that basic urban activities and facilities can be located in risk-bearing areas. When the risk-bearing areas in terms of residential areas are analyzed, it is seen that unplanned developed urban areas (slum areas) constitute the risk-bearing areas. In addition, in planned developed areas, the risk level is high in areas with high population density and low green space ratio (Aydın, Erdin, & Kahraman, 2017).

Geographically low-risk areas in our cities become more risky when combined with wrong spatial development strategies and land use planning.

2.4. ADAPTATION MEASURES

Conducting urban risk analyses based on new research and data planning processes will be made climate sensitive, and sustainable, resilient urbanization will be ensured by transforming the carbon-intensive urbanization model of rapid growth, sprawl and misuse of land.

The first step in identifying adaptation measures for urban built-up areas in the face of climate change is to identify cities and their characteristics that are currently highly vulnerable to risks such as heavy rainfall and heat waves. All When our cities are evaluated, what is seen first and foremost is rapid growth and sprawl. When this situation is evaluated in the context of climate change, it reveals a fragile structure against the negative effects of climate change. Although it varies depending on the form of sprawl, in general terms, the negativities observed are the destruction of agricultural and forest lands, settlement on unsuitable lands, urbanization that does not establish a balance with nature, infrastructure constructions, the need for new resources (water, electricity, natural gas) and increasing demands, increase in transportation demands, automobile dependency and widespread transportation network, increase in impervious surfaces and decrease in green areas. All these factors have a negative impact on the climate, but also cause more damage from the hazards that arise due to changing conditions. Cities that have changed from compact form [3] to fringed form and where planning decisions encourage sprawl our country can be observed throughout. Linear development with fringed form, peripheral city and satellite urban trends are also observed. Cities with sloping topography, fragmented and incompatible sprawl patterns, areas with stream beds and high ground water and areas with flood risk are under serious threat from heavy rainfall. Especially the cities of the Black Sea Region stand out in terms of this threat due to their sloping structures, sprawl tendencies and urban expansion in risky areas. The cities in the region with high flood and inundation risk are the that have experienced high loss of life and property in recent years. On the other hand, while coastal cities in the Mediterranean and Aegean Regions are expanding natural They suffer great losses in the face of heavy rains and storms because they do not observe the balance. Similarly, cities with limited natural areas, no air corridors, concealed water lines and high-density settlements face a serious threat from heat waves. Especially metropolitan cities stand out in terms of this threat due to their widespread urban forms [4], high densities, development tendencies and insensitive practices towards blue infrastructures. Cities showing similar tendencies may cause serious loss of life and health problems in case of a heat wave. In addition, the fact that urban development areas are proposed more than necessary in the spatial plans of the cities is one of the most important issues that increase the risk. It is clear that urban sprawl models designed through plan decisions are the most important threat in the context of climate change and need to be reconsidered. Controlling urban development or spatial planning that is more balanced with nature will be an important adaptation action.

[3] It is a single or multi-focused collective urban development model that allows mixed uses, where different uses can coexist in the land use pattern, has a relatively higher density, and where the most appropriate use of urban land is targeted with construction decisions. Compact cities provide a sustainable use of space by reducing spatial sprawl.

[4] An urban model in which urban activities and functions are located far from each other and transportation between them increases dependence on private and public vehicles. In this model, the development of highways and the presence of vehicles are crucial for urban mobility.

In terms of adaptation in urban built-up areas, priority should be given to storm-related damages, water security, flood risk, management of migration, threat of heat and cold waves, quality of life, air pollution, rapid growth, quality of the built environment and investment projects. In this regard, it is important to create risk maps for climate change-induced disasters and to take these maps into account in spatial planning processes. 829.1 and 829.1 of the 12th Development Plan
Emphasized in policy and measure 829.2. As emphasized in Policy and Measure 831.2, performing data analysis on disasters and integrating them with integrated early warning systems an important action that will increase the adaptation capacity of cities to climate change.

In this framework, adaptation measures can be developed as follows:

- Sensitive areas such as water surface, wetlands, agricultural areas and forest areas should be protected within urban settlements. Urban settlements should not be allowed within a certain distance from sensitive areas.
- Damages due to storms on the coasts are serious. Resilience of coastal settlements, transportation infrastructures such as ports and tourism facilities to climate change should be increased.
- Arrangements should be made in areas where there is a risk of sea swell, flooding due to heavy rainfall and river flooding.
- In the face of increasing water demand and lack of rainfall, projects should be developed for drinking water supply and an improved water governance system should be established.
- Restrictions should be imposed on the built environment in terms of physical characteristics.
- Green buildings in harmony with nature and resilient to climate change should be promoted.
- Planned relocation should be carried out in risky areas.
- In urban areas, ecological repair and restoration should be carried out in places such as waterfronts, valleys and wooded areas.
- Alternative modes of transportation should be developed to shorten public transportation times.
- more resilient and robust urban infrastructure network is needed to cope with climate change impacts.
- Urbanization pressure on agricultural areas and water basins should be reduced.
- Establishment of industrial facilities on agricultural land should be prevented
- Urban green spaces should be protected and increased.
- Transformation should be based on the location choices and impacts of industrial areas.
- Climate sensitivity should be required for investment projects.
- Early warning systems should be established.
- Emergency services should be improved.
- Coordination and cooperation between actors should be ensured.
- Knowledge should be increased, legislation improved and financing opportunities increased.
- State institutions and relevant laws should be made available to take tough measures for urban developments that pose risks.
- All data should be planned to be produced continuously and standardized, and a database should be created.
- Municipalities should increase their budgets to combat climate change.
- Cultural heritage must be protected from climate change.

In addition to the framework and measures described above, since urban areas are very dynamic and complex areas, adaptation actions should be determined within a framework of fiction. In this context, the framework should include climate hazards, urban components affected by these hazards, the prominent problem areas of the cities of our country on a component basis in the face of these hazards, and adaptation actions that include the solution of each problem categories (Figure 5). The actions identified cover and respond to all the issues included in this construct. First of all, the most prominent hazards for the cities of Turkey are highlighted as heat and cold wavesheavy rainfalldroughtstorms and hail. The urban components affected by these hazards are building stock, green areas, technical infrastructure, industrial facilities and transportation systems. For the building stock, the prominent problem areas in the cities of our country due to climate change are illegal buildings, flood risk areas and the buildings located in these areas, material preferences and building densities that are incompatible with the climate, misuse of land, wrong location choices and lack of design guidelines/guidelines. Problem areas related to green areas are inadequate green areas with low accessibility that do not meet per capita standards. The most prominent problem area in terms of technical infrastructure is that capacities remain low in the face of a changing climate. Problems that arise when industrial facilities are considered are facilities under flood and flood risk, wrong location choices and pollutant species densities. Finally, in the transportation component, automobile dependency and limited pedestrian and bicycle access come to the fore. In order to eliminate the problems identified for urban settlements and adapt to the changing climate, three categories of actions are defined: technological actions (hard-gray), social actions (soft) and nature-based (green) actions. Technological actions include applications such as building materials, embankment and infrastructure construction, green roofs and facades, while social actions include training, capacity building, legislative changes, coordination, cooperation and plan development. Nature-based actions include actions such as increasing green areas and protecting existing ones, creating ecological corridors, urban agriculture practices and rainwater harvesting systems. In line with the fiction developed, 3 main strategic objectives were identified to cover the issues specified in each action category and adaptation actions were grouped under these objectives.

Climate hazards	**Kent components**	**Problems**	**Action types**
Heat wave	Building stock	Illegal buildings Risky buildings Incompatible materials Incompatible densities Misuse of space for other purposes Wrong location choices Lack of design guidelines/guidelines	Technological actions: Set construction of building materials Infrastructure construction Green roofs and facades
Cold wave	Green areas	Insufficient amount of space Low accessibility	Social actions Education Capacity building Legislation Coordination Developing cooperation Spatial planning
Severe precipitation	Technical Infrastructure	Low and resistive capacity	Nature-based actions: Green spaces Urban agriculture Ecological corridors Rainwater collection areas
Drought	Industrial facilities	Risky (flood, flood) facilities Wrong location choices Pollutant species	
Storm/hail	Transportation	Automobile dependent structure Limited pedestrian and bicycle access	

Figure 5 Considerations when Identifying Adaptation Actions for Urban Settlements

Strategic Objective 1. Increasing the adaptive capacities and resilience of cities and urban dwellers.

Urban areas at risk of flooding and flooding
and structures Detection, fragile needs of
groups eye in front of considering that
Improvement, Evacuation
corridors its creation, transformation closed escape
lines opening, stream beds stream
creation of protection zones around the perimeter.
KNT2. Building roofs and increasing the resilience of facades against severe weather events, location-specific green roofs, facades and smart building dissemination of applications.
KNT3 Urban infrastructure Improvement,

capacity increasing, Drainage
systems again structuring,
unbundling of combined sewerage (rainwater, wastewater) systems, use of smart systems (monitoring by means of sensors).
KNT4. City climate monitoring stations evaluation of its establishment.

Revising legislation and plans to increase adaptation capacity to climate change**.**

Review and revise the zoning legislation in the context of climate change
to be for the implementation of the program.

KNT6. Within the scope of adaptation to climate change, climate data, includingsuch as site selection, spatial planning, urban design, prevailing wind direction, passive ventilation and insolation, construction and implementation.
Consideration field router
Guidelines
Development.

KNT7. Spatial data for urban areas
using risk maps.

KNT8. New construction and revision
requiring each level spatial
plans and plan-making processes, local
reviewing and revising climate change action plans and analyses.

Strategic Goal 3. Ensuring sustainable urbanization that is balanced with nature and climate resilient.

KNT9. Create green (ecological) corridors with new parks, groves, afforestation areas and planted gardens with accessible and dense natural surfaces within the urban fabric; transform unused (brown) areas/buildings into green areas or emergency shelter areas/spaces; green corridors on the periphery of urban settlements and between industrial zones and settlements
its creation.

KNT10. Protect existing water surfaces; create rain ditches and natural water surfaces in urban and peri-urban areas; design public spaces with a that collects water during heavy rainfall and transfers it to a storage system
transformation.

Establishing sub-centers and pedestrian zones with a pedestrian-oriented approach for sustainable urban transportation, carrying out pedestrianization projects, and implementing climate change projects such as extreme temperatures.
to be compatible with its effects.
KNT12. In fertile agricultural lands in urban areas
urban Agriculture
applications
and the creation urban gardens.

SOURCE Kent

Aydın, M. B., Erdin, H. E., & Kahraman, E. D. (2017). Identification of Regions Bearing RiskClimate Change in Terms of Spatial Structure CharacteristicsIzmir Planning, 274-285. doi: 10.14744/planlama.2017.61587

Emmanuel, R. (2005). An Urban Approach to Climate-Sensitive Design, Strategies System Tropics. Spon Press USA. DOI: https://doi.org/10.4324/9780203414644

Gartland, L. (2008). Heat Islands, Understanding and Mitigating Heat in Urban Areas. Earthscan UK and USA. DOI: 10.1080/07293682.2011.591742

Givoni, B. (1998). Climate Considerations in Building and Urban Design. Van Nostrand Reinhold New York

Herrmann, J., & Matzarakis, A. (2010). Influence of mean radiant temperature on thermal comfort of humans in idealized urban environments. https://www.urbanclimate.net/matzarakis/papers/BIOMET7_Herrmann_Matzarakis_5 Retrieved from 22_527.pdf.

Krellenberg, K., & Turhan, E. (2017). How to respond to climate change at the local level : a guideline for Turkish cities. https://www.econstor.eu/handle/10419/171261Retrieved from

Sass, R. L. (n.d.). It is not cool to be hot in Houston. Retrieved March 1, 2022, from Department of Ecology & Evolutionary Biology. Retrieved from http://www.ruf.rice.edu/~sass/UHI.html.

Talu, N. (2019). Local Climate Action Planning and Practices in Turkey. Ankara. https://www.iklimin.org/moduller/kent-yiep.pdfRetrieved from

Talu, N., & Kocaman, H. (2022). PoliciesLegal and Institutional Structure in Combating Climate Change in Turkey. Climate Change Training Modules. Retrieved from

TCDIB-a (Republic of Turkey Ministry of Foreign Affairs) (2022). UN Framework Convention on Climate Change: Retrieved from https://www.mfa.gov.tr/bm-iklim-degisikligi-cerceve-sozlesmesi.tr.mfa.

TCDIB-b (Republic of Turkey Ministry of Foreign Affairs) (2022). Kyoto Protocol. Retrieved from https://www.mfa.gov.tr/kyoto-protokolu.tr.mfa.

TCDIB-c (Republic of Turkey Ministry of Foreign Affairs) (2022). Paris Agreement. Retrieved from https://www.mfa.gov.tr/paris-anlasmasi.tr.mfa.

UNEP (2022). Taking action now can secure our future. Retrieved https://unepccc.org/new-ipcc-report-from taking-action-now-can-secure-our-future/

ó ó a WATER KAYAKS

Ø YÖNETINI

climate adaptation

3.1. GENERAL FRAMEWORK

In 2022, 57 billion m3 of water will be used for 44
billion m3 (77%) was used for irrigation water, while 13 billion m3 (23%) was used for drinking-utilization and industrial water.

Climate change affects the relationship between the atmosphere, hydrosphere and biosphere and causes changes in the hydrological cycle. Turkey is geographically located between the temperate zone and the subtropical zone, and its location and landforms have led to the formation of different climatic characteristics. While more temperate climate characteristics are observed in the coastal regions due to the sea effect, continental climate characteristics are observed in the inland areas where the sea effect is prevented from reaching due to the high mountains lined up parallel to the coasts. This situation causes regional differences in Turkey's precipitation regime.

Turkey's average annual precipitation for the period 1991-2020 is 573.4 mm, which corresponds to an average annual precipitation volume of 450 billion m^3. The Eastern Black Sea Region receives the most precipitation (1,200-2,500 mm/year), while the Central Anatolia Region (around Salt Lake) receives the least precipitation (250-300 mm/year). Except for the coastal settlements in the Mediterranean and South Aegean regions, the rest of Turkey receives snowfall in winter (DSİ, 2021a).

In addition to the differences in precipitation regime, increasing temperatures also affect the hydrological cycle and the location, time, duration and intensity of precipitation are adversely affected. With the climate projections prepared for Turkey, it is estimated that climate change will increase the variability of precipitation and thus directly affect the potential and availability of water resources. In addition, it is predicted that there will be an increase in disasters such as floods and floods due to the possibility of drought and water scarcity and changes in rainfall intensity.

In the projections until 2100, winter precipitation is to fall more in the form of rain and snow cover is expected to melt more rapidly and join the surface runoff due to the increase in temperatures. At the same time, the distribution of precipitation throughout the year, i.e. its intensity and frequency, is to change or shift. Precipitation is predicted to fall more as rain rather than snow and the snowpack is expected to melt faster, causing water shortages when water is needed most, especially in regions where urban and agricultural water needs are regulated by the snowpack at high altitudes throughout the year (Republic of Turkey Ministry of Development, 2018).

Turkey's current average annual flow of water is 185.37 billion m^3. This amount is the average volume of precipitation
corresponds to 41.2%. The groundwater recharge amount calculated and reported as a result of hydrogeological surveys is 23.0 billion m^3 and the groundwater operating reserve is 17.8 billion m^3 (DSİ, 2021).

Within the framework of today's conditions, the surface water potential that can be consumed for various purposes is 94.0 billion m^3 per year on average. Together with 18.0 billion $m^{(3)}$ of groundwater potential, the consumable surface and groundwater potential of our country is 112.0 billion m^3 on average per year (DSİ, 2021a). As of 2021, the water used constitutes 52.2% of the consumable surface and groundwater potential.

By the end of 2022; 18.055 billion m3 the groundwater reserve has been allocated. 12.168 billion m3 for irrigation purposes (4.642 billion m3 Irrigation Cooperatives-DSİ Irrigations - Public Irrigations, 7,526 billion m3 individual irrigations), 4,259 for drinking water purposes billion m3 and 1.628 billion m3 of groundwater was allocated for industrial purposes.

Approximately 35% of Turkey's 24 million ha agricultural area is economically irrigable (8.5 million ha). By the end of 2021 this area is about
Irrigated agriculture is practiced on 80.6% (6.85 million ha). Approximately 3.54 million ha of this area was constructed by DSİ (DSİ, 2022).

Looking at sectoral water use, according to 2022 statistics, total annual water consumption in our country is 57 billion cubic meters, of which 44 billion (77%) cubic meters is used for agricultural irrigation purposes, 13 billion cubic meters (23%) is used for drinking-utilization (12%) and industrial purposes (11%).

Table 3 Sectoral Water Uses as of 2018

Sector	Surface+ Groundwater (billion m^3/year)	Utilization Rate
Irrigation	43,95	%80
Drinking-Use	6,584	%12
Industry	4,418	%8
Total	**54,952**	**%100**

Source : TURKSTAT

In Turkey, the highest water use is realized in the agricultural sector. It is foreseen that disasters such as drought and water scarcity due to climate change have negative impacts primarily on provinces whose economies are based on agriculture and have large irrigation areas. Within the scope of irrigation projects developed by DSİ as of 2018, the total irrigation area is 3,334,521 ha and provinces are grouped according to the size of their agricultural areas. Giresun, Istanbul and Yalova have irrigation areas below 1,000 ha. In 35.8% of the provinces (29 provincesirrigation areas of 10,000-
50,000 ha of irrigation area. The irrigation areas of the provinces were evaluated taking into account the ratio of the total irrigation area developed by DSİ as of 2018 (DSİ, 2021).

Accordingly, the provinces with the highest irrigation area in total irrigation area are Şanlıurfa (9.56%), Konya (9.10%) and Adana (7.44%).
provinces. Irrigation areas in these provinces are over 250,000 ha. As of 2018, no irrigation projects have been realized in Ardahan, Artvin, Bartın, Hakkari, Ordu, Rize, Siirt, Trabzon and Zonguldak provinces.

In Turkey, 77% of sectoral water use is used for agricultural activities. Efficient and economical use of water used in agriculture is very important both for the efficient use of water resources and for adaptation to climate change. Among irrigation methods, the highest water loss (35%-60%) occurs in surface irrigation. In sprinkler and drip irrigation (piped system) methods, water loss is less (5%-25%). As of 2018, 73.4% of the irrigation systems applied in irrigations larger than 1000 ha constructed by DSİ are irrigated with conventional and canalized systems, while 26.6% are irrigated with piped systems.

At the provincial level, the ratio of the area irrigated with closed (piped) system in irrigation developed by DSİ as of 2018 to the total irrigation area of the province was evaluated (DSİ, 2021). Accordingly, provinces are grouped. 23 provinces do not have a closed (piped) irrigation system (31.9%). Irrigation with closed (piped) system

Aksaray, Eskişehir, Karaman and Niğde are the provinces with less than 5% of the irrigated area. There are 6 provinces where the ratio of the area irrigated with closed (piped) system is above 50%. These provinces are Balıkesir, Adıyaman, Gaziantep, Muğla, Tunceli and Batman. Batman has the highest rate with 96.4%.

Within the scope of efficient use of water, water losses should be reduced and water saving should be ensured by giving the plant as much water as it needs. The ratio of total plant irrigation water requirement to the amount of water taken from the water source to the network is called "irrigation efficiency". When it is aimed to provide water to the plant as much as the irrigation water requirement, the irrigation efficiency will also increase. Pursuant to the Regulation on the Control of Water Use in Irrigation Systems and Reduction of Water Losses, it is aimed to increase the irrigation efficiency to 55%. Accordingly, the ratio of irrigation areas with an irrigation efficiency above 55% to the total irrigation area of the province in irrigations developed by DSİ as of 2018 at the provincial level was evaluated (DSİ, 2021). Accordingly, provinces were grouped and irrigation efficiency in irrigations in 30 provinces

It was observed that it was below 55% (41.7%). The provinces where the ratio of irrigation areas with an irrigation efficiency above 55% to total irrigation area is below 10% are Adana, Afyonkarahisar, Edirne, Elazığ, Muğla, Nevşehir, Niğde, Sinop and Tokat (12.5%). There are 6 provinces with an irrigation area ratio above 50%. These provinces are Aksaray, Burdur, Bursa, Tekirdağ, Aydın and Mardin (8.4%). Aydın has the highest rate with 88.7%.

Climate change is expected to have negative impacts on drinking and potable water resources. Urban population growth also the demand for water. Therefore, it is foreseen that drought and water scarcity hazards will affect provinces with high annual total water withdrawal and per capita water use more By provinces

As of 2018, 6,193.16 hm$^{(3)}$ of water for drinking purposes at municipal level was withdrawn from surface and groundwater resources and lakes. Of the water withdrawn for drinking purposes, 46.5% was from surface water sources and 53.5% from groundwater sources. 59 out of 81 provinces (72.8%) utilize surface and groundwater resources. 22 provinces (27.2%) use only groundwater for drinking and potable water (TurkStat, 2021a).

Provinces are grouped according to their annual drinking and potable water withdrawals. Population size and loss rates are the most important factors in determining the amount of water withdrawal. In 2022, the average loss rate in drinking water systems in our country is 32% and the total amount of water taken into the drinking and utility network across the country is approximately 6.08 billion cubic meters. About 2.2 billion cubic meters of this water was lost before reaching the user. The lowest water withdrawal is less than 10 hm^3 per year in Ardahan, Artvin, Bartın, Bayburt, Gümüşhane, Hakkari, Iğdır, Kilis and Tunceli (provinces

11.1%), the ratio of water withdrawn by these provinces to total water withdrawn is between 0.07%-0.13%. In 29.6% of the provinces (24 provinces), water withdrawals are between 10.01 and 25 hm$^{(3}$The provinces with the highest water withdrawals are Istanbul (1,041 hm$^{(3)}$)), Ankara (475.2 hm$^{(3)}$)) and Izmir (324.6 hm$^{(3)}$)). The ratio of drinking and potable water withdrawn by these provinces to total annual water withdrawal is 16.8%, 7.8% and 5.2%, respectively (TurkStat, 2021a).

As of 2018, municipality-level use of YAS for drinking and potable purposes was 2,878.5 hm^3, this amount of all withdrawn water

46.48% (TurkStat, 2021a). Provinces are grouped according to the ratio of the annual amount of drinking-utility water withdrawn from surface water wells to the total amount of water withdrawn from all sources (surface water wells, RWS, lake). In 27.2% of the provinces (22 provinces), drinking-utilization water only from

The lowest use of YAS is in Ankara, Diyarbakır, Eskişehir, İstanbul, Kırıkkale, Trabzon and Yalova. The lowest use of YAS is in Ankara, Diyarbakır, Eskişehir, İstanbul, Kırıkkale, Trabzon and Yalova and the annual rate is less than 10% (of the provinces
8.6%), the ratios of groundwater withdrawn by these provinces to total withdrawn water
between 0.04% and 9.4%. Surface water resources are mostly used in these provinces.

The average daily water withdrawal per capita by municipalities in Turkey is 224 l/person/day (TurkStat, 2021a). Provinces are grouped according to the average daily water withdrawal per capita. The lowest amount of water withdrawn per capita is in Hakkari (117 l/person/day). Hakkari is followed by Iğdır (130 l/person/day) and Diyarbakır (147 l/person/day). The number of municipalities with average water withdrawals between 200-250 l/person/day is 30, representing 37% of all municipalities. The province with the highest per capita water withdrawal is Kars with 461 l/person/day. Kars is followed by Muğla (403 l/person/day), Ardahan (382 l/person/day), Kahramanmaraş (357 l/person/day) and Trabzon (355 l/person/day).

Water losses occurring in drinking and utility water transmission lines are divided into physical and administrative water losses; the total these losses is expressed as total water loss. In general, about 60% of total water losses are physical water losses and about 40% are administrative water losses (Muhammetoğlu & Muhammetoğlu, 2017).

Considering that it may give an idea about the water losses of the provinces, the difference of the amount of water withdrawn by the municipalities to the drinking and potable water network to the amount of water distributed through the drinking and potable water network as of 2018 was taken and this figure was divided by the amount of water withdrawn. According to TurkStat data, as of 2018, the total amount of water withdrawn by municipalities was 6,193.2 hm$^{(3)}$) and the amount of water distributed was 4,045.5 hm$^{(3)}$) (TurkStat, 2021a). Throughout Turkey municipalities

The ratio of the difference between withdrawn and distributed water to withdrawn water is 34.7%. According to the evaluation, provinces are grouped. The ratio of the difference between withdrawn and distributed water is between 10-20% per year in Afyonkarahisar, Aydın, Bingöl, Karabük, Kırıkkale, Manisa, Nevşehir, Osmaniye, Tunceli and Uşak (12.3% of the provinces). In 23.5% of the provinces (19 provinces), this rate is between 35-40%. The highest rate
Mardin with 79.4%. This province is followed by Batman, Trabzon, Erzurum and Kahramanmaraş. The ratio of withdrawn-distributed water difference in these provinces is
59.3%, 58%, 57% and 55.6%.

Access to healthy and clean water is a fundamental human right. Access to clean water and infrastructure services in cities are important for quality of life and public health. Within the scope of reliable water supply and protection of water quality, drinking water treatment and wastewater treatment and facilities should be operated properly, necessary drinking and potable water networks and sewerage networks should be put into service and discharges to the receiving environment should be made in accordance with the criteria. According to TurkStat data, as 2018, 1,397 out of 1,399 municipalities were served by drinking and potable water networks. The ratio of the municipality population served by drinking and potable water network to the total municipality population is high across Turkey and is 98.6% on average (TurkStat, 2021a). Provinces are divided into 8 groups according to this ratio. Mardin has the lowest rate with 86%. In 30.9% of the provinces, this ratio is 88%-
98% (25 provinces). In 67.9% of provinces, this rate is above 98% (55 provinces).

According to TurkStat data, as of 2018, 443 out of 1,399 municipalities (31.7%) were served by drinking and potable water treatment plants (TurkStat, 2021a). One reason for the low rate is that the drinking and potable water withdrawn by municipalities is mostly supplied from groundwater springs and wells of good quality. Municipalities served with drinking and potable water treatment plants

The ratio of municipality population to total municipality population is 60.1%. According to this ratio, provinces are divided into 10 groups. The proportion of provinces without drinking and potable water treatment plants is 22.2% (18 provinces). In 16 of these provinces, only groundwater is used. The province with the highest rate is Istanbul. All of the water used in this province is treated in drinking and potable water treatment plants. Including Istanbul, Adana, Ankara, Diyarbakır, Eskişehir, Karabük, Kırıkkale, Kilis, Kocaeli and Yalova (11.1% of provinces) are the municipalities where more than 80% of the municipal population is served by drinking and potable water treatment plants.

According to TurkStat data, as of 2018, 1,357 out of 1,399 municipalities (97%) were served by sewerage networks. The ratio of municipality population served by sewerage network to total municipality population is high across Turkey and average
90.7% (TurkStat, 2021b). According to TurkStat data, 644 (46%) of 1,399 municipalities were served by wastewater treatment plants as of 2018. The ratio of municipal population served by wastewater treatment plants to the total municipal population is 78.7% (TurkStat, 2021b).

As of 2018, the amount of wastewater discharged to the receiving environment is 4,795.1 hm^3. The amount of wastewater treated is 4,236.4 hm^3. Ratio of treated wastewater to discharged waste water
88.4% (TurkStat, 2021b). Provinces are grouped according to this rate. The proportion of provinces without a treatment plant is 8.6%. In provinces where the ratio of treated wastewater to discharged wastewater is 99%, all of the discharged wastewater is considered as treated. The rate of these provinces is 17.3%.

Dams are constructed for drinking-utilization, irrigation, power generation, industrial use and industrial use, aiming to provide water supply during dry and dry periods and to reduce flood risks during rainy periods by regulating the flows from rivers in order to reduce the impact of changes in precipitation regime on water resources. are water storage structures constructed for flood control purposes. Hydrological, topographical and geological-geotechnical characteristics of the selected location are important in the construction of these structures.

Dams and ponds constructed by DSİ by provinces as of 2018 (DSİ, 2021) are grouped according to their number. In 25.9% of the provinces, facilities with 10-20 storage facilities have been constructed. Provinces with two or less storage facilities are Ağrı, Ardahan, Bartın, Batman, Bitlis, Düzce, Muş, Siirt, Trabzon, Yalova and Zonguldak (13.6%). Provinces more than 50 storage facilities are Afyonkarahisar, Balıkesir, Edirne, Konya and Sivas (6.2%). There are no storage facilities constructed by DSİ in Rize.

The impact of climate change on water resources is also reflected in dam occupancy rates. Dam occupancy during dry periods in rates declines are observed.

Constructed by DSİ and active water volume
For dams of 3 million m^3 and above, although the opening years are different, the average occupancy rates were evaluated according to the availability of data between 2010 and 2019 (DSİ, 2021). Looking at the 10-year change, it is seen that the average annual occupancy rate of dams has changed around 40%. The occupancy rate of dams decreased to approximately 29% in 2014.

Provinces without dams with the determined active volume are Bartın, Bitlis, Giresun, Hakkari, Iğdır, Karabük and Sakarya. In the assessment, provinces were grouped according to their occupancy rates. In 83.6% of the provinces (60 provinces), the average occupancy rate of dams was below 50%. During the selected period, the lowest average occupancy rates were realized in the dams in Adıyaman (7.7%) and Niğde (7.8%). The highest occupancy rate was
It was realized in Trabzon with 94.2%.

Impacts of climate change on the incidence of floods, floods/floods size and can cause a change in their frequency. In addition, changes in land use, unplanned urbanization, interventions in stream beds, inadequate infrastructure, etc. also increase the effects of these disasters. Floods are among the most frequently experienced disasters in our country.

According to MGM data, as of 2021, provinces are grouped according to the total number of floods/inundation events occurring on provincial basis in Turkey (MGM, 2021). Provinces 19.8% (16 provinces) of the provinces experienced between 11-20 floods and 19.8% (16 provinces) experienced between 51-75 floods. The least number of (2 incidents) occurred in Bayburt (1.2%). Provinces with more than 100 flood/inundation incidents are Balıkesir, İstanbul, İzmir, Konya, Muğla, Rize and Antalya (8.6%). Antalya had the highest number of floods/inundation incidents (163 incidents).

Flood control activities within the scope of protecting the socio-economic structure in Turkey are carried out by relevant institutions, primarily DSİ, and municipalities.

As of 2018, the number of flood control facilities in operation within the scope of structural measures by provinces was evaluated (DSİ, 2021). As of 2018, flood control facilities in operation

Provinces are grouped according to their numbers. Provinces 30.9% of the provinces have 100-150 flood control facilities (25 provinces). Provinces with 25 or less facilities are Batman, Hakkari, Iğdır, Istanbul, Karaman, Kilis and Şanlıurfa (8.6%). Provinces with more than 200 flood control facilities are Afyonkarahisar, Ankara, Bursa, Edirne, İzmir, Konya, Sivas and Erzurum (9.8%). Erzurum has the highest number of flood control facilities with 392.

Within the scope of flood control works, the flood control facilities constructed as of 2018 and the areas protected from flooding were evaluated (DSİ, 2021). Provinces were grouped by calculating the ratio of the size of flood-protected areas to the area of the province. In 19.8% of the provinces, the areas protected from flooding exceed the area of the province.
between 10‰ and 25‰ (16 provinces). Ardahan, Batman, Bitlis, Diyarbakır, Hakkari, Kars, Kars, Kilis, Malatya, Mardin, Ordu, Siirt and Van (14.8%) are the provinces with flood-protected areas less than 1 ‰ of the provincial surface area. Provinces with areas protected from flooding
Adana, Iğdır and Osmaniye (3.7%) are the provinces with a rate greater than 100 ‰.

3.2. SECTORAL LEGAL FRAMEWORK AND RESPONSIBLE INSTITUTIONS

Many institutions and organizations with authority and responsibility in water resources management coordination between institutions due to the existence of an organization strengthening, uniformity in authorization, permission, inspection and sanction processes It is important to make arrangements to ensure this.

Water management in Turkey has a centralized structure. Strategic decisions and plans at the national level are taken centrally, and the decisions and plans are implemented by the provincial units of the relevant ministries and local administrations. Within this administrative structure, there are many institutions and organizations directly or indirectly related to water management in different roles and at different levels. These institutions and organizations can be categorized at three administrative levels: national, regional and provincial.

At the national level, the Presidency of Strategy and Budget (PSB), Ministry of Agriculture and Forestry (MoAF), Environment, Urbanization and Climate Change (MoEUCC, Ministry of Energy and Natural Resources, , Ministry of andTourism, Ministry of Industry and Technology, Ministry of Transport and Infrastructure, Ministry of Interior, and DED are at the decision-making level.

The main institutions that carry out their activities at national level but also at regional/basin level are the General Directorate of State Hydraulic Works (DSI), General Directorate of Water Management (GDWM), General Directorate of Forestry (GDoF), General Directorate of Meteorology (MGM) and İLBANK. At the provincial level, the provincial directorates of the relevant ministries, Special Provincial Administrations, Metropolitan Municipalities, Water and Sewerage Administrations (SUKI), Provincial and District Municipalities, irrigation unions and cooperatives, chambers of industry and commerce, private sector representatives and representatives of non-governmental organizations.

In the process of harmonization with the European Union acquis, various studies have been carried out to develop a river basin management model for transition to integrated and sustainable water management in Turkey. The European Union Water Framework Directive is one of the most important pieces of legislation ever adopted in the field of environment. One of the most important requirements of the Water Framework Directive (WFD) is the adoption of a "river basin management" approach through the designation of "river basin areas" and the appointment of "competent authorities" to manage them.

"By-Law on Preparation, Implementation and Monitoring of Basin Management Plans" was published on October 17, 2012 in order to ensure basin-based management. In 2017 and 2019, revisions were made to this regulation. On January 8, 2019, the Communiqué on the Establishment, Duties, Working Procedures and Principles of the Central Basin Management Board, Basin Management Committees and Provincial Water Management Coordination Boards was published and basin-based management efforts are ongoing.

Within the scope of basin-based management, a Central Basin Management Board was established at the central level, with the Water Management Coordination Board at the highest level. Basin Management Committee was established at basin level and Provincial Water Management Coordination Board was established at provincial level.

Within the management structure; Provincial Water Management Coordination Boards submit the implementation follow-up table of basin-scale management plans to Basin Management Committees. Basin Management Committees are composed of Provincial Water Management Coordination Boards and relevant institutions or organizations. that he made evaluates the activities and submits the meeting minutes and reports to the Central Board of Basin Management. Central Board of Basin Management delegation from basins

The Water Management Coordination Board discusses the agenda items created according to the reports and submits them to the Water Management Coordination Board.

The institutions in Turkey that have direct and indirect roles in water resources management are summarized below.

The organization, duties and powers of the Ministry of Agriculture and Forestry are set out in Articles 410 to 440 of Presidential Decree No. 1. The Ministry was created in 2018 by merging the Ministry of Food, Agriculture and Livestock with the Ministry of Forestry and Water Affairs.

In summary, the Ministry is tasked with plant and animal production and food safety, protection of soil, water resources, forests and biodiversity, raising awareness of farmers, regulation of agricultural markets, farmer training, etc.

The duties of the General Directorate of Water Management include; To carry out studies to determine policies for the protection, improvement and utilization of water resources, to prepare and have prepared river basin management plans on basin basis in order to protect and improve the ecological and chemical quality of the aquatic environment by considering the balance of protection and utilization of water resources, including coastal waters, to carry out legislative studies on integrated river basin management, to follow up the processes arising from international conventions and other legislation on the protection and management of water resources, To carry out works related to transboundary and boundary-forming waters in cooperation with the relevant institutions and to carry out studies on the impact of climate change on water resources and to determine protection plans and special provisions for surface and ground waters from which drinking-utilization water is supplied or planned to be supplied, to set targets, principles and receiving environment standards for the protection of the quality and quantity of surface and ground waters with the relevant institutions and organizations to determine water quality, to monitor or have water quality monitored, and to carry out the secretariat service of the National Water Board.

The issues related to the reduction of water losses are addressed in the Regulation on the Control of Water Losses in Drinking Water Supply and Distribution Systems published in the Official Gazette No. 28994 dated 08.05.2014 (Amended O.G:30874, dated 31.08.2019). Article 9 of this Regulation states that "Metropolitan and provincial municipalities shall reduce water losses to a maximum of 30% until 2023 and 25% until 2028; other municipalities shall reduce water losses to a maximum of 35% until 2023 and 25% until 2028.
30% by 2033, and to a maximum of 25% by 2033." As per the 2017 Regulation on the Control of Water Use and Reduction of Water Losses in Irrigation Systems, it is aimed to increase irrigation efficiency above 55%.

In the 12th Development Plan, "880.2. Water loss rate and non-revenue water targets will be determined with the real value of water by using economic leakage level indices." and "880.3. for activities will be supported." The issue of combating water losses is mentioned in the policy measures.

The duties of the General Directorate of State Hydraulic Works include irrigation facilities, flood control facilitiesdrinking water and sewerage projects within the scope of planning and development of water resources, conducting studies on transboundary and border-forming waters, water allocations, monitoring the quality of surface and groundwater, erosion and sediment control, land consolidation and in-field development services and hydroelectric power generation.

Among the duties of the General Directorate of Agrarian Reform are; efficiency in agricultural irrigation, protection of soil resources, determination of the principles of establishment of soil and irrigation water analysis laboratories, analysis of land, soil and water resources and soil, land and water classification.

The General Directorate of Agricultural Research and Policies is responsible for conducting research on the development and rational use of soil and water resources, and conducting scientific research on aquaculture in seas and inland waters.

The duties of the General Directorate of Fisheries and Aquaculture include the protection of fisheries and aquaculture resources, conducting or commissioning scientific research on aquaculture in seas and inland waters, determining production and aquaculture areas and taking measures to protect these areas from damage.

The duties of the General Directorate of Nature Conservation and National Parks include the identification of national parks, nature parks, nature monuments, nature conservation areas and wetlands, the protection, development and management of those registered by the Ministry of Environment, Urbanization and Climate Change, the protection of wildlife and in-forest water resources, streams, lakes, ponds and wetlands.

The duties of the Water Institute of Turkey include directing and following up future studies on water, developing the short and long term water management strategy of our country, developing sustainable water policies and developing the necessary means and tools to produce strategies to solve global water issues, conducting scientific research in order to develop national and international water policies, conducting national and international water related researches, developing national and international water policies.

To follow the work of international organizations, information production and statistical activities and other external developments and to cooperate with foreign institutions and organizations on issues within the scope of the Institute's mandate.

The duties of the General Directorate of Environmental Management of the Ministry of Environment, Urbanization and Climate Change include determining and ensuring the implementation of procedures and principles regarding pollutant elements and the elimination and control of pollution in order to protect ground and surface waters, seas and soil, prevent or eliminate pollution, and to make and have emergency response plans made.

The duties of the General Directorate of Environmental Impact Assessment, Permitting and Inspection monitoring receiving environmentsestablishing the relevant infrastructure, and determining measurement and analysis criteria for environmental pollution.

Among the duties of the General Directorate of Local Administrations; Water and sewerage of local administrations Infrastructure The duties and services assigned by the legislation regarding its business and operations, such as realizing its services, are to perform, follow up, finalize and develop.

General Directorate for Combating Desertification and Erosion is responsible for carrying out plans and projects for combating desertification and erosion, avalanche, landslide and flood control and integrated basin improvement plans and projects based on basin integrity in order to protect the soil, develop natural resources and combat climate change.

Among the duties of the General Directorate for the Protection of Natural Assets; determining the procedures and principles regarding the registration, approval and announcement of national parks, nature parks, nature monuments, nature conservation areas, wetlands and other areas with similar protection status and determining the procedures and principles regarding the determination, registration, approval, amendment and announcement of natural assets and natural protected areas and special environmental protection zones

To determine, manage and ensure the management of the procedures and principles and to determine the principles for the use and structuring of national parks, nature parks, nature monuments, nature conservation areas, natural protected , wetlands, special environmental protection zones and other areas with similar protection status and to make, have made, amend, approve, implement or ensure the implementation of all types and scales of environmental layout, master and implementation development plans.

The General Directorate of Meteorology is directly tasked with conducting studies and investigations to determine the climatic characteristics of Turkey, archiving and publishing the information obtained. The institution was established to open and operate meteorological stations, make and evaluate observations, make weather forecasts for various sectors and provide meteorological information support.

The duties of İller Bankası Anonim Şirketi (İLBANK) include financing drinking water supply, wastewater and storm water projects of local governments from national and international sources and providing technical support for project preparation, implementation and management processes.

The Disaster and Emergency Management Presidency (AFAD), a subsidiary of the Ministry of Interior, is in charge of taking the necessary measures for the effective realization of services related to disasters and emergencies, including floods and floods, at the national level, and ensuring the coordination of the preparation and risk reduction before the occurrence of the disaster, the intervention to be carried out during the disaster and the work to be carried out afterwards. AFAD and DSİ conduct joint surveys in areas of potential danger in order to reduce flood and flood losses before disasters, and as a result of these surveys, flood control facilities related to the reclamation of streams They are designed and constructed by DSİ. However, the works and procedures related to the transfer of the structures that are located within the flood boundaries and cannot be protected by the flood control facilities constructed by DSİ to an area without disaster risk are carried out by AFAD. In addition, Special Provincial Administrations are also involved in intervention during disasters and recovery activities after disasters and provide support under the coordination of AFAD.

The duties of the Ministry of Health General Directorate of Public Health include monitoring and inspecting the quality of drinking and potable water, inspecting swimming pools and monitoring water quality, permitting the sale of packaged water, conducting market surveillance and inspection activities, monitoring and classifying the quality of bathing water and informing the public in order to protect and improve public health, reduce and prevent disease risks.

Ministry of Industry and Technology; determination of industrial policy, establishment of industrial zones and sites, supervision of these organizations, inventory of industrial enterprises, collection of statistical informationand evaluation.

The Ministry of Transport and Infrastructure is responsible for preparing plans and programs of railways, ports, harbors, shelters and related equipment and facilities, coastal protection structures, coastal structures and facilities and related facilities to be built by the state in cooperation with relevant institutions.

The Ministry of Foreign Affairs, in coordination and cooperation with the executing institutions and organizations in bilateral and multilateral platforms, follows up the developments in the field of water, conducts negotiations in accordance with Turkey's transboundary water policy, harmonizes with the relevant legislation of the European Union and is responsible for the realization of activities for its implementation.

TurkStat's duties include the compilation of data and information on water and wastewater, production, publication and dissemination of necessary statistics.

. Policies and priorities in the field of water management are determined within the scope of the Development Plan, Medium Term Program and Presidential Annual Program prepared under the coordination of the Presidency of Strategy and Budget. The Development Plan serves as the main policy document for the preparation of sectoral plans and programs in the field of water management. Strategy and Budget Directorate to ensure that the strategic plans of public administrations are prepared in accordance with the development plan, the policies set by the President and the goals and objectives set out in the medium-term program, and to monitor their implementation and It is tasked with ensuring that it is prepared in accordance with the policies and the goals and objectives set out in the medium-term program, monitoring its implementation and evaluating its results.

3.3. EFFECTS OF

Climate changeby reducing the availability of and accessibility to water resources, increases vulnerability and has negative impacts on water-dependent sectors.

While the demands on water allocation and use are increasing day by day, water resources are decreasing and water quality is deteriorating (MoAF, 2018).

Changes in the precipitation regime that may occur with the increase in temperature values due to climate change are estimated to negatively affect the availability of water resources through changes in precipitation distribution, snowmelt, soil moisture, river and groundwater supply. Climate change increases the vulnerability of water resources by reducing the availability of and accessibility to water resources, leading to negative impacts on water-dependent sectors. Drought and water scarcity due to increasing temperatures and decreasing precipitation, and floods and inundations due to increasing precipitation are projected to pose risks on socio-ecological systems.

The risks that may arise as a result of the decrease in soil moisture, increase in evaporation, decrease in river flows, groundwater levels and dam storage levels due to drought effect caused by decrease in precipitation amount and increase in temperature can be listed as follows:

- Decrease in potable water resources, inability to meet household water needs,
- Ecosystem water not being able to meet its needs,
- Pollution of water resources,
- Failure to meet agricultural irrigation water needs, decrease in crop yields,
- Economic losses as a result of failure to meet energy production and industrial needs,
- Economic losses resulting from the inability to meet sectoral needs such as trade, tourism, recreation, mining, animal husbandry, transportation and transportation.

Floods and inundations that occur as a result of heavy rainfall pose a risk on flood-affected properties (houses), agricultural areas, socio-economic elements (energy facilities, infrastructure facilities, roads, hospitals, schools, factories, trade areas, shopping centers, etc.), especially loss of life.

It is estimated that climate change will also affect water demands for drinking-utilization, agriculture, energy, industry, etc. The pressure on water resources is increasing due to the growing urban population. Agriculture is the leading sectoral water use in the world with an average of 70%. Due to population growth, food security, urbanization, economic growth, land use preferences and climate change, inter-sectoral competition for water resources is expected to increase.

In Turkey, water is mostly used in the agricultural sector (about 77%). Approximately 76% of the water used in agriculture comes from surface water and 24% from groundwater. This puts pressure on surface and groundwater. When DSİ irrigations are analyzed, surface irrigation methods are used in about 60% of irrigations, where water 35%-35%.
between 60%. However, irrigation efficiency remains at 51%. Climate change will affect agricultural areas, crop yields and animal husbandry.

an increase in droughts and other extreme climatic events, leading to a decrease in yields assurance It is foreseen that climate change will affect water resources. For this reason, within the scope of vulnerability and risk analysis studies regarding drought and water scarcity that will be experienced as a result of the negative impact of climate change on water resources, the agriculture sector has priority within the scope of adaptation studies in terms of its water saving potential.

Cities increase their attractiveness depending on their socio-economic development. In addition to increasing population and land use decisions, employment decisions are also important issues affecting urban water demand. In drought and water scarcity conditions, there are difficulties in meeting urban water demands and water shortages are experienced. The use of packaged water has become widespread in cities. As a result of unplanned construction, increase in impervious surface areas and interventions in stream beds, the impact of floods and inundations increases, resulting in loss of life and property. The urban poor are particularly affected by this situation. While water loss rates in our country are high compared to developed countries at 32%, the rate of non-revenue water
40% in urban areas. This highlights the importance of vulnerability and risk analyses for drought, water scarcity and flooding in cities, as well as adaptation efforts for water conservation and flood control.

Untreated water discharged into the receiving environment causes pollution in water resources. Decrease in river flows and decrease in water levels in lakes cause deterioration in water quality due to the presence of nutrients and pollutants in less volume of water. The increase in water temperatures decreases the amount of dissolved oxygen, which directly affects water quality. Long lasting drought causes pollutants to accumulate on the soil surface, which poses a risk to the quality of water resources when rainfall begins.

Another important factor is that heavy rainfall intensively carries sediments, point and diffuse pollutant sources to river beds. During floods, the risk of deterioration of the quality of water resources increases, especially as a result of sewage overflow and runoff from agricultural areas and urban runoff.

Droughts and floods make water storage difficult. Storage of water is essential during dry periods and controlled release before floods to protect downstream communities. Since the design of water storages takes into account a lower amount of flow variability and uses relatively shorter historical data, the designed storage volume may be insufficient for flood control if variability increases. In addition, flows caused by early snowmelt in spring also cause difficulties in dam operation.

It is predicted that groundwater will also be negatively affected by climate change due to changes in precipitation. In most regions, groundwater is the main source of water for irrigation, drinking and industrial water supply. as utilized. Renewable groundwater is affected by hydrological processes and thus climate change, depending directly on surface conditions. are affected. Most renewable groundwater aquifers are under pressure from overdraft at a rate faster than the recharge period.

Ecosystems and biodiversity are the most vulnerable systems to climate change. Wetlands fed by rainfall and rivers provide habitats for many species and to reducing flood damages. Decrease in precipitation and deterioration in water quality threaten wetlands.

Water Resources Sector Risk Analysis: Drought

analyzing risks to climate change in the water resources management sector at the provincial level in Turkey for primarily

Impact chains were prepared according to drought hazard and shared in Figure 6. While determining the impact chain, the indicators necessary to analyze the risk of the sector were determined. However, within the scope of the study, analyzes were carried out in line with the data available for all provinces.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Ortalama sıcaklık artışı	Kuraklık	Nüfus yoğunluğu	Kişi başı su potansiyeli	Kanalizasyon şebekesi ile hizmet verilen nüfus	Su kaynaklarında azalma
Toplam yağış miktarında azalma	Yağış miktarı ve yağışlı gün sayısında azalma	Sulama alanları oranı	Belediyeler tarafından çekilen içme-kullanma suyu oranı	Arıtılan atık suyun deşarj edilen atık suya oranı	Hane halkı su ihtiyacını karşılayamama
	Ardışık kurak gün sayısında artış	Kişi başı çekilen içme-kullanma suyu miktarı	Belediyeler tarafından çekilen içme-kullanma suyu ile dağıtılan suyun farkı oranı	Depolamalı tesis sayısı	Tarımsal ürünlerin veriminde düşüş
		Baraj doluluk oranları	Tarım sektörü GSYH'nın oranı	Sulama randımanı %55'in üzerinde olan sulama alanlarının oranı	Sektörel su ihtiyaçlarını karşılayamama
				Borulu sulama sistemi olan sulama alanı oranı	
				Arazi toplulaştırması yapılan alanın oranı	
				Sosyo-Ekonomik Gelişmişlik Endeksi skoru	

Figure 6 Impact Chain: Water Resources Management Sector and Drought

When the drought exposure of the water resources sector at the provincial level is analyzed, it is seen that provinces with high population density, irrigation area ratio, and average daily water withdrawal per capita have very high exposures. Accordingly, high and very high levels of exposure were found in provinces located in the eastern part of the Marmara Region including Istanbul, coastal provinces of the Aegean and Mediterranean Regions, Ankara, Konya, Karabük and Southeastern Anatolia provinces in Central Anatolia.

Sensitivity is at high levels in provinces with high levels of water stress and parameters such as municipalities' drinking and potable water ratios, sector total of agriculture sector GDP, the difference between total drinking and potable water withdrawn by municipalities and water distributed. According to , Marmara

In the Central Anatolia Region, sensitivity is above the high level except for Çanakkale and Balıkesir provinces. Sensitivity is high or very high in Ankara, Eskişehir, Konya, Aksaray and Nevşehir in Central Anatolia; İzmir, Aydın and Denizli in the Aegean; Samsun Amasya and Ordu in the Black SeaAdana, Osmaniye and Hatay in the Mediterranean; and Gaziantep, Şanlıurfa, Mardin and Diyarbakır in Southeastern Anatolia.

In general, the population of municipalities served by sewerage networks, the ratio of treated wastewater to discharged wastewater, the number of dams and ponds is high, irrigation efficiency Provinces with irrigation areas above 55% and provinces with high socio-economic development rankings have very high adaptive capacity. Accordingly, in the western half of the country in general adaptive capacity is determined to be medium or above and decreases towards the east.

The vulnerability analysis, in which sensitivity and adaptive capacity are assessed together, reveals that provinces in the southeastern half of the country have moderate or higher levels of vulnerability. However, vulnerability is high in Düzce, Zonguldak, Samsun, Ordu, Trabzon and Tokat in the Black Sea region; Sakarya, Kırklareli and Edirne in Marmara; and Aksaray, Nevşehir, Niğde, Çankırı and Kırıkkale in Central Anatolia.

The current period water resources drought risk with all components has been analyzed and its distribution by provinces is given in Figure 7. According to the results of the risk analysis, the drought risk is at high levels in the provinces located in the southern and southeastern half of the country, where the vulnerability is generally determined to be high. Accordingly, Konya, Isparta, Aksaray, Niğde, Nevşehir in the south of Central Anatolia; all provinces in the Eastern Mediterranean, all provinces in Southeastern Anatolia, provinces in Eastern Anatolia (except Erzincan, Tunceli and Bingöl), Edirne, Sakarya, Yalova and Manisa are at high levels of drought risk.

Figure 7 Current Period Risk Map: Water Resources Management Sector and Drought

Water Resources Sector Risk Analysis: Heavy Rainfall

In the water resources sector, a risk analysis was also conducted for heavy rainfall hazard and the impact chain is given in Figure 8. While determining the impact chain, indicators necessary to analyze the risk of the sector have been identified. However, the data that can be obtained for all provinces within the scope of the study in line with analyzes were carried out.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Yağış miktarı ve sıklığında artış	Şiddetli yağışlı gün sayısında artış	Nüfus yoğunluğu	Yaşanan toplam sel ve taşkın sayısı	Depolamalı tesis sayısı	Can ve mal kayıpları
	Sel ve taşkın		Yapay alanların oranı	Taşkın koruma alan oranı	Ekonomik kayıplar
				Taşkın koruma tesis sayısı	
				Arazi toplulaştırması yapılan alan oranı	
				Orman alanları oranı	
				Sosyo-Ekonomik Gelişmişlik Endeksi skoru	

Figure 8 Impact Chain: Water Resources Management Sector and Heavy Rainfall

When the exposure of the water resources sector to heavy rainfall at the provincial level is analyzed, the exposure is very high in Istanbul, Kocaeli, Sakarya, Yalova, Bursa, Bursa, Izmir, Ankara, Gaziantep and Hatay provinces due to their population density. Exposure to heavy rainfall is moderate or above in the provinces located on the Mediterranean and Aegean coasts, and high in the Eastern Black Sea region.

When the susceptibility of the provinces is analyzed, the provinces with a high number of floods/inundations and a high ratio of artificial areas have a high level of susceptibility. Accordingly, in the Marmara Region, Aegean, Mediterranean and provinces of Anatolia, susceptibility is generally determined at high and very high levels. However, sensitivity is also high in the Black Sea provinces of Zonguldak, Samsun, Ordu, Giresun, Rize, Şanlıurfa and Van.

When the adaptive capacity of provinces is evaluated, as in the drought study, adaptive capacity is higher in the western half of the country. In general, except Erzurum, all provinces in Eastern Anatolia and Southeastern have very low adaptive capacity.

In the vulnerability assessment, Eastern Mediterranean provinces, Southeastern Anatolia, provinces in the east of Eastern Anatolia and Eastern Black Sea provinces have high vulnerability. Likewise, Kırşehir, Nevşehir, Aksaray and Kayseri, which are located to the east of Ankara, are also highly vulnerable.

The heavy rainfall risk of the water resources sector in the current period has been analyzed and its distribution by provinces is presented in Figure 9. Looking at the risk distribution of heavy rainfall for Turkey's water resources sector, almost all provinces located along the coastline and in the southeast of the country moderate or above risk. Accordingly, Istanbul, Tekirdağ, Yalova, KocaeliSakarya in the north of Marmara; Düzce, Zonguldak, Bartın, Karabük, Ordu, Giresun, Trabzon, RizeArtvinAmasya and Tokat in the Black Seaİzmir, Manisa, Muğla in the Aegean; Antalya, Mersin, Adana, Osmaniye and Hatay in the Mediterranean; Kayseri in Central Anatolia; Gaziantep, Adıyaman, Şanlıurfa, Batman in the Southeast; and Elazığ, Muş and Van in Eastern Anatolia have high and very high risks of heavy rainfall. determined.

Figure 9 Current Period Risk Map: Water Resources Management Sector and Heavy Rainfall

3.4. ADAPTATION MEASURES

As Turkey is located in a semi-arid climate zone, water quality improvement, increasing the amount of usable water and maintaining the balance between conservation and utilization It is of great importance to ensure its sustainability.

Climate change in Turkey, impact of climate change on water resources and adaptation many studies are being carried out. Some of these studies carried out in recent years are summarized below.

The National Water Plan (2019-2023) prepared by the Ministry of Agriculture and Forestry summarizes the following on water resources management deficiencies in water legislation, overlapping authority among institutions, lack of coordination and institutional capacity among institutions, supply-demand imbalance between water demand and available water in certain basins/regions, high water losses in agricultural irrigation, significant water loss drinking water networks and distribution systems, drought, water withdrawals and water pollution pressure threaten ecosystems, bottlenecks were identified as inadequacies in the protection of water resources and water pollution, the need to prevent pollution in all dam basins and river basins, especially those supplying drinking water, inadequacies in increasing water supply, ensuring efficient use of water and reuse of used water, and a decrease in hydroelectric energy production due to drought.

The Ministry of Agriculture and Forestry organized the 1st Water Council in 2021. Within the scope of the Council, Water Efficiency; Basin Scale Management of Water; Water Law and Policy; Water Security and Waste Water Services; Protection and Monitoring of Water Resources in terms of Quality and Quantity; Impact of Climate Change on Water Resources and Adaptation; Decision Support Systems in Water Resources Management; Water Resources Development; Agricultural Irrigation; Storage Facilities (Underground and Above Ground Dams, Ponds) and Water, Forestry and Meteorology.

Under 11 topics, working group reports were prepared. The 28-article 1st Water Council Final Declaration containing the decisions taken at the end of the Council was published.

Again in 2021, a parliamentary investigation to determine the measures to be taken to minimize the effects of global climate change, combat drought and use water resources efficiently Commission Report published.

"Water Efficiency Strategy Document and Action Plan (2023-2033) within the Framework of Adaptation to a Changing Climate" 2023/9 by the Ministry of Agriculture and Forestry, General Directorate of Water Management in order to address the current situation, national and international legislation, plans, programs and documents in force and the bottlenecks encountered in this process, to determine the institutions and organizations that will assume direct responsibility and cooperate in the implementation of the practices and the future goals and strategies regarding water efficiency. numbered It entered into force with a Presidential Circular. In addition, in order to ensure the realization of the actions in the policy document

In the 12th Development Plan, it is included in the policy and measures item 880.1.

In the Climate Council organized by the Ministry of Environment, Urbanization and Climate Change in 2022, the issue of determining, implementing and monitoring adaptation actions of sectors at national, regional and local scales by conducting climate change impact, vulnerability and risk analyses was emphasized. In the Council water decisions were also taken on actions related to resource management.

The strategic objectives that can be set in order to overcome the bottlenecks identified as a result of the evaluation of the documents prepared and the legislation and to implement the proposed policies can be summarized as follows.

- Strengthening Water Resources Management Efforts,
- Expansion of Water Resources Monitoring Network and Strengthening of Information Management System,
- Protection of Water Resources,
- Efficient Use of Water Resources,
- Development of Financing Policies,
- Improving Training, Awareness Raising, Capacity Building and R&D Activities.

It is necessary to develop adaptation measures in line with the strategic targets set against the risks that may arise as a result of the negative impacts of climate change.

Since Turkey is located in a semi-arid climate zone, it is of great importance to improve water quality, increase the amount of usable water and ensure the sustainability of the balance between conservation and utilization (MoAF, 2018).

In Turkey, many institutions have duties, authorities and responsibilities regarding water. This situation causes various problems in water management. As it is known, within the scope of harmonization with the European Union acquis and integrated basin management, the Water Law has been amended in order to create a legislation that will eliminate the above-mentioned deficiencies. Preparation work is underway.

Integrated water resources management constitutes an important approach to mitigate the impacts of climate change on water resources. Successful and integrated water management; stakeholder strategies that ensure participation, build sustainability into planning processes, coordinate land and water resources management, consider the relationship between water quality and quantity, use the link between surface and groundwater, protect and restore natural systems, and take climate change into account.

Basin-scale management plans prepared with an integrated water resources management approach cover all plans related to water at the basin scale such as basin protection action, basin water allocation, basin management, basin flood management, basin drought management. These plans are prepared in order to protect the quantity and quality of surface and groundwater bodies in the basin, to allocate them in accordance with the priorities of needs and to ensure sustainable water use by protecting them from disasters such as drought and flood.

In this context, in order to establish integrated basin management, the procedures and principles regarding the establishment and functioning of the Central Basin Management Board, Basin Management Committees and Provincial Water Management Coordination Boards have been regulated for the preparation, implementation and follow-up of basin-scale management plans and ensuring coordination among institutions in this process.

Implementation of basin-scale management plans monitoring Basin Management Committees have been established for each basin in order to carry out the works on the basin scale. Basin Management Committees are established for each basin in order to contribute to the basin-scale management plans, to monitor and evaluate the implementation of the plans, to monitor the activities for the protection of drinking-utilization water resources, to ensure the implementation of the drinking-utilization water basin protection plans prepared, to solve the problems related to water management at the basin scale.

To carry out studies for Provincial Water Management Coordination Committees and relevant institutions or organizations that he made It is the most powerful structure in the basin, tasked with evaluating the studies, ensuring public access to information, receiving opinions and active participation in the process of preparing, reviewing and updating basin-scale management plans. In this respect, it is important to increase the effectiveness of basin management committees.

The procedures and principles regarding the duties, authorities and responsibilities in the works to be carried out with the relevant institutions within the scope of reducing the effects of possible agricultural drought in Turkey and determining the measures to be taken were regulated (CB Decree No. 5140). In line with the Decree, an agricultural drought management structure was established to mitigate the effects of agricultural drought and to combat agricultural drought. Agricultural Drought Management refers to the Agricultural Drought Management Coordination Board and Monitoring, Early Warning and Forecasting Committee, Risk Assessment Committee, data flow units, working groups and agricultural drought provincial crisis centers. Provincial crisis centers are also tasked with preparing provincial agricultural drought action plans, preparing and updating data on provincial land holdings, water resources and climate.

Floods/floods are effective in Turkey from time to time. There are many legal and institutional regulations on flooding, including DSİ, SYGMÇEMGMOGMMGMAFAD, Governorships, Special Provincial Administrations, metropolitan and provincial municipalities have various responsibilities. Accordingly, there is a need to improve the existing organizational structure and working systematic in order to effectively manage flood risks at the basin scale (T.R. Court of Accounts, 2022). Publication of the Flood Law, primarily zoning plans

Protection of stream beds and prevention of construction in stream beds should be ensured. In addition, structural measures for flood control should be designed by considering nature-based solutions within the scope of the legislation.

Sustainable management of water resources is only possible by successfully establishing a supply-demand balance. In this direction, the quantity and quality of water resources, sectoral water needs and consumption should be accurately determined. In this context, the monitoring network should be strengthened and the data collected by different institutions should be transferred to the National Water Information System (NWIS) within common standards and the functionality of the system should be increased and made widespread. This issue is emphasized in the 12th Development Plan and the efficiency of the National Water Information System should be increased by providing up-to-date data by all relevant institutions and organizations and legislation infrastructure should be strengthened
876.1. in the policy and measure item 876.1.

In order to protect drinking and utility water basins against pollution, it is necessary to prepare protection plans in accordance with the relevant legislation within the scope of determining protection areas and protection principles.

The negative impacts of climate change make effective and holistic water management activities essential for all sectors in ensuring water security. Identifying all risks that may threaten the security of water from the source to the end user in ordinary and extraordinary situations, determining the levels of these risks and putting forward the necessary technical, legal and administrative measures to eliminate these risks are essential in increasing the capacity to adapt to climate change in water resources management. In addition, floods caused by the impact of climate change and prolonged dry periods, it is necessary to be prepared for the negative impacts of climate change with "emergency action plans focused on sustainable water management" (before, during and after disasters). With the implementation of "Drinking Water Safety Plans from Source to Tap" to be prepared with this understanding in provinces, losses will be reduced and the capacity to adapt to climate change in the drinking water sector will be increased throughout the country. With the preparation of similar plans for the Agriculture and Industry sectors throughout the country, "National Water Security Plans" will be prepared.

In Turkey, surface and groundwater resources are used for water consumption for drinking, agriculture, industry, etc. These water uses are met from lakes, existing storage facilities, spring waters and wells. In this direction, sustainability is important in the management of water resources.

In this direction, the priority areas for adaptation studies to be carried out on water resources management are summarized below.

- Integration of climate change adaptation efforts into water resources management policies must be ensured.
- As identified in the 2019 National Water Plan, the fragmented water legislation, overlapping authority and lack of coordination between institutions elimination of is important.
- It is necessary to reduce losses in urban water use under the pressure of increasing population and intensive migration, to expand alternative water resources such as rainwater, gray water, used water and to develop adaptation measures for the efficient use of water resources.
- Turkey has important aquatic ecosystems and special environmental protection zones due to its geographical location. Meeting the water needs of these areas in terms of quantity and quality is imperative for the continuity of the ecosystem.
- Water is withdrawn from some natural lakes within the scope of industrial and agricultural irrigation, in addition to drinking and utilization, which pressure on the lakes. In this direction, it is important to supply the water needed by the ecosystem and to ensure the necessary water quality.
- Climate to change conservation of wetlands, restoration and rational use of ecologically degraded areas and artificial wetlands in order to strengthen adaptation creation of is important.
- Within the scope of adaptation to climate change, it is necessary to develop measures for irrigation management and efficient use of water in the agriculture sector, where a large share of surface and groundwater is used; in this context, it is necessary to expand closed systems, increase irrigation efficiency, determine drought-resistant crop patterns suitable for the water availability of the basin, reuse used water and water returned from agriculture and similar measures should be taken. It is necessary to develop adaptation measures for recording, monitoring, efficient use and recovery and reuse of groundwater and surface water used in agriculture, industry, tourism, services, mining, animal husbandry and similar sectors.
- In tourism facilities, efficient use of water should be ensured through rainwater harvesting, reuse of gray water and used water, preference for arid landscaping, etc. Excessive use of groundwater, groundwater

pressure on groundwater. Protection of groundwater, monitoring of groundwater operation areas and controlled use of groundwater should be ensured. It is important to construct underground dams and create artificial groundwater supply structures.

- It is important to reduce water pollution from agricultural, urban and industrial sources and to protect water quality.
- Within the scope of mitigation of flood damages, it is important to establish flood forecasting and early warning systems, to take necessary structural and non-structural measures, and primarily to protect the river beds from development pressure.
- With the changing rainfall regime, rainwater that flows especially from upstream basins with excessive precipitation, causes floods or landslides, mixes with the sea, and where traditional rainwater collection systems are insufficient, can be recharged by recharge systems to recharge groundwater. Establishment and its dissemination is important.
- It is necessary to inform and train water users on the efficient use of water, water saving and disasters, and to develop and expand R&D and scientific activities.

In addition, reduction of water losses in all sectors, especially in urban, agricultural and industrial areas, prevention of water waste in individual uses, dissemination of efficient, modern and environmentally friendly techniques in agricultural irrigation, dissemination of alternative water resources such as rainwater, gray water, brackish water, etc., especially used water in urban uses, implementation of sponge city models with nature-based solutions against extreme climate events such as drought and excessive rainfall, keeping water in the use cycle in industrial uses, dissemination of clean production techniques. In urban uses, dissemination of alternative water resources, implementation of sponge city models with nature-based solutions against extreme climate events such as drought and excessive rainfall, keeping water in the use cycle in industrial uses, using clean production techniques and products long life Increasing the utilization and recycling potential and establishing technical and economic incentives and support mechanisms for all these activities are also very important for our national water policies.

Adaptation measures on water resources management can be combined under the following two strategic objectives.

Strategic Objective 1. "Improving the political and legal framework in the field of water resources management, increasing data and information production and sharing, strengthening institutional capacity, cooperation and awareness"

With this action, it is aimed to prepare basin-scale management plans (basin protection action plan, basin water allocation plan, basin management plan, basin flood management plan, basin drought management plan) according to the Regulation on Preparation, Implementation and Monitoring of Basin Management Plans for effective basin-based management of water, and to monitor the implementation of measures and actions in existing plans. While the pressure on water resources, which are essential for the continuity of life and development activities, is increasing day by day due to the negative effects of climate change and the increase in consumption, it is aimed to prepare national water security plans in order to ensure "water security", which can be defined as ensuring sustainable, equitable and reasonable access to water in sufficient quantity and quality. In addition, preparation of basin-based water efficiency action plans for drinking and potable water; preparation of water resources used for the production of a good or service Total water footprinting studies need to be carried out in order to determine the amount and to reach a basin-based consumption-based water use indicator. In addition, within the scope of this action, numerous legal and regulatory measures on floods/flooding that cause loss of life and property should be taken.

It is also aimed to establish an effective flood risk management structure by evaluating the institutional arrangement and to prepare provincial agricultural drought action plans and follow up the actions within the scope of combating drought.

Preparation of basin-scale management plans, implementation and follow-up of measures, precautions and actions under existing management plans.

With the following action, within the scope of increasing water resources data and information production, establishing a water information management system where data collection, storage, analysis and sharing will be carried out in accordance with national standards; increasing the number of wastewater generating facilities logging into the Wastewater Information System for monitoring wastewater at the provincial level; strengthening the monitoring of wastewater treatment plant effluents with an installed capacity of 5.000 m^3/day and above through Continuous Wastewater Monitoring Systems (CWMS); to prevent the dumping of excavation wastes in stream beds in order to protect stream beds and prevent factors that may cause flooding and to increase the effectiveness of the controls carried out, dissemination of the "Excavation Management Information System" monitoring of the quantity and quality of surface and ground waters. In addition, within the scope of this action, it is also aimed to continue monitoring activities by improving the monitoring network in line with the needs in order to ensure continuity in monitoring the quantity and quality of surface and groundwater; to create an inventory by determining the quantity and quality of surface and groundwater and sectoral water consumption in order to create a basis for water resources development projects by determining the existing water potential and usable water potential at the basin level.

ESSN2. Active water and wastewater provision of management for Monitor ing and knowledge systems development, above ground underground and water sources of Quantity and

Establishing an inventory of water quality and sectoral water consumption.

Within the scope of the action, it is also aimed to establish an effective flood risk management structure by evaluating the numerous legal and institutional regulations on floods/flooding that cause loss of life and property, and to prepare provincial agricultural drought action plans and follow up the actions within the scope of combating drought.

ESSN3. Improvement of legislation on water management.

Due to rapid growth, urbanization and climate change, among other factors, water resources are both decreasing and being polluted rapidly. In order to prevent this situation, it is first necessary to determine the impact of climate change on different water resources.

Identifying the impacts of climate change on water resources, lakes, wetlands and coasts.

Monitoring the implementation of the Water Efficiency Strategy Document and Action Plan (2023-2033) in the Framework of Adaptation to a Changing Climate.

Since water is a common resource used across sectors, resource efficiency strategies for each sector are of great importance for the sustainable management of water resources. In this direction, in all sectors in our country water "Water Efficiency Strategy Document and Action Plan within the Framework of Adaptation to a Changing Climate" was prepared, which sets forward-looking targets and strategies in order to promote water efficiency.

The actions identified within the scope of **Strategic Goal 2. "Ensuring** the protection, improvement and efficient use of water resources" are given below with their explanations:

With this action; according to the "Communiqué on Procedures and Principles for the Preparation of Drinking and Potable Water Basin Protection Plan based on the By-Law on the Protection of Drinking and Potable Water Basins", the preparation and implementation of basin protection plans for water resources that are supplied or planned to be supplied with drinking and potable water. is aimed to be sustained.

Continuation of basin protection activities for surface and groundwater resources from which drinking and potable water is supplied or planned to be supplied.

The Action aims to prevent pollution of water resources by controlling wastewater and to prevent water pollution. quality of protection for restricting discharge standards; accelerating the construction/renewal of Wastewater Treatment Plants needed throughout the basin; increasing the amount of treated wastewater; purified wastewater treatment for the purpose of Su meet the required quality criteria according to the Regulation on Pollution Control will provide degree treated wastewater, again is aimed to be used.

ESSN7. Protecting the quality of water resources for the purpose of dischar ge standards and by updating all parameters implementation in basins, increasing the amount of treated wastewater, increasing the rate of reuse of treated wastewater by 2030 15% by the end of the year.

With the following action; monitoring water quality and water levels of fragile aquatic ecosystems in the context of climate change within the scope of protection of water resources and aquatic ecosystems; determining water balance sheets of lakes and natural lakes where water is withdrawn for sectoral purposes in order to protect their ecosystem characteristics; within the scope of the "Regulation on the Protection of Wetlands" Governance Preparation of Management Plans, implementation of the provisions of the existing Management Plan and monitoring;

It is aimed to reintroduce degraded wetlands back into nature and to increase the water retention

Monitoring water quality and water levels of aquatic ecosystems in terms of climate change impactsprimarily sectoral lakes where water is withdrawn for use to be of all natural lakes their budgets for water removal, aquatic ecosystems regarding c areas and wetland areas protected plans preparation/revision Management and implementation, identification, improvement and restoration of damaged wetlands, artificial lakes, ponds using natural resources and creation of artificial wetlands.

The Action aims to establish an inclusive legal framework for stormwater management in cities, including protection of stormwater from pollution, collection, collection and reuse of stormwater and to establish an information management system for stormwater management.

ESSN9. Legal framework for stormwater management preparation of the framework , rain water infrastructure and pollution sources to their Regarding preparing and updating the inventory.

With another action; according to the "Regulation Amending the Regulation on the Control of Water Losses in Drinking Water Supply and Distribution Systems", the water loss rate in the Metropolitan Municipality will be reduced to a maximum of 30% by 2023 and 25% by 2028; in district municipalities to a maximum of 35% by 2023, 30% by 2028 and 25% by 2033. for "Regulation on Stormwater Collection, Storage and Discharge Systems" and "Regulation on Stormwater Collection, Storage and Discharge Systems" in order to collect stormwater and use it for park-garden irrigation, fire, etc. According to the "Regulation on the Amendment of the Planned Areas Zoning Regulation" larger than 2000 m²

It is aimed to establish stormwater collection systems in buildings to be constructed on parcels; to expand the use of gray water; to increase the proportion of the population served by drinking and potable water network (piped system) within the scope of access to healthy water at the provincial level; and to utilize the effluent of wastewater treatment plants as an alternative water source in cities in areas such as agricultural irrigation, environmental feeding, landscape irrigation and sanitary use.

SUY10. Municipalities water losses strategy relevant legislation and water of the efficiency document to their goals According to ratio downgrading, in cities rain alternative water sources such as harvesting and use of gray water sources water safe drinking water Increasing access to the network.

Ensuring efficient use of water in irrigation areas, which have the highest water consumption among the sectors, with the following action within the scope of In accordance with the Regulation on the Control of Water Use and Reduction of Water Losses in Irrigation Systems, reducing water losses in irrigation systems and preventing illegal use, developing irrigation facilities, using efficient and appropriate irrigation methods, planning irrigation time, applying the correct crop alternation, increasing irrigation efficiency will increase Measures need to be implemented and monitoring and evaluation studies need to be carried out. The Water Efficiency Strategy Document and Action Plan within the Framework of Adaptation to a Changing Climate aims to increase irrigation efficiency to 60% by 2030. Necessary measures should be taken to increase irrigation efficiency to 60% by 2030. Within the scope of efficient use of groundwater, switching to "Night Reservoir System Operation" in order to save water and reduce energy costs in pumping irrigation; water use in irrigation

Other examples of good practices that can be implemented include remote control and automation of irrigation facilities with digital technologies in order to control and identify irrigation facilities, and the installation of meters in piped irrigation systems. With the projects to be prepared in accordance with the "Implementing Regulation on Land Consolidation and In-Field Development Services", it is aimed to prevent the degradation and fragmentation of agricultural lands due to natural and artificial effects, and to increase the efficiency in irrigation by means of irrigation, drainage, stream improvement, etc. Using water more efficiently by evaluating different recovery alternatives such as improving the quality of water returning from agriculture by reusing water returning from agriculture, cyclically reusing it in the same irrigation and opening new irrigation areas by transferring it to agricultural areas that are not currently irrigated irrigation can be ensured.

ESSN11. Scaling up practices that increase efficiency in agricultural irrigation in line with the objectives of the Water Efficiency Strategy Paper.

In order to protect groundwater, which is one of the most important water resources, and to ensure efficient and sustainable use, determination of groundwater withdrawals in accordance with the Law on Groundwater, Regulation on the Protection of Groundwater against Pollution and Degradation and Communiqué on the Protection of Aquifers and Springs Supplying Drinking Water, It is aimed to ensure sustainable groundwater use through practices such as protection of groundwater, prevention of unauthorized withdrawals, installation of meters on wells, development of groundwater storage facilities, and protection and improvement of the quantity and quality of groundwater bodies.

Determination of protection areas of groundwater resources for drinking water purposes, conducting studies on groundwater bodies, preparing annual groundwater withdrawal monitoring and control reports in groundwater operation areas, installing meters in groundwater operation wellsincreasing underground dams and groundwater artificial supply structures.

Within the scope of determining sectoral water uses, it is important to establish legislation on monitoring and recording the use of surface and groundwater in the industrial sector, efficient use and recovery. Within the scope of this action, it is aimed to monitor and record the use of surface and groundwater used in the industrial sector; to ensure efficient use of water used in cooling water, process or production in industry, energy and mining sectors and to promote the reuse of used water.

Monitoring and recording the use of surface and groundwater in industrial enterprises, industrial zones and sites within the framework of the legislation to be established and the Water Efficiency Strategy Document, ensuring efficient use and recovery of water used in industry, energy and mining sectors.

Considering nature-based solutions in flood control works within the scope of the actions given below in order to protect from and minimize the damages of floods/flooding, which are sometimes seen due to heavy rainfall and whose effects increase as a result of interventions to the river beds; flooding expanding forecasting and early warning systems; capacity rehabilitation of flood and flood facilities; soil conservation works in flood and flood risk areas; upstream flood control works is aimed to be sustained.

Taking structural measures within the scope of flood control works by considering nature-based solutions, extending flood forecasting and early warning systems, continuing capacity rehabilitation works of flood and flood facilities, continuing soil conservation works in flood and flood risk areas, accelerating upstream flood control works, establishing and extending drought forecasting and early warning systems.

REFERENCES: Water Resources Management

DSI (2021)DSİ Official StatisticsRetrieved from https://www.dsi.gov.tr/Sayfa/Detay/972.

DSI (2021a). Soil Water Resources. Retrieved from https://www.dsi.gov.tr/Sayfa/Detay/754.

DSI (2022). DSI Annual Report for 2021. General Directorate of State Hydraulic WorksMinistry of Agriculture and Forestry. Retrieved from https://cdniys.tarimorman.gov.tr/api/File/GetFile/425/Sayfa/759/1107/Dosya Galeri/2021_yili_faaliyet_raporu.pdf.

FKA (2013). Land Consolidation Activities, TRB1 Region (Bingöl, Elazığ, Malatya, Tunceli). Euphrates Development Agency, Malatya. https://www.kalkinmakutuphanesi.gov.tr/assets/upload/dosyalar/arazi- Retrieved from toplulastirma.pdf.

MGM (2021). General Directorate of Meteorology, Ankara.

Muhammetoğlu, H., & Muhammetoğlu, A. (2017). Handbook on Control of Water Losses in Drinking Water Supply and Distribution Systems. General Directorate of Water Management. https://www.tarimorman.gov.tr/SYGM/Belgeler/SU%20VERİMLİLİĞİ/İçme%20Suyu% 20Temin%20ve%20Dağıtım%20Sistemlerindeki%20Su%20Kayıplarının%20Kontrolü Retrieved from %20El%20Book%20.pdf.

Republic of Turkey Ministry of Development (2018). Specialized Commission on Water Resources Management and Security Report, On First Development Plan (2019-2023). https://www.sbb.gov.tr/wp- Retrieved from content/uploads/2020/04/SuKaynaklariYonetimi_ve_GuvenligiOzelIhtisasKomission Raporu.pdf.

Court of Accounts (2022). Flood Risk Management Court of Accounts Report. Retrieved from https://www.sayistay.gov.tr/reports/wPoAKK1Qey-taskin-risk-yonetimi.

TOB (2018). National Water Plan (2019-2023). Ministry of Agriculture and Forestry, Ankara. Retrieved from PLANI.p

TUIK (2021a). Municipality Su Statistics, 2018. Retrieved from https://data.tuik.gov.tr/Bulten/Index?p=Belediye-Su-Istatistikleri-2018-30668

TUIK (2021b). Municipality Wastewater Statistics 2018. Retrieved from https://data.tuik.gov.tr/Bulten/Index?p=Belediye-Su-Istatistikleri-2018-30668

TurkStat (2021 c). National Accounts, 2018. https://data.tuik.gov.tr/Kategori/GetKategori?p=ulusal- Retrieved from hesaplar-113.

TARIM VE GIDA GÜVENCESİ

iklime uyum

4.1. GENERAL FRAMEWORK

Agriculture is a strategic sector as it is the main food producing sector. sector. Therefore, agriculture economic, social and environmental aspects, in particular to ensure the country's food security and safety be sustainable. A high share of price and value-added for farmers is essential for competitiveness. as well as increasing the ability can also make sustainability possible.

Turkey's diversity of climate and natural resources allows for the cultivation of a large number of agricultural products. However, this diversity brings with it many different risks, options and scenarios in terms of the impact of climate change and adaptation to climate change in the agricultural sector.

Agriculture in Turkey is the largest agricultural sector in Turkey, meeting the food needs of around 85 million people by 2021, accounting for 6% of GDP and exports and 6% of employment.
It is an important sector, accounting for 17% (TurkStat, 2022). Turkey is a major producer and exporter of agricultural products in world markets and the 7th largest agricultural producer in the world (OECD, 2016). Agricultural GDP reached USD 58.7 billion in 2022 (TurkStat, 2023). The agricultural sector includes input providers, farmers, traders, processors, warehouses in the agri-food chain from production to consumption, transporters It has a vital role in generating revenue for all actors such as wholesalers, retailers, etc.

As of 2021, Turkey has 23 million hectares of cultivated agricultural land and produces over 250 agricultural products. According to the latest agricultural census, there are around 3 million farms in Turkey. Most of these are small family farms with family labor and have an average of 6 hectares of land. They account for 80% of the total cultivated land, with 18 million hectares of land are used for the cultivation of field crops, while the rest is used for fruit growing, vegetable growing, viticulture and olive cultivation. The main crops in Turkey are cereals, which are grown on 60% of the land. The rest of the cultivated area is used for the production of other field crops such as sugar beet, cotton, sunflower, potatoes, dry beans, chickpeas, onions, etc.; vegetables (tomatoes, peppers, cucumbers, etc.); fruits and other perennial crops (apples, citrus fruits, grapes, figs, hazelnuts, olives, tea, etc.) (TurkStat, 2022).

Agricultural land in Turkey has been decreasing over the years (cultivated agricultural decreased from 28 million hectares in 1990 to 23 million hectares in 2021). Although the area cultivated in cereals, Turkey's largest cereal crop, decreased from 13.7 million hectares to 11.1 million hectares between 1990 and 2021, production increased from 30 million tons to 37 million tons (TurkStat, 2022). The main reason for this is the improvement of cultural practices and the use of inputs, especially fertilizers.

Livestock breeding is also an important agricultural activity in Turkey. The livestock sub-sector, consisting of cattle, sheep, goats and poultry, is carried out in traditional and industrialized ways. In 2021, there will be 18 million heads of cattle, 42 million heads of sheep and 12 million heads of goats in Turkey.
4% and the number of goats increased by 11%. In the same period, poultry farming also developed rapidly and the number of poultry increased by 166%. The white meat sector in particular has become the sector that meets a large part of the animal protein needs of the population. The production of animal products such as milk, meat and eggs has also increased rapidly since 1990 due to the increase in the number of animals and the increase in the number of cultivated and hybrid breeds in cattle breeding. Turkey's milk production in 2021 23

million tons, white meat production was 2.3 million tons and red meat production was 2 million tons. On the other hand, aquaculture is also an important source of animal protein and an economic contributor in Turkey. In 2021, a total of 800 thousand tons of aquaculture products were produced, of which 328 thousand tons were from hunting and 472 thousand tons from aquaculture (TurkStat, 2022).

Agriculture is a strategic sector due to food production. For this reason food security

Agriculture needs to be economically, socially and environmentally sustainable in order to be protected. In agricultural production, production methods that use soil and water efficiently and cleanly and cause less greenhouse gas emissions should be chosen. The agricultural sector also needs to be competitive. A high farmer's share of price, quality and added value increases the ability to compete and makes sustainability possible. can.

4.2. SECTORAL LEGAL FRAMEWORK AND RESPONSIBLE INSTITUTIONS

Many policy documents in the agriculture sector include climate change adaptation in agriculture.

The main policy documents in the agriculture sector are the Law on Agriculture (2006), the 11th Development Plan (2019-2023) and the 2019-2023 Strategic Plan of the Ministry of Agriculture and Forestry (MoAF). These documents also include emphasis and actions on climate change adaptation.

The Law on Agriculture was enacted in 2006. Its aim is to determine the necessary policies and regulations for the development and support of the agricultural sector and rural areas in line with development plans and strategies. The objectives of agricultural policies are to increase the level of welfare in the agricultural sector by developing agricultural production in line with domestic and foreign demand, protecting and developing natural and biological resources, increasing productivity, strengthening food security and safety, developing producer organizations, strengthening agricultural markets and ensuring rural development. One of the principles of agricultural policies is sustainability, human health and sensitivity to the environment.

11. The Development Plan (2019-2023), under the"Climate Change, Food Security and Efficient Use of Water, states that Turkey is among the countries that will be most affected by climate change and is already facing increasing sudden and heavy rainfall, floods and droughts. It is also stated that Turkey continues its efforts to reduce greenhouse gas emissions and adapt to climate change in line with its status as a developing country.

Turkey will cover the period 2024-2028

12. In the Development Plan period, issues pertaining to the agricultural sector Another policy document

In the 2023 Strategic Plan of the Ministry of Agriculture and Forestry (MoAF), Turkey's mission is defined as "mobilizing the ecological resources in our country in an effective, efficient and sustainable manner with a development model perspective and securing economic security, food supply security and human health through ecological, plant and animal added value" and vision as " exemplary ecological resource management on a global scale". The objectives of the 2019-2023 Strategic Plan are as follows:

- Raising welfare in rural areas, ensuring stable food supply by increasing productivity and quality in agricultural production,
- Ensuring food and feed safety from production to consumption, taking necessary measures for plant and animal health and welfare,
- To protect fisheries and aquaculture resources and ensure their sustainable functioning,
- To ensure sustainable management of soil and water resources,
- To effectively combat climate change, desertification and erosion,
- To ensure the conservation and sustainable management of biological diversity,
- Improving institutional capacity.

The fifth objective in the TOB 2019-2023 Strategic Plan is related to climate change. The objectives under this objective are as follows:

- Increasing capacity to combat climate change, erosion and desertification
- Identify and prevent land degradation and erosion
- Measuring the possible impacts of climate change on agriculture and developing recommendations taking measures

In addition, in line with the 12th Development Plan (2024-2028), the preparation of the MoAF 2024-2028 draft Strategy Plan is ongoing.

In addition to these basic documents in the agriculture sector, there are many legal regulations and policy documents related to adaptation to climate change. Some of these are as follows:

- Law on Soil Conservation and Land Use (Law No. 5403 dated 03/07/2005)
- Law Amending the Law on Soil Conservation and Land Use (Law No. 6537 dated 30/04/2014)
- Turkey's Strategy and Action Plan for Combating Agricultural Drought (2023-2027)
- Ecosystem-based Adaptation Strategy for Anatolian Steppe Ecosystems (2022-2036)

In the Strategic Plan 2022-2023 of the Ministry of Environment, Urbanization and Climate Change; in order to achieve the goal of protecting the environment and natural resources, combating climate change, desertification and erosion, the agricultural and

The following objectives have been identified that may be relevant.

- Capacity to combat climate change, desertification and erosion will be increased, and a sustainable land management model will be developed to combat natural disasters.
- The number of protected areas will be increased and natural protected areas will be re-evaluated within the framework of ecologically based scientific principles.

Turkey's main policy documents on climate change also plan adaptation actions on agriculture-related issues. These policy documents are as follows:

- Turkey's National Climate Change Strategy 2010-2023
- Turkey National Climate Change Action Plan 2011-2023
- Turkey's National Climate Change Adaptation Strategy and Action Plan 2011-2023
- Green Deal Action Plan (2021)
- Climate Council Decisions (2022)

4.3. EFFECTS OF CHANGE

The most important expected impacts of climate change on the agricultural sector in Turkey
impact of drought is predicted to be drought. Drought risk, Inland Anatolia, Southeast Anatolia and It is highest in provinces in the Eastern Anatolia Region.

Agriculture is the production of raw materials using soil and seeds (plant and animal) and the processing of these raw materials into complete or semi-finished products. Crop production, animal production, processing of products, aquaculture and fisheries are activities within the agricultural sector. The agricultural sector is a strategic sector as it produces the food necessary for human life. For this reason, each country directs its agricultural sector with appropriate policy instruments to ensure its food independence. In addition to food, the agricultural sector produces many products such as feed, fiber, leather, fuel, and products used in the field of health. These products create employment in production, processing, storage, distribution and sales stages, provide export income, and contribute to economic development by creating income for the country, region and individuals (Dellal, 2021a). In order to fulfill these tasks and ensure production, it needs climate parameters such as temperature and precipitation. In addition, weather conditions are suitable for plant and animal needs, and climate hazards such as droughts, floods, hail and cyclones are avoided. harm should not be seen (Dellal, 2021b).

Most of Turkey is under the influence of semi-arid climate conditions. For this reason, changes in the amount and distribution of precipitation due to both water resources and dry agriculture, which generally depends on precipitation, have significant impacts on the agricultural sector. Since climate is the first factor that enables agricultural production , temperature, precipitation and

Changes in carbon dioxide content in the atmosphere, increases in extreme climate events and sea level rise affect agriculture. These impacts are briefly as follows (Dellal and McCarl 2007, Dellal 2018, Dellal et al. 2020):

Crop Production: Changes in temperature, precipitation and carbon dioxide content in the atmosphere and an increase in extreme climatic events change plant growth, water requirements, yield, quantity and quality of production, supply of production materials such as seeds, seedlings and saplings, and harvest time. Crop losses increase due to more frequent and severe droughts or excessive rainfall. These changes in production quantity affect costs. Plant diseases and pests increase, more pesticides are needed, the number of sprayings increases and the spraying time is extended according to the production schedule.

Soil: In addition to temperature and rainfall, soil moisture, moisture storage capacity and soil fertility are important for plant growth. An increase in temperature decreases soil moisture and more irrigation is required to meet the water needs of the plant. However, high evaporation due to temperature can also make irrigation difficult. In addition, temperature increases the microbial composition of the soil, which can negatively affect the nutrients in the soil.

Animal Production: Animal production is directly or indirectly affected by climate change. As temperatures rise, the balance between heat production and heat utilization in animals can be disrupted. In animals reproduction changes in the cycle, decrease in pregnancy rate, increase in abortions, increase in mortality rate, decrease in feed consumption rate, decrease in feed conversion to product, live weight changes, milk and meat production can lead to a decrease. Changes in the amount of animal production also affect costs.

Water Use: An increase in temperature increases evaporation, which can lead to a decrease in the volume of water stored for irrigation. In addition, changes in the temperature regime alter the timing and duration of snowfall, which may result in the amount of water needed during the summer period not being met. The amount of groundwater and the rate of transformation are other factors that are also affected. The demand for non-agricultural water used in settlements or some industries may increase with temperature. Inter-sectoral competition may arise in the use of water.

Other Impacts: In addition to the direct impacts of climate change, there are factors that indirectly affect agricultural production. For example, sea level rise can lead to loss of fertile coastal areas and flooding. Indirect impacts such as weeds, pests and diseases, soil erosion, etc. can also be more severe with temperature increase.

The impacts of climate change on agriculture can have an impact on food security, development and international trade. Since agriculture is an economic activity in addition to food supply, it also has a significant impact on economic balances. For example, reduced production can lead to higher product prices, higher prices paid by consumers, increased imports and reduced exports.

The most important expected impact of climate change on the agricultural sector in Turkey is a decrease in yields. For Turkey, only the expected changes in temperature and precipitation by 2080 will decrease crop yields by 8.3% for wheat, barley, rye, oat and 8.3% for maize.
13.8%; sunflower 11.8%; legumes (dry beans, chickpeas, green and red lentils) 11.8%; paddy 19.7%;

It is estimated to decrease by 15.8% for sugar beet and 5% for cotton. Extreme climate events such as droughts, floods, hail, etc. are expected to occur more frequently and severely, causing more yield and production losses (Dellal et al., 2019). The agricultural impacts of climate change have been studied on a regional scale, for example, it was estimated that there would be a 76% decrease in wheat and 66% decrease in sunflower yields in the Thrace region according to temperature and precipitation scenarios (TAGEM, 2021).

The agriculture sector is the sector most affected by climate change due to its nature-dependent structure. The direct relationship of agricultural activity with ecosystems such as soil, water and forests, changes in the average of climate parameters such as temperature, precipitation, relative humidity and wind, and increases in the frequency and severity of climate hazards such as drought, floods and storms directly affect the agricultural sector.

The negative impacts of climate change are already being observed in this sector, which has high exposure and sensitivity. These impacts are expected to increase with significant repercussions in key areas such as sectoral production, consumption, international trade, employment, poverty, food security and social equity. Therefore, it is important to increase resilience and adaptation to the potential negative impacts of climate change in agriculture

In the agriculture sector, the hazard component includes factors related to climate change and direct physical impacts. It is the potential occurrence of climate-induced impacts (short and long term) that can damage production and supply chains, ecosystems and natural assets such as soil, water, forests and biodiversity. These hazard components include impacts on agriculture-related infrastructures and infrastructure such as transportation, irrigation, storage and energy. At the same time, the food chain also includes the linkages agricultural inputs and outputs with other sectors, the economy as a whole and

Secondary hazards in urban areas are also important.

Agriculture Sector Risk Analysis: Drought

Drought is expected to be the most important impact of climate change on the agricultural sector in Turkey. Therefore, within the scope of this study, the effects of drought on crop production and livestock were analyzed vulnerability and risk assessment has been made and risk maps have been created.

The impact chain in crop production (Figure 10) was created by systematically linking climate-related risks and their components and identifying risk components and underlying factors. Weakening of agricultural ecosystem services, decreasing yields, price increases, producer income and employment losses, sectoral contraction are important risks estimated in crop production.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Toplam yağış miktarında azalma	Kuraklık	Tarım alanları oranı	İşletme başına ödenen ihbar sayısı	İşletme başına düşen poliçe sayısı	Tarımla bağlantılı ekosistem hizmetlerinin zayıflaması
Ortalama sıcaklık artışı	Yağış miktarı ve yağışlı gün sayısında azalma	Tarımsal işletme sayısı	Tarım sektörü GSYİH oranı	Toplam traktör sayısı	Tarımsal verimlerin düşmesi ve dalgalanması
	Ardışık kurak gün sayısında artış	Sulama alanları oranı	Toplam tahıl üretim miktarı	Sulama randımanı %55'in üzerinde olan sulama alanlarının oranı	Fiyat artışları
		Gıda zincirleri*	Toplam kuraklık ihbar sayısı	Borulu sulama sistemi olan sulama alanı oranı	Üretici gelir ve istihdam kayıpları
		Sektörün bölgesel ekonomik bağlantıları*	Tarımsal işletme başına ödenen zarar sigortası tutarı	Arazi toplulaştırması yapılan alan oranı	Sektörel, bölgesel ve makro-ekonomik daralma, enflasyon, ticaret açıkları
		Tarım dışı sektör bağlantıları*	Tarım ve tahıl yoğunlaşma endeksleri	Sürekli sulanan alanlar oranı	Gıda güvensizliği ve yoksullaşma
		Üreticiler ve üretim*	Buğday, arpa ve mısır verim değişkenlikleri	Paydaşların risk ve maruziyet algısı*	Toplumsal eşitsizliklerin artması
		Toprak ve su ekosistemleri*	Dönemsel, ürün büyüme fazı hassasiyetleri*	İnsani ve sosyal sermaye*	Bitkisel hastalıkların artması
			Tarım verimin fiziksel etkilere hassasiyeti*	Fiziksel altyapı ve sermaye*	Verim ve üretim kayıplarının yarattığı fiyat artışları nedeniyle gıda güvenliği riskleri
			Aşırı iklim olaylarının neden olduğu ani ürün kayıpları*	Teknolojik seçenekler ve erişim*	Sektörel fiyat artışları nedeniyle artan makro ekonomik riskler (enflasyon, ticaret açığı)
			Tarımsal üretim ve ürün deseni bazı duyarlılıklar*	Kritik kurum ve kaynaklarla ilgili karar süreçleri *	Toprak ve su varlıkları üzerine artan rekabet
			Hane tarımsal geliri*	Risk yönetim süreçleri*	Yerel biyoçeşitlilik kaybı
			Sektörün makro ve bölgesel ekonomi bağlantıları*	Bilgi yönetimi ve bilgiye erişim*	

Figure 10 Impact Chain: Agriculture-Grain Sector and Drought

*The * symbol indicators not used in risk analyses.*

Exposure in crop production was analyzed with data on total agricultural area, pasture-grassland areas, number of enterprises and irrigation area in the provinces. Turkey's 1990-2019 During this period, in agricultural areas, many provinces in the Aegean, Central Anatolia and Southeastern Anatolia regions were found to be exposed to drought hazards and to be highly susceptible to drought.

One of the main factors determining economic sensitivity is the agricultural intensification profile of the province. Concentration in a single product increases sensitivity. For example, concentration in wheat production increases the sensitivity of that province, while increasing product diversity decreases sensitivity. The share of the agricultural sector in the GDP of the province, the number of drought-related notifications, and the size of the damages paid are other indicators that reveal the sensitivity of the provinces. As a result of the data obtained, provinces in the Central Anatolia Region are determined as provinces with very high and high sensitivity.

As a result of the analysis made by taking into account data such as the number of policies per enterprise, irrigation efficiency in the province, and the structure of irrigation systems in relation to adaptation capacity in crop production, it was concluded that

Adaptive capacity was found to be relatively high in Thrace, Central Anatolia and Southeastern Anatolia.

Vulnerability analysis was conducted by evaluating sensitivity and adaptive capacity components together. Accordingly, the vulnerability of the Marmara and Aegean Regions and the provinces located in the south of the country was determined to be low, while the vulnerability of some provinces in the Eastern Black Sea and Eastern Anatolia Regions with high sensitivity was determined to be relatively high.

When the drought risk of crop production in the agricultural sector is analyzed, although the adaptive capacity of the provinces of Central Anatolia Region is high, the drought risk of crop production is very high and high. In most of the provinces with high sensitivity, drought risk was determined at very high or high level. According to the current period conditions, Konya, Karaman, Isparta, Mersin, Giresun, Sivas, Malatya, Kahramanmaraş, Hatay, Kars, Ağrı and Van are the provinces with the highest risk (Figure 11).

Figure 11 Current Period Risk Map: Agriculture-Cereals and Drought Relationship

Livestock Sector Risk Analysis: Drought

In animal production, the impact chain has been prepared by systematically associating climate-related risks and their components, similar to the crop production impact chain, and is presented in Figure 12.

The expected risks in animal husbandry can be listed as yield losses, cost and price increases, increased losses due to extreme climatic events, income decreases, economic contraction in the sector and food safety risks.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Toplam yağış miktarında azalma	Kuraklık	Toplam mera alanları oranı	İşletme başına ödenen ihbar sayısı	Mera alanları oranı	Artan patojenler, parazitler ve vektörlere bağlı hastalıklar
Ortalama sıcaklık artışı	Yağış miktarı ve yağışlı gün sayısında azalma	Toplam canlı hayvan sayısı	Tarım sektörü GSYİH oranı	Toplam mera ıslah çalışmaları oranı	İçme suyunda kıtlık
	Ardışık kurak gün sayısında artış	Aşırı iklim olaylarına maruz kalan mera alanı ve işletme sayısı*	Toplam süt üretim miktarı	İşletme başına düşen poliçe sayısı	Hayvansal verim kayıpları
		Yem fiyatlarındaki artışın toplam maliyetlerdeki oranı*	Toplam kuraklık ihbar sayısı	Mera uyum planları*	Maliyet ve fiyat artışları
		Sektörünün bölgesel/ yerel ekonomideki oranı*	Tarımsal işletme başına ödenen zarar sigortası tutarı	İklim uyum kapasitesi yüksek genetik geliştirme çalışmaları*	Aşırı iklim olayları kaynaklı zarar artışları
		İklim değişikliği kaynaklı hastalıklara maruz kalan hayvan sayısı*	Kırmızı et ve süt üretim değerinin bölgesel ekonomi katkısı*	Sektör ve işletme uyum destekleme kaynakları/ fonları*	İşletme gelir daralması ve değişkenliği
			Kırmızı et ve süt bazlı verim sıcaklık esneklikleri*	Büyükbaş hayvancılık sıcaklık stresi yönetim planı*	Sektörel ekonomik daralma ve istihdam kaybı
			Aşırı iklim olayı zararları*	Uyumla ilgili planı olan işletme sayısı*	Verim ve üretim kayıplarının yarattığı fiyat artışları nedeniyle gıda güvenliği riskleri
			Yetiştirilen hayvan cinslerinin hastalıklara duyarlılıkları*	Sıcaklık artışı ve aşırı iklim olaylarına karşı altyapı yatırımı yapan işletme sayısı*	Sektörel fiyat artışları nedeniyle artan makro ekonomik riskler (enflasyon, ticaret açığı)
			İşletme reel gelirleri iklim indeksi*		Toprak ve su varlıkları üzerine artan rekabet
					Yerel biyoçeşitlilik kaybı

Figure 12 Impact Chain: Livestock Sector and Drought

*The * symbol indicators that are not used in risk analyses.*

The most important exposure indicator in the livestock sector is the total number of livestock. The high number of animals is a factor that increases the exposure of provinces. In this framework, Eastern Anatolia and Central Anatolia provinces have high exposure. The ratio of pasture areas to total geographical area is also identified as one of the exposure indicators in the livestock sector.

The most important sensitivity components in livestock production are the number of drought notifications and livestock production (only milk production data were available), as well as loss insurances paid per enterprise. Accordingly, it is observed that sensitivity is relatively high in Manisa and Kütahya provinces along with Central Anatolia in the eastern provinces, whereas it is lower in the eastern provinces.

In terms of adaptive capacity, only pasture areas and the area where pasture improvement works were carried out could be accessed. According to the results obtained, it is seen that adaptive capacity is relatively high in Thrace and Central Anatolia in general.

According to the results of the vulnerability analysis, provinces in the Aegean and Mediterranean Regions stand out with high and very high levels of vulnerability. However, while vulnerability is high in the west of Central Anatolia, it decreases as we move towards the east.

When drought risk in the livestock sector is analyzed, it is seen that Konya and the provinces to its south and Eastern Anatolia provinces have high levels of risk. According to the current period data Konya, Karaman, Drought risk is very high in Aksaray, Niğde, Isparta, Antalya, Mersin, Kahramanmaraş, Malatya, Şanlıurfa, Elazığ, Diyarbakır, Muş, Ağrı, Erzurum and Kars (Figure 13).

Figure 13 Current Period Risk Map: Livestock Sector and Drought

4.4. CHANGE ADAPTATION MEASURES

Agriculture policy instruments for climate change adaptation in the agriculture sector capital, infrastructure, technology and information resources will be strengthened.

Measurement and development of human and social capital in agriculture, development of physical capital stocktechnological options and access to technology, structure of institutions and decision-making authorities and means of support, access to financial risk management tools, knowledge management and access to information are important.

Measuring and developing human and social capital in agriculture

Of the key socio-economic factors at the provincial level, one of the most determinant variables of adaptive capacity is the human development status of the province as measured by the 2017 SESI (Socio-Economic Development Index) score. SEGE reports reflect the socio-economic development level of a province or district. In this framework, in order to improve adaptation capacity, provinces lagging behind in education, health and economic development indicators at the district level will be provided with training. and health investments should be prioritized.

The age, education and gender profiles of agricultural producers, as well as the knowledge and education levels of employees of stakeholder institutions related to the agricultural sector are very important factors determining adaptive capacity. In order to improve adaptive capacity specific to the agriculture sector, relevant information should be collected systematically at lower levels such as agricultural enterprises, rural areas, villages, etc. and services and investments in education, health, equal opportunities for women and men should be prioritized for areas lagging behind in this field.

Sociological structure of the rural population, social and economic protection networks, social and

The protection and effectiveness of individual rights, the structure of social participation and equality, the prevalence of civil society organizations providing support in agricultural and rural areas are very important variables in terms of adaptation capacity. In order to improve adaptation capacity and prioritize the remaining administrative areas in resource and service allocation, relevant information should be systematically collected at lower levels such as provinces, districts, villages, etc. and adaptation action plans should be guided accordingly.

Land per enterprise is an important indicator of adaptive capacity. Justice, social benefit and women-centered land consolidation efforts are an investment area that will increase adaptive capacity. Provinces with low adaptive capacity and land per enterprise should be prioritized.

Associations serving in the agricultural sector should be supported for climate change adaptation and capacity building.

Climate change directly affects marine fisheries, which are important for some provinces. Along with these impacts, measures should be taken regarding the distribution of species that are the source of income for the fisheries sector, changes in annual catches, introduction, early detection, spread, destruction and management of invasive species. Income supports should be provided to increase the job and income risks of family fishing groups, which are especially common in provinces such as Muğla and Samsun, and investments should be made to create alternative income opportunities. Strategies that take into account the sustainability of diminishing resources and the socio-economic status and living conditions of fishermen should be developed.

Developing physical capital stock

In order to sustain agricultural production, the most important action is to protect and improve the current state of soil and water assets. In the name of conservation and development plans, soil and water assets should be analyzed and actions should be designed accordingly. It is necessary to prevent agricultural lands from being taken out of agriculture, to expand consolidation efforts, to make land use plans and to monitor the implementation process according to the plans.

It is necessary to ensure the protection of the qualities of agricultural lands, pastures and rural landscapes, to monitor pasture capacities and productivity, to identify and implement options that will help water balance in pastures and increase productivity.

The stock of basic infrastructure and superstructure related to agriculture, such as irrigation, transportation, logistics, energy, and its regional and local distribution are very important variables in terms of adaptive capacity.

In agricultural production, decreasing rainfall and increasing droughts under the impacts of climate change the water problem very critical. Therefore, the prevalence, efficiency and quality of agricultural irrigation infrastructure is the most important infrastructure requirement for adaptation.

Irrigation efficiency is key for the sustainability of water assets and thus the long-term adaptive capacity. As targeted in the 2017 "Regulation on Control of Water Use in Irrigation Systems and Reduction of Water Losses" (Official Gazette, 2017), investments to increase irrigation efficiency should be prioritized in provinces where the ratio of irrigated areas with irrigation efficiency above 55% is low compared to the total irrigation area of the province.

Increase physical investments in climate change adaptation that reduce exposure and increase efficiency in transport and logistics (modern warehousing, cold/cool air chain systems, efficient transport infrastructure).

Increased costs of livestock production can be significant for some regional and provincial economies. Capacity to mitigate heat stress development, ventilation and cooling investments should be supported. Support retrofitting of building, energy and road infrastructure.

Every stage of the supply chain in the agriculture sector vulnerability should be assessed; adaptation actions should be determined accordingly and the multi-stakeholder agriculture sector should be addressed in an integrated manner. Vulnerabilities need to be identified and adaptive capacity needs to be developed with the objective of making the chain more equitable, inclusive and sustainable, taking into account the Farm-to-Fork Strategy.

Technological options and access to technology

Factors such as access to new biological, chemical, infrastructural and information technologies in agriculture, and the prevalence and distribution of their use are crucial for building capacity to adapt to climate change.

Measures need to be taken to reduce the vulnerability of important crops for the province to climate change in the medium and long term. For example, in provinces where vulnerability is high due to reduced yields, the main factors that cause this should be identified and appropriate measures should be taken (such as variety change, crop pattern change).

In crop production and livestock breeding, studies should be carried out at provincial and/or district level to determine the appropriate crop pattern and livestock breeding system that can ensure efficient use of soil and water resources and conservation of biodiversity.

Investments should be made in the use of technologies such as satellite-based and sensor-based early warning and monitoring technologies, information systems and integrated agricultural application technologies, which are rapidly becoming widespread worldwide, and these technologies should be used in agricultural areas with low adaptive capacity. businesses access will be prioritized should be mainstreamed.

Especially in crop production, yield and production losses are expected to increase due to the increase in the number and frequency of disasters such as drought, heavy rainfall, floods and storms. Early warning systems should be expanded in the province. It is necessary to develop and implement systems and infrastructure for combating and adapting to droughts, floods, hail and floods, the impact of which is increasing in Turkey.

In addition to the dissemination of new technologies, traditional and natural methods that are environmentally friendly and increase the capacity to adapt to climate change de support is needed. In this context, it is important to develop inclusive and integrative urban agriculture practices with the community playing a participatory role. Measures should be taken to increase the number of people practicing organic agriculture and good agricultural practices across Turkey and to expand these practices in all provinces. Similarly, no-till agricultural practices, conservation and restorative agricultural practices, rain harvesting, permaculture, and living windbreaks should be promoted.

TARSİM (Agricultural Insurance Pool) is one of the important adaptation tools for climate risks. Extreme heat, extreme cold, number of consecutive dry days, floods and inundation, hail, storm intensity and frequency are covered by TARSİM within the framework of certain principles. This instrument an important capacity for the management of production-related risks. Damage prevention and risk mitigation systems such as Hail Netting and Covering Systems (against hail), Wind Blades (against frost)Fogging Systems (against frost), which are supported by TARSİM in the form of premium discounts, should also be encouraged. The available data do not provide detailed information on the technology use profiles of agricultural enterprises at provincial or district level. In order to improve adaptive capacity different technologies categories should be systematically collected at the lower levels of province, district, village, farmer profile and technological investment prioritization should be made accordingly.

Structure and support tools of institutions and decision-making authorities

The prevalence and effectiveness of central and local institutions serving the agriculture sector, their competencies in decision-making and implementation related to climate change, and the participation and influence of other components in decision-making processes are important factors in determining adaptive capacity.

Agricultural policies and legislation need to be reviewed and updated in order to create a sustainable and competitive agricultural sector that is resilient to climate change, uses technology effectively, and takes into account the basin's crop pattern and water budget.

The quality and quantity of support provided to agricultural enterprises should be prioritized and diversified to reduce exposure to climate change and increase adaptive capacity:

- **Agricultural income diversification supports:** In provinces where agricultural income is concentrated on a single crop, efforts should be made to diversify income.
- **Support for crop diversification:** In provinces where agricultural income is concentrated in one product group (wheat, barley, hazelnut, apricot, poultry farming), efforts should be made to diversify products.
- **Support for biodiversity:** Support small family businesses growing endemic crops important for sustaining biodiversity at local, regional and national level.
- **Crop subsidies that reduce sensitivity to climate change:** From products with high climate sensitivity to products with low

transition will lead local subsidies should be designed.

- **Non-farm income diversification subsidies:** Non-farm income generation for agricultural enterprises is an important adaptation method that reduces climate-related risks. Data should be collected in this area (non-agricultural income profiles of households) and investments should be made to develop alternative income opportunities in rural areas (tourism, health, energy, etc.).

- **Support for adaptation technology:** Resources allocated to technological investments in areas such as smart irrigation, smart crop monitoring and early warning should be significantly increased.

- **Adaptation-centered R&D support:** Resources allocated to R&D to enhance adaptive capacity, particularly seed development, should be significantly increased.

- **Support for medicinal plant production:** With climate change, it is expected that widespread and infectious diseases that do not currently exist will be experienced. For this reason, medicinal plants used in the treatment of diseases should be identified and their increase in production quantities should be supported.

- **Support for green infrastructure:** Resources allocated to infrastructure investments in logistics, transportation, efficient storage, especially smart irrigation systems, should be significantly increased.

- **Support for nature-climate friendly agricultural practices:** Traditional and natural methods that increase adaptive capacity to climate change should also be supported. In this framework, organic agriculture, good agricultural practices, no-till agriculture, conservation and restorative agriculture, rain harvesting, permaculture, living windbreaks should be supported. With the Ecosystem Based Adaptation (EBA) Strategy determined Harmony actions should be accompanied by clear policy objectives and periodically performance assessments should be made.

- **Support for legume production and consumption:** Emphasis should be given to the expansion of legume production and consumption. Support should be provided for the expansion of organic legume production and microbial fertilizer application during legume production.

- **Biological/nature reserve areas:** Agricultural areas identified due to low agricultural potential or critical ecosystem services should be considered as biological reserve areas. Producers working on these areas should be provided with income support to protect these areas.

- **Beekeeping:** Capacity building in beekeeping is crucial for adaptation. In provinces where beekeeping is widespread, beekeeping harmonization studies should be intensified and households and enterprises engaged in beekeeping should be supported in this direction. Beekeeping sector Harmony The link (risk relationship) with other sectors (especially fruit production and tourism) should be taken into account when developing capacity.

  - **Fishing** Changes in seawater temperature as a result of climate change and water parameters changes have adversely affected aquatic biodiversity and living resources have faced significant threats of extinction. With rising sea temperatures, fish species are becoming more economically viable, such as crop yields, reproduction and survival rates. important factors are changing. However, the risks of new diseases are increasing. Different or specific pollutants (emerging pollutants) solution-oriented studies should be carried out regarding risks arising from climate change. Increasing extreme climate events such as storms may damage facility infrastructures and require new investments. In light of these impacts and risks, infrastructure and scientific research support should be provided to increase the adaptive capacity of aquaculture. Strategies for combating invasive species should be developed (natural methods, etc.)

- **Women-centered adaptation supports:** In the context of climate events, women farmers and women agricultural workers are negatively affected, especially on the production side. Specific support instruments should be developed for women farmers and women agricultural workers. Women farmers and women workers with high vulnerability to climate hazards and low adaptive capacity should be prioritized and their adaptive capacity should be increased through support.

- **Implementation and sanctions:** It should be essential to support enterprises that carry out agricultural activities in accordance with climate change adaptation methods. However, the obligations of enterprises operating without adhering to these measures and precautions and damaging natural assets in a way that threatens agricultural sustainability should be increased and penal sanctions should be established and applied when necessary.

- **Revision of trade policies for climate change adaptation purposes:** The impacts of climate change on both export- and import-oriented products should be taken into account when determining international trade policies, and relevant policy instruments (import taxes, subsidies, bilateral, regional and global trade relations and agreements) should be used to mitigate the risks in this direction. Domestic

  Strategies and action plans should be prepared for products that are dependent on imports due to the inability of production to meet domestic demand, and whose imports have been increasing over the years.

  Investments should be made to develop local markets and supply chains to reduce dependence on food imports and capture more value from agriculture.

- **Protection of export products:** Export-related risks, especially the protection of producers from income loss shocks caused by extreme climate events, prioritization of adaptation efforts in export products, and planning for regional and ecological distribution of products should be made. Comprehensive reporting and projections should be made especially on the export of water-intensive crops, and species and varieties with high resistance to climate change should be selected. development of and investments should be increased for its dissemination.

Access to financial risk management tools

The capacity to respond to risks in different links of agricultural supply chains, the structure of production, processing, trade and consumption networks, and the capacity to measure and mitigate interlinked systematic risks should be improved.

One of the most important adaptation tools for climate risks is agricultural insurance. The number of insurance policies per enterprise should be increased, and provinces and/or crops with relatively low rates should be prioritized within the scope of crop pattern and production planning and support practices of the Ministry of Agriculture and Forestry.

More detailed modeling in addition to the existing practices with technology investments through TARSİM, crop pattern and production planning and support practices of the Ministry of Agriculture and Forestry for farmers and/or products

In this context, premium support should be increased according to vulnerability and risk levels, reduced for products that are not suitable for planning, loss indemnities should be strengthened by using instruments such as deductibles and co-insurance rules, and income guarantees should be increased.

Not only the climatic impacts of climate insurance but also its socio-economic interactions should be monitored at the local level as a risk factor and insurance coverage should be diversified locally. Since the developments to be made in this area will bring an increasing budget burden in the light of the climate risks that are expected to increase, financing plans should be made dynamically in a timeline and flexibility to meet these burdens.

Information management and access to information

The reliability of the information provided to decision-makers and the competence of public and private organizations in the agricultural sector to produce information should be improved.

The breadth and depth of research studies on climate impacts and adaptation in the agricultural sector in universities should be increased, and the competence to incorporate existing scientific research and data into decision-making processes should be improved. In addition, universities should adopt interdisciplinary approaches in this field and develop solution-oriented and innovative strategies for climate change-related problems in the agricultural sector. Appropriate cooperation and support should be provided in line with these strategies.

Climate sensitivity studies should be conducted on climate variables and main agricultural products in all regions.

Development of plant species and animal breeds with relatively low climate sensitivity; protection of local breeds with high adaptive capacity, Supporting and dissemination is required.

Research on new plant and animal diseases and harmful organisms that may emerge due to climate change and measures should be taken against the risks of diseases and harmful organisms. In order to make a systematic assessment of Turkey's capacity in this regard, study involving relevant stakeholders and experts is required.

The number of personnel in provincial/district directorates of agriculture should be increased and their competencies in climate change adaptation should be strengthened. Provinces lagging behind in this field should be provided with competent personnel support.

Farmers across Turkey should be supported with large-scale, short- and long-term training programs on the observed and expected impacts of climate change. Local and crop-based trainings should be provided on self-adaptation efforts and their benefits.

Trainings on knowledge and practices on publicly supported adaptation efforts should be provided. Both local teams of the Ministry of Agriculture and Forestry, local representatives of the private sector, and leading farmers should be supported with training of trainers to disseminate this training.

Comprehensive trainings on climate change and agriculture should be provided to children and youth in schools in rural and urban areas through the Ministry of National Education (MoNE) and the Council of Higher Education (YÖK), and in schools in rural areas through universities for the holism of knowledge and competencies in the field of adaptation.

All producers across Turkey should be supported by modern telecommunications networks and technologies, and a vibrant and dynamic communication network where they can receive reliable, accurate and reliable information that can benefit them from day-to-day operations to their long-term plans.

In the light of this information and recommendations, three strategic targets for adaptation to climate change in the agriculture sector have been identified and twelve actions have been proposed to achieve these targets.

Strategic Objective 1. Developing the policy and legal framework for adaptation of the agriculture sector to climate change, strengthening institutional capacity, cooperation and awareness.

Reviewing and updating agricultural policies and legislation to create a sustainable and competitive agricultural sector that is resilient to climate change and uses technology effectively, taking into account the basin's crop pattern and water budget.

TAR2. Planning agricultural production on the basis of agricultural basins or enterprises and in planning Revision of agricultural subsidies to achieve the targets.

TAR3. Adaptation to the impacts of climate change for the purpose of agriculture sector

Activity showing stakeholders for education awareness raising and Capacity dissemination of development activities.

ion

Ensuring the protection, development and sustainable use of ecosystems and natural resources.

Appropriate cropping pattern and animal husbandry system in crop production and animal husbandry that can ensure efficient use of soil and water resources and conservation of biodiversity at provincial and/or district level to determine

for Studies

Making farmer orientation

Preparation of guidelines for the purpose.

landscaping of

TAR5 Agriculture qualities of and rural of their land,

pastures

protection of d Provision,

Pasture

capacities and efficiency

Monitoring,

help water balance in pastures,

identification and implementation of options to increase efficiency.

TAR6. Developing nature-based solutions guidelines for agricultural activities at national level, developing an ecosystem-based food production model, implementing and disseminating agroforestry activities in the agricultural environment.

TAR7. Promoting sustainable aquaculture compatible with climate change, protection, development and sustainable use of aquatic biodiversity, developing a plan to combat invasive species in fisheries.

TAR8. Improve support for households and enterprises engaged in beekeeping; take into account the linkage (risk relationship) with other sectors (especially fruit production, tourism and honey forest).

Increasing R&D studies on the impact of climate change on agriculture and adaptation, developing database, information technologies and innovation practices in agriculture and carrying out agricultural activities accordingly.

TAR9. Agriculture sector climate

Supporting and developing R&D studies on the impacts of change and adaptation.

Identification and monitoring of socio-economic factors that play an important role in determining vulnerability in the agricultural sector (at province, district, village level).

Developing database, information technologies and innovation applications and innovative activities in agriculture and conducting agricultural activities accordingly.

Reducing losses and damages related to critical infrastructures (irrigation, cold chain, modern storage, transportation infrastructure, etc.) and the impacts of climate change on the insurance system by considering

Development.

SOURCE: Agriculture and Food Security

Dellal, I. McCarl, B., (2007). Climate Change and Agriculture: Predictions for Turkey, International Conference on Global Climate Change and its Environmental Impacts, KOSKI, Konya.

Dellal, İ. (2018). The Impact of Climate Change on Agriculture Sector, TURKTOB Journal, Issue 28, p:31.

Dellal, İ., Ünüvar,F.İ., Bolat. M., Polat, K., (2020). Climate Change and Agriculture: Economic Impact, Adaptation and Mitigation Policies, TMMOB Chamber of Agricultural Engineering, Turkey Agricultural Engineering IX. Technical Congress Proceedings Book I, Ankara.

Dellal, I., Unuvar, F.İ. (2019). Effect of climate change on food supply of Turkey Journal of Environmental Protection and Ecology. https://www.researchgate.net/publication/335974011_EFFECT_OF_CLIMATE_CHA Retrieved from NGE_ON_FOOD_SUPPLY_OF_TURKEY.

Dellal, İ.(2021a). Impact of Climate Change on Turkey's Food Security5th International, 25. National People Health Congress, 13-18 December 2021. Retrieved from https://uhsk.org/2021/uhsk_kongre_kitabi.pdf

Dellal, İ. (2021b). Climate crisis and Agri-Food Sector. 3rd International Congress on Agriculture and Food Ethics, Agriculture and Food Ethics Association (TARGET). https://www.targetder.org/dosyalar/file/yayinlar/3%20-
Retrieved from %20Tarım%20Gıda%20Etik%20Kongresi%20%20Bildiri%20Kitabı.pdf

OECD (2016). Evaluation of Agricultural Policy Reforms in Turkey. https://www.oecd.org/publications/evaluation-of-agricultural-policy-reforms-in-turkey-9789264113220-en.htm.Retrieved from

Official Gazette (2017). Regulation on Control of Water Use in Irrigation Systems and Reduction of Water Losses. 16.02.2017 dated and 29981 numbered Official Gazette. Retrieved from https://www.resmigazete.gov.tr/eskiler/2017/02/20170216-1.htm.

TAGEM. (2021). Analysis of the Sensitivity of Sunflower and Wheat Crops to Climate Change with Aquacrop Model (2021), Kırklareli

TURKSTAT (2022). Population, National Accounts, Foreign Trade, Labor Force, Agriculture Statistics. https://biruni.tuik.gov.tr https://www.tuik.gov.tr/ from received.

BİYOLOJİK ÇEŞİTLİLİK VE EKOSİSTEM HİZMETLERİ

iklime uyum

5.2. GENERAL FRAMEWORK

To increase studies on biodiversity in our country and to increase public awareness of ecosystem services awareness needs to be raised.

Our country is extremely rich in terms of species diversity as it is on the migration routes of species during the ice age and interglacial periods. At the same time, the fact that it has very different climatic characteristics, the diversity of bedrock and soils formed from them, flat hilly, mountainous areas, rocky areas, dunes, steppes, lakes and rivers have enabled the species migrating to our country to use these places as shelters in changing climatic conditions. On the other handgenetic diversity has increased and new species have emerged due to geographical isolation, natural selection and evolution by mutations. Davis (1971) classified our country as Irano-Turanian, Europe-Siberia and Mediterranean phytogeography (Türkeş, 2015). In addition, since humans started agriculture in the south of Turkey, many cultivated plants originated in this region and their ancestors are still living naturally. Two of the 8 gene centers (Mediterranean and Middle East) identified by Vavilov for cultivated species are in Turkey (FAO, 2019).

Although our species diversity is high, it is noteworthy that there are more studies on plants and vertebrate animals, while there are gaps in studies on various groups such as invertebrate species and fungi. There is no current data source where all the species in our country are given together. However, with the data compiled from various sources, it can be said that the total number of taxa in our country is more than 42 thousand (Table 2).

Table 4 Number of taxa in Turkey

Animals	Number of taxa	Endemic number of taxa	Plants	Number of taxa	Number of endemic taxa
Terrestrial mammals	175[1]	9[1]	Vascular Plants	12.141[1]	3.497[1]
Cetacean	11[2]	0	Black mosses	910[6]	7[7]
Birds	500[1]	0	Ferns	101[6]	3[4]
Reptiles	146[1]	19[7]	Green and red algae	2.150[6]	Unknown
Bivalves	39[1]	15[1]	Lichens	1.000[6]	Unknown
Inland water fish	403[1]	163[1]	Water algae	3.690[3]	Unknown
Sea fish	512[3]	0	Liverworts	168[4]	Unknown
Insects	20.000[4]	4.000[4]			
Molluscs	522[4]	203[4]			
Corals	24[5]	Unknown			
Total	22.332	4.409	Total	20.160	3.507

[1] **(**DKMP, 2021**)**; [2] Dede & Tonay (n.d.); [3] Bilecenoğlu et al. (2014); [4] (DKMP, 2019); [5] Topçu & Öztürk (2017); [6] DKMP (2008); [7] Ursavas &e Işin (2018); [8] Taşkın (2019)

4,409 of the animal taxa and 3,507 of the taxa in groups such as plants, mosses and lichens are endemic. Endemism rates are 20% and 17% respectively. When the endemism rate is evaluated in terms of the 6 living groups examined within the scope of the Noah's Ark National Biodiversity Database Project carried out by the General Directorate of Nature Conservation and National Parks, this rate is 27.6%. Of this, 3.2% belongs to local endemic taxa (DKMP, 2021).

Taxa from the Noah's Ark database have an IUCN category of very endangered (CR), distribution data of taxa classified as endangered (EN) and vulnerable (VU) by province can be accessed. Taxa in these categories are defined as threatened. A total of 6 different living groups analyzed in the database in our country There are 13,404 taxa, of which 117 are listed as very endangered (CR), 155 as endangered (EN) and 146 as vulnerable (VU). Accordingly, the total number of threatened taxa in Turkey is 418 (Figure 14).

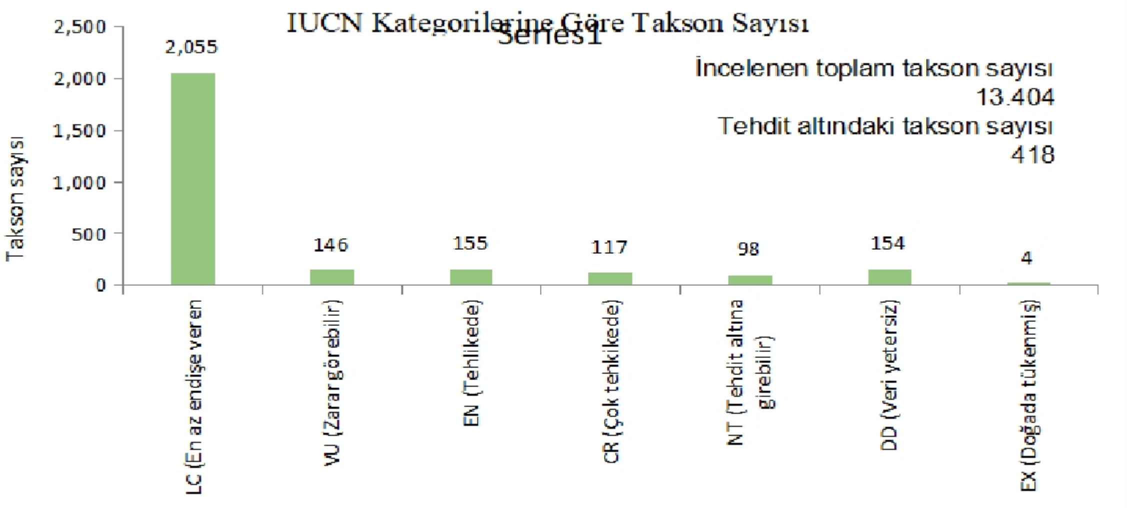

Figure 14 Distribution of taxa in Turkey according to IUCN categories

Turkey is rich in habitat and ecosystem diversity as well as genetic and species diversity. However, the number of awareness and scientific studies on habitat diversity is very low.

There are data sources for various ecosystems in our country, which has a surface area of 78 million ha excluding the seas, produced using ground measurements or satellite images. Of these, the CORINE (Coordination of Environmental Information) land cover classification produced by the Ministry of Agriculture and Forestry stands out in terms of showing temporal change (MoAF, 2021). When the data are analyzed, it seen that the areas suitable for agriculture are in the first place with 18.7 million ha, followed by 11.4 million ha. million ha, followed by heterogeneous agricultural areas. This is followed by sparsely vegetated areas and natural grasslands with 9.3 and 8.9 million ha, respectively. The highest area change between 1990 and 2018 was in heterogeneous agricultural areas with a decrease of 1.2 million ha. There were significant decreases in sparsely vegetated areas, mixed forests, natural grasslands and bare rocks.

Ecosystems in our country produce many products such as food, water and wood raw materials. They also provide supportive ecosystem services such as carbon storage, wastewater treatment, climate regulation and cultural ecosystem services such as tourism, recreation, transhumance, contributing to society .

5.3. SECTORAL LEGAL FRAMEWORK AND RESPONSIBLE INSTITUTIONS

In our country, all legislation that includes provisions on land use, biodiversity and ecosystem services, and for effective nature conservation, biodiversity needs to be recognized in all relevant legislation. protection must be essential.

The institutions directly responsible for biodiversity in Turkey are DKMPGM, BSGM and TVKGM. OGM is also responsible for some protected areas such as protected forests. In this context, the most important laws related to protected areas are the National Parks Law No. 2873 and the Law No. 2863 on the Protection of Cultural and Natural Heritage. Land Hunting Law No. 4915 and Fisheries Law No. 1380 also contain provisions directly related to biodiversity. However, there are also laws related to various ecosystems such as agriculture, forests and pastures. Forest Law No. 6831, Soil Conservation and Land Use Law No. 5403, Pasture Law No. 4342, Coastal Law No. 7121 can be given as examples. In particular, according to Articles 16, 17 and 18 of the Forestry Law, uses other than forests can be permitted, and according to Additional Article 16, unproductive, stony and rocky areas can be excluded from forest boundaries. Again, some provisions in various laws such as the Mining Law No. 3213, the Law No. 2634 on Tourism Incentives, the Law No. 5346 on the Utilization of Renewable Energy Resources for the Purpose of Electricity Generation may directly or indirectly negatively affect biodiversity and ecosystems. MoAF, General Directorate of Fisheries and Aquaculture (BSGM), General Directorate of Crop Production (BÜGEM), General Directorate of Livestock Production (HAYGEM), General Directorate of Water Management (SYGM), General Directorate of State Hydraulic Works (DSİ), General Directorate of Agricultural Reform (TRGM) Agricultural Research General Directorate (TAGEM) can be given as examples of stakeholder institutions. In the MoEU, General Directorate of Spatial Planning (MPGM), General Directorate of Combating Desertification and Erosion (ÇEMGM), General Directorate of Environmental Impact Assessment, Permitting and Inspection (ÇEDİDGM), General Directorate of Environmental Management (ÇYGM), General Directorate of Meteorology (MGM) are important stakeholders. Among these actors and stakeholders, the Strategic Plan for Climate Change Adaptation in Forestry has been prepared by DG Forestry. In addition, in the 2019-2023 Strategic Plan of the MoAF, the targets covering biodiversity and ecosystem services are set as follows:

- To protect biological diversity and ensure its sustainable management
- Genetics sources protect and ensure sustainable use
- No. 2873, to ensure effective management in protected areas subject to the National Parks Law and to develop nature tourism
- Identifying areas with natural, historical and cultural resource values, declaring them as protected areas and ensuring their sustainable management
- To ensure the protection and continuity of biological diversity, to raise awareness
- Ensuring sustainability in wildlife and hunting management

Among the international conventions to which Turkey is a party, the United Nations Convention on Biological Diversity is directly related to the field. The United Nations Framework Convention on Climate Change and the United Nations Convention to Combat Desertification also contain provisions on biodiversity and ecosystem services, especially the protection of ecosystems and the prevention of their destruction. Apart from these, there are some other related to biological diversity

Examples of international conventions are listed below.

- International Convention for the Protection of Birds (Paris)
- Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona) and related protocols
- Convention for the Protection of the World Cultural and Natural Heritage (Paris)
- European Convention for the Conservation of Wildlife and Habitats (Bern)
- Convention for the Protection of the Black Sea against Pollution (Bucharest)
- International Treaty on Plant Genetic Resources for Food and Agriculture
- Convention on Wetlands of International Importance, Especially as Waterfowl Habitats (RAMSAR)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Convention on Long-Range Transboundary Air Pollution
- International Convention for the Prevention of Pollution from Ships (MARPOL)
- Convention for the Protection of the Ozone Layer (Vienna)

In the European Union, various directives and council decisions are directly related to biodiversity. The most important of these are Council Directive 79/409/EEC on the Conservation of Wild Birds, Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna and Council Directive 92/43/EEC on the Protection of Natural Habitats and of Wild Flora and Fauna in the Field of Water Policy. Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action.

In addition, in recent years, the European Union has prepared various 2030 strategies such as Forest Strategy, Biodiversity Strategy, Soil Strategy. In this regard, with the European Union Nature Restoration Law adopted on June 22, 2022, 20% of the destroyed marine and terrestrial ecosystems in Europe should be restored by 2030 and all of them by 2050. is foreseen.

There are even statements in the European Green Deal for the protection of biodiversity and ecosystem services. In the European Commission, the Draft Nature Restoration Law became law on July 12, 2023.

Regulating our legislation in accordance with the international conventions to which we are a party, eliminating contradictions and prioritizing the purpose of all relevant legislation as nature conservation to be should be ensured. In the 2030 Biodiversity Strategy of the European Union, a target of 30% of the continent's marine and terrestrial protected areas has been set. In the Aichi targets of the Convention on Biological Diversity, the proportion of protected areas, which was determined as 17% worldwide, has been updated as 30%. Increasing the proportion of protected areas in Turkey is seen as an important target and efforts are being made to this end.

5.4. EFFECTS OF CHANGE

Biodiversity and ecosystem services negatively affected by all climate hazards; habitat changes, pollution, over-exploitation, invasive species, invasive species, low awareness.

Thousands of species, dozens of habitats and ecosystems in our country are affected by droughts, temperature increases, floods and floods, storms, forest fires sea It is possible to say that they will be adversely affected by all climate hazards, up to the rise in temperature. For example, temperature increases primarily affect the phenology of species. Thus, there is earlier flowering in spring and later leaf fall in fall. Increased temperatures will increase respiration and transpiration, so it is not possible to increase plant growth in arid conditions. In fact, premature defoliation or desiccation may occur in summer and fall due to lack of water. On the other hand, sudden temperature drops in spring and fall can cause frost damage. Temperature increases are expected to lead to changes in migration times, earlier reproduction periods and shorter incubation periods in animal species. The sex of some species in our country depends on temperatures. One of these is *the Caretta caretta*, which buries its eggs in the sand and the sex of this species depends on the nest temperature. According to a study, when the nest temperature rises from 29.7°C to 31.5°C in this species that builds its nests on beaches female number of individuals from 60% to 90% (Sezgin, 2016). Temperature increases are also expected to cause plants to migrate, shifting their distribution areas latitudinally northward and towards the peaks of mountains (Ustaoğlu, 2009; Zeydanlı et al., 2010; Akyol & Örücü, 2019; Dağtekin et al., 2020; López-Tirado et al., 2020; Ergin, 2022). There are studies showing that some bird species will migrate several hundred kilometers to the north and some species will lose their breeding grounds (Abolafya et al., 2013). It is stated that due to the warming of marine waters, the distribution of many benthic and pelagic marine organisms will narrow, migration will be forced, reproduction problems may occur, and especially species that prefer cold waters are more sensitive (Kayhan et al., 2015). Some invertebrate species can increase the number of offspring they give in a year due to the increase in temperature. However, this situation can also lead to rapid reproduction and multiplication of pests and expand their impact areas. Especially in agricultural and forest areas, it is highly likely that economic losses will increase with the increase in pests. Temperature increases are also expected to affect various seagrass species in the seas of our country. Chefaoui et al. (2018) explain that according to the RCP8.5 (IPCC Climate Change scenarios) scenario, up to 75% of *Posidonia oceanica* meadows may be damaged in the mid-21st century and all of them are at risk of extinction in 2100. Similarly, they state that *Zostera marina*, a species that prefers cold water, may disappear with the warming of the seas.

One of the most important effects of temperature increases and drought events will be to increase the risk of forest fires spreading over large areas in a short time. As a matter of fact, 133 thousand ha of forest, 26 thousand ha of agricultural and 2,300 ha of treeless forest areas were burned in fires between July 28 and August 15, 2021. Although climate change was not effective in the outbreak of these fires, temperatures of up to 45°C, prolonged droughts and strong winds made it difficult to extinguish the fires.

Temperature increases can lead to negative impacts such as an increase in the frequency and severity of agricultural droughts due to a change in precipitation regime in agricultural areas and a decrease in precipitation, a decrease in agricultural production, a change in planting times, and an increase in irrigation water demand.

Due to temperature increases, snowfall is expected to fall as rain, snow cover and glaciers will melt, resulting in reduced water flows in rivers. Reduced river flows are expected to adversely affect fish species migrating from sea to freshwater or inland waters. Eels and sturgeon species that migrate between the sea and fresh waters may not be able to do so if lakes or rivers are cut off from the sea. Water levels are expected to decrease and the physicochemical properties of water are expected to change due to increasing temperatures and increased evaporation on water surfaces. Species sensitive to changes in temperature and water quality are expected to be adversely affected by these changes. Fish mortality may occur if the amount of dissolved oxygen in the water decreases. In the event of complete drying up of the rivers, if there are no small puddles of water called refugia, fish, amphibians such as salamanders and some frog species, and invertebrates such as dragonflies and damselflies may die out completely or their numbers may decrease significantly.

Sea level rise, another climate hazard, threatens plant species living in coastal dunes. Sea level rise may cause the breeding areas of species such as *Caretta caretta* and *Chelonia mydas*, which use dunes as spawning grounds, to shrink (Kaska, 2021).

The response of species to climate change and their adaptive capacities are different. However, in nature, species are not independent from each other and there are predator-prey, symbiotic, etc. relationships between them. Even if a species adapts to climate change, disruption in the food chain or disruption of synchronization between species can have negative effects.

Extreme climate hazards such as storms, snow, lightning, wet landslides can cause trees to fall or break in forests. These climate hazards also negatively affect agricultural areas, especially greenhouses. Storms and hailstorms are the most common extreme climatic events in our country, along with floods and overflows, and cause great economic losses. In this context, dust storms in semi-arid areas can even negatively affect human health.

However, it is predicted that there will be an increase in the number of invasive alien species entering our country due to climate change. Even today, it is known that there are many invasive alien species such as pufferfish (*Lagocephalus sceleratus*), lionfish (*Pterois miles*), sea urchin (*Diadema setosum*), Singapore turtle (*Trachemys scripta elegans*), water hyacinth (*Eichornia crassipes*) in marine and terrestrial ecosystems. The Ministry of Agriculture and Forestry, General Directorate of Fisheries and Aquaculture has started to implement a support program since 2020 in order to reduce the populations in the ecosystem by creating hunting pressure on pufferfish species, which are invasive species, and to reduce their participation in the stock, and approximately 130,000 pufferfish species have been supported so far. within the scope of fishing has been carried out, preventing the increase of their populations and distribution areas in the Mediterranean and Aegean Sea. This situation also benefits the countries that are riparian to the Mediterranean and the Aegean Sea as well as as well as , It has also contributed to the protection of biodiversity in our seas.

On the other hand, in addition to the fight against the invasive alien species pufferfish, a series of activities are carried out in order to create hunting pressure on lionfish (Pterois miles), sea urchin (Diadema setosum) and migratory jellyfish (Rhopilema nomadica), which are other invasive species with increasing distribution in our seas, and to bring them into the economy.

Finally, the products and services produced by species, habitats and ecosystems are also inevitably affected by climate change.

Each of the thousands of species in our country is to be affected differently by climate hazards. This is because each species has ecological characteristics and requirements such as population sizes, adaptive capacities and colonization abilities, migration rates, threat factors other than climate change, and feeding habits. Unfortunately, there is insufficient data to conduct species-based vulnerability and risk analysis. The same is true for habitats and ecosystems. Each habitat and ecosystem will be affected by different climate hazards. For example, islands and coasts will be more affected by sea level rise, forests by fires and droughts, wetlands by droughts and heavy rainfall, cities by hot weather. waves and floods. Again, factors other than climate change that increase the adaptive capacity and sensitivity of each ecosystem are also different. Therefore, separate vulnerability and risk analyses need to be conducted for each ecosystem across the country. Within the scope of the study, drought was taken as a climate hazard, and vulnerability and risk analysis of this hazard was carried out for species diversity, carbon storage ecosystem service and wetlands.

Biodiversity and Ecosystem Services Sector - Risk Assessment of Species Diversity: Drought

Considering that all species living in terrestrial ecosystems and inland waters will be negatively affected by drought eventsdata on the number of taxa in provinces in the Noah's Ark database were used as exposure indicators in the impact chain (Figure 15).

The fact that species are endemic or threatened according to IUCN increases their sensitivity. However, some factors other than climate hazards (land degradation, forest fires, erosion, agricultural irrigation, population density, etc.) can also affect species their fragility sensitivity indicators were determined considering that they would increase the sensitivity of the province. For some indicators such as pollution and invasive species, no provincial level data could be found. On the other hand, the existence of protected areas and the presence of natural areas in the provinces are thought to contribute to the protection of species and provide refuge for migrating species. Although connecting fragmented habitats with ecological corridors is also a factor that would facilitate adaptation, it has not yet been used in Turkey due to the limited studies in this context. Similarly, the effective implementation of species conservation action plans or protected areas management plans can also protect species. These indicators could not be used in the analyses due to the fact that the number of species conservation action plans, which is about 100 to date, and implementation studies are insufficient or not related to climate change. The implementation of the prepared species conservation action plans is monitored at least every 5 years and it is planned to include climate change scenarios in the future species action plans. For the adaptive capacity component, socio-economic indicators were used. This

It was evaluated that increasing the level of education, the number of associations operating in the field of environment and nature conservation, and the level of income in the provinces would increase the awareness on biodiversity.

When the exposure of species diversity by provinces was evaluated, it was revealed that the exposure was generally higher in provinces with more species diversity. Species diversity in the provinces located in the Mediterranean and Central Anatolia come to the forefront. Similarly, the exposure of species diversity to drought is high in the Marmara Region. In provinces in the Black Sea and Aegean regions, it is noteworthy that exposure is at high and medium levels. In the Black Sea Region, only Artvin and Giresun have a very high level of exposure . In contrast to Provinces in Southeastern and Eastern Anatolia have lower levels of exposure to species diversity than other regions.

Type diversity When sensitivity is evaluated, the Mediterranean region comes to the forefront. This is due to the high number of endemic and threatened taxa in this region, as well as factors such as mining, forest fires, settlement pressure and population density that threaten taxa. Similarly, in Konya, Karaman and Niğde provinces in the Central Anatolia Region, sensitivity was determined to be very high. In the Aegean Region, it is understood that the sensitivity is very high and high in the coastal provinces, except Aydın in the Aegean Region, and decreasing in the Central Aegean Region.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Toplam yağış miktarında azalma	Kuraklık	Bitkiler	IUCN Tehdit altındaki tür olması	Korunan alanların oranı	Orman alanlarının zarar görmesi
Ortalama sıcaklık artışı	Yağış miktarı ve yağışlı gün sayısında azalma	Kuşlar	Endemik olması	Doğal alanların oranı	Göl ve akarsu sistemleri ile sulak alanların kuruması veya su seviyesinin azalması
	Ardışık kurak gün sayısında artış	Memeliler	Lokal endemik olması	Önlisans ve üzeri eğitim almış nüfus oranı	Otlak ve bozkırlardaki tek yıllık bitkilerin kuruması
		Balıklar	Arazi tahribatı olup olmaması (maden vb.)	Çevre, doğal hayat, hayvanları koruma dernek sayıları	Ekosistem hizmetlerinde gerileme
		Sürüngenler	Karayolları, demiryolları ve ilgili alanlar ile havaalanları oranı	Kişilerin gelir durumu	Endemik ve tehdit altındaki türlerin yok olması
		Çift yaşamlılar	Sulu tarım yapılan alanların oranı	Ekolojik koridorlar*	Tür içi ve türler arasındaki ilişkilerin bozulması
		Habitatlar*	Erozyon miktarı	Etkin olarak uygulanan korunan alan yönetim planlarının olması*	Canlıların göçe zorlanması
		Türler*	Orman yangınları sayısı		Canlılarla birlikte patojenlerin de taşınması
			Yerleşim ve endüstriyel alanların oranı		
			Nüfus yoğunluğu		
			Kirlilik**		
			İstilacı türler**		

Figure 15 Impact Chain: Biodiversity and Ecosystem Services Sector Drought-Species Diversity Relationship

*The * symbol indicates indicators that cannot be used in risk analyses, and the ** symbol indicates that there is no data for the indicator.*

According to adaptive capacity indicators, provinces in Eastern Anatolia and Southeastern Anatolia have low adaptive capacity. Similarly the provinces of Çorum, Yozgat, Kırıkkale, Nevşehir in Central Anatolia have low adaptive capacity due to the low socio-economic indicators in these provinces and the small amount of protected areas. The provinces with very high adaptive capacity in terms of species diversity are developed provinces such as Istanbul, Ankara, Izmir, Antalya, Bursa, Muğla and Eskişehir. Provinces such as Artvin, Rize, Erzincan and Tunceli have more natural areas. Due to this, it has been determined that the adaptive capacity in terms of species diversity is at a high level.

When the current drought risk results of species diversity are evaluated, the provinces in the Eastern Mediterranean, central and western Southeastern Anatolia, and Konya, Karaman and Niğde in Central Anatolia stand out with high risk levels (Figure 16). In Kars and Erzurum in Eastern and Giresun in the Black Sea Region, species diversity is at very high risk to drought.

Figure 16 Current Period Risk Map: Biodiversity and Ecosystem Services Sector Drought-Species Diversity Relationship

As explained earlier, each species will be differently affected by climate hazards. The species diversity and drought vulnerability and risk analyses conducted here should be taken as examples. Species-specific vulnerability and risk analyses, particularly for endemic and threatened species, are important for developing actions to protect these species. However, for species-based analysis, the ecology of the species, pressure factors, protection measures, etc. are needed.

When evaluating the drought risk obtained for species diversity, it should not be considered that species diversity in provinces where the risk is low is not under pressure. In general, since the drought risk is lower in the Black Sea and Marmara Regions compared to other regions, species diversity in these regions is not affected by drought.

will be less affected than in southern regions. However, the future change of factors other than climate change could not be examined in this study, and land degradation that increases the sensitivity of species diversity or increases in the number of invasive species that cannot be evaluated due to lack of data may increase the risk of species diversity. On the other hand, species in these regions are also under pressure from other climate hazards. For this reason, measures to reduce sensitivity and increase adaptive capacity should be taken in provinces where the risk is low.

Biodiversity and Ecosystem Services Sector Risk Analysis of Carbon Storage: Drought

The threat of drought also negatively affects many ecosystem services provided by ecosystems. These include ecosystem services such as food production, water production, habitat creation, and carbon storage. Within the scope of this study, the drought risk of carbon storage ecosystem service is taken as an example and the prepared impact chain is given in Figure 17. Because natural ecosystems, especially forests, wetlands, wetlands, coastal areas and soils are extremely important carbon sinks, and the 12th Development Plan, which our country has set as a target It is of utmost importance to protect and increase their areas in order to reach the 2053 net zero emission target with a low-carbon growth approach that puts the fight against climate change at the center.

Drought events can lead to the drying up of very important carbon sinks such as wetlands, leading to the deterioration of the carbon storage function stored in these areas. The amount of carbon stored or annually accumulated by wetlands in Turkey could not be evaluated within the scope of the analysis due to insufficient measurements. Exposure, as factors such as overproduction of wood from forests, land use changes and urbanization pressure can also lead to a reduction in the amount of carbon ecosystems store or take up from the atmosphere annually. indicator can be evaluated as an indicator of adaptive capacity in the drought-carbon storage relationship. Activities that can be taken to increase the amount of carbon stored in natural ecosystems, such as afforestation, rehabilitation of hollow closed forests, pasture improvement, can be considered as adaptive capacity indicators in the drought-carbon storage relationship. Similarly, erosion prevention efforts or good agricultural practices can be used as adaptive capacity indicators as they will increase organic carbon stocks in soils.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Toplam yağış miktarında azalma	Kuraklık	Ormanlardaki odun artımı	Aşırı odun üretimi	Ağaçlandırma	Ormanlardaki ağaçların gelişiminin yavaşlaması
Ortalama sıcaklık artışı	Yağış miktarı ve yağışlı gün sayısında azalma	Ormanlardaki ağaç serveti	Erozyon miktarı	Boşluklu kapalı ormanların rehabilitasyonu	Sulak alanların kuruması veya su seviyesinin azalması
	Ardışık kurak gün sayısında artış	Toprak organik karbon stokları	Arazi tahribatı olup olmaması (maden vb.)	Islah edilen mera alanları	Otlak ve bozkırlardaki tek yıllık bitkilerin kuruması
		Doğal alanların oranı	Yanan orman alanları	Orman alanlarındaki değişim oranı	Yutaklarca atmosferden alınan CO_2 miktarının azalması
		Makilikler, bozkırlardaki bitkiler*	Yerleşim ve endüstriyel alanların oranı	İyi tarım uygulamaları ile toprak organik karbon stoklarının arttırılması*	2053 yılı net sıfır karbon emisyon hedefinin tutturulamaması
			Aşırı otlatma yapılan alanlar**	Doğal gençleştirme ile genetik çeşitliliğin korunması**	Toprak verimliliğinin azalmasıyla verim artışındaki azalma
				Erozyon kontrol çalışmaları**	Sıklığı, şiddeti ve etki alanı genişleyen orman yangınları
					Ağaç serveti ve artımın azalması
					Toplumun odun ham maddesi ihtiyacının karşılanamaması

Figure 17 Impact Chain: Biodiversity and Ecosystem Services Sector Drought-Carbon Storage Relationship

*The * symbol indicators that cannot be used in risk analyses, while the ** symbol indicates that there is no data for the indicator.*

When the drought exposure of the carbon storage ecosystem service by provinces is analyzed, it is seen that the Black Sea Region, which has a higher amount of forest area and therefore a higher amount of tree wealth and increment, stands out. Exposure was also found to be high in the Mediterranean Region, which also has more forest areas. On the other hand, in Central Anatolia and Southeastern Anatolia, the low forest cover and low organic carbon stocks in soils due to intensive agriculture have led to very low exposure.

Sensitivity is quite high in provinces with high wood production and in the Aegean, Mediterranean and Marmara Regions where land use change (mining areas, settlement areas, etc.) occurs. Provinces in the Aegean and Mediterranean Regions also have a high amount of forest area lost to forest fires, which increases sensitivity. In some provinces such as Artvin and Bayburt

In the provinces, the possibility of transportation of soil organic matter due to high water erosion increases the sensitivity. However, in general, in the Eastern Anatolia, Southeastern Anatolia and Central Anatolia Regions, where forest areas are low, sensitivity was found to be low due to the low amounts of forest areas damaged by fires and wood production.

The adaptive capacity in provinces with more rehabilitated closed forests and rehabilitated pastures was determined at a high level. Since the data on newly established forest areas was not available, afforestation data could be used as an indicator. Accordingly, adaptive capacity was found to be high in provinces with high annual afforestation such as İzmir and Denizli. On the other hand, in some provinces in Thrace, Western Black Sea and Eastern Anatolia carbon storage in terms of provinces adaptive capacities were found to be low.

Carbon storage ecosystem drought risk of the service,

Today, provinces in the Eastern Black Sea and Mediterranean regions are at high risk (Figure 18).

Figure 18 Current Period Risk Map: Biodiversity and Ecosystem Services Sector Drought-Carbon Storage Relationship

In the Marmara Region, the risk is very high in Edirne, Çanakkale and Yalova. In the Aegean Region, the risk of carbon storage being affected by drought is at high and medium levels. This is mostly due to the fact that forest areas, which are expected to be more affected by drought, cover larger areas in these regions. On the other hand, the risk is very low in Central Anatolia and Southeastern Anatolia, which have low forest areas. Although the risk of drought is lower in the Black Sea Region today compared to other regions, the higher risk of disruption in carbon storage is due to excessive wood production and high erosion in these regions, as well as afforestation, rehabilitation and pasture improvement of your work less is due to the fact that.

Biodiversity and Ecosystem Services Sector Risk Analysis of Wetlands: Drought

The final assessment between drought and the biodiversity and ecosystems sector was made with a special focus on wetlands. Wetlands are one of the ecosystems that will be at risk due to drought hazard, as both precipitation decreases and evaporation increases in parallel with temperatures, and the impact chain prepared for the analysis is shown in Figure
19 given by 19. The danger of drought is the risk of wetlands drying up completely or water levels to fall can lead to the destruction of these wetlands. Accordingly, these wetlands

Animals using these areas are forced to migrate and aquatic species lose their habitats. With drought, water use in irrigated agricultural areas and domestic water consumption increase the pressure on aquatic ecosystems. Land degradation and the increase in concretized surfaces increase the sensitivity of wetlands as they increase surface runoff and reduce the amount of water infiltrating into the soil. As water infrastructures built on rivers can impede the migration of aquatic species, additional measures such as the establishment of migration routes should be considered to ensure the protection of wetland species. Although pollution was intended to be used as a sensitivity indicator in wetlands, it could not be included in the analysis due to lack of data. Therefore, it is considered as a sensitivity factor. On the other hand, the presence of natural areas and protected wetlands that facilitate the migration of species is considered as an indicator of adaptive capacity in terms of species conservation. Again, most of our wetlands are used for the discharge of domestic and industrial wastewater. Therefore, the proportion of treated wastewater was selected as an adaptive capacity indicator. However, the quality of treatment is also important here. Treatment should be advanced biological treatment to prevent water pollution. Similarly, reuse of treated water can also prevent water pollution. If piped irrigation systems are used in agriculture, water withdrawal in aquatic ecosystems may decrease as water consumption decreases. As the level of education increases and the number of associations related to nature conservation increases, it is evaluated that wetlands can be protected due to the increase in the level of awareness.

Based on the exposure analysis, high levels of exposure were found in Central Anatolia, the Lake District and the provinces around Lake Van, as well as Kayseri, Adana, Izmir, Ardahan and Samsun, where there are many wetlands.

When the sensitivity of wetlands is analyzed, it is found that sensitivity is high in Central and Southeastern Anatolia, where irrigated agriculture is practiced, and in the Aegean, Mediterranean and Marmara Regions. In the Black Sea Region, sensitivity was found to be high in Samsun province, which has Yeşilırmak and Kızılırmak deltas. In provinces such as Istanbul, Izmir and Ankara, which have densely populated and highly urbanized areas, high pressures on aquatic ecosystems have led to high sensitivity. On the other hand, in most provinces of Eastern Anatolia and Black Sea Regions, sensitivity was determined as low.

When looking at the adaptive capacity of provinces, the provinces in the Aegean, Mediterranean and Marmara Regions, where the number of associations and the proportion of university graduates are higher, and the provinces of Ankara and Eskişehir have high adaptive capacity. The high amount of water treated in developed provinces also strengthens adaptive capacity. On the other hand, in some provinces such as Tunceli, the presence of natural areas and the prevalence of piped irrigation systems increase adaptive capacity. Most provinces in Eastern and Southeastern Anatolia have low adaptive capacity.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Toplam yağış miktarında azalma	Kuraklık	Bataklık alanların oranı	Sulu tarım yapılan alanların varlığı	Doğal alanların oranı	Sulak alanların kuruması
Ortalama sıcaklık artışı	Yağış miktarı ve yağışlı gün sayısında azalma	Tuz bataklık alanlarının oranı	Çeltik üretimi yapılan alan varlığı	Arıtılan atık suyun deşarj edilen atık suya oranı	Sulak alanlarda su seviyesinin değişmesi
	Ardışık kurak gün sayısında artış	Tuzlalar oranı	Sulanan meyve bahçeleri varlığı	Çevre, doğal hayat, hayvanları koruma dernek sayıları	Suların bazı fizikokimyasal özelliklerinin değişimi
		Su yolları oranı	Sulanan karışık tarım alanı varlığı	İyi tarım uygulamaları yapılan alanların oranı	Kuşlar ve diğer hayvanların göçleri
		Su kütleleri (akarsular, göller, barajlar) oranı	Yerleşim ve endüstriyel alanların miktarı	Önlisans ve üzeri eğitim almış nüfus oranı	Su canlılarının zarar görmesi
		Kıyı lagünleri oranı	Nüfus yoğunluğu	Korunan sulak alanlar ve ÖÇK alanlarının oranı	Yutaklarca atmosferden alınan CO_2 miktarının azalması
			Arazi tahribatı olup olmaması (maden vb.)	Borulu sulama sistemi olan alanların oranı	Taşkın vb. afetlerde artış
			Göçleri engelleyen baraj ve gölet varlığı		Balıkçılık vb. Ekosistem hizmetlerinin azalması
			Kişi başı çekilen günlük ortalama içme-kullanma suyu miktarı		Sazlık yangınları
					Biyolojik çeşitlilik kaybı

Figure 19 Impact Chain: Biodiversity and Ecosystem Services Sector Drought - Wetlands Relationship

When the drought risk assessment of wetlands is made, it comes to the forefront that the Central Anatolia Region and the Eastern and Southeastern Anatolia Regions are more risky in the current period (Figure 20). In the Black Sea Region, the drought risk of wetlands is at low levels. This situation indicates that both the drought hazard in the Black Sea Region and the low sensitivity of the provinces in the region. The drought risk of wetlands in Marmara (except Edirne), Aegean and Western Mediterranean were also found to be relatively low. This is due to the high adaptive capacity in these regions.

Figure 20 Current Period Risk Map: Biodiversity and Ecosystem Services Sector Drought-Wetlands Relationship

5.5. ADAPTATION MEASURES

Climate protection of biodiversity and ecosystem services
responsibilities and authorities on biodiversity should be clearly defined, lack of data and low awareness should be addressed, and nature conservation should be prioritized in relevant action plans.

In Turkey, the concept of combating climate change is mostly understood as greenhouse gas mitigation efforts. Awareness of the concept of adaptation, which is as important as mitigation and is addressed as a separate pillar under Article 7 of the Paris Climate Agreement and includes the steps to be taken to cope with the impacts of climate change, needs to be improved. In particular, adaptation measures such as ecological restoration, nature-based solutions and ecosystem-based disaster risk reduction, which are of increasing importance worldwide, are closely related to biodiversity and ecosystem services. However, it is noteworthy that awareness on biodiversity is as much in need of improvement as the concept of adaptation to climate change. Effective nature conservation is also the basis for sustainable economic development. Biodiversity loss and desertification are among the global ecological problems that put our future at risk. In recent years, holistic approaches that address climate change, biodiversity loss and desertification together and emphasize synergistic effects have gained importance. For these reasons, four strategic objectives have been identified in order to increase awareness and capacity to carry out adaptation efforts in the field of biodiversity and ecosystem services, to prioritize these issues in legislation, to eliminate the lack of scientific data and monitoring studies, and to ensure the use of nature conservation in adaptation efforts.

The continuation of research, monitoring and evaluation activities is also emphasized in Article 872.6 of the 12th Development Plan.

Increasing awareness and capacity on biological diversity, ecosystem services, nature-based solutions, ecosystem-based adaptation, sharing data and information among all stakeholders Provision, preventing confusion of authority and strengthening cooperation.

In order to increase the awareness and capacities of both society and institutions on issues such as biodiversity, nature conservation, nature-based solutions, ecosystem services and their contribution to adaptation to climate change, it would be beneficial to diversify the trainings organized by MoNE, TÜBİTAK and YÖK, support projects, prepare films and brochures, and expand the in-service trainings organized.

BEK1. Climate to change Harmony climate and nature literacy programs execution, in schools and universities Education programs biological Diversity and ecosystems updating them with a focus on the skills and qualifications required for conservation, developing nature conservation projects, and organizing communication campaigns using different tools for different target audiences.
Increasing institutional capacities in the field of biodiversity and ecosystems, ensuring coordinated data and information sharing among all stakeholders, preventing confusion of authority and strengthening cooperation.

Habitat fragmentation and change, pollution, excessive pollution, threatening biodiversity and ecosystem services reducing the pressure of factors such as utilization.

Today, climate change ranks relatively low among threats to biodiversity and ecosystem services such as habitat fragmentation and change, pollution, overuse, invasive alien species. However, it is known that it may become more dominant in the future as the effects of climate change intensify, and together with other pressure factors, a significant number of species may face the risk of extinction. For the conservation of biodiversity and ecosystem services, it may be insufficient to work only on the adaptation of species and ecosystems to climate change. For this purpose, eliminating or limiting negative impacts on biodiversity and ecosystems and controls are considered as an adaptation option. In this context, studies such as preventing pollution in ecosystems and updating pollution limit values by considering species and ecosystems can be carried out. There is also a need for legislation to prevent noise and light pollution, especially during breeding times. Combating poaching, fishing and biotrafficking can also be considered in this context.

There are many national legislations on biodiversity and ecosystem services. Biodiversity should also be protected in accordance with numerous international conventions. Some of the national legislation includes provisions that facilitate land use changes, which sometimes negatively impact nature conservation. Review of such legislation by passing international conventions and the provisions that are incompatible with nature conservation principles should be removed. For example, the number of permits granted under Articles 16 and 17 of the Forestry Law is quite high. is high. In fact, the number of permits granted to renewable energy facilities in forest areas is increasing day by day, and some of these are within the scope of malmitigation. It would be useful to review the legislation on areas such as agriculture, pasture, tourism and coasts with a focus on nature conservation.

Conservation-utilization balance should be ensured in our protected areas. The fact that there are two different institutions directly responsible for protected areas leads to conflicts of authority. It is considered that eliminating these conflicts will ensure effective nature protection.

Ensuring that species diversity is identified for all classes of species in Turkey will ensure that all ecosystems harboring endemic and threatened species have protection status and are considered as sensitive areas in EIA processes. In addition, prioritizing ecosystem services in EIAs and including issues such as biodiversity offsetting or offsetting land degradation (ATD) instead of planting a certain proportion of trees instead of trees cut down will reduce pressures on ecosystems. It is important to include ecosystem services, land degradation offsetting and biodiversity offsetting strategies in the EIA Regulations and to include the mitigation hierarchy (Avoidance > Mitigation > Compensation) in the EIA Regulations to ensure this. The impacts of climate change on biodiversity, ecosystem services and land degradation are included in the 12th Development Plan's policies and measures article 872.6, which states that "Research, monitoring and evaluation activities will be continued."

Updating the legislation on biodiversity and ecosystem services with a focus on nature conservation, harmonizing protected area categories with international standards, and strengthening cooperation and coordination among relevant institutions to ensure effective management in these areas.
Preventing, monitoring and controlling land/habitat change and air, water, soil, plastic and noise pollution that harm biodiversity.
To ensure sustainable management and utilization of forest, agriculture, livestock and water resources, identify problems in sustainability and prepare a roadmap to solve them.

Research, monitoring and evaluation of the impacts of climate change on biodiversity and ecosystem services.

Although it is stated that the biological diversity in our country is quite rich, researches
It remains more in the form of creating a list of flora and fauna. Again, some classes of living things such as invertebrates, fungi, lichens
even species lists are incomplete. For this reason first of all all all living creatures in our country
groups, their ecological requirements, their relationship with other species, climate
on issues such as how they are affected by the change research Need
are available. Monitoring the current status of species, ecosystem services
producing underpinnings such as maps, invasive
the need for research such as monitoring and controlling alien species
is also constantly increasing. On the other hand, the European Nature Information System (EUNIS) Habitat
potential Natura2000 areas through assessments to be made within the scope of the classification of protected areas
of the amount of to increase will be able to contribute. In addition, within the scope of 2053 net zero carbon emissions

Increasing the amount of carbon stored in forests is becoming increasingly important. Factors such as forest fires, biotic (insect and fungal damage) and abiotic factors (storms and snow fall), and excessive wood production reduce the carbon sequestration of forests. This situation, which may be perceived as related to mitigation, is actually directly related to adaptation. Because biotic and abiotic damages and forest fires are expected to increase with climate change. Since carbon storage is also an ecosystem service, increasing carbon storage in forests and other ecosystems will create a synergistic effect between mitigation and adaptation.

BEK6. all species in classes of living things change of and cataloging, designation with climate biological Diversity and ecosystem services interactions
research, identification of critical species and habitats, undertaking projects to monitor their ecology and populations, developing strategies and taking measures to identify, monitor (introduction, early detection, spread), control (eradication and management) invasive alien species.
Conducting research to compile traditional ecological information to identify, map and integrate the products and services provided by ecosystems and the contributions of nature to humans into both spatial and administrative plans.
Monitoring of climate change-induced biotic (e.g. insect and fungal damage) and abiotic factors (e.g. storms and snow cyclones) that damage forests; and
inventory of the amount of damaged area/wood

ecosystems, long term climate change
ecosystems, monitoring and/or forecast
ecosystems, management of Harmony -based
ecosystems, forests hale
ecosystems. Forest with fires effective
to be brought struggle preventive measures Priority
giving.

Increasing the amount of protected areas for effective nature conservation, restoring damaged ecosystems and integrating climate change adaptation into management plans.

Climate change is known to force species to migrate. Due to other pressure factors (habitat fragmentation and change, pollution, overuse, invasive alien species), the natural habitats of species are shrinking and they may enter the process of extinction. For this reason, both the 2030 Biodiversity Strategy of the European Union and the decisions of the Conference of the Parties to the Convention on Biological Diversity include targets for increasing protected areas. This target aims to increase the number of protected areas in marine and terrestrial ecosystems in 2030.
30% of protected areas in Turkey. In our country, the ratio of protected areas to the surface area of our country is around 13% and it should be ensured that the ratio of protected areas is further increased by protecting rich species, habitats and biodiversity, improving ecosystem services, ensuring the conservation of marine and terrestrial protected areas and thus contributing to the current situation in the world. With the awareness that reducing the loss of biodiversity, combating climate change and benefiting from ecosystem services at the global and local level can only be possible by increasing and protecting protected areas, it is also of great importance to protect sink areas such as seagrass meadows, which create resistance to the effects of climate change and have very high carbon storage properties. It would be beneficial to integrate adaptation to climate change into scientific research, investigation and conservation activities such as biodiversity surveys, species and habitat monitoring activities, carrying capacity surveys and management plans carried out in land, coastal and marine protected areas.

Most of the measures taken against extreme weather events in our country are building ponds against drought, concreting streams to prevent floods hard adaptation measures such as enclosing them in beds. These are more construction-oriented adaptation measures with limited impact. Some can even be said to cause maladaptation. Nature-based solutions that protect ecosystems and utilize biodiversity and ecosystem services in adaptation efforts are becoming increasingly important. In our country, it should be aimed to spread and prioritize good practice examples such as soil conservation efforts against floods and windbreaks in the Central Anatolia Region.

Ecosystem degradation is increasing due to the destruction of natural ecosystems and their conversion to agriculture, pasture and settlements, over-exploitation and pollution. Ecological restoration of these degraded ecosystems is emerging as a strategy all over the world to protect and increase both biodiversity and ecosystem services such as carbon sequestration in sinks, flood prevention, water production and erosion control. In this regard, the EU Nature Restoration Law envisages the restoration of 20% of the destroyed marine and terrestrial ecosystems in Europe by 2030 and all of them by 2050. In recent years, the Convention to Combat Desertification has also prioritized the balancing of land degradation (ATD). Bringing ecological restoration efforts to the agenda in our country will increase the synergy in mitigation and adaptation efforts.

Playing an active role in contributing to international efforts to increase the proportion of marine and terrestrial protected areas to 30% globally.
Including biodiversity conservation, supporting ecosystem services and climate change adaptation in species/habitat conservation action plans and management and development plans of protected areas.
BEK11. Conduct an inventory of destroyed and fragmented ecosystems and identify destroyed destroyed ecosystems across the country.
restoration of the fragmented

ecosystems binding. ecological corridor

Identifying examples of good practices in Turkey and internationally on issues such as nature-based solutions and ecosystem-based adaptation and
construction of application projects.

REFERENCES: Biodiversity and Ecosystem Services

Abolafya, M., Onmuş, O., Şekercioğlu, Ç.H. & Bilgin, R. (2013). Using Citizen Science Data to Model the Distributions of Common Songbirds of Turkey Under Different Global Climatic Change Scenarios. PloS ONE 8(7): e68037. DOİ: https://doi.org/10.1371/journal.pone.0068037

Akyol, A. & Örücü, Ö. K. (2019). Investigation and evaluation of stone pine (*Pinus pinea* L.) current and future potential distribution under climate change in Turkey. CERNE, v. 25, n. 4, p.415-423. DOI: http://dx.doi.org/10.1590/01047760201925042643

Bilecenoğlu, M., Kaya, M., Cihangir, B. & Çiçek, E. (2014). An updated checklist of the marine fishes of Turkey. Turkish Journal of Zoology, 38: 901-929. doi: 10.3906/zoo- 1405-60

Chefaoui, R.M., Duarte, C.M. & Serrão, E.A. (2018). Dramatic loss of seagrass habitat under projected climate change in the Mediterranean Sea. Global Change Biology 24(10): 4919-4928. DOI: https://doi.org/10.1111/gcb.14401

Çiçek, E., Fricke, R., Sungur, S., & Eagderi, S. (2018). Endemic freshwater fishes of Turkey. FishTaxa 3(4):1-39. from https://www.biotaxa.org/ft/article/view/3-4-1.

Dağtekin, D., Şahan, E.A., Denk, T., Köse, N. & Dalfes, H.N. (2020). Past, present and future distributions of Oriental beech (*Fagus orientalis*) under climate change projections. PloS ONE 15 (11): e0242280. DOI: https://doi.org/10.1371/journal.pone.0242280

Davis, P.H. (1971). Distribution patterns in Anatolia with particular reference to endemism. In Plant Life of South-West Asia (Eds: Davis, P.H., Harper, P.C. & Hedge, I.C.) Edinburgh, pp. 15-27.

Dede, A. & Tonay, A.M. (n.d.). Marine mammals of Turkey. Turkish Marine Research Foundation. https://tudav.org/calismalar/denizel-biyocesitlilik/deniz-memelileri- Retrieved from calismalari/turkiyenin-deniz-memelileri.

DKMP (2008). National Biodiversity Strategy and Action Plan (NBSAP) 2007-2017. Ankara: National Biodiversity Strategy and Action Plan 2007. T.C. Ministry of Environment and Forestry, General Directorate of Nature Conservation and National Parks Publications. http://www.nuhungemisi.gov.tr/Content/Documents/ubsep-turkce.pdf

DKMP (2019). National Biodiversity Action Plan 2018-2028 NBSAP Additional Action Plan, Ministry of Agriculture and Forestry, General Directorate of Nature Conservation and National Parks, Ankara. https://www.

DKMP (2021). Noah's Ark National Biodiversity Database. General Directorate of Nature Conservation and National Parks. Retrieved from http://www.nuhungemisi.gov.tr.

Ergin, M. (2022). Estimation of the Effects of Climate Change on the Spread of Some Tree Species within the Borders of Ankara Regional Directorate of Forestry I.Ü.-Cerrahpaşa Institute of Postgraduate Education, Doctoral Dissertation.

FAO (2019). Turkey's Biodiversity: Contribution of Genetic Resources to Sustainable Agriculture and Food Systems. Ankara. 222 p. Licence: CC BY-NC-SA 3.0 IGO. https://www.fao.org/documents/card/en/c/CA1517TRRetrieved from

Kaska, Y. (2021). How Climate Change Will Change Sea Turtle Conservation Efforts. Climate Change and Its Impacts on the Seas of Turkey. Turkish Marine Research Foundation (TÜDAV) Publication no: 60, Istanbul, Turkey.

Kayhan, F.E., Kaymak, G., Tartar, Ş., Akbulut Ş., Esmer, H.E. & Yön Ertuğ, N.D. (2015). Effects of global warming on fish and marine ecosystems. Erciyes University

Fen Sciences Institute Magazine, 31(3):128-134. Retrieved from https://dergipark.org.tr/tr/download/article-file/236029.

Kurnaz, M. (2020). Species list of Amphibians and Reptiles from Turkey. Journal of Animal Diversity, 2(4): 10-32. DOI: http://dx.doi.org/10.52547/JAD.2020.2.4.2

López-Tirado, J., Vessella, F., Stephan, J., Ayan, S., Schirone, B. & Hidalgo, P.J. (2020). Effect of climate change on potential distribution of Cedrus libani A. Rich in the twenty-first century: an Ecological Niche Modeling assessment. New Forests, 1-14. DOI: https://doi.org/10.1007/s11056-020-09798-y

Sezgin, Ç. (2016). Investigation of the effect of temperature on tadpole sea turtle (*Caretta caretta* L.) juvenile sex ratios and adult migration. Pamukkale University Graduate School of Natural and Applied Sciences Department of Biology Master's Thesis, 93 p. https://gcris.pau.edu.tr/handle/11499/1148Retrieved from

Taşkın, E. (2019). List of Plants of Turkey, Aquatic Plants. Ali Nihat Gökyiğit Foundation Publications, 804 p., Istanbul.

TOB (2021). Corine Project. Retrieved from https://corine.tarimorman.gov.tr/corineportal/.

Topçu, N.E. & Öztürk, B. (2017). Mediterranean deep-sea corals and their status in Turkish seas. Proceedings the I. Turkey Deep Sea Ecosystem Workshop, June 19, 2017, Çanakkale, 139-152.

Türkeş, M. (2018). Biogeography A Paleogeography and Ecology Approach. Kriter Publishing House - Ankara

Ursavas, S. & Işin, Z. (2018). New records of Bryum gemmiferum and Atrichum crispum for Turkey. Plant Biosystems. 1-5. DOI:10.1080/11263504.2018.1539041.

Ustaoğlu, B. (2009). Possible Effects of Climate Change on Hazelnut Agriculture in Turkey. PhD Thesis Prepared at Istanbul Technical University Eurasian Institute of Earth Sciences, Department of Climate and Marine Sciences. Retrieved from https://polen.itu.edu.tr/items/d9b00b6b-6841-444f-b04d-14be055c36f5

Zeydanlı, U., Turak, A., Bilgin, C., Kınıkoğlu, Y., Yalçın, S. & Doğan, H. (2010). Climate Change and Forestry: From Models to Practice. Ankara. Nature Conservation Center. Retrieved from https://dkm.org.tr/uploads/yayinlar/1585596904875.pdf.

HALK SAĞLIĞI

iklime uyum

6.1. GENERAL FRAMEWORK

Established in 1930 with the Public Health Law, the health system of the Republic of Turkey has taken its place among the model systems in the world with the experiences it has gained over the years and the radical reforms carried out recently.

Established in 1930 with the Public Health and Hygiene Law, the health system of the Republic of Turkey has taken its place among the model systems in the world with the experiences it has gained over the years and the radical reforms carried out recently. It has a well-developed service network with primary healthcare services consisting of health homes, health centers, family health and community health centers spread to the remotest corners of 81 provinces, public hospitals, university hospitals and private hospitals, which have been further strengthened recently with the city hospitals projects. The capacity of the Ministry of Health, whose preparedness and response systems for health emergencies have been strengthened according to today's needs and the realities of the country with an all hazards approach, also includes the world's largest National Medical Rescue Teams (UMKE) consisting of health volunteers and stands out as an international model in this respect.

All reforms aim to provide quality, effective and qualified health services, and in this direction, significant progress has been made towards the goal of universal health coverage, which significantly reduces inequalities in health financing, access to health services and final health indicators. In the process of developing and implementing all these plans and policies, the needs of the society, geographical characteristics of the country, population structure and culture, global trends and scientific and technological developments are taken into consideration.

All these developments have had a positive impact on Turkey's key health indicators over the years. Infant and under-five mortality rates declined steadily, and the infant mortality rate was realized as 9.1 per thousand in 2022. Regarding maternal mortality, the maternal mortality rate, which was 18.4 per 100,000 live births in 2009, was realized as 12.6 per 100,000 live births in 2022 (Republic of Turkey Ministry of Health, General Directorate of Health Information Systems, 2023).

Turkey already has one of the largest vaccination programmes in the world, and childhood immunization programmes are very effective, with almost the entire child population being vaccinated. According to the Ministry of Health Health Statistics Yearbook 2021, the number of physiciansdentistspharmacists, nurses and midwives per 100,000 people are 217, 47, 43.9 and 343, respectively (Health Statistics Yearbook 2021). As one of the most important parameters of health systems, policies to improve the number, quality and rights of health workers are prioritized. In this context, current and effective policies are being developed to improve Turkey's position in world comparisons, particularly in the OECD, and most recently the White Reform launched in 2022 was put into practice. The reform includes the enactment of a law on violence in health, the enactment of a malpractice law, and a new pension and incentive system that reorganizes personal rights. to life the transition.

As a developing country with an aging population, Turkey's disease burden is in line with this trend. This one Non-communicable diseases (NCDs), especially cardiovascular diseases, cancer Turkey's most important diseases

burden of mortality. The top three causes of death in Turkey in 2019 were circulatory system diseases, cancer and respiratory system diseases. Life expectancy at birth in Turkey was 78.6 in 2017-2019. For women
81.3 years of life expectancy and 75.9 years of life expectancy for men show an increase over the years. Healthy life expectancy in Turkey the years 2016-2018 58.3 years at birth (59.9 for men ;
56.8 for women), while in 2017-2019
57.3 years (59.1 for men ;
55.4 in women) (Life Tables, 2017- 2019). Although life expectancy has increased in recent years, NCDs have a negative impact on healthy life expectancy.

Increasing the health literacy level of the society has recently found itself an important place among health policies. In this context, according to the data of the Turkey Health Literacy Level and Related Factors Survey published by the Ministry of Health General Directorate of Health Promotion in 2018, only 23.4% of the society is at an adequate level (Ministry of Health, 2018).

As the 21st century's biggest global threat and defined as a health crisis by the World Health Organization (WHO), the Ministry of Health has important responsibilities regarding climate change. The General Directorate of Public Health (DGPH) has the leading role in carrying out adaptation efforts for the health impacts of climate change. The issue of climate change and health needs to be addressed with a multidisciplinary and holistic approach. Therefore, under the coordination of DGPHS, the Directorate General of Emergency Health Services (DGERH), Directorate General of Health Investments (DGHDI), Directorate General of Health Promotion (DGPH), Directorate General of Health Services (DGHS), Directorate General of Public Hospitals (DGPH), Health Information All relevant central and provincial units of the Ministry, particularly the Directorate General of Systems (DGSS), the Directorate General of European Union and Foreign Affairs (DGEUA) and the Directorate General of Health for Borders and Coasts (DGHSC), have important roles to play.

National response to the health impacts of climate change regulations The Ministry of Health has initiated efforts to update the National Program and Action Plan for Mitigating the Negative Impacts of Climate Change on Health, which was published in 2015. As a first step, a revision workshop was held on October 12-13, 2021, and the update work continues in parallel with global climate and health policies.

"Turkey Country Profile on Health and Climate Change" was prepared in collaboration with the Ministry of Health and WHO in order to reveal the current situation regarding country-specific climate hazards, climate-sensitive health risks and potential health benefits of climate change mitigation. The profile was introduced at a side event organized at the 26th Conference of the Parties (COP27) of the United Nations Framework Convention on Climate Change on November 8, 2022.

Within the scope of the Paris Agreement, Turkey's National Contribution Declaration (NDC) was updated on April 13, 2023, and in the new updated text, the Ministry of Health, in terms of its field of work, stated "Sustainable and resilient to the climate crisis". health systems", a new commitment was added. In line with this development, Turkey was among the countries that made a health commitment to improve climate and health action within the scope of the implementation of the Paris Agreement. In this context, the scorecard for Turkey for the main indicators for environment and health, which provide a snapshot of the current situation that contributes to measuring and monitoring the progress of countries, has been created by WHO.

In the context of global climate health developments, Turkey participated in the "Climate Resilient Health Systems" group of the Alliance for Transformative Actions on Climate Change and Health (ATACH), an initiative launched by WHO. In addition, during the COP28 held in Dubai on November 31-December 12, 2023, Turkey participated in the meeting of Ministers of Health at the Deputy Minister level for the first time in the history of the COP and became a party to the Declaration on Climate and Health adopted after the meeting.

On the other hand, in Turkey, which is among the countries that will be most affected by the climate crisis due to its location, forest fires and wildfires caused by extreme climate and weather events related to climate change are increasing day by day.

The incidence of health emergencies that UMKE responds to, such as floods, is increasing. UMKE-ATAK Teams were established in 2023 with the aim of improving this capacity and adding search and rescue capability in addition to medical intervention.

In addition, within the scope of the Instrument for Pre-Accession Assistance to the European Union (IPA) IPA-III Period 2023 Programming, the "Strengthening the Capacity of the Ministry of Health to Mitigate the Negative Impacts of Climate Change on Health Project" received preliminary approval from the European Commission.

6.2. SECTORAL LEGAL FRAMEWORK AND RESPONSIBLE INSTITUTIONS

Turkey is a country that monitors, assesses and evaluates the health impacts of climate change. reporting infrastructure, profile and strategy. Establishment of a climate-sensitive disease list, manpower trained in climate and health, public health early warning system will strengthen it.

Article 56 of the Constitution and Article 1 of the Public Health Law assign the responsibility for the protection of public health to the state. The State has this duty under Presidential Decree No. 1 According to the Decree (OG: 10.07.2018/30474), it is carried out through the Ministry of Health. Studies on the health impacts of climate change are defined in the duties of various departments (Department of Environmental Health, Department of Infectious Diseases and Early Warning, of Public Health Reference Laboratories) working under the Directorate General of Public Health (DGPH) as stated in the Directive on Service Units and Duties of the Directorate General of Public Health. In provinces, activities are carried out through Provincial Health Directorates, Community Health Centers, District Health Directorates and Family Health Centers. Among the duties of the Department of Environmental Health is to "take or have taken the necessary measures on air pollution and climate change". In 2021, the "Department of Early Warning and Response to Health Threats" merged with the Department of Communicable Diseases and was renamed the Department of Communicable Diseases and Early Warning and Response. Its structure includes the task of "coordinating cooperation with national and international scientific institutions on Early Warning and Response and Field Epidemiology" (Terms of Reference of the Department of Communicable Diseases and Early Warning).

Acute Gastroenteritis Syndromic surveillance (emergency room data for specified ICD-10 codes) in 81 provinces, districts and hospitals can be monitored instantly through the İZCİ system within the Early Warning and Response unit. According to the signals received, verification, risk assessment, research and resource identification, intervention and response can be evaluated (Ministry of Health, 2022). Ayrıca 2019 yılında devam eden sektörler arası koordinasyon ve iş birliği çerçevesinde Halk Sağlığı Genel Müdürlüğünce oluşturulan Bulaşıcı Hastalık Sürveyans ve Erken Uyarı Sistemi (İZCİ) çalışmalarında ihtiyaç duyulan meteorolojik ölçüm, tahmin ve uyarılara ait verilerin Meteoroloji General A protocol was signed to determine the principles for the use of these data by the General Directorate of Public Health and data sharing is carried out within this framework. Work on the integration of meteorological data on climate change and the IZCI monitoring system is ongoing (Ministry of Health, 2022). Within the scope of the Early Warning Unit "Health Security in Turkey Project", prioritization, risk assessment and risk mapping studies for all threats (biological, chemical, environmental, radiological and nuclear) including climate change are ongoing with the participation of other relevant sectors (Ministry of Health, 2022). The Ministry of Health, worldwide implementation of the WHO International Health Regulations (IHR) published in 2005 required services in accordance with health regulations (WHO, 2008). IHR Stakeholder Countries are obliged to report and respond to all incidents that may pose a potential threat to public health in a timely manner . Required capacity

It is known as Early Warning and Response (EUC). The IHR (2005) is a legal agreement between countries to work together for global health security. The IHR is not limited to any specific disease. It covers all types of events that pose a threat to human health. Resolution 2119/98 of the European Parliament and of the Council of September 24, 1998 on the prevention and control of communicable diseases at Community level Development, cooperation and coordination between Member States improve epidemiological surveillance network and the establishment of an early warning and response system for the diseases listed in the annex to the decision. Decision 1082/2013 of 22 October 2013 was extended to cover a range of other threats to health, including infectious diseases as well as other biological or chemical agents or environmental events, including climate change-related hazards, and decided to ensure a broader coordinated approach to health security at Union level.

Launched in 2010 and published in 2015, the Ministry of Health's "National Program and Action Plan for Mitigating the Negative Impacts of Climate Change on Health" is the only official regulation on the impacts of climate change on the health sector in Turkey (Republic of Turkey Ministry of Health Public Health Institution of Turkey, 2015). The Ministry of Health contributes to the health section of the national climate change documents of other institutions and organizations. In order to ensure that national regulations on the health impacts of climate change can be realized at the same pace, it is planned to update the National Program and Action Plan for Mitigating the Adverse Effects of Climate Change on Health published by the Ministry of Health in 2015. 12-13 October In 2021, a revision workshop was organized as a first step. The work on updating the action plan was started in 2021. In November 2022, Turkey Health and Climate Change Country Profile was published.

In the National Climate Change Strategy (2010-2020) and Climate Change Action Plan (2011-2023) published by the Ministry of Environment, Urbanization and Climate Change, it is aimed to investigate the effects of extreme weather events on human health, to investigate the interaction between infectious diseases and health risks, to strengthen the infrastructure in risky areas and to strengthen the capacities of health institutions (Climate Change Strategy (2010-2020)) (Climate Change National Action Plan 2011-2023). In the health section of Turkey's Climate Change Adaptation Strategy and Action Plan (2011-2023), determining the current and future impacts and risks of climate change on human health and improving the capacity of the national health system to combat climate change-induced risks are prioritized.

The health section of Turkey's Seventh National Communication includes the impact of extreme climate events, current situation assessments on diseases transmitted by vectors and rodents, and the content of the national health impact report (MoEU, 2018). After the Paris Agreement entered into force, the "Parliamentary Investigation Commission Established to Determine the Measures to be Taken to Minimize the Effects of Global Climate Change, Combat Drought and Efficient Use of Water Resources" of the Grand National Assembly of Turkey started its work in March 2021. The Commission listened to experts on the health impacts of climate change and

The minutes included combating climate change for health, increasing efforts to mitigate greenhouse gases and adaptation to climate change, preparing Turkey's climate and health profile, early warning, preparedness, immediate response, and increasing public awareness.

6.3. EFFECTS OF CHANGE

Climate change affects the social determinants of health, individual and community health will affect the relationship of other sectors with health. Changing climate increase the national burden of disease in Turkey, and the health sector should be at the center of the sectoral risk analysis of climate change.

The most prominent hazards in Turkey are drought, heavy rainfall, heat waves and high winds. Hazards in the health sector are discussed under six headings:

1. Extreme Weather Events
2. Changes in Water Resources
3. Sea Level Rise
4. Hot and Cold Air Waves
5. Change in Air Quality
6. Increased Ultraviolet Radiation

Eight impacts of these hazards on individual and public health will be visible.

1. Heat and cold related diseases
2. Side effects of ultraviolet radiation
3. Health problems caused by changes in air quality
4. Food and water related diseases
5. Changing infectious disease agents
6. Vector-borne diseases
7. Mental health issues
8. New and re-emerging diseases

The impacts of climate change will not only manifest themselves through individual and social health problems. It will have an impact on all components of the health sector. This impact can be individual or cumulative due to multiple hazards. Climate change linked to human The impact of mobility on the relationship between climate and health is also expected in this context.

Existing efforts in health legislation and health management related to the management of climate-sensitive diseases will be improved by considering new models and scenarios. Similar to the establishment of climate change units in municipalities, the central, provincial and district organizations of the Ministry of Health need units to manage the relationship between climate change and health, and management mechanisms will need to be strengthened. Health service planning should take into account the dangers and risks of climate change as well as the population. Coefficients used in health level indicators will need to be adjusted to coefficients compatible with climate threat indices.

One of the most vulnerable sectors to the negative impacts of climate change is the health sector. Sectoral target populations may vary numerically. For example, the number of people working in agriculture, the number of people receiving services from the energy sector. If sufficient food products are not grown, if there is no energy for the processing, preparation and presentation of food, malnutrition and related diseases will be the problem of the whole society. For this reason, it is planned to increase efforts to increase the capacity of the health sector (manpower, health facilities, budget, information systems), to develop, harmonize and make it resilient.

In order to realize all this, a climate-sensitive health sector strategy document needs to be prepared.

The impact of the COVID-19 pandemic should not be ignored in the projections and scenarios to be built for the impacts of climate change on the health sector. In addition to those who get sick and die from COVID-19, those who have prolonged COVID-19 cases (those who have COVID-19 or are affected other diseases seen in people) are known. In addition, those suffering from mental health problems due to ecological stress, anxiety and grief, disengagement from work and social life, unemployment and destitution have led to an increase in vulnerable groups in society. The health impacts of potential climate change hazards may be greater than expected.

Here are the points that the health sector in Turkey plans to improve in the face of climate change:

- Implementation of a national consultation mechanism under the coordination of the Ministry of Health to combat climate change in the field of health with the One Health approach
- Reflecting the data processed by the national and local climate-sensitive disease list and monitoring system, together with vulnerability and risk maps and climate change scenarios, to the health statistical yearbooks in cooperation with all institutions
- Improving existing health information systems to monitor the health impacts of climate change and integrating them into national climate change monitoring systems
- Filtering and/or sharing climate-related health indicators from existing health data collection systems
- Moving the existing tracking systems to Geographic Information Systems (GIS) infrastructure as in the fight against vectors; tracking diseases, control methods, breeding areas together with climate hazard indicators, and switching to integrated systems with other relevant institutions and organizations in provinces
- A cross-disciplinary and cross-sectoral epidemiology team examining the relationship between climate change and healthreporting and policy of the scientific board/commission that will contribute to the formation of the scientific board/commission, establishment of a coordination mechanism
- Developing training modules for the training of personnel who will take part in the health impacts of climate change
- Strengthening manpower, budget and time planning in the face of the possibility that the seasonal, monthly, annual periods of existing combat programs may spread throughout the year
- Strengthening the communication of the health sector with other sectors; realizing efforts to create a common language in the relationship between climate and health for different disciplines and sectors
- Increasing academic support to increase the number of academic studies and studies on new and re-emerging diseases due to climate change impacts
- Working to create a pool of quantitative and qualitative evidence for Turkey on the relationship between climate and health
- Raising awareness on climate migration by focusing on the impact of climate and health movements
- Developing efforts to address populations made vulnerable by extreme climate events, disasters and the protracted effects of COVID-19
- Carrying out studies to include the health department more in sectoral action plans
- Working on the preparation of health and climate change action plans at local level
- structured activities on climate change and its health impacts in schools of other disciplines of the health sector, especially in medical faculties

to carry out studies on having programs

- Preparation of a structured training curriculum for physicians on the importance and requirements of taking an environmental history during the examination as well as climate change trainings to ensure that taking an environmental history while taking a health history is included in routine services
- Raising awareness of the public on climate and health impacts, developing methods that can reach all people who will be affected by the health impacts of climate change and everyone quickly
- Initiating efforts at local and international level to include the climate change code in the ICD
- Conducting studies to review the current state of health infrastructure against the climate crisis
- Supporting the awareness and response capacities of UMKE and 112 teams for climate emergencies
- Taking a more active role by advocating internationally for health issues to be more prominent in global climate negotiations

Health Sector Risk Analysis: Heat Wave

Climate change affects social and environmental determinants of health, such as clean air, clean drinking water, adequate food and safe shelter. The prominent hazards in Turkey are drought, extreme rainfall and heat waves. The vulnerability and risk analysis of the health sector in Turkey has been conducted through the heat wave in order to set an example and provide evidence for future studies.

The impacts that may arise as a result of the heat wave, the groups that will be exposed to the impacts, Turkey's vulnerability level (sensitivity and adaptive capacity) and the size of the resulting risk are presented in the following impact chain (Figure 21).

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Ortalama sıcaklık artışı	Sıcak hava dalgası	Nüfus yoğunluğu	Bağımlı nüfus oranı	Kişi başı GSYİH	Sağlıklı, kaliteli yaşam ve iyilik halinde bozulma
Aşırı sıcak gün sayısında artış	Ardışık sıcak gün sayısında artış	Kent merkezinde yaşayan nüfus*	15-49 yaş arası kadın nüfus oranı	112 acil sağlık hizmetleri başına düşen nüfus	Hava kalitesinde düşüş
		0-14 yaş altı çocuk nüfus oranı*	Dolaşım sistemi kaynaklı ölümler	100.000 kişiye düşen uzman hekim sayısı	Su kıtlığı, sağlıklı ve güvenli suya erişimde güçlük
		65 yaş üzeri yaşlı nüfus oranı*	Kaba doğum hızı oranı	Lise ve üzeri eğitime sahip nüfus oranı	Toprak miktarı ve kalitesinin bozulması, sağlıklı ve güvenli gıdaya erişimde güçlük
		Sadece kadın nüfustan oluşan hane sayısı*	Bebek ölüm hızı	Kanalizasyon şebekesi/arıtma tesisi ile hizmet edilen nüfus*	Vektörlerde değişim
		Sadece 65 yaş üzeri nüfustan oluşan hane sayısı*	İlkokul ve altı eğitime sahip nüfus oranı	Su şebekesi/arıtma tesisi ile hizmet edilen nüfus*	Dehidratasyon (susuzluk)
		Tarım sektöründe işsizlik oranı*	Nüfus artış hızı	Yönetim kapasitesi*	Böbrek hastalıklarında artış
			Doğuşta beklenen yaşam süresi*	Sağlık okur yazarlık oranı*	Beslenme bozukluğu (anne, bebek, çocuk) (anne sütü eksikliği, bodurluk)
			Güvenilir içme suyuna erişim oranı*	Soğutma sistemi kapasitesi*	Alerjiler, solunum, kalp, damar, göz, kulak, burun, boğaz hastalıklarında artış
			Kent Karakteri*	Güvenli fiziksel aktivite alanı ve süresinin nüfusa oranı*	Bulaşıcı hastalıklarda artış, salgınlar
			Sosyal eşitsizlik oranı*	Sosyal ağların ve iletişimin mevcudiyeti*	Ruhsal sorunlar
			Neden özel ölüm hızı*	Kaybedilen yaşam yılları (YLL)*	Bulaşıcı olmayan hastalıklarda değişim
			Hastalıklar*		Su ve gıdayla bulaşan hastalıklar
			Fonksiyon ve yeti yitimi*		Yaralanmalar
					Genel hijyen koşullarında yetersizlik
					Zoonotik hastalıklarda değişim
					Fonksiyon ve yeti yitimi oranlarında değişim
					İşgücü kaybı artışı
					Vektörlerle bulaşan hastalıklarda artış
					Ölümler

Figure 21 Impact Chain: Health Sector and Heatwave

*The * symbol indicators not used in risk analyses.*

In general, population, population density, population living in urban centers, child population (0-14, 0-4 years, under 1 year, %), elderly population (65+ years, %), proportion of female population aged 15-49 years, proportion of female population aged 15-49 years, proportion of population under 5 years (0-4 years, %), number of female-only households and number of female-only households and number of female-only households aged 65+ years can be used for exposure analysis of the health sector.

In the national exposure analysis for Turkey, population density was grouped and evaluated. Accordingly, in Turkey, exposure is high in provinces with high population density and low in provinces with low population density. Istanbul, Kocaeli, Sakarya, Yalova and Bursa in the Marmara Region; Izmir in the Aegean Region; Hatay in the Mediterranean Region; Central Anatolia

Exposure is very high in Ankara in the Marmara Region and Gaziantep in Southeastern Anatolia. Exposure is high in Tekirdağ in Marmara; Düzce, Zonguldak, Karabük, Samsun, Ordu and Trabzon in the Black Sea Region; Manisa and Aydın in the Aegean Region; Antalya, Mersin, Adana, Osmaniye in the Mediterranean; and Şanlıurfa, Diyarbakır and Batman in the Southeastern Anatolia Region.

For the sensitivity analysis of the health sector; crude birth rate, life expectancy at birth, rate of access to safe drinking water, population served by sewerage network / treatment plant, urban-rural segregation, population growth, education level, dependency ratio, elderly dependency ratio, child dependency ratio, 15-49 female population ratio, social inequality rate, mortality, cause-specific mortality rate (especially circulatory system-related deaths), diseases and function and disability indicators can be used. In the national sensitivity analysis for Turkey, crude birth rate, population growth rate, ratio of population with primary school education or less to population above 15 years of age, population dependency ratio, ratio of female population aged 15-49, ratio of circulatory system-related deaths to total deaths, infant mortality rate indicators were used. According to the results obtained, it was observed that the sensitivity at the national scale increased the most due to the increase in crude birth rate and infant mortality rate, while the population growth rate and the ratio of female population aged 15-49 years were not as effective. The ratio of circulatory system-related deaths to total deaths, which is among the susceptibility indicators, was found to be highest in Aydın, Denizli and Kırıkkale. In these provinces, the current danger of heat wave is high in Aydın, very high in Denizli and moderate in Kırıkkale. General susceptibility is low in Aydın and Denizli and moderate in Kırıkkale. Except for a few provinces in the Eastern and Southeastern Anatolia Regions, susceptibility to heat waves is high and very high. In other regions , Afyonkarahisar and Sinop In the provinces, susceptibility is very high due to mortality and low levels of education.

Health service and management capacity, health literacy rate, population served by sewerage network/treatment facility, population served by water network/treatment facility, education level, cooling system capacity, safe physical activity area and duration/population, availability of social networks and communication, years of life lost (YLL) and economic status indicators can be used for adaptive capacity analysis of the health sector in Turkey. In this study, population per Emergency Ambulance, number of specialized physicians per 100000 people, high school and above education rate and GDP per capita were evaluated.

At the national scale, the adaptive capacity for the health sector generally decreases as one moves towards the east. Especially in provinces located in Eastern and Southeastern Anatolia, adaptive capacity is at the lowest levels. In addition, sensitivity is very low in Sinop and Bartın in the Black Sea Region. The provinces with the highest adaptive capacity are Ankara, Antalya, Artvin, Bolu, Çanakkale, Çanakkale, Edirne, Erzincan, Eskişehir, Isparta, İstanbul, İzmir, Kırıkkale, Kocaeli, Muğla, Tunceli and Yalova.

When the adaptive capacity against heat wave hazard is analyzed, the adaptive capacity is particularly low in provinces where the hazard is high. Although the heat wave hazard is high in these provinces, the very low level of adaptive capacity is a red alert for the future. In the analyses, the most important reasons for the very low level of adaptive capacity by provinces are income level, the number of specialized physicians and the low number of people with high school education and above.

According to the results of the vulnerability analysis of the health sector, the provinces with the highest level of vulnerability generally have the highest adaptive capacity.

The provinces in Southeastern and Eastern Anatolia have low vulnerability levels. These provinces are followed by Afyonkarahisar, Aksaray, Sinop, Çankırı, Çorum, Niğde and Yozgat with high vulnerability levels.

A risk analysis was conducted for the health sector by evaluating the exposure and vulnerability of provinces according to the heat wave hazard. Accordingly, the risk levels of the provinces in the Southeastern and Eastern Mediterranean Regions, which have the highest level of vulnerability, have also been determined at the highest level. Along with Aegean and Mediterranean

The risk level was determined as moderate and above in the regions. Except for the Southeastern and Eastern Anatolia provinces, Aydın and Manisa provinces have the highest risk of heat waves, while Uşak, Denizli, Afyonkarahisar, Konya and Niğde provinces have high risk. Izmir, Muğla, Burdur and Antalya have a moderate risk in the health sector. In the Marmara Region, Balıkesir and Tekirdağ have a high risk, while Çanakkale and Bursa have a medium risk. In Central Anatolia, the risk is medium and below (Figure 22).

Figure 22 Current Period Risk Map: Relationship between Health Sector and Heat Wave

The most basic conclusion that can be drawn from the risk analyses is that in terms of the health sector, the danger of heat waves in Turkey

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prioritization of provinces in Southeastern Anatolia and Eastern Anatolia in the adaptation policies to be implemented

6.4. ADAPTATION MEASURES

Resilient, high adaptive capacity for the health sector, health impact in the initiative to tackle climate assessment will be made and health will be one of the priority areas in sectoral harmonization policies.

Adaptation measures in the health sector were evaluated under the headings of evidence-based decision-making, climate-smart health impact assessment, leadership with a public health perspective, adaptation policies that provide healthy living environments, realizing adaptation of the health sector to the health impacts of climate change, climate-sensitive common language and communication between sectors, and ensuring adaptation of health facilities to climate change.

Evidence-based decision making

In order to ensure the adaptation of the health sector to climate change, solid evidence is needed first. For this purpose, scientific methods that will help analyze the relationship between climate and health should be used and the results of studies with high levels of evidence should be evaluated.

Epidemiology analyzes evidence-based scientific methods in the field of health. Epidemiology is a methodology that includes scientific methods used in the examination of problems in both clinical and community medical sciences with various dimensions. If we look at the detailed definition; it is seen that it is a branch of science that includes all scientific methods used in defining the place, person, time characteristics of health-related events / problems, determining the causes and / or risk factors of these problems and determining the solution-producing methods for the determined causes and risk factors (Tezcan, 2017). Descriptive, analytical and experimental/intervention methods for investigating health problems in medical science studies are used. Descriptive research is observational research that is used to identify health problems and to reveal the place-person-time characteristics in detail. Case reports-series used in rare diseases and ecological studies used to evaluate the relationships between human communities and the environment are in the descriptive research group. Analytical studies, which are studies in which the cause and effect relationships of the identified problems are tried to be revealed, are case-control, cross-sectional and cohort studies. Thirdly, experimental studies are those in which the level of evidence of cause-effect relationships is increased and interventions for solutions are tested. In a field such as climate change, where multidisciplinary and multisectoral approaches are used together, the discipline of epidemiology can be used with the analysis methods of other disciplines. cannot be used without blending.

There are numerous studies on environment and health conducted by the Ministry of Health, other sectors and academics. These studies have been reoriented towards the relationship between climate and health, climate and health adaptation. structuring and prioritization is beneficial. Looking at the studies, an ecological study investigating the relationship between cancer and the environment was conducted in Aydın in 2018. In this study, four groups of basic environmental risk factors (air, watersoilnutrientsin Aydın province and the spatial distribution of cancer cases registered in Aydın Adnan Menderes University Application and Research Hospital were determined and the relationship between cancer cases and environmental risk factors where they live was examined. In the study, geographical information system (GIS) was used for spatial distribution, air, water, soil and food samples were taken from the places determined according to cancer incidence.

correlation between them was examined (Karagülle & Evci Kiraz, 2018).

Another study that can be used to assess health effects is a cohort study. It is a study that provides data with a high level of evidence; it reveals the real risk. However, it requires time and has a high budget compared to other studies. Climate change will be a part of life. For this reason, cohorts should be formed and analyzed quickly. Cohort means groups with the same characteristics. In order to ensure adaptation of the health sector to climate change, there will be a large number of groups, i.e. cohorts, that need to be monitored and studied. The points with the highest vulnerability and the groups living in these points; the groups with the highest vulnerability and their living areas are the areas where cohort research will be initiated rapidly

An evidence pool should be created by combining all indicators of people, health and all determinants of health, living spaces and climate with ecological or cohort-type studies to be planned. Sharing the data of this evidence pool will guide further studies. All sectoral data and evidence on the relationship between climate and health can be shared gradually (raw data, confidential, public, academic, public information, etc.) in line with ethical rules and personal data protection principles.

All studies are carried out to protect the health of the public, to take precautions against adversities and to improve their health. Therefore, all studies should be matched with studies in other sectors, and existing early warning systems should be developed with health data and messages, with the public as the final recipient.

Health impact assessment in response to climate change

Before and during the construction of new climate change adaptation policies, it is useful to include targets, strategies and action plans in the scope of health impact assessment (HIA) (Evci Kiraz E., 2018). HIA is a tool particularly suitable for decision-makers. HIA stages can be used to have city dwellers who understand the health impacts of climate change, participate in plans to mitigate the impacts, know and implement the measures to be taken, and lead the community to implement them. In summary, HIA consists of the stages of investigation, discernment, decision-making, implementation, monitoring and evaluation, and reconstruction. SIA should be implemented in order to protect health from the negative impacts of climate change and not to lead to new climate-changing actions.

Leadership with a public health perspective

The basic principles of leadership with a public health perspective are as follows (Türkmen & Evci Kiraz, 2021):

-Health should be put at the center

-Health for all

-Health in every policy

-Single health

Good health and well-being

-Being an example in public health

Within the framework of these principles, the following questions should be answered:

-What are and/or will be the elements of climate change affecting health in Turkey/city?

-How/how much has health (social determinants of health, people, society, system) been affected and/or will be affected in Turkey/city?

-What the sensitivity of Turkey/city?

-What is Turkey's/city's adaptation capacity (plans, projects, human resources, training, finance, structures, systems)?

WHO's national/local action plans on health supporting departments are requested to be strengthened. To this end, health should be a dedicated chapter in national and local adaptation plans prepared by leaders with a public health perspective and/or national/local climate and health adaptation plans should be prepared.

Cohesion policies that ensure healthy living environments

Climate change adaptation policies in Turkey can be realized more rapidly when they are addressed with cities that are not alien to the concept of urban health (Evci Kiraz E., 2021). Within the scope of the WHO Healthy Cities Project, there is a national healthy city network in Turkey. The coordination of the national network is currently carried out by the Union of Healthy Cities of Turkey (UHD).

The concept of urban health is framed by the following:

-Protecting the health of the city

-Monitoring the health of the city

-Assessing the health of the city

-Identifying risks in cities and taking precautions

-Preparedness for emergencies in cities

-To produce plans, programs, projects and policies to improve the health of the city, to plan services, to develop manpower and to create and/or renew the training curriculum

It is beneficial to monitor internal migration movements due to climate change and to prepare regions receiving migration as resilient and healthy living environments according to spatial and health indicators. Rural areas and smart systems for the risks of the future again should be evaluated and strengthened.

To realize the adaptation of the health sector to the health impacts of climate change

Adaptation planning and policy making in the health sector will be more complex than in other sectors. The health sector has cross-cutting areas with other sectors. Care should be taken to ensure that the adaptation efforts of other sectors are compatible with health.

What needs to be done for an adaptation policy compatible with the health impacts of climate change are listed below:

-Working with health impact chains based on the Turkey Health Profile

-Preparing Climate Change Adaptation Plans for Urban and Rural Health

-Planning focused on climate determinants of health

-Monitoring the disease/health problems surveillance system together with meteorological data, climate signals, scenarios, projections, vulnerability and risk analysis of other sectors

- Establishing regional, city, neighborhood, point, spatial, social, individual early warning and rapid response mechanisms

-Working fast and continuously, integrated with other programs, without making the process a burden

-Regional, city, neighborhood, point, spatial, social, individual detection of risk

-Reducing and preventing risks and expected health impacts, protecting the community from impacts, being prepared for the unexpected

Developing special control mechanisms for the agents included in the list of climate-sensitive diseases

-Knowing, monitoring and reducing vulnerabilities and being prepared for the worst

-Flexible, short and long term goals, strategies and action plans

-Spatial business intelligence (GIS-based) combined with future-projected technologies, such as tele-epidemiology

To identify and make available the needed and/or missing data for the relationship between climate and health through epidemiology and other sector-specific analysis methods

-To have a research perspective that can change at the same speed as the rate of change of risks and respond to the needs

-Blending scientific and organizational approaches

Self-developed, up-to-date, educated, employed manpower with a culture of working with different disciplines and sectors

-Allocate budget

-Making a time calendar

Climate-sensitive common language and communication across sectors

Common language and communication systems need to be established so that the health sector can understand other sectors and other sectors can understand the health sector and its approach to health accurately and clearly.

After the 2015 revision of the National Program and Action Plan on Mitigating the Adverse Impacts of Climate Change on Health, trainings at country and provincial level should be accelerated. Trainings should not be limited to the health sector, other sectors should also be included in the trainings and issues such as climate change, health impacts of climate change and sectoral adaptation should be learned together.

Informing vulnerable groups about frequent events due to climate change in Turkey, training them if necessary, organizing their living spaces, raising their awareness on early warning systems, providing them with experience so that they can be ready immediately in the face of events and show the desired reflexes, and directing them to areas where they can receive immediate services,

prioritized to be
able to receive services Ensuring
such arrangements should
be put on the agenda.

The common language of medical people is the international disease coding system. This system, whose short name is ICD, should be updated according to the list of climate-sensitive diseases. For this purpose, studies on the list of climate-sensitive diseases for Turkey should be initiated. This list should be organized at the level of country, region, province, district, neighborhood, residence and household. The relationship between climate risks and diseases should be established. The significance of the relationships should be questioned through scientific studies, and the results of studies with the highest significance between the dependent and independent variables should be used as evidence. While Turkey is waiting for the ICD update due to the different risks it has in the region and within itself, Turkey should be served with a list of climate-sensitive diseases.

In Turkey, there is a lack of information on how employee health will be affected in sectors that will be affected by climate change. The issue of worker health should be included in the adaptation action plans to be prepared. In action plans, the effects of climate change on employee health in sectors working in open areas (agricultural workers, security guards, archaeologists, excavation and construction sector, geological engineers, etc.), sectors working in closed areas (furnace, steel industry, glass industry, food sector, office workers, etc.), sectors where groups requiring special policies work should be evaluated separately.

Databases, social media, digital networks, smart applications are used more intensively for communication. A database reflecting the relationship between climate change and health in Turkey, compatible with other climate databases and feeding them is necessary. Communication networks should make accurate, continuous and stable publications and shares using this data.

As the common language and communication increases, scientists, academics, decision-makers and practitioners can do more and more projects, scientific publications, innovations, R&D, investments, etc. together. Legislation will also need to address climate change and

The new legislation should be reviewed in terms of its health impacts and revised in a common language, and new legislation should be based on public health-centered legislation development.

Ensuring adaptation of health facilities to climate change

First of all, the use of renewable and sustainable energy in healthcare facilities should be encouraged. Existing practices such as green hospitals, city hospitals and Leadership in Energy and Environmental Design (LEED) certification should be brought together under a single roof with a view to the health impacts of climate change. Health participation in accreditation programs in their facilities is recommended.

When the above seven headings are analyzed, it is seen that in order to protect public health from the negative impacts of climate change, it is beneficial to adopt two priority strategic objectives in adaptation actions.

Strategic Objective 1. Strengthening the infrastructure for evidence-based analysis, assessment and reporting on climate change in the field of health, and increasing R&D studies.

Develop a list of indicators and health impact chains based on the Turkey Climate and Health Profile; establish a system for data collection, continuity, analysis and harmonization of these studies with existing practices such as notification, early warning, etc.
Increasing epidemiological research on the physical, mental and social impacts of climate change; identifying places and populations with high vulnerability to potential hazards at regional and city level; planning health services according to climate determinants.
Preparation of legislative infrastructure for Health Impact Assessment of measures taken for climate change.

Increasing joint R&D activities with other sectors and disciplines for monitoring, protection, prevention and early diagnosis of diseases caused by climate change (heat, cold, ultraviolet-related; due to deterioration of water, air, food quality; animal and vector-bornenewre-emerging infectious; mental health).

Strengthening the capacity, cooperation and awareness on climate change and health perspective in all institutions and organizations at national and local level.

Establish a high-level coordination unit, working groups and climate and health ethics committees to carry out activities such as monitoring and communication.
IP6. The periodic agenda item of the Public Hygiene Boards in provinces should be climate change and health impacts or urban health.
climate change protection from negative impacts. **SAG7.** Climate responsive disease list and its use; identification of climate-sensitive diseases within the country; preparation of a climate and health dictionary for disciplines and sectors.
Initiating, developing and disseminating climate and health literacy studies, training manpower working in the health sector
Re-organization of environment, urban, climate and health related education curricula and practice guidelines with a climate change and health perspective.
Ensuring accreditation of health facilities as climate change resilient facilities.
SAG11. Climate and health

unity in the field of national/local Public Society work wit realized Plan program h number and community cohesion efforts and Increasing participation. Proje ct

Occupational Health and Safety (OHS) legislation will be reviewed with respect to occupational safety, occupational diseases and public health aspects related to climate change impacts and adaptation, risks will be identified and updates will be made.

SOURCE: Public Health

Bora Başara, B., Soytutan Çağlar, İ.AygünA.ÖzdemirTA.KulaliB.UzunSB.Kara, S. (2021). Health Statistics Yearbook 2019. Ankara: General Directorate of Health Information Systems, Ministry of Health. Retrieved from istatistikleri-yilligi-2019pdf.pdf.

Bora Başara, B., Soytutan Çağlar, İ., Aygün, A., Özdemir, T., Kulali, B., Yentür, G., Ünal, G. (2022). Health Statistics Yearbook 2020. Ankara: General Directorate of Health Information Systems. Retrieved from https://dosyasb.saglik.gov.tr/Eklenti/43399,siy2020-tur- 26052022pdf.pdf?0

SB (n.d.). Job Description of the Department of Communicable Diseases and Early Warning. General Directorate of Public Health. Retrieved from https://hsgm.saglik.gov.tr/tr/baskanligimiz-14/görev-tanımı.html.

Evci Kiraz, E. (2018). Health Impact Assessment. J Biotechinol & Strategic Health Res, 2(2), 82-86. Retrieved from https://dergipark.org.tr/tr/pub/bshr/issue/39479/447278.

Evci Cherry, E. (Ed.). (2021). City Health, Turkey Klinikleri. https://www.turkiyeklinikleri.com/journal/public-health-special- Retrieved from topic/444/issue/2021/7/4-0/sehir-sagligi/tr-index.html.

TURKSTAT (2020). Life Tables, 2017-2019. https://data.tuik.gov.tr/Bulten/Index?p=Hayat- Retrieved from Tables-2017-2019-33711.

MOEUU (2012). Climate Amendment Strategy (2010-2020). Retrieved from https://www.gmka.gov.tr/dokumanlar/yayinlar/Turkiye-Iklim-Degisikligi-Stratejisi.pdf.

MOEUU (2012). Climate Amendment National Action Plan 2011-2023. Retrieved from https://webdosya.csb.gov.tr/db/iklim/banner/banner591.pdf

Karagülle, D., & Evci Kiraz, E. (2018). Environmental Health Action Plan Studies in Aydın Province - Environmental Risk Factors Research. Retrieved from https://acikbilim.yok.gov.tr/handle/20.500.12812/587555.

MOH (2022). Taken from the official comments of the Ministry of Health on the national report.

TUIK (2020). Health Expenditures Statistics, 2019. Retrieved from https://data.tuik.gov.tr/Bulten/Index?p=Health-Expenditure-Statistics-2019-33659

SB (2022). Health Statistics Yearbook 2020. Health Information Systems General Directorate, https://dosyasb.saglik.gov.tr/Eklenti/43399,siy2020-tur- Retrieved from 26052022pdf.pdf?0.

MOH (2015). National Program to Mitigate the Adverse Effects of Climate Change on Health and Action Plan Turkey People Health Institution. Retrieved from https://hsgmdestek.saglik.gov.tr/tr/cevresagligi-haberler/i-klim-degisikliginin-saglik- uzerine-ol olumsuz- etk etkileri- azalilmasi-ulusal-programi-and-eylem-plani-revisionu- calistayi-yapildi.html

Tezcan, S. (2017). Basic Epidemiology.

MOEUU (2018). Turkey's Seventh National Statement. https://webdosya.csb.gov.tr/db/cygm/icerikler/yed-nc--ulusal-b-ld-r-m-20190909092640.pdf.Retrieved from

Türkmen, M., & Evci Kiraz, E. (2021). Building Public Health Capacity and Leadership in the City. City Health (pp. 1-4). Ankara Turkey Clinics. https://www.turkiyeklinikleri.com/article/tr-sehirde-halk-sagligi-kapasitesini-arttirmak- Retrieved from and-leadership-96694.html.

WHO (2008). International health regulations (2005) 2nd edition. Geneva: World Health Organization. Retrieved from https://www.who.int/publications/i/item/9789241580410.

ENERJİ

iklime uyum

7.1. GENERAL FRAMEWORK

Turkey wants to get rid of its high dependence on fossil resources. renewable energy sources is at the forefront of capacity growth.

Turkey has made significant progress and diversified its domestic energy supply sources, tripling its renewable energy-based electricity generation in the last decade. However, in terms of fossil fuel needs, Turkey is 93% oil, 99% natural gas and 99% coal.
30% is dependent on foreign energy. Economic growth and population trigger an increase in energy demand, leading to high levels of energy imports due to insufficient domestic energy resources.

Turkey's National Energy Plan was published on 19.01.2023. However, in recent years, Turkey has been investing more in renewable energy in the energy sector, which contributes both to the reduction of greenhouse gas emissions and adaptation to climate change. Installed capacity commissioned in the two-year period covering 2021 - 2022
Approximately 78% of power plants were realized with renewable resources.

Turkey, with an installed capacity of more than 100,000 MW, needs to implement policies and efforts for emission reduction and climate change adaptation with coal-fired power plants, whose share in the installed capacity of electricity has been gradually decreasing due to renewable-oriented policies in recent years, on the one hand, and renewable energy plants based on wind and solar, especially water, which are more vulnerable to climate hazards, on the other hand.

It is important in terms of climate change, sustainability and economic impacts that Turkey, which has set a 2053 net zero emission target in its energy and climate policies, takes into account the interactive mechanisms of adaptation and mitigation in the energy sector in these targets and efforts. While the energy sector is a key sector for mitigation, it should be a structural component of adaptation actions and efforts. Increasing the knowledge base and human, institutional and organizational capacity for adaptation in the energy sector will increase the ability to build success and synergies.

7.2. SECTORAL LEGAL FRAMEWORK AND RESPONSIBLE INSTITUTIONS

In Turkey, energy decision-makers in Turkey are increasingly working to build an energy sector is resilient to climate change.
compliance with awareness levels
strengthen their capacities and
It is vital that they include harmonization
in their top policy documents.

Since 2015, Turkey has made significant investments in many sectors, particularly in the energy sector, which have had a significant impact on GHG emission reductions. As in many other countries, the energy sector has the highest share of GHG emissions compared to other sectors. Therefore, policies and measures to reduce GHG emissions have focused more on energy policies, particularly in the energy sector, including explicit targets for renewable energy generation. Turkey continues its efforts to further increase this ratio. The country's energy policy has prioritized the maximum use of renewable energy resources, while increasing security of supply and reducing dependence on imports. Turkey's main mitigation policy in the energy sector for 2030 is to maximize the use of energy efficiency and renewable potential, taking into account feasibility, market conditions and energy security. The Renewable Energy Resources Support Mechanism (YEKDEM) and the Regulation on Renewable Energy Resource Areas (YEKA) have contributed significantly to accelerating renewable energy investments, particularly in wind and solar energy.

As of September 2022, Turkey has a total installed capacity of 102,281 MW. With 55,630 MW, renewable energy sources account for 54% of Turkey's installed capacity for electricity generation. This year, Turkey is one of the 14 countries in the world with over 100,000 MW of installed capacity. has been. Renewable energy sources
Hydroelectricity has a share of 30.9%, wind 10.9%, solar 8.8%, geothermal 1.6% and biomass 1.8% of the 54% share. Energy resources commissioned in the last two years
97% from renewable sources and the rest from combined power generation (cogeneration), which is good practice in terms of efficiency. In 2021, around 3,000 MW of capacity was commissioned in solar and wind energy. Turkey is among the world's leading countries in this respect.

Turkey ranks twelfth in the world and fifth in Europe in terms of renewable installed capacity, and first and second in Europe in terms of geothermal and hydraulic installed capacity, respectively. The share of wind and solar energy in total generation is
It exceeded 15.5%, the highest rate in Asia. In addition, according to the International Energy Agency 2022 Renewable Energy Statistics, Turkey is the second most energy-recovery system-intensive country in the world.

The primary guiding policy documents and sectoral legislation for the energy sector are given below:

- Energy Efficiency Law (2007)
- Law on the Utilization of Renewable Energy Resources for Electricity Generation (2005)
- Law on Geothermal Resources and Mineral Waters (2007)
- Electricity Market Law (2013)
- Natural Gas Market Law (2001)
- Law on the Establishment and Operation of Nuclear Power Plants and Sale of Energy (2007)
- Electricity Generation from Renewable Energy Sources Certification and

Regulation on Support (YEKDEM) (2013)

- Regulation on Increasing Efficiency in the Use of Energy Resources and Energy (2011)
- Turkey Hydrogen Technologies Strategy and Roadmap (2023)
- Energy Efficiency Strategy Document and National Energy Efficiency Action Plan (2017-2023 and to be updated)
- Turkey National Energy Plan (2022-2035)

The Ministry of Energy and Natural Resources and its related, associated and affiliated organizations are the main institutions responsible for the energy sector in Turkey.

7.3. EFFECTS OF CHANGE

It is fed by the snow cover accumulated on high mountains due to the average temperature increase and drought events.
HEPPs that generate electricity are at great risk due to early snowmelt.
underneath.

The energy sector in Turkey is among the sectors that will be affected by climate change and is exposed to various natural disasters such as droughts, floods, forest fires, earthquakes and landslides from time to time. Although there have been no major damages and disruptions to energy infrastructure due to climate hazards to date, extreme climate events with increasing severity and frequency are expected to pose significant challenges and damage to the sector in the future. In Turkey, thermal and renewable energy infrastructure is vulnerable to a range of climate hazards such as drought, extreme heat, storms, heavy rainfall and sea level rise, which will increase the vulnerability of energy infrastructure.

Most of the practices and studies on climate change in the energy sector have focused on both the contribution of GHG emissions to climate change and the impact of emission mitigation policies on the energy sector. However, studies on the impacts of climate change on the sector and the development of actions and policies to adapt to these impacts have not yet become widespread.

In order to adapt to climate change in Turkey, it is first necessary to analyze the impacts of climate change on the energy sector and make a comprehensive assessment. For this purpose, the impacts of climate change on (1) the amount of available primary energy and energy balance (2) the capacity to provide energy to consumers and (3) lead to changes in energy consumption patterns.

Onshore refineries in Izmir and Izmit and onshore refineries in Kırıkkale and Batman process crude oil. Sea level rise, floods and strong storms are expected to have negative impacts on these facilities. Extreme heat, high winds, droughts, flash floods, storm surges and wildfires are expected to increase in frequency due to climate change, and toxic releases, oil spills, fire or explosion hazards (Natech incidents) could potentially have negative consequences (European Commission, 2012 and Necci, et al., 2018). Given that climate hazards are the most critical factor that can increase the occurrence of a Natech event (Hasan and Foliente., 2015), measures need to be taken to ensure the resilience of oil infrastructure, investments in the oil industry and the safety of people and the environment. Revealed It's coming out.

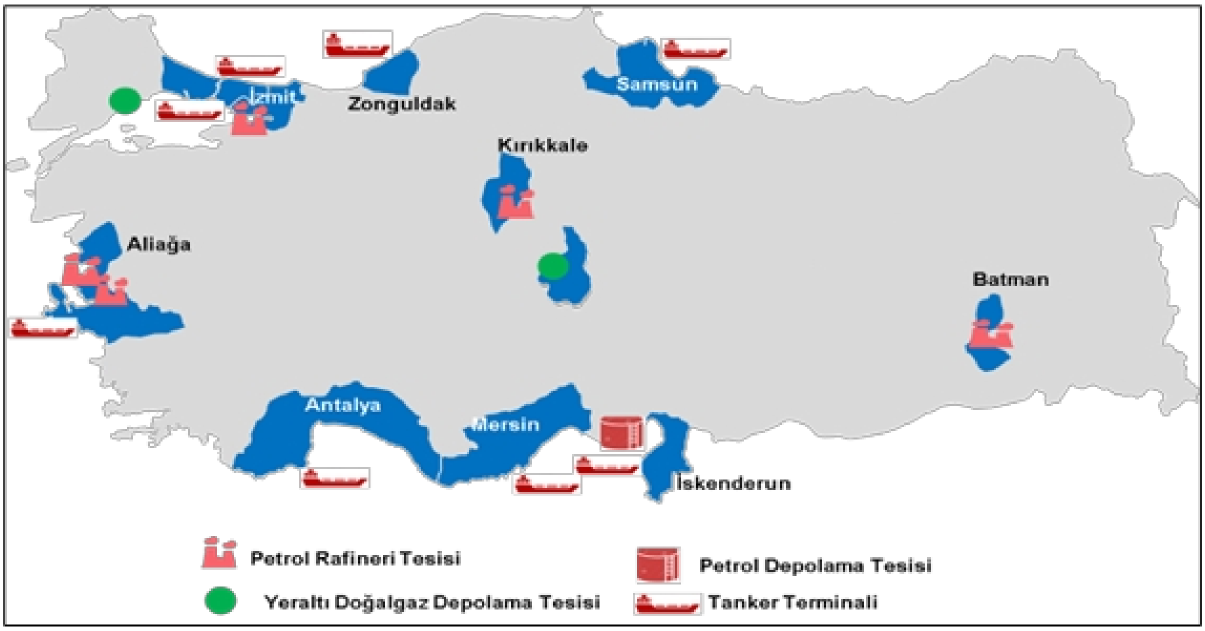

Figure 23 Refineries, Oil and Natural Gas Storage and Terminals in Turkey

In addition to impacts on energy generation potential, climate hazards can also have a negative impact on the capacity of the energy system to convert this potential into final energy to be supplied to consumers to meet different energy services. These impacts can be decomposed into impacts on the technologies that transform energy and on the transmission, distribution and transfer of energy. Hydropower plants with constructed reservoirs that are not designed to manage increased flows due to seasonal variation (Vicuña et al., 2007), thermal power plants whose output and efficiency will be affected by changes in ambient temperature and humidity (Arrieta and Lora, 2005), or differences in the quantity and/or quality of water resources for competing uses (Feeley et al., 2008; Durmayaz and Söğüt, 2006) power plants located in coastal lowlands subject to storm surges and coastal erosion and flooding (Neumann and Price, 2009) are examples of impacts on energy-converting technologies.

Since HEPPs in Turkey are both dam and river type HEPPs, their vulnerability to climate change more is high. The most important factors affecting hydroelectric energy

The important climate characteristic is the seasonal and inter-annual variability of precipitation as well as the average annual rainfall. For run-of-river HEPPs, heavy rainfall as well as low rainfall can disrupt electricity generation as it can damage turbines and components. Runoff, together with the amount of precipitation, significantly distorts the effect of precipitation on river flow. In addition, changing climate can threaten hydropower generation, especially in snow-dominated basins in the north and east, where reduced snow cover in the mountains affects river levels. Erzincan province, where the Euphrates River originates, is very sensitive to melting snow waters, which may have negative impacts on the runoff.

As with all energy sources that utilize the sun, photovoltaic power plants are also affected by changes in sunshine duration and cloud cover. In addition, for wind turbines to operate efficiently, the wind speed must be stable and at a certain level. For an economic wind power plant (WPP) investment, a wind speed of at least 7m/s is required. Wind speeds of up to 20 meters per second operate the turbine at full capacity. However, when the wind exceeds this speed, the turbine can stop automatically. This leads to excessive

It shows that strong winds from weather events can affect power plants. Turkey wind potential at different wind speeds in the seas and on land. High wind speeds of 7 meters per second and above are found in the Aegean Sea, the western part of the Black Sea and the Mediterranean Sea between Mersin and Cyprus, while on land, wind speeds of less than 7 meters per second are spread over all regions and provide the opportunity to generate electricity.

The share of coal, natural gas, liquid fuels and multi-fuel power plants, known as thermal power plants, in Turkey's installed capacity is close to half with 48.3%, but this share is gradually decreasing. Thermal power plants operating in the country drew 8.2 billion tons of water in 2020, 56% of which was from the sea, while the remaining cooling water was drawn from wells, dams and rivers (TurkStat, 2021). For example, some thermal power plants use water drawn from streams or seawater, while some natural gas cycle power plants uses a dry cooling system and seawater.

Extreme climate events caused by climate change can affect energy transmission through the degradation of Turkey's energy infrastructure. Floods, avalanches, landslides, severe wind and ice loads and other extreme climate events can affect both transmission power lines and gas transmission systems (Vlasova and Rakitina, 2010). Energy distribution can also be affected by fires or falling trees and heat waves, which can cause power transformer failures and losses in substation capacity (Sathaye et al., 2011). Above-ground sections of pipelines (Figure 24), which supply an average annual consumption of approximately 50 billion m(3) of natural gas, are affected by extreme high and low temperatures through material damage and thermal expansion or contraction. Heavy rainfall events can damage underground pipelines, exposing them.

Figure 24 Crude Oil and Natural Gas Pipelines

Energy Sector Risk Analysis: Heat Wave

Hot Air waves their impact on the energy system is limited to the supply side is not. Since final energy use can be affected by temperature change, higher temperatures lead to higher cooling demand. Temperature increase also increases electricity demand in industry and

It can also affect the demand for water and electricity for irrigation in agriculture. The increase in average temperature and heat wave events in Turkey can increase the demand for electricity used in agricultural irrigation, industry, residences and commercial buildings, sometimes creating peak demand.

In addition, the heat wave may adversely affect the substations that provide electricity transmission distribution and cause them to be out of operation. Figure 25 shows the impact chain prepared for increasing temperatures and heat waves.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Ortalama sıcaklık artışı	Sıcak hava dalgası	Akaryakıt ve doğal gaz stokları	Termik santrallerde elektrik üretiminde verimlilik	Sosyo-Ekonomik Gelişmişlik Endeksi skoru	Elektrik santralleri verimliliğinde ve mevcut üretim kapasitesinde azalma
Aşırı sıcak gün sayısında artış	Ardışık sıcak gün sayısında artış	Linyit rezervleri	RES'lerde verimlilik kaybı	Yerel İklim Değişikliği/ Enerji Planının olması	Soğutma için artan elektrik talebi
		Sanayide elektrik talebi	GES'lerde verimlilik kaybı	Enerji tesisleri içinde finansmana erişim kolaylığı	Isıtma için akaryakıt, kömür, odun ve doğal gaz talebinde azalma
		Tarımsal sulamada elektrik talebi	HES'lerde buharlaşmayla üretim kaybı	Elektrik santrallerinde şebekeye erişim kolaylığı	Feyezan ile HES altyapısına verilen hasar
		Ticarette elektrik talebi	JES'lerde verimlilik kaybı	Enerji tesislerinin maliyetleri ve piyasa değerlerinde değişim*	HES'lerde su hacminde azalma
		Trafo merkezleri ve elektrik iletim hatları	Elektrik dağıtım ve iletim kaybı		Elektrik iletim hatlarında sarkma, kapasite ve iletkenliğinde/ verimliliğinde azalma
		Enerji iletim ve taşıma sistemleri*	Müşteri başına kesinti sıklığı		
			İstasyon sayısı		
			Trafo merkezlerinin verimlilik kaybı		
			Araç klimaları için artan akaryakıt talebi*		
			Termik santrallerde artan su sıcaklığı nedeniyle daha fazla soğutma için elektrik talebi*		

Figure 25 Impact Chain: Energy Sector and Heatwave

*The * symbol indicators not used in risk analyses.*

According to the heat wave hazard of Turkey, a risk analysis was conducted for the energy sector by evaluating the hazard, exposure and vulnerability of the provinces together and the risk map is shown in Figure 26. Accordingly, while the risk in the energy sector is low in provinces located in the north of Turkey, it is high in provinces located in the south. Although there are no critical energy facilities in provinces such as Kastamonu and Çankırı, which are located in the north with relatively low levels of economic and social development, energy demand and the realization of this demand electricity transmission lines and substations can increase the risk. In provinces where thermal and renewable energy plants are installed, efficiency is expected to decrease due to temperature increase. Compensating the reduced electricity generation by increasing the installed power capacity will also reduce the vulnerability in the region. Thus, the high number of lignite power plants in provinces such as Çanakkale, İzmir and Kahramanmaraş causes the risk level to be high to medium. On the other hand, the provinces with high levels of vulnerability such as Uşak, Aydın and

The risk is very high in Tekirdağ provinces. Provinces such as Antalya, Mersin, Adana, Osmaniye and Hatay in the Mediterranean Region very high risk, especially due to the density of transmission lines and increasing energy demand increasing vulnerabilities. Malatya and Batman in Eastern and Southeastern Anatolia provinces have low adaptation capacities, which leads to high risks. In Ankara and Konya provinces in Central Anatolia, the risk reaches high levels due to the high number of thermal and renewable energy facilities, density of transmission lines and high energy demand.

Figure 26 Current Period Risk Map: Energy Sector and Heat Wave Relationship

Energy Sector Risk Analysis: Drought

Drought can affect the functioning of the existing hydropower system and even jeopardize the viability of planned investments. Therefore, changes in the precipitation regime due to climate change add a significant amount of uncertainty to the already uncertain functioning of hydropower systems.

River flow is highly variable, especially between seasons. Small run-of-river hydroelectric facilities can affect electricity generation by affecting their operational cooling water requirements. Facilities that could be affected are coal, natural gas, nuclear, geothermal and biomass energy less resilient and more vulnerable to climate change. Reservoir storage capacity compensates for seasonal or annual variations in water flow, allowing electricity generation to be matched to changing power demand. Therefore, reservoirs can act as a buffer, storing potential energy and helping to cope with climate change. An important impact of drought on energy systems is the impact on thermal power plants and oil refineries

power plants. Figure 27 shows the impact chain related to drought hazard in the energy sector.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Toplam yağış miktarında azalma	Kuraklık	Termik santrallerin kurulu gücü	Termik su kaybı	Sosyo-Ekonomik Gelişmişlik Endeksi skoru	HES üretim kapasitesinde azalma
Ortalama sıcaklık artışı	Yağış miktarı ve yağışlı gün sayısında azalma	HES kurulu güç	RES'lerde üretim kaybı	Deniz kıyısında bulunan tesisler ve soğutma sularının denizden karşılanması*	Su kullanıcıları arasındaki rekabet riski
	Ardışık kurak gün sayısında artış	Biyokütle santralleri	HES'lerde üretim kaybı	Yerel İklim Değişikliği/ Enerji planlarının yapılmış olması	Termik santrallerde soğutma verimliliği ve dolayısıyla üretimin düşmesi
		Petrol rafineri sayısı	JES'lerde üretim kaybı	HES'lerde taşkın önleme uygulaması*	
		Elektrik üretim santralleri*	Su rekabeti	HES'lerin çok amaçlı kullanımı*	
		Kömür/ linyit santralleri*	Termik santralde soğutma suyu ihtiyacından kaynaklanan üretim kaybı*		
		Doğalgaz santralleri*	Petrol ve doğal gaz sondaj ve üretim için su ihtiyacı*		
			Termik santrallerinde maliyet artışı*		

Figure 27 Impact Chain: Energy Sector and Drought

*The * symbol indicators not used in risk analyses.*

A risk analysis was conducted for the energy sector by evaluating the exposure and vulnerability of provinces according to drought hazard, and the risk map is shown in Figure 28. Accordingly, it is seen that there are three parallel lines in the risk map on Turkey's critical energy facilities. On the eastern line, the risk is very high in Erzurum, Bingöl, Elazığ, Diyarbakır and Şanlıurfa provinces due to the reduction or even cessation of electricity generated from hydroelectric power plants built on Turkey's largest rivers such as Tigris, Murat and Euphrates. On the second line, the Kızılırmak and Yeşilırmak rivers Sivas and the provinces of Kahramanmaraş, Adana and Hatay, which have significant water-dependent hydroelectric and thermal power plants, have very high risks. A third small parallel line can be added to these regions with a very high risk level due to thermal power plants in Çanakkale and Tekirdağ and natural gas exploration and production. Between the second and third lines, the Central Anatolian Refinery and thermal power plant in Kırıkkale, which operates as an onshore refinery located on the Kızılırmak River, keeps the risk of this province at a very high level.

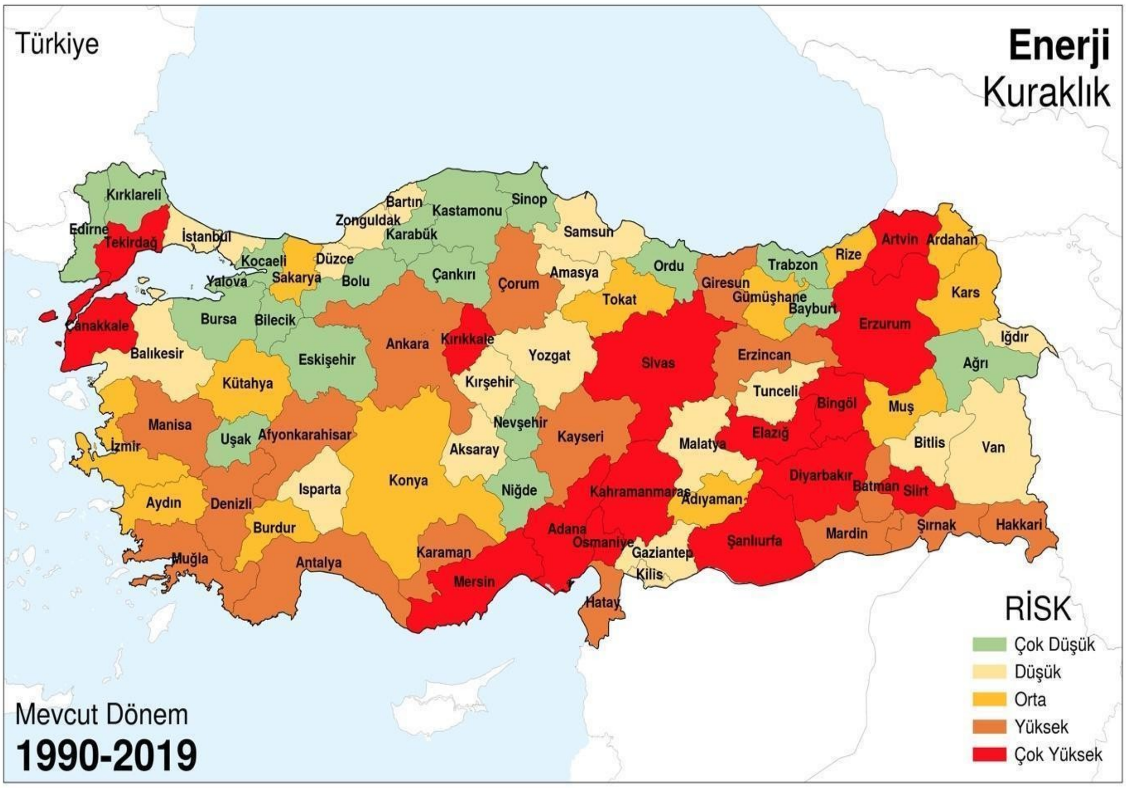

Figure 28 Current Period Risk Map: Energy Sector and Drought

7.4. ADAPTATION MEASURES

The key to securing the country's uninterrupted energy supply is for the energy sector to develop the highest possible resilience to climate change.

Adaptation to the impacts of climate change is becoming increasingly important as a complementary response strategy for reducing greenhouse gas emissions. While the main objective of adaptation strategic objectives and their actions is to ensure the security of people and assets, in the case of the energy system, the primary objective is to guarantee energy supply and balance production and consumption in time and space. Two strategic objectives have been set for the energy sector.

Strategic Objective 1. Developing the political and legal framework for the adaptation of Turkey's energy sector to climate change, strengthening institutional capacity and cooperation, and increasing the production and sharing of information and data.

ENR1. Providing necessary training and awareness raising activities to public institutions and private sector decision makers in the energy sector to improve their institutional capacity and information networks on climate change adaptation.

ENR2. Identify the needs for climate services in the energy sector and the impact of climate change risks identification and evaluation.

ENR3. Climate risks and climate change harmonization in the field of energy and resources

prepared politics documents to be taken integrate care of. d

Strategic Objective 2. Strengthening the generation, transmission-distribution and storage infrastructure in energy resources, taking into account the necessary designs and increasing the flexibility of the electricity energy system in order to ensure adaptation to climate change.

Climate change will not directly affect the actual amount of fossil fuels, but it could have an impact on access to fossil fuel reserves and the exploration and extraction of these resources.

Exploration, production and storage of energy resources

When excessive rainfall peaks and turns into floods and overflows, and in the face of the danger of erosion, lignite reserves and stocks in open fields may be affected by floods and overflows. In addition, excessive rainfall increases the amount of trace pollutants seeping through the soil layer.

It can be said that the potential of geothermal energy source, which is another important energy source, is quite high. The increase in the average ambient temperature and the increase in water temperature reduces the efficiency of power plants that use hot water produced by natural outflow or drilling in geothermal fields located in all regions, especially in Aydın province.

In addition, oil and gas exploration activities onshore and offshore, exploration, prospecting, drilling and production equipment and platforms are affected by strong storms, so it is necessary to improve models that predict extreme wind and sandstorms and reinforce drilling rigs with more robust materials.

Oil and natural gas storage facilities

Numerous oil ports and terminals along Turkey's coastline provide access to seaborne imports from the Mediterranean and Black Sea. In extreme weather conditions such as heat waves, floods and storms, these tanks should be engineered with insulation, drainage, early warning, redesign and robust materials and engineering solutions against climate hazards due to the flammable and explosive products they contain. Review of structural design thresholds for strong storms in oil storage tank farms, from lightning Protection systems Development, drainage systems need to be designed for the rapid removal of oil spills, to eliminate spills and at the same time to protect against fire.

Natural gas pipelines

High winds and storms can damage offshore and onshore pipelines and related equipment, and can lift heavy objects and strike pipelines, causing structural damage. They can also damage valves, pumping stations and river crossings, causing gas leakage and ignition, fire and air pollution. Lightning can pierce pipelines, causing fires or explosions. It is recommended that more robust and structurally resilient oil and gas pipeline designs are preferred to counter these impacts, and that future new-build equipment should be adapted by adopting upgraded design standards. As natural gas is transported underground in steel pipes, its vulnerability to precipitation and temperature extremes is low.

Thermal power plants

Since thermal power plants lose efficiency and require more cooling water under the threat of increasing ambient temperature and drought, the design of dry cooling systems, wastewater reuse using it, adaptation actions are required, such as recovering evaporated water in recirculation systems and improving aqueous cooling. On the other hand, dykes and other protective embankments may need to be raised to avoid the risk of increased physical damage and disruption to coastal installations as extreme rainfall peaks and sea level rise increase.

In line with the net zero emission target, instead of fossil-based power plants, renewable energy is used both in electricity generation and in meeting the self-consumption of industry and households. The share of energy sources will gradually increase. On the demand side, efficiency-enhancing actions and innovations in electricity and fuel consumption stand out. Starting with hydroelectric power plants, we can consider flexibility in generation in the form of wind, solar and biogas power plants.

Hydroelectric Power Plants

The fact that HEPPs with high capacity in hydroelectricity are located on the Euphrates, Murat and Tigris Rivers and that these rivers rely on snow and rain waters in the high regions of Eastern Anatolia shows that they are sensitive and vulnerable to climate change. With climate change, the duration and speed of melting of snow cover will put pressure on the turbines and their components on the Euphrates, Murat and Tigris Rivers, and debris and sediment will be generated by the drift of trees, stones and soils into the dam body. In addition, the changing climate may threaten hydropower generation, especially in snow-dominated basins in the north and east, where reduced snow cover in the mountains affects river levels. In Erzincan province, it should be taken into consideration that the rapidly melting snow waters of the Euphrates River and its tributaries such as the Murat River will negatively affect the HEPPs built on it.

Increasing storage capacity can mitigate the impact of the amount of water lost through evaporation during low precipitation and high temperatures, as 685 rivers, dams and hydroelectric power plants with an installed capacity of 31,336 MW are facing increased average temperatures, heat waves and droughts, leading to a reduction in available generation capacity and changes in operations. Declining snow cover also leads to reductions in available generation capacity and changes in operations, requiring adaptation actions such as improving short-term water flow forecasts, establishing water management strategies and additional storage capacity, increasing turbine flow capacity, and implementing operational strategies to manage ice cover formation.

In the face of heavy rainfall and the possibility of flooding, HPPs, especially river-type ones, will have an increased risk of physical damage and changes in operations. Since such HPPs without dams or water storage basins are more vulnerable to flooding and erosion, various discharge or alternative routes to flooding need to be planned. In addition to increasing storage capacity, the resilience of dam walls and turbines needs to be increased and sediment removal needs to be organized.

Wind Power Plants

The distribution of Turkey's wind potential by provinces and regions according to different wind speeds at sea and on land has been studied by MENR. 7 per second High-grade wind speeds of 7 meters per second or more are observed in the Aegean Sea, the western Black Sea and the Mediterranean Sea between Mersin and Cyprus, while on land, wind speeds of less than 7 meters per second spread to all regions and provide the opportunity to generate electricity. Wind power density, which is the amount of energy (watts) per m^2, is observed to be 200-400W per m^2 on average on land in Turkey. The areas where the power density is 500-600 W per m^2 are mostly in the Aegean Sea, where the wind speed is 7 meters and above. The distribution of the installed capacity of wind power plants in operation and under construction in Turkey by provinces is given in Figure 29 .

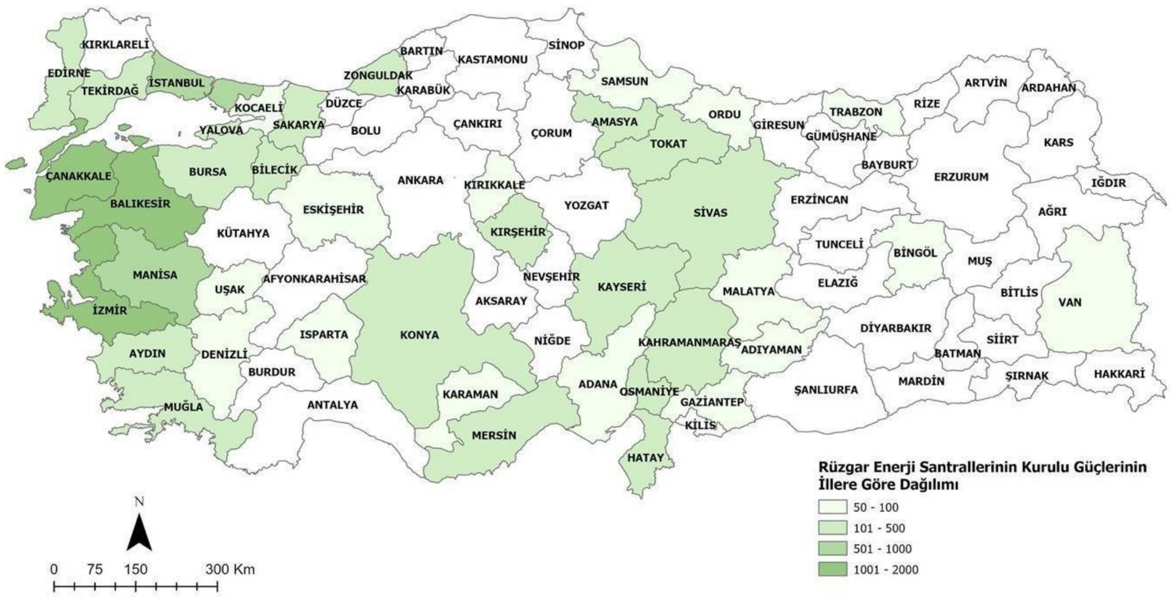

Figure 29 Distribution of Installed Capacity of Wind Power Plants by Province

Changes in wind frequency create uncertainty over the operation of wind with a total installed capacity approaching 12,000 MW, which have been commissioned together with power plants under construction, and it is possible that the turbine may become inoperable in high or low winds. In the face of this situation, it is necessary to consider power outages in energy system planning or to create and maintain spare capacity.

Increased average temperatures cause lower air density because wind can reduce the efficiency of electricity generation at the power plant.

Solar Power Plants

When Turkey's Solar Energy Potential Atlas (GEPA) is examined, it is clearly seen that the solar energy potential of the regions below the Ardahan-İzmir line is quite high, with a potential of 1,600 kWh per m(^{2}per year. SPPs with a total installed capacity of more than 10,000 MW are expected to be exposed to climate hazards such as heat waves and increasing average temperatures reduces panel efficiency and therefore energy output. If the ambient temperature is high, the capacity of the underground conductors is also reduced. Depending on the amount of electricity lost here and the costs of alternative cooling options, cooling is used to reduce efficiency losses.

plants can be installed. To reduce losses and increase outputs, it may be possible to improve the airflow under the mounting structure and opt for heat-resistant PV cells and module components. The distribution of SPPs by provinces in Turkey is given in Figure 30.

Figure 30 Distribution of Installed Capacity of Solar Power Plants by Province (MW)

Extreme weather and climate events such as heavy snow, hail and high winds can have negative effects on solar panels. Snow accumulation on the panel reduces the efficiency, while hail damages the panels. Debris carried by the wind can disrupt collector surface areas. Selecting a module surface that is suitable for self-cleaning and, if possible, selecting locations with a lower probability of dust, sand and snow can be a solution to such problems. It is also necessary to choose a stronger mounting structure, choose a location that can cope with flooding, and reinforce cables and components in case extreme climatic events such as heavy rainfall and lightning physically damage the components of the system and reduce output.

Biogas, Biomass, Waste Heat and Pyrolytic Oil Power Plants

As of end-April 2023, the total installed capacity of biogas, biomass, waste heat and pyrolytic oil power plants in Turkey was 2,385 MW, of which 2,071 MWe were registered as licensed. The distribution of registered plants by provinces in Turkey is shown in Figure 31, with Istanbul, Ankara, Balıkesir and İzmir having the highest capacity. In the face of the heat wave and increasing average temperatures, the thermal and water efficiency of such power plants is likely to decrease. For this reason, it is necessary to plan for losses in the electricity generation of power plants used in the conversion of waste to energy in various industrial branches, and energy planning should be based on backup or hybrid resources in order not to disrupt production, and it should be foreseen that more process and cooling water is needed at increasing temperatures.

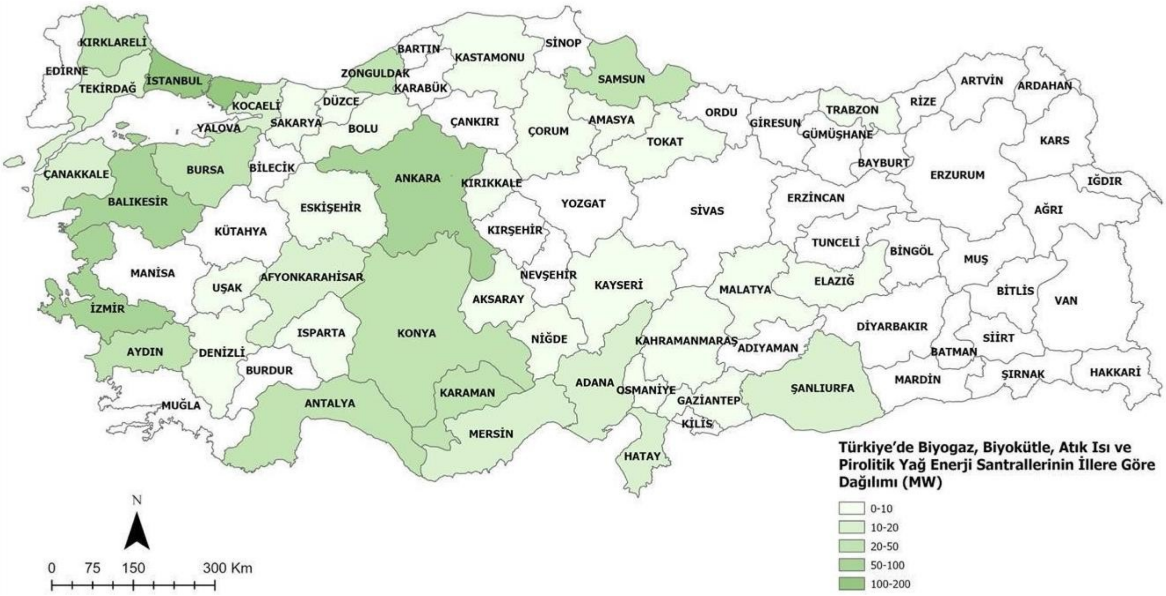

Figure 31 Distribution of Biogas, Biomass, Waste Heat and Prolycite Oil Power Plants in Turkey by Province (MW)

Electricity Transmission-Distribution Infrastructure

Atmospheric conditions affect the degree of power flow of transmission and distribution lines. Conductor is affected not only by the electrical heating effect, but also by ambient temperature, insulation and wind speed. Higher temperatures therefore lead to increased transmission line losses and elongated transmission line cables. Elongated cables increase the risk of forest fires. Cutting vegetation under and near conductors is an adaptation option. In forested areas, replacing overhead lines with underground cables can also be an option, but underground cables are about ten times more expensive than overhead lines because they are more difficult to install and maintain (Parsons, 2012). The cost difference is smaller for lower voltages. However, since most of Turkey's distribution networks consist of overhead lines outside the provincial or district center areas, costs are not low. According to EMRA 2020 year-end data, the length of distribution lines is 1,204,979 km. Of this, 967,378 km are overhead lines and 237,601 km are underground lines . With this transformers, as well as the lines together, can overheat and fail. Active coolers can be added to transformers.

Extreme weather conditions are problematic for transmission systems. A events such as frost and icing can cause sparks on insulators, switchgear and transformers, so insulator design needs to be improved. High winds, heavy rainfall and lightning can all cause failures in the system. This requires rerouting lines through open areas or along roads, regularly keeping vegetation at a safe distance and investing in better storm and hurricane forecasting tools. With the expectation that extreme weather conditions will become more frequent and intense with climate change, there is the possibility of greater damage to the system and consequent supply disruptions (Wood 2003).

It can be said that extreme temperatures and heat waves trigger fires and affect high and medium voltage lines in areas with high forest and tree cover.

In addition to extreme winds, increasing average temperatures have led to increased energy loss in electricity transmission and distribution lines. According to the report published by National Grid (2010), the capacity of overhead lines is reduced by 10% and underground cables
4% and 7.5% for transformers in the distribution network. For aluminum and copper conductors, the increase in electricity loss due to increased temperature is estimated to be about 0.4°C per degree Celsius (Haynes 2010). These increased transmission losses with changing climate will need to be included in design calculations for maximum temperature or rating for upgraded and newly constructed transmission and distribution lines.

Electricity and Fuel Demand

The total amount of consumption billed in Turkey in 2020 was 233,437 GWh for consumers connected at distribution voltage level and consumers connected at transmission voltage level. The distribution of this consumption by provinces is shown in Figure 32. The highest consumption was realized in Istanbul with 38.49 TWh, corresponding to 16.49% of the total consumption. Istanbul was followed by Izmir with 6.53%, Ankara with 6.04%, Bursa with 5.50% and Kocaeli with 4.88%.

Figure 32 Distribution of Electricity Consumption by Province

Rising temperatures will likely increase demand for electricity for cooling and decrease demand for fuel oil and natural gas for heating (US DOE, 2013). Many factors can affect energy demand, including temperature and other weather conditions, population, economic conditions, energy prices, consumer behavior, and the characteristics of energy-using equipment (USGCRP, 2009). Although it is difficult to estimate the effects of increasing temperatures on total energy demand, in Turkey during the summer season when temperatures exceed 40 ^{0}degrees Celsius, residential, commercial and industrial

Increases can be expected where cooling accounts for the largest share of energy use in buildings (largely from electricity). On cold days in winter, heating is mostly natural gas and coal.

On the other hand, power outage is affected not only by temperature but also by wind speed, humidity, precipitation and cloud cover. These affect air conditioning, space heating, cooling and water pumping loads, which will increase both peak and 24-hour demand. In extreme temperature situations, the strain on electricity systems to meet demand

Peak demand is particularly important as it is likely to be a major driver of electricity efficiency improvements. For electricity end-users, requiring minimum energy performance standards for new commercial buildings and electricity-using appliances (lighting, air conditioning, refrigeration) with labeling and certification schemes for both buildings and major appliances, developing legislation and access to finance for electricity efficiency improvements, replacing incandescent lamps with much more efficient light emitting diodes (LEDs), adopting ISO 50001, a global energy management standard, and opting for evaporative cooling or absorption cooling systems reduce electricity demand.

Petroleum Products, Natural Gas and Coal Demand

Petroleum products are produced in refineries and distributed to dealers. The percentage distribution of dealers' sales to consumers is shown in Figure 33. Here, both the distance of petroleum products transported by land tankers from refineries and the distance between the stations in the province are important in terms of floods and landslides caused by the negative effects of climate change on transportation routes. The impact of climate change on all petroleum products, including LPG, is the disruption of transportation routes during the transportation of products from distributor companies or importers' warehouses to sales stations due to weather events such as excessive rainfall, floods, erosion or landslides, and the inability of stations, which have to provide service around the clock, to sell fuel and thus consumers. fuel is that he can't find it.

Figure 33 Distribution of Fuel Sales by Province

The vulnerability of the sale or consumption of petroleum products to climate change can be attributed to the increased demand for petroleum products due to the increased use of vehicle air conditioning to cool and heat the vehicle in extreme heat or cold.

will be oriented. It is worth noting that a change in average temperature will change fuel consumption, affecting the use of air conditioning not only in buildings but also in vehicles. Fuel consumption is positively correlated with temperature and for every 1°C increase, 0.01 to 0.03 liters more fuel is consumed (Roujol, 2009). The use of air conditioning is estimated to reduce the efficiency of vehicles at highway speeds by about 12% (Parker, 2005).

Industrial energy demand is not critically sensitive to climate change (Scott and Huang, 2007). Most processes operate at relatively constant ambient temperatures and therefore have a relatively stable demand. However, continuous refrigeration processes, for example related to food processing and storage, have relatively small temperature variations and are therefore more dependent on the outdoor temperature (especially since these refrigeration processes often exchange heat with the outdoor air). Therefore, part of the baseload electricity demand can be expected to be temperature dependent (Hekkenberg, 2007).

Finally, in these activities, there may be problems in the transportation of petroleum products during floods and overflows that occur during heavy rains. The distance may be important in the transportation of petroleum products supplied from depots to stations.

ENR4. Integrate climate change adaptation into relevant decisions affecting water resources management and operation of HEPPs with dams, increase water retention capacity or give preference to HEPPs with pumped storage
dam bodies and power plant equipment

resilience an d turbine efficiency increasing.

ENR5. Take necessary measures to protect open lignite quarries and stockpiles from climate hazards such as floods, heat waves, etc. **ENR6.** Vulnerability to sea level rise for onshore energy facilities and Risk analysis Making and taking the necessary measures.

ENR7. Taking measures to prevent damage to overhead electricity-transmission-distribution infrastructure due to climate hazards.

ENR8. Oil and natural gas exploration and production
platforms and transmission-distribution pipelines

Taking measures against the impacts of climate change on tank farms.

ENR9. Reducing damages and efficiency losses in WPPs

ENR10. Establish early warning and response systems for energy management to improve maintenance schedules and respond quickly to post-disaster recovery needs.

ENR11. In order to increase energy efficiency in buildings, starting from building design, use of efficient appliances, new and efficient technology, and the dissemination of district heating/cooling systems.

Interaction with other sectors

The impacts of climate change on energy systems can have indirect impacts both within the energy sector and on other economic/natural systems. Likewise, impacts on economic and natural systems may also affect energy supply and demand. The impacts of climate change should be assessed holistically, taking into account inter-sectoral relations. The allocation of scarce water resources to sectors is a key cross-sectoral impact. Most climate change impact assessments focus on water scarcity or availability. Therefore, a comprehensive adaptation strategy to climate change requires an integrated water management plan.

Heat waves and droughts increase the amount of water required by energy systems, while the multiple uses of water resources (human and animal consumption, irrigation, ecosystem maintenance and wastewater control) add significant complexity to the energy system.

Extreme winds can also damage overhead power lines and cause direct loss of power supply in all sectors of the economy, especially energy-intensive sectors. This delay or disrupt production.

Again, if agricultural irrigation is practiced in the region, power outages will negatively affect the cultivation of agricultural products.

For example, a sudden flood event could affect the generation of a hydroelectric power plant, leading to power outages in the region. Lack of electrical power can affect other complementary critical infrastructure served by the utility, such as communications and telecommunications.

The design, under the coordination of the Ministry of Energy and Natural Resources, of advanced tools and models that use energy sector vulnerabilities and adaptation measures to assess trade-offs between various forms of energy production and various adaptation measures, and between climate change adaptation goals and other relevant national priorities, will be crucial in combating climate hazards.

SOURCE: Energy

Arrieta F.R.P., & Lora E.E.S. (2004). Influence of ambient temperature on combined-cycle power-plant performance. Applied Energy 80:261-72. DOI: https://doi.org/10.1016/j.apenergy.2004.04.007

Durmayaz A., & Sogut O.S. (2006). Influence of cooling water temperature on the efficiency of a pressurized-water reactor nuclear-power plant. International Journal of Energy Research 30:799-810. DOI: http://dx.doi.org/10.1002/er.1186

EMRA (2021). Electricity Market 2020 Market Development Report. Ankara. Retrieved from https://epdk.gov.tr/detay/icerik/3-0-0-102/yillik-rapor-elektrik-piyasasi-gelisim-raporlari.

European Commission. (2012). Natech Accidents When Natural Disasters Trigger Technological Accidents.

Feeley, T.J., Skone, T.J., Stiegel, G.J., McNemar, A., Nemeth, M., Schimmoller, B. (2008). Water: a critical resource in the thermoelectric power industry. Energy, 33:1-11. DOI: https://doi.org/10.1016/j.energy.2007.08.007

Hasan, S., & Foliente, G. (2015). Modeling Infrastructure System Interdependencies and Socioeconomic Impacts of Failure in Extreme Events: Emerging R&D Challenges. Nat. Hazards, 78, 2143-2168. Retrieved from https://doi.org/10.1007/s11069-015-1814-7.

Haynes, W.M., CRC. 2010. Handbook of Chemistry and Physics, CRC Press, Boca Raton, FL.

Hekkenberg, M., Moll, H.C. (2009). Dynamic temperature dependence patterns in future energy demand models in the context of climate change. Schoot Uiterkamp AJM Energy 34:1797-1806. DOI: https://doi.org/10.1016/j.energy.2009.07.037

National Grid (2010). Climate Change Adaptation Report, National Grid Electricity Transmission. Retrieved from https://www.nationalgrid.com/electricity- transmission/document/143201/download.

Necci, A., Girgin, S., Krausmann, E. (2018). Understanding Natech Risk Due to Storms- Analysis, Lessons Learned and Recommendations; JRC Technical Reports;.Publications Office of the European Union, Luxembourg. DOI:10.2760/21366, JRC114176.

Neumann, J.E., & Price, J.C. (2009). Adapting to climate change. The public policy response. Public infrastructure. RFF Report. Retrieved from https://rosap.ntl.bts.gov/view/dot/17294.

Parker, D.S. (2005). Energy efficient transportation for Florida. Energy Note FSEC-EN-19. Cocoa, Florida: Florida Solar Energy Center, University of Central Florida. http://www.fsec.ucf.edu/Pubs/energynotes/en-19.htm accessed 20.08.2022.

Parsons, B. (2012). Electricity Transmission Costing Study, an Independent Report Endorsed by the Institution of Engineering & Technology. https://www.theiet.org/impact-society/factfiles/energy-factfiles/energy-generation-and- Retrieved from policy/electricity-transmission-costing/.

Roujol S, Jounard R. 2009. Influence of passenger car auxiliaries on pollutant emission factors within the Artemis model. Atmospheric Environment; 43:1008-14. DOI: https://doi.org/10.1016/j.atmosenv.2008.01.016

Sathaye, J.A., Dale, L.L., Larsen, P.H., Fitts, G.A., Koy, K., Lewis, S.M., de Lucena, A.F.P. (2011). Estimating impacts of warming temperatures on California's electricity system. DOI: https://doi.org/10.1016/j.gloenvcha.2012.12.005

Scott, M.J., & Huang, Y.J. (2007). Effects of climate change on energy use in the United States in Effects of climate change on energy production and use in the United States. Washington DC, A Report by the U.S. Climate Change Science Program and the subcommittee on Global Change Research. Retrieved from https://digitalcommons.unl.edu/usdoepub/12/.

MENR (2022a). Geothermal. Retrieved from https://enerji.gov.tr/eigm-yenilenebilir-enerji-kaynaklar-jeotermal.

MENR (2022b). Wind. https://enerji.gov.tr/eigm-yenilenebilir-enerji-kaynaklar-ruzgarRetrieved from

MENR (n.d.). Solar Energy Potential Atlas. Retrieved from https://gepa.enerji.gov.tr/MyCalculator/.

TURKSTAT (2021). Water and Wastewater Statistics(2020). Retrieved from Atiksu-Istatistikleri-2020-.

US DOE (2013). Energy Sector Vulnerabilities to Climate Change and Extreme Weather. https://www.energy.gov/articles/us-energy-sector-vulnerabilities-climate-change-and- Retrieved from extreme-weather.

USGCRP (2009). Global Climate Change Impacts in the United States. Global Change Research Program, Cambridge University Press, New York. Retrieved from https://www.nrc.gov/docs/ML1006/ML100601201.pdf.

Vicuña, S., Leonardson, R., Hanemann, M.W., Dale, L.L., Dracup, J.A. (2008). Climate change impacts on high elevation hydropower generation in California's Sierra Nevada: a case study in the Upper American River. Climatic Change 87: S123-37. DOI: https://doi.org/10.1007/s10584-007-9365-x

Vlasova, L., & Rakitina, G.S. (2010). Natural risks management in the gas transmission system (GTS) of Russia and contribution to climate services under global climate change. Management of weather and climate risk in the energy industry. NATO Science Series, Springer Academic Publisher; 2010. P. 315-25. DOI: https://doi.org/10.1007/978-90-481-3692-6_21

Wood., J. (2003). The effect of one degree. IEE Power Engineer, (17)3. DOI: 10.1049/pe:20030301

TURİZM KÜLTÜREL MİRAS

iklime uyum

8.1. GENERAL FRAMEWORK

The tourism sector in Turkey has been growing except for the years of economic crisis.
share of income is increasing and this situation is expected to continue in the future.
is targeted. Sectoral sustainability and the protection of natural and cultural heritage against climate risks be protected.

Turkey's tourism sector's contribution to national income (2019 4.6%; TÜİK, 2021) and employment
(2018; 7.7%; 2.2 million people; OECD, 2020) contribution has been increasing for a long time. Tourism is among the fastest growing sectors in the country.
54 sub-sectors directly (AKTOB, 2014). Travel expenditures in Turkey accounted for 51.9% of total service exports in 2018 (OECD, 2020). The number of international visitors and tourism revenues have been on an upward trend since the 2000s, except for the crisis years, and reached 51.9 million and $38.9 billion in 2019, respectively. Spending per visitor remained low and followed a fluctuating course (751 $ in 2019; TÜRSAB, 2020; TÜİK,
2021). The sector, which was severely affected in terms of income and human resources during the pandemic, recovered rapidly and maintained its top position in terms of the number of tourists and income. Russia and the European Union countries are the foreign markets where most tourists come to Turkey. Domestic tourism activities showed a similar upward trend, with 126.4 million trips recorded in 2018 (62.1% overnight stays; 37.9% day trips; OECD2020). For tourism to be sustainable in the country, tourist spending needs to be much higher in return for the resources offered. The increase in the sector's share in national income also affects the sustainability of the country's economy due to the impact of climate risks on the sector in addition to the existing ones. Turkey is striving to maintain its ambition in the tourism sector in the coming periods. Both in the National Development Plan (NDP, 2023) and sectoral

In the National Strategy Document (NTS, 2023), diversification of tourism, season length, service quality, number of visitors with a high propensity to spend, length of stay and increasing non-accommodation expenditures are adopted as medium and long-term targets. Among the types of tourism planned to be developed are tourism activities that will generate high income but may be affected by climate hazards. The continuation of tourism activities with the current understanding and the realization of policy objectives may expose natural and cultural values to overuse and destruction, and therefore, sustainability principles should be taken into account in access to services such as food, water, energy, transportation and communication. Climate hazards, changes in the areas and seasons suitable for existing tourism activities in Turkey and the emergence of new destinations may cause additional financial and natural resource requirements. Strategies involving new tourism activities will be needed to utilize the idle facility and human resource capacity that will arise when existing destinations are not preferred. The emergence of favorable seasons in the countries that are target markets brings the diversification of the market to the agenda. Difficulties in increasing tourist expenditures by integrating tourism types, achieving occupancy rates in enterprises, maintaining income and employment in a balanced manner due to seasonal shifts will be able to live (EUROCONTROL, 2021).

Turkey is home to rich civilizations with thousands of years of history. This potential has placed universal responsibilities on the country to protect its historical, cultural and natural environment. Natural and cultural heritage assets that also serve tourism (such as historical buildings, archaeological sites and monuments), museum artifacts and

Our intangible cultural heritage assets are non-renewable national resources. Climate hazards are a global threat to natural, cultural and mixed cultural assets that are currently negatively affected by degrading environmental factors (IUCN, 2017). Climate hazards cause physical and chemical changes on these assets, sudden and long-term deterioration processes and contributing to the emergence of new deterioration events (Bertolin, 2019).

8.2. SECTORAL LEGAL FRAMEWORK AND RESPONSIBLE INSTITUTIONS

Although the Ministry of Culture and Tourism is the only institution directly responsible for tourism and cultural heritage in Turkey, the sector too many actors in the value chain and therefore has a multilateral legal and administrative dimension. shows.

The only institution directly responsible for tourism and cultural heritage in Turkey is the Ministry of Culture and Tourism. Different general directorates under the Ministry are responsible for tourism and cultural heritage sectorally (such as the General Directorate of Cultural Heritage and Museums and the General Directorate of Foundations).

The most important legal regulation on tourism and cultural heritage is the Law No. 2634 on Tourism Incentives. This law is a guiding legal framework that clarifies detailed definitions and practices related to the tourism and cultural heritage sector. The law includes Culture and Tourism Protection and Development Regions, Tourism Centers, classification and certification of facilities. In addition to this law, *the TGA Turkey Sustainable Tourism Program Certificate, established in accordance with Law No. 7183 on the Turkish Tourism Promotion and Development Agency,* addresses issues such as making facilities sustainable and environmentally sensitive, protecting and using natural tourism resources, which will directly increase adaptive capacity to climate hazards and risks. Sub-legislation based on Law No. 2634 also contributes to climate change issues in terms of implementation. For example, the Communiqué on the Issuance of Environmentally Responsible Accommodation Facility Certificates published by the Ministry of Culture and Tourism in the Official Gazette dated June 19, 2017 is about issuing certificates to eligible facilities upon their application. Apart from this, climate change and are also technical studies addressing tourism and cultural heritage. Climate Council
146. The Resolution states that "The impacts of climate change on tourism and cultural heritage values should be identified and adaptation and sustainability of tourism activities to climate change should be ensured".

Other legal frameworks related to tourism and cultural heritage are the National Parks Law No. 2873 and the Law No. 2863 on the Protection of Cultural and Natural Heritage. These laws contain important provisions on decisions regarding the establishment and use of land for tourism purposes. The Forestry Law No. 6831, the Soil Conservation and Land Use Law No. 5403, and the Pasture Law No. 4342 are also laws that need to be taken into consideration when making land use decisions. The EIA Regulation is also an important piece of legislation for tourism activities.

As stakeholder institutions, the MoEU is the institution that should work in partnership with the Ministry of Culture and Tourism. As sub-units, the General Directorate of Spatial Planning (MPGM), the General Directorate of Environmental Impact Assessment, Permitting and Inspection (EIAIDGM), and the General Directorate of Environmental Management (GDoE) are important stakeholders. In addition, the newly established Turkish Tourism Promotion and Development Agency, tourism-related NGOs (TÜRSAB, Turkish Hoteliers Association (TÜROB), Turkish Tourism Investors Association (TTYD), Anatolian Tourism Enterprises Association (ATİD), NGOs engaged in awareness-raising activities and projects related to the protection of cultural heritage, etc.are also influential stakeholders in the sector.

There are no international conventions directly related to the sector and climate change to which Turkey is a party. In addition, from the articles and actions of the Paris Climate Agreement and the European Green Deal, tourism and cultural heritage sector provisions on sustainability are enacted. The Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona) and the Convention for the Protection of the World Cultural and Natural Heritage (Paris) are conventions indirectly related to the tourism and cultural heritage sector. The World Heritage Committee, which decides on the cultural properties to be added to the UNESCO World Heritage List; ICOMOS, IUCN, International

The Research Center for the Conservation and Restoration of Cultural Property (ICCROM), in partnership with the World Heritage Center and the German Federal Agency for Nature Conservation (BfN), has developed the Climate Vulnerability Index (CVI) framework for World Heritage sites. This index holistically assesses the vulnerability of World Heritage sites to the Outstanding Universal Value and associated communities.

8.3. EFFECTS OF CHANGE

Tourism sector in Turkey development, differences between provinces shows. The first five provinces where tourism is developed are responsible for more than half of the total number of jobs, facilities and tourists. This situation is reflected in increases the sector's risk.

In the tourism sector in Turkey, climate risks are manifested as a decrease in tourist satisfaction and tourism revenues. For this reason, all value chain links for tourist satisfaction are exposed to climate hazards.

Determining the current and future vulnerability to climate hazards is important for the consistency of the actions to be taken. Risks arising from climate hazards are expected to affect human capital (investment-operators, local people), tourism assets (natural and cultural assets and awareness-raising and promotional activities), service quality (social capital, accessibility and facilities) and ultimately the number of tourists and tourism revenue (Table 5).

Table 5 Impacts of climate change on the tourism value chain

<table>
<tr><th colspan="2" rowspan="2">TEHLİKE</th><th colspan="2" rowspan="2">MARUZİYET</th><th colspan="4">ETKİLENEBİLİRLİK</th><th colspan="2" rowspan="2">RİSK</th></tr>
<tr><th colspan="2">Duyarlılık</th><th colspan="2">Uyum Kapasitesi</th></tr>
<tr><td colspan="10">1. Kültür – İnanç Turizmi, 2. Deniz – Kum – Güneş Turizmi, 3. Kış ve Dağ Turizmi, 4. Medikal – Sağlık – Termal Turizm, 5. Doğa, Macera ve Spor Turizmi, 6. Şehir Turizmi, 7. İş Amaçlı Seyahatler (MICE), 8. İlgi - Yaratıcı Turizm (gastronomi vb.), 9. Eko – Agro – Kırsal Turizm</td></tr>
<tr><td colspan="10">TURİST MEMNUNİYETİ YAKLAŞIMI</td></tr>
<tr><td colspan="10">BEŞERİ SERMAYE</td></tr>
<tr><td colspan="3">Yatırımcı / İşletmeci</td><td colspan="4">Turizm Çalışanı</td><td colspan="3">Yerel halk</td></tr>
<tr><td colspan="3">Kayıtlı Turizm İşletmeleri</td><td colspan="4">Turizmde İstihdam Oranları</td><td colspan="3">Yaş dağılımı</td></tr>
<tr><td colspan="3"></td><td colspan="4">İstihdam Edilenlerin Özellikleri</td><td colspan="3">Kadın – erkek</td></tr>
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<tr><td colspan="3"></td><td colspan="4">İş Başı Eğitim</td><td colspan="3">Okullaşma</td></tr>
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<tr><td colspan="3"></td><td colspan="4"></td><td colspan="3">Eğitim seviyesi</td></tr>
<tr><td colspan="3">TURİZM DEĞERLERİ (ÇEKİCİLİKLERİ)</td><td colspan="6">HİZMET KALİTESİ</td><td>ÜCRET</td></tr>
<tr><td>Yaratıcı Endüstriler</td><td>Turizm Varlıkları</td><td>Etkinlikler</td><td colspan="2">Sosyal Sermaye</td><td colspan="2">Erişilebilirlik</td><td colspan="2">Tesisleşme</td><td>Turist sayısı</td></tr>
<tr><td>El sanatları üreticileri</td><td>Doğal Değerler</td><td>Yerel rehberler</td><td>Tanıtım Pazarlama</td><td>Kalite Güvencesi</td><td>Hizmet (Altyapı)</td><td>Ulaşım (Taşımacılık)</td><td>Yeme – İçme</td><td>Konaklama</td><td>Turizm geliri</td></tr>
<tr><td>Hediyelik eşya üretimi</td><td>Kültürel Değerler</td><td>Organizatörler</td><td>Seyahat Acenteleri</td><td>Puanlama Sistemi</td><td>Su</td><td>Havayolları</td><td>Restoran</td><td>Belgelerine göre tesisler</td><td></td></tr>
<tr><td>Hediyelik eşya satışı</td><td></td><td>Animatörler</td><td>Basın - Medya</td><td>Sertifikasyon Kurumları</td><td>Enerji</td><td>Otobüs</td><td>Kafe – Bar</td><td>(İşletme</td><td></td></tr>
<tr><td>Yerel sanatçılar</td><td></td><td></td><td>Kamu Kurumları</td><td></td><td>İletişim</td><td>Kruz & Feribot</td><td>Pastane</td><td>Yatırım</td><td></td></tr>
<tr><td>Yerel pazarlar</td><td></td><td></td><td>Turizm STK'ları</td><td></td><td>Sağlık</td><td>Demiryolu</td><td>Yerel gıda üreticileri</td><td>Belediye)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Bankacılık</td><td>Taksi</td><td></td><td></td><td></td></tr>
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Human capital refers to the investors, operators, employees and local people in the tourism sector and is among the important factors for quality service delivery and the sustainability of the number of tourists and income as a result. The profile of the investor or operator can affect the institutionalization of businesses, the development of measures against climate risks, and the capacity to benefit from incentives and supports.

The number and quality of tourism employees contribute to the sector's adaptation to climate risks. In the tourism sector, women and young labor force with education above high school level provide advantages in terms of service quality, while vocational and on-the-job trainings are important in increasing the quality of human resources against climate risks (İŞKUR, 2021a).

In the activity segments related to the tourism sector (NACE Rev.2; Code: 51, 55, 56, 79, 90, 91, 93) SSI registered insured employment rate is 6.8% across the country (SSI, 2021). While 31% of total employment in tourism is in Istanbul, 10.5% is in Antalya, followed by Ankara, Izmir, Bursa and Muğla. Those employed in sectors related to tourism 61.1% are located in the first 6 provinces. Tourism is the sector providing the highest employment in Antalya and Muğla.

According to the Labor Market Survey (İŞKUR, 2021), 6.9% of total employment in Turkey is in "accommodation and food service" and "culture, arts, entertainment, recreation and sports" activities related to tourism. These sectors account for 7.8% of female employees and 6.6% of male employees. In the distribution within the sector itself , women's employment employment ratio 32.0% of men and 68.0% of women (İŞKUR, 2021).

In terms of workplace size, the majority of enterprises in the tourism sector (87.5% and 91.4%have2 and 9 employees. While the proportion of enterprises with 10 to 19 and over 20 employees varies between 4% and 7.5%. "Accommodation and food service activities", "required professional skills/qualifications has "insufficient number of employees", "insufficient number of employees with sufficient work experience" and "insufficient applications for this occupation" (İŞKUR, 2021).

Employment in the sector is concentrated in certain provinces. Tourism employment across the country is low compared to other sectors.

Local people are qualified human resources and potential tourism entrepreneurs for tourism sustainability. The presence of an educated population aged between 15 and 34 is an advantage for the protection of tourism values and tourism entrepreneurship. Educated female labor force employment should be high in provinces with intensive tourism activities.

Tourism Values (Attractors); natural and cultural assets, local flavors and creative local flavors that guide tourist motivations and preferences and enable tourism activities Products with event organizations. Designing all processes of tourism values and products in line with sustainable tourism principles and increasing awareness activities will bring adaptation to climate risks.

On Natural and Cultural Values, Turkey significant richness and competitive advantage in terms of tourism with its cultural heritage, coastline, forest cover, favorable weather and topographical conditions. In order to increase the resilience of natural and cultural heritage against climate risks, a balance between protection and utilization needs to be established. Detailed studies should be carried out on these resources as they may be exposed to climate hazards such as extreme weather events, forest fires, sea level rise, as well as chemical and biological effects with temperature increases. Tourism activities should be controlled to prevent overuse pressure in these areas. For sustainable and planned tourism development, different statuses should be granted by KTB. 234 "Tourism Centers and Culture and Tourism Protection and Development Regions" have been declared (KTB, 2022). These centers are mostly located in Antalya, Istanbul, Izmir and Muğla. Indicators for the number of immovable cultural assets in need of protection, the number of protected areas, and the ratio of protected areas to province area (KTB, 2022a) are important to know the areas that may be affected by climate risks for tourism. Across the country, there are planned development efforts to protect a high number of cultural and natural heritage assets and bring them to tourism. This serves to increase the resilience of the sector against climate hazards and risks.

Tourism products offered in destinations, such as tours and events, increase length of stay and tourist spending and localize tourism.

adoption. It is important that the guides and organizers providing these services are competent in terms of professional skills and climate risks.

Service Quality is addressed under the sub-headings of social capital components (in terms of promotion and quality assurance), access to services and physical infrastructure, and facilities, and provides important indicators on the capacity of provinces to adapt to climate risks.

Social Capital covers themes such as the cooperation and coordination of tourism value chain actors, their ability to establish control mechanisms and act jointly to provide quality service, joint promotion and marketing activities, and contributes to the sustainability of tourism by developing a very serious adaptive capacity against the effects of climate hazards. Tourism associations including the private sector, responsible public institutions, local press and media, professional organizations in the nature of public institutions, and for-profit or non-profit NGOs established for the protection of tourism and cultural heritage should take part in this alliance and eventually it should have an institutional identity such as a destination management organization. The number of certified agencies, which are among the parties that can take part in this association, is 12,818 in Turkey as of March 2022. Approximately 70% of the agencies across the country are located in the first five provinces (KTB, 2022b). Provinces that are prominent in the tourism sector have a high number of local newspapers (national average is 1.5 per 100,000 inhabitants; BİK, 2022). The number of cooperatives and associations related to tourism is highest in the first five provinces that are prominent in tourism. Nationwide, the rate of tourism development cooperatives is 3% (TB, 2022). The number of associations operating on themes such as tourism, environment, sports, culture, arts and cultural heritage is lower than expected in major tourism centers such as Muğla and Antalya. The proportion of culture and arts and tourism associations across the country is 5 (Republic of Turkey Ministry of Interior General Directorate of Relations with Civil Society, n.d.)

Accessibility is considered as access to infrastructure services such as energy, water, waste management and support services such as health, banking and shopping in the tourism value chain, while transportation alternatives to a destination are also expressed with this concept.

Access to infrastructure and support services refers to access to services such as water, energy, communication, health services, banking infrastructure, shopping and waste management. In terms of these indicators, there is no significant negativity across the country. In the tourism sector, overuse of water during the season and wastewater discharge is an important sustainability issue. Infrastructure works should be carried out to treat and recover the water consumed especially in pools and domestic use, and rainwater should be used. Waste management should be environmentally benign. In this context, recycling projects should be supported and the negative effects of waste on the ecosystem should be minimized. Furthermore, in order to promote sustainable waste management practices, education campaigns should be organized to raise public awareness and citizens should be informed. Local governments should be supported to provide adequate and uninterrupted municipal services in destinations that are highly preferred during the tourism season. Electrical energy is used to produce products and services in the tourism value chain. Uninterrupted energy must be provided to fulfill a wide range of support services such as heating, cooling, kitchen, housekeeping, food and beverage and lift infrastructure in ski resorts. The ever-increasing need for energy across the country and the difficulties in diversifying energy sources cause energy problems in the tourism sector. The use of fossil fuel-generated electricity increases the carbon footprint of the tourism sector and damages tourism values.

gives. In this context, the concept of green tourism, which supports the use of renewable energy sources and energy efficiency and It is important to disseminate these practices. Due to the impact of climate hazards, there will be problems in uninterrupted energy supply in tourism due to excessive energy and infrastructure damage. These problems reduce the quality of service in the sector and cause great damage to the image of destinations. Apart from the three big cities, Bursa and Kocaeli, which stand out with their industrial production, followed by Antalya, where the tourism sector is intense. The rate of electricity usage for the public and private services sector and other subscriber groups is Antalya
Muğla and Aydın, which are provinces with high tourism, have a 54.4% in-province usage rate, while this rate is 7% across the country and is the third highest. This type of usage is also high in Muğla and Aydın, provinces with high tourism (EMRA, 2022). Although infrastructure indicators for communication services are improving in the provinces, the damage caused by climate hazards should be taken into account in infrastructure investments.

Tourist access to health services is important for both health tourism and tourist health. While providing health services to overseas patients increases revenues, treating tourists in emergencies is also important in terms of destination image (MoHKHGM, 2022). Across the country, health indicators are close to the OECD average. Emergency response teams should be deployed in tourism regions as extreme climate events will increase problems such as injuries, drowning and heat stroke. In addition, teams specialized in new health problems that may arise due to climate change should be trained.

Banking services are one of the important services that tourists need access to in a destination. A robust digital and physical banking infrastructure in the face of climate risks tourism sector will contribute to resilience. Banks also contribute to the sector by providing value chain actors with appropriate financing opportunities to raise environmental awareness and take measures to adapt to climate risks in the tourism sector.

In terms of tourism, transportation services refer to access to destinations and tourism attractions. Spatial accessibility in the tourism sector contributes to the utilization of tourism values and competitiveness. Natural and cultural tourism values should not be harmed while creating transportation infrastructure. In order to reach destinations and attractions, attention be paid to diversification of modes, low carbon emissions, the use of environmentally friendly practices and the creation of infrastructure suitable for carrying capacity. The intensive use of fossil fuel-dependent public and individual vehicles in tourism increases the carbon footprint of the sector. For this reason, the use of rail and sea routes for tourism trips should be increased. Infrastructures for land, air, rail and sea routes should be resilient against climate hazards, and infrastructures created by sea filling should be reviewed.

According to the number of SSI-registered establishments (NACE Rev.2; Code: 51, 55, 56, 79, 90, 91, 93), Istanbul has the highest share of **tourism establishments and enterprises in** Turkey (27%). This is followed by Izmir, Ankara, Antalya and Muğla. In Muğla and Antalya, the sector with the highest number of facilities and enterprises is tourism. Only "accommodation" and "travel agency tour operator reservation services and related activities" (NACE Rev.2 Codes 55 and 79) have the highest number of establishments in Istanbul, followed by Antalya and Muğla (24.6%, 11.9% and 8.4% respectively). The distribution of tourism enterprises in SSI records by provinces is not balanced across the country. The proportion of establishments in the first 5 provinces is more than half of the country as a whole (in Group 1

50.4% in the first group and 54.9% in the second group). The agglomeration of enterprises in the tourism sector in certain provinces and their low proportion within provinces are negative features in terms of the resilience of the sector to climate change risks.

Between 2001 and 2022, investment incentives for tourism-related activity groups (STB, 2022) were highest in Muğla and Antalya (31.4% and 26.8%). Across provinces, the tourism sector received fewer incentives than other sectors. The reason for this is that there are few enterprises in the sector, except in provinces with capacity in tourism, and they lack the institutional capacity to benefit from government incentives and support. In Turkey, tourism enterprises with high institutional capacity, capital accumulation and therefore high resistance to risks are concentrated in the first five provinces. These provinces received 52.1% of total tourism investment incentive certificates.

In the first 5 provinces, 49.1% of municipality and ministry certified accommodation facilities and 66.5% of the number of rooms are located (KTB, 2020c). In provinces with a high number of accommodation facilities, the number of environmentally sensitive facilities also increases. The expansion of environmentally sensitive facility practices by KTB will reduce the tourism sector's vulnerability to climate risks and increase its adaptive capacity (KTB, 2022c). The number of certified facilities other than accommodation is important for achieving quality standards in tourism and resilience against climate hazards (KTB, 2022d). The number of Blue Flag Award-winning marine facilities, beaches and marinas and such ratings to the preparedness of destinations for adaptation to climate risks. The number of blue flags provinces and facilities is higher in AntalyaMuğlaİzmir and Aydın (Blue Flag, 2022).

Tourism facilities are expected to be affected by climate hazards at different levels depending on the region, type of tourism, tourist profile and type of operation.

Accommodation facilities, in particular, are expected to struggle to keep up with competition due to high inputs such as increased energy demand and costs, food prices and labor costs. Facility operators will be the tourism actors most likely to be affected by fluctuations in the number of tourists and length of stay due to changing seasons and durations due to changes in snow depths and favorable periods in winter tourism and thermal comfort conditions in summer tourism. Facility operators may have to make new investments due to negative impacts on resource values such as rising sea levels, access to suitable snow cover at higher altitudes, and possible losses in water resources and forest areas that enable tourism. In addition, within the scope of adaptation to climate change, it is important to make accommodation facilities resistant to disasters caused by extreme climate events and to strengthen the existing ones, to make careful site selection and building orientation, and to create architectural designs taking into account environmental conditions. In the construction of facilities, the use of local materials that are suitable for the climate and can be obtained with a short supply chain should be supported and low-carbon production systems should be used.

In terms of the number of tourists and tourism revenues, Turkey will be the fourth country hosting the highest number of tourists and the seventh country generating the highest revenues in 2022 (UNWTO, 2021). The economic sustainability of the tourism sector is jeopardized by the low expenditures per tourist compared to the length of stay (KTB, 2022e). It is necessary to develop policies that aim to increase tourism revenues by taking climate risks into account. Environment and climate sensitive, high income generating tourism types should be adopted. Market countries where tourists come from have become very important due to the impact of climate hazards. Due to temperature increase and heat waves in some regions

Summer tourism activities have started to be carried out in the source country where tourists come from. Destinations that receive a large number of tourists from such countries need to address this issue. In addition, other types of tourism will also experience loss of tourists and income due to the damage or decrease in tourism values. The first 5 provinces have a share of 59.61% in terms of the number of tourists. In terms of the number of overnight stays, the share of the first 5 provinces is over 70%.

Tourism and Cultural Heritage Sector Risk Analysis: Heat Wave

In the impact chain prepared for the tourism sector, economic and social indicators belonging to the value chain links that ensure tourist satisfaction are identified. Losses in areas such as the number of tourists, tourism income and employment are as risks, and the impact chain prepared for the heat wave hazard is given in Figure 34.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Ortalama sıcaklık artışı	Sıcak hava dalgası	Nüfus yoğunluğu	Turizmin toplam istihdamdaki oranı	Kişi başına mevduat	Turist memnuniyetinin azalması
Aşırı sıcak gün sayısında artış	Ardışık sıcak gün sayısında artış	Toplam turist sayısı oranı	Doğal ve kentsel sit alanları sayısı	Toplam sigortalı/işbaşı eğitim alanların oranı	Dış mekan turizm etkinliklerinin yapılamaması
		Konaklama tesisi sayısı*	Belediye belgeli yatak sayısı oranı	Zorunlu sigortalı kadın oranı	Turizm varlıklarının zarar görmesi (kültürel, doğal)
		Kültürel varlıkların sayısı*	Geceleme sayıları oranı	Lise ve üzeri eğitim almış nüfus oranı	Hizmet kalitesi ve güvencesinde azalma
		Yeme – içme tesisi sayısı*	15-64 yaş arası nüfus oranı*	Faal dernek sayısı	Hizmetlere erişimde zorluk
		Kara, hava, deniz ve demiryolu yolcu sayısı*	Turizm değer zincirindeki sigortalı sayısı*	Kooperatif üye sayısı	Erişilebilirlikte azalma
			Tesislerin doluluk oranı*	Yerel gazete sayısı	Destinasyon imajının bozulması
			İptal, divert, rötar uçak seferi sayıları*	Ulaşım modu sayısı*	Ziyaretçi sayısında azalma
			Kişi başı turizm gelirleri*	Kültür ve turizm koruma ve gelişim bölgeleri sayısı	Turizm gelirinde azalma
				Belgeli tesis sayısı*	Sektörden ayrılmalar
				Yerel ürün pazarı sayısı*	İstihdamın azalması
				İstihdamın sektörel dağılımı*	Sosyal ve ekonomik sorunlar
				Turizm ile ilgili yatırım teşvik belgeleri*	

Figure 34 Impact Chain: Tourism and Cultural Heritage Sector and Heatwave

*The * symbol indicates indicators that are not used in risk analyses.*

Exposure of the tourism sector was found to be high in provinces with high numbers of tourists and tourism facilities. Accordingly, exposure is very high in the provinces of the Aegean and Mediterranean coastline and the Northern and Eastern Marmara Region. Exposure was high in the Central Aegean, South MarmaraEastern MediterraneanDiyarbakır, Mardin and Batman in Southeastern Anatolia, and the Western and Central Black Sea regions.

The responsiveness component is analyzed based on value chain components such as human capital and service infrastructure that will ensure service quality in tourism. There are differences across provinces due to factors such as the number of facilities, number of visitors and length of stay, and the distribution of tourism values. Accordingly, Istanbul, Çanakkale and Balıkesir in the Marmara Region; İzmir, Aydın and Muğla in the Aegean Region; Antalya and Mersin in the Mediterranean Region; Eskişehir, Afyonkarahisar, Ankara, Konya, Aksaray and Nevşehir in Central Anatolia; Şanlıurfa in the Southeast Region; and Rize in the Black Sea Region have the highest level of sensitivity.

The adaptive capacity of provinces is analyzed using indicators that take into account the presence of social and thematic sectors that can support the tourism sector, the development of civil society and the performance of the private sector. Accordingly, adaptive capacity was found to highest in Istanbul, Kırklareli, Edirne, Balıkesir and Bursa in Marmara; Izmir, Muğla, Denizli in the Aegean; Antalya in the Mediterranean; Eskişehir and Ankara in Central Anatolia; and Düzce, Samsun, Ordu, Giresun and Trabzon in the Black Sea region. As we move towards the East and Southeast, adaptive capacity reaches the lowest levels.

The vulnerability component was formed by evaluating the sensitivity and adaptive capacity components together. Accordingly, while on the one hand, the presence of natural and cultural heritage assets and the presence of visitors and employment in the sector are considered, on the other on the other this situation The existence of the social, human and monetary capital necessary to overcome the sensitivity it will create is taken into account. In this case, the tourism sector undeveloped The vulnerability is expected to be higher in provinces located in the southwest and east of Central Anatolia. The provinces with the highest vulnerability in the tourism sector are located in the southwest and east of Central Anatolia. This group also includes Mersin, Kahramanmaraş and Hatay in the Eastern Mediterranean, and Şanlıurfa and Diyarbakır in Southeastern Anatolia. Vulnerability is high in Çanakkale and Aydın in the west; Kütahya in the Inner Aegean; Burdur in the Mediterranean; Bartın, Kastamonu and Rize in the Black Sea; Adana and Gaziantep in the south; Tokat in Central Anatolia; and the west and northeast of Eastern Anatolia and Van. All regions and provinces that are prominent in tourism have low vulnerability levels. The reason for this is that although the sectoral parameters related to tourism and thus the sensitivity are high, the adaptive capacity along with sensitivity is also high in these regions.

Figure 35 shows the heat wave risk of the tourism sector. Accordingly, Aydın and Muğla in the South Aegean; Antalya, Mersin, Adana, Hatay and Kahramanmaraş in the Mediterranean; Konya, Niğde, Nevşehir and Kayseri in Central Anatolia; and Gaziantep, Şanlıurfa and Diyarbakır in the Southeast.

The very high level of risk in these provinces is due to the high level of heatwave hazard and sectoral activity. These two high indicators increase the risk to the sustainability of natural and cultural assets. Therefore, the provinces located further north have higher levels of tourism activity, the risk is generally lower.

Starting from Tekirdağ in Thrace, Çanakkale in Southern Marmara; İzmir, Manisa, Uşak and Afyonkarahisar in Aegean; Ankara, Sivas in Central Anatolia; Black Sea

Bartın and Karabük; Malatya, Elazığ, Adıyaman, Van in Eastern Anatolia; Mardin and Batman in Southeastern Anatolia are at high levels of risk. Accordingly, the risk is relatively high in provinces with high values such as the density of tourism assets serving tourism, the number of enterprises operating in the tourism sector and the number of people employed, and the number of tourists and facilities. Therefore, adaptive capacity in these provinces needs to be improved.

The factors that increase the risk for provinces are the intensity of tourism activities and values. This Despite the intensity, the risks are increased by the low institutional capacity, human, social and monetary capital that can mitigate the effects of climate hazards. With these results, it should not be thought that cities that are not in the high-risk group, such as Istanbul and Izmir, which are ranked globally in terms of tourism, will not be harmed by climate hazards.

Figure 35 Current Period Risk Map: Tourism and Cultural Heritage Sector and Heatwave

8.4. ADAPTATION MEASURES

Tourism and cultural heritage sector in Turkey against climate risks resilience and adaptive capacity will be enhanced and sustainability will be ensured.

The World Tourism Organization states that the emphasis on climate change should be strengthened in national tourism development strategies. Countries with high and expected tourism sectoral shares in national GDP have higher vulnerability to climate hazards (Scott et al., 2019). In Turkey, the share of the tourism sector in GDP is on the rise. Moreover, increasing the contribution of the tourism sector is among the priorities in medium and long-term national and regional development plans. Climate risks are expected to reduce the contribution of tourism to the national economy and make it more difficult to achieve sectoral strategic goals. Early adaptation of Turkey's tourism sector to climate change will make it more competitive on a global scale. This adaptation will be possible through adaptation actions to be developed and implemented with the participation of all actors in the tourism value chain.

The scope of actions to be taken to achieve the strategic objective of increasing the resilience and adaptive capacity of the tourism and cultural heritage sector in Turkey against climate risks and ensuring its sustainability has been determined by taking into account the current status and vulnerability levels of the value chain components. In this context, the 4 components considered at the top level are Human Capital (Tourism Investors and Operators, Tourism Employees, Local People), Cultural Heritage and Natural Tourism Values (Creative Industries, Tourism Assets, Events), Service Quality (Social Capital, AccessibilityFacilitationand Tourism Revenues. and Number of Tourists. The actions presented are envisaged to support these 4 components in terms of content. Accordingly, the 3 strategic objectives, the necessity of these objectives and the actions are presented below.

Increasing the capacity of tourism investments and enterprises to adapt to climate change in terms of infrastructure.

Tourism investments, facilities and enterprises are unprepared for the risks arising from climate hazards in terms of their current tourism activities and physical structures. Destination and region-based measures should be determined to improve and adapt their physical structures to climate change and the risks that may arise. Their institutional structures need to adapt through capacity building by conducting training and awareness-raising activities on climate change and the risks that will arise. In addition, another requirement is that both the physical structures and the tourism activities of existing and new enterprises should be adapted to climate risks and built in harmony at the outset. In this regard, existing legislation and practices In addition to sustainability and environmental sensitivity certification practices, actions covering transformation and adaptive installation for adaptation to climate risks should be proposed. As a result, it is an important requirement to develop both physical and institutional capacity to adapt to climate risks in investments, facilities and enterprises.

TUR1. tourism facilities resilient to climate risks, transforming existing ones and Harmony Developing criteria for increasing capacities **TUR2.** Tourism facilities criteria developed appropriate as transformation, supervision and support Establishing legal and administrative infrastructure for **TUR3.** Tourism in businesses and nationally sustainable tourism in destinations applications Providing trainings and technical support for dissemination

Strategic Objective 2. Improving social infrastructure in the tourism and cultural heritage sector to build capacity to adapt to climate change.

Increasing the capacity of qualified human resources in the tourism and cultural heritage sector and the existence of a culture of joint action specific to destinations will both increase the quality of service in the sector and make significant contributions to the sector in terms of sustainability. The training and employment of human resources with vocational and technical knowledge and sufficient knowledge and awareness of climate hazards and risks is extremely important in terms of adaptation capacity. In this regard, in addition to the activities of official educational institutions, organizing campaigns for education and awareness-raising purposes and providing cooperation opportunities will be very positive steps. Training, awareness-raising and awareness-raising campaigns should be organized for the human resources in the tourism value chain regarding the impacts of climate risks on the tourism sector and adaptation measures, and efforts should be made for actors to act jointly and to create destination organizations. It is important to determine the subjects, qualifications and legal framework for vocational training in tourism, including issues related to climate change, and to provide training in pre- and post-graduate schools and centers providing tourism education on the effects of climate change, hazards and risks on tourism, and on the recognition and use of environmental technologies. In order to make cultural assets resilient to climate risks, all kinds of interventions, especially restoration and conservation works, should be carried out.

In order to be carried out in a timely and accurate manner, it is necessary to eliminate the lack of expert personnel in responsible institutions and to carry out studies to increase the awareness of existing experts, to create a common pool of experts on climate change for institutions working in the field of cultural heritage, and to carry out studies to improve human resources such as defining the duties, powers and responsibilities of the relevant personnel.

In order to protect the universal value of cultural heritage and fulfill the conditions for physical protection, there are important requirements such as the implementation of legislative provisions, cooperation national and international organizations to benefit from international conservation practices and criteria, and the transfer of human and financial resources to build capacity in relevant institutions. In order to make cultural heritage resilient to climate risks, institutions involved in decision-making processes should jointly use digital data platforms such as MUES (Museum National Inventory System) and TUES (Immovable National Inventory System), a climate vulnerability index should be created to determine the level of vulnerability of cultural heritage items to climate hazards, and heritage impact assessment and risk analysis should be carried out in coordination with groups active in the field, The financial and technical capacity of institutions and organizations responsible for cultural heritage and related institutions and organizations on climate change adaptation needs to be increased in order to identify priority intervention areas and needs, and to carry out timely and accurate interventions.

Carrying out visitor planning by considering the balance between conservation and utilization and carrying capacities, providing virtual sightseeing opportunities through digital applications, working with local administrations and non-governmental organizations

will be made coordinated to contribute to minimizing climate risks in heritage sites by supporting studies, to work on the inclusion of climate change in their priority areas and strategic plans by relevant and responsible institutions, UNESCO, ICOM, ICOMOS, UNDP
It is extremely important to develop projects that will enable international organizations, central and local governments and CSOs to effectively benefit from national and international funds.

Including promotional activities that can limit the use of natural resources by taking into account climate hazards, that do not build the destination image and tourist motivation on consumption, and that contribute to the spread of responsible tourism understanding will increase the adaptive capacity of the tourism sector. development will contribute. Sustainable tourism understanding of tourism promotion and marketing activities in tourists will create It is also important to ensure that the tourism preferences and motivations of target markets that will change due to climate change are researched and updated in order to increase adaptation capacity.

In educational institutions, responsible organizations and related to the sector NGOs on the impacts of climate change on tourism sector and cultural heritage and adaptation measures
training and awareness activities
Increasing an d Technical capacity
regulation.

TUR5 Tourism destinations local ownership, partner Movement how to and by ensuring cooperation among parties, climate will increase capacity to adapt to change
Destination Manage ment offices its creation.

TUR6. Assessment of climate risks to movable and immovable cultural heritage items and sites identification and prioritized intervention areas and

Preparation of guidelines to provide guidance on identifying the needs of cultural heritage. **TUR7.** Assessment of the vulnerability of cultural heritage to climate hazards Detection to be and mitigation, protection of cultural assets and ensuring local, national and international cooperation for of your work and coordination.

TUR8. Preparing promotional materials in accordance with target markets, changing tourist preferences and motivations, sustainable and responsible tourism approach and using them in country and destination-based promotions

Strategic Objective 3. Taking climate change adaptation into account in strategic and spatial decisions related to tourism and cultural heritage and ensuring coordination among authorized institutions.

Coordination among institutions in the preparation of spatial and strategic plans for tourism and cultural heritage and the implementation of their decisions will provide significant advantages in establishing a balance between conservation and utilization. Inter-institutional cooperation is also required for the new plans to be prepared to include climate risk adaptation measures and the implementation of legislation. In this sense, it is very important to update the national tourism strategy by taking into account climate change adaptation actions, to establish a coordination structure between central and local administrations in order to prevent confusion of authority over areas with protection status in existing and planned tourism destinations, to prepare spatial plans that take into account climate hazards in order to prevent land demands and rent formation that arise due to the development of the tourism sector in existing and planned tourism areas, and to supervise their implementation locally.

Start planning studies for sustainable tourism activities in new areas that will be formed as a result of the shift of tourism areas and seasons due to climate change, tour and Coordination in the planning of event organizations in a way that does not cause overuse pressure in certain regions and providing support to agencies during the implementation phase, planning and strategy development studies for the development of niche tourism types in special themes and areas (international thematic routes such as EuroVelo and Council of Europe Cultural Routes, creative tourism activities based on intangible cultural heritage, development of activities such as mountain tourism, etc.) are among the important needs.

Moving away from the current tourism understanding and practices based on the overuse of natural resources, ensuring the transformation of tourism according to sustainability principles, and making responsible and sustainable tourism understanding dominant in the value chain are necessary issues to make both the sector and the resources used by the sector resilient against climate risks. For this reason, from businesses starting with Environment technologies, eco-innovation and other The dissemination of environmentally friendly practices and the development of alternative and high income-generating tourism types in line with tourist motivation and preferences are important for mitigating climate risks.

Developing medium and long term action plans to promote sustainable tourism practices instead of the current tourism practices that put pressure on natural resources, making legal and administrative arrangements and regulating the incentive system, including climate risk analyses that take into account climate change and hazards in investment decisions for tourism purposes, ensuring that tourism value chain components and destinations are identified in Turkey Sustainable Tourism Program in terms of sustainability criteria within the scope of the Sustainability Framework should evaluated and monitored. Establishing early warning systems in tourism regions, strengthening search and rescue teams, encouraging the use of environmentally friendly means of transportation for access to destinations and tours, meeting the needs of areas with technical infrastructure needs due to climate change and increasing population during the tourism season in order to reduce climate risks that may be experienced in current tourism activities, making forecasts and measures against extreme weather events, providing the necessary infrastructure and human resources, being ready for situations that may cause physical damage, loss of life and injuries destinations financing and additional funds are seen as important issues to ensure that municipal services are delivered in line with the principles of sustainability.

TUR9. Updating the strategic objectives for preserving and transferring cultural heritage to the future within the scope of national tourism strategy update studies, taking into account climate change adaptation actions.

TUR10. Considering adaptation to climate change in spatial plans to be prepared for potential tourism areas that may arise due to climate change, ensuring sustainable land use

TUR11 Climate Preparation of sustainable tourism strategies for the identification and development of focal points for niche tourism types in specific themes and areas in order to reduce vulnerability to change.

SOURCE: Tourism and Cultural Heritage

AKTOB (2014). 100 Years of Tourism in Turkey Towards 2023, Structure, Size and Contribution of Tourism Sector to the Economy: Socio-Economic Impacts of Tourism and Accommodation Sector. Antalya; Retma Matbaa.

Bertolin, C. (2019). Preservation of Cultural Heritage and Resources Threatened by Climate Change. Geosciences, 9(6); 250 - 261. DOI: https://doi.org/10.3390/geosciences9060250

BİK (2022). Local Newspapers. Retrieved from https://bik.gov.tr/gazeteler/.

EMRA (2022). Electricity Sector Report. Retrieved from https://www.epdk.gov.tr/Detay/Icerik/3-0- 24/elektrikyillik-sektor-raporu.

EUROCONTROL (2021). Climate Change Risks for European Aviation Study 2021, Impact of Climate Change on Tourism Demand Technical Report. https://www.eurocontrol.int/publication/eurocontrol-study-climate-change-risks- Retrieved from european-aviation.

İŞKUR (2021). Market Analysis Report. Retrieved from

İŞKUR (2021a). Statistics. Retrieved from

IUCN (2017). International Union for Conservation of Nature, Annual Report 2017. Retrieved from https://portals.iucn.org/library/sites/library/files/documents/2018-007-En.pdf.

KTB (2020c). 2020 Tourism Statistics. Retrieved from

KTB (2021). Tourism Statistics. Retrieved from

KTB (2022). Culture and Tourism Protection and Development Regions. https://yigm.ktb.gov.tr/TR- Retrieved from 9669/ktkgb-ve-turizm-merkezleri.html.

KTB (2022a). Provinces According to Protection Required Immovable Culture Presence Statistics. Retrieved from varligi-istatistigi.html.

KTB (2022b). Ministry of Culture and Tourism General Directorate of Investment and ManagementAgency Inquiry. Retrieved from

KTB (2022c). Environmentally Friendly Tourism Management Certified Accommodation Facility Statistics. Retrieved from https://yigm.ktb.gov.tr/TR-277167/cevreye-duyarli-turizm-isletme-belgeli--konaklama- facility-istatistikleri.html.

KTB (2022d). Non-Accommodation Facilities. https://yigm.ktb.gov.tr/TR-232959/arastirma-ve- Retrieved from reports.html.

KTB (2022e). Number of Visitors. Retrieved from https://yigm.ktb.gov.tr/TR-249709/yillik-bultenler.html.

Blue Flag (2022). Blue Flag Numbers. Retrieved from http://www.mavibayrak.org.tr/tr/Default.aspx.

OECD (2020). Tourism Trends and Policies 2020, Turkey. Retrieved from https://www.oecd- ilibrary.org/sites/f3b16239-en/index.html?itemId=/content/component/f3b16239-en.

SBB (2019). Presidency of the Republic of Turkey Presidency of Strategy and Budget 11th Development Plan (2019 - 2023). Retrieved from https://www.sbb.gov.tr/wp-content/uploads/2022/07/On_Birth_Kalkinma_Plani-2019-2023.pdf

MOHKHGM (2022). Health Indicators. Retrieved from https://khgmozellikli.saglik.gov.tr/svg/inc/saglik_gostergeleri.pdf.

Scott, D., Hall, C. M., & Gössling, S. (2019). Global tourism vulnerability to climate change. Annals of Tourism Research, 77: 49-61. DOI: https://doi.org/10.1016/j.annals.2019.05.007

SSI (2021). Monthly Statistics Information. Retrieved from http://www.sgk.gov.tr/wps/portal/sgk/tr/kurumsal/istatistik/aylik_istatistik_bilgileri.

STB (2022). Industry and Technology Ministry of Investment Incentive Statistics. Retrieved from gtNmU3ZjdjYjM5YWFjIiwidCI6IjM3Y2E0YWM5LWJkNjUtNDBmYy1iMDU0LWQyZmZmNDRmMTJjOCIsImMiOjl9.

TB (2022). Cooperative Information System. Retrieved from https://koopbis.ticaret.gov.tr/.

TTS (2023). Turkey Tourism Strategy Action Plan 2007-2013. Retrieved from https://www.ktb.gov.tr/Eklenti/906,ttstratejisi2023pdf.pdf?0

TURKSTAT (2021). Tourism Statistics, Second Quarter: April - June, 2021. Retrieved from https://data.tuik.gov.tr/Bulten/Index?p=Tourism-Statistics-Quarter-II:-April-June,- 2021-37441

TÜRSAB (2020). Distribution of Average Expenditure by Years Share of Tourism Revenues in GDP. Retrieved from https://www.tursab.org.tr/istatistikler-icerik/turizm-geliri.

I.B. (n.d.). Associations Activity Fields According to Distribution. Retrieved from https://www.siviltoplum.gov.tr/derneklerin-faaliyet-alanlarina-gore-dagilimi.

UNWTO (2021). UNWTO World Tourism Barometer and Statistical Annex. https://www.e- Retrieved from unwto.org/doi/abs/10.18111/wtobarometereng.2021.19.1.1.

climate

9.1. GENERAL FRAMEWORK

Turkey's main targets the production of mainly export-oriented intermediate and industries producing final goods development. This
Industry sector in Turkey gross gross

technical infrastructure for adaptation and the process of change that the sector will undergo are of critical importance.

The industrial sector is one of the most important components of the Turkish economy, with the largest share belonging to the manufacturing industry.

Looking at the sectoral activities that make up GDP based on data for 2022, the manufacturing industry sector is the second largest branch of activity after the service sector (TurkStat2020).

When we look at the change in the share of GDP over the years, although there were fluctuations between 1998 and 2019, there were no significant changes in its share, which was 17.6% on average (Figure 36).

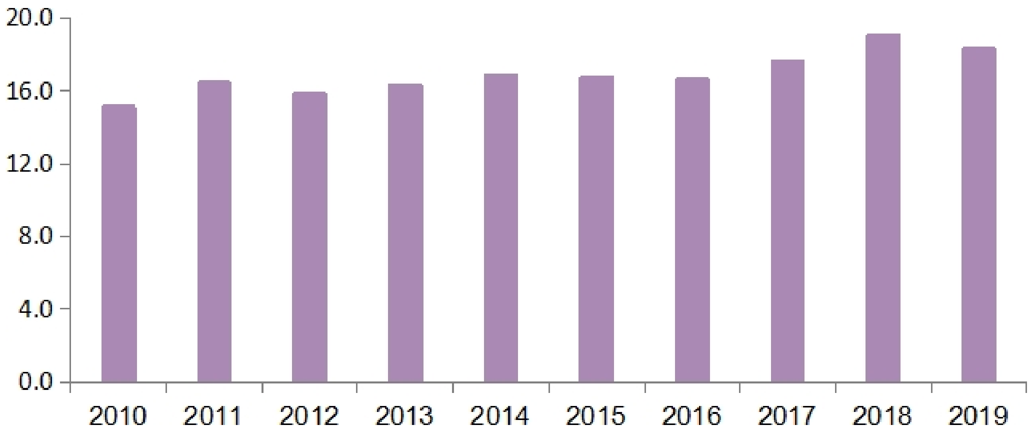

Figure 36 Share of Manufacturing Industry Value Added in GDP (%)

According to TurkStat data, when the number of employees by economic activity is analyzed between 2009 and 2021, the number of employees in the manufacturing industry increased by about 60%, but its share in the total (29% on average) did not change significantly (TurkStat, 2022).

The capacity utilization rate, which is one of the main indicators that enables monitoring the change in production activities, was approximately 78% between 1998 and 2021 according to the Central Bank of the Republic of Turkey (CBRT) EVDS statistics, and the lowest capacity utilization rate was realized as 66.9% in 2009 as a result of the global financial crisis and 61.6% in April 2020 as a result of the Covid-19 pandemic.When the production values by economic activities for the same years In 2009

It is seen that the share of the manufacturing industry, which had a share of 43%, rose to 47% in 2020.

According to the Organized Industrial Zones Supreme Organization (OSBÜK), there are 332 OIZs approved by the Ministry of Industry and Technology and 31 Agriculture Based Specialized Organized Industrial Zones (DBOSB) approved by the Ministry of Agriculture and Forestry. Looking at the value added of Turkey's manufacturing, the manufacturing of food products ranked first in 2020.

high-tech companies in the manufacturing industry will exceed the total in 2020.
0.5%, while their share of turnover is 3.4%, about 6 times higher. Again, the share of medium-high technology companies in turnover is 27%, about 2.5 times the number of organizations. is observed. While the proportion of medium-low technologists remains unchanged, the total

low-tech companies, which constitute more than half of industrial companies, account for only 38% of turnover (TurkStat2021) (Figure 37).

Within the framework of the Twelfth Development Plan, Turkey export-oriented, predominantly export-oriented economy

It is aimed to develop industries producing intermediate and final goods. In terms of the cost of low-carbon development and adaptation to climate change, the technology profile in the industrial sector will be one of the leading determining factors .

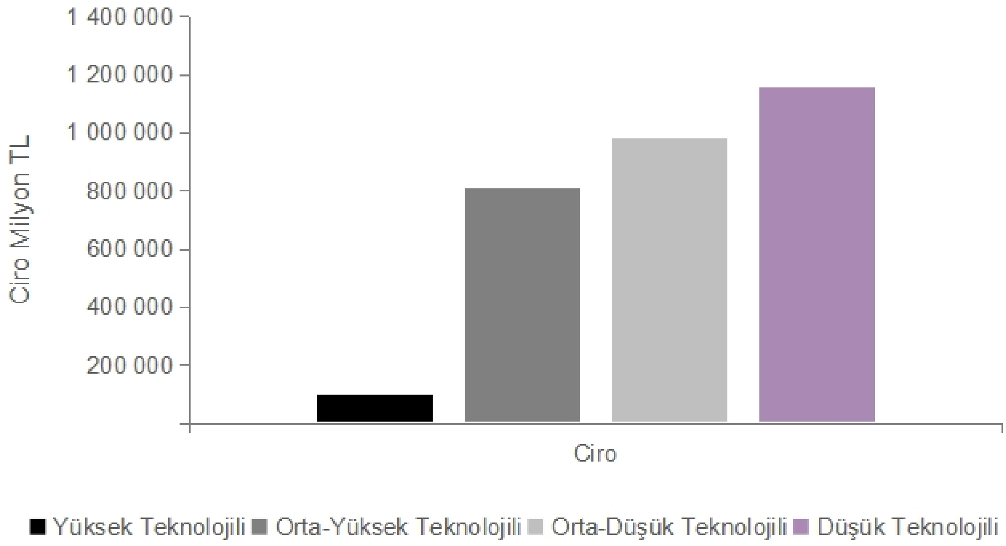

Figure 37 Turnover Breakdown by Technology Level

9.2. SECTORAL LEGAL FRAMEWORK AND RESPONSIBLE INSTITUTIONS

Medium (2030) and long (2053) term greenhouse gas emission mitigation and climate change adaptation the implementation of its objectives, fundamental changes over time will be required. This process will be a driving force for efficiency, savings, innovation and nature-based solutions in the industrial sector.

Following the entry into force of the Paris Agreement, Turkey submitted its Intended Nationally Determined Contribution in 2015 and became a party to the Paris Agreement in 2021. It submitted its updated First National Contribution to the UNFCCC in 2023. Activities in the buildings, energy, industry, transportation, waste, agriculture and forestry sectors are carried out within the scope of the National Contribution Declaration.

With the implementation of the Eleventh Development Plan (2019-2023), which identified the United Nations (UN) 2030 Sustainable Development Goals as a priority area, the issue of linking economic growth and climate agendas gained momentum, and this approach continues with the Twelfth Development Plan. The macroeconomic advantages of integrating renewable energy and energy efficiency, infrastructure investments and financial resources to low-carbon solutions have also started to be recognized.

In the Medium Term Program for 2024-2026, it is stated that, taking into account the multifaceted environmental, social and economic impacts of climate change and within the framework of development priorities, emphasis will be placed on green transformation in all areas and sectors of the economy. Unless steps are taken towards a solution, there is a significant risk that the problems caused by climate change, which are closely related to the future of the global economy, will turn into bigger problems in the future.

Turkey's Climate Change Adaptation Strategy and Action Plan 2011-2023 focuses on five areas: water resources management; agriculture and food security; ecosystem services, biodiversity and forestry; natural disaster risk management; and human health. Although the industrial sector is not included in these five priority areas in terms of vulnerability, it is envisaged as a stakeholder of many efficiency-oriented activities in the actions determined on the basis of highly vulnerable sectors and themes.

Turkey's 2023 Industry and Technology Strategy Paper was prepared with the vision of "National Technology, Strong Industry". The Strategy Paper is divided into five main components and 23 sub-policies: (1) High Technology and Innovation, (2) Digital Transformation and Industrial Movement(3Entrepreneurship(4Human Capital and (5) Infrastructure. The Strategy Document aims to increase the number of software engineers in Turkey from 140,000 to 500,000 by 2023. By 2023, Turkey is expected to offer at least 23 smart products or services based on breakthrough technologies on a global scale. Finally, the Strategy Paper estimates that the number of startups that start at the venture stage and reach a valuation of USD 1 billion or more will reach at least 10 by .

Within the scope of the Climate Change Adaptation Strategy and Action Plan, assessments were made on climate risks for the industrial sector.

Borsa İstanbul's BIST Sustainability Index, Carbon Disclosure Project (CDP and voluntary sustainability and integrated reports of organizations include greenhouse gas mitigation measures, climate risks and planning activities. In addition, in recent years, some reports have addressed climate change risks within the scope of the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD).

Turkey recognizes that slowing the rate of demand growth through increased energy efficiency is a critical foundation for enhancing energy security. To this end, the 2017- 2023 National Energy Efficiency Action Plan aims to reduce Turkey's primary energy consumption by 14 percent from business-as-usual levels in various sectors, including industry and certain cross-cutting areas.

Announced in December 2020 by the European Union, the Green Deal sets additional targets to those set out in the Paris Agreement to make Europe carbon neutral by 2050 and reduce greenhouse gas emissions by 55% by 2030 compared to 1990 levels. The agreement is financed by the European Green Deal Investment Plan, designed to mobilize at least €1 trillion worth of public and private investment over the next decade.

The European Union has proposed a number of strategies to achieve its objectives under the Green Deal, one of which is the carbon regulatory mechanism at the border (CCSM). The CBA Regulation, formally proposed by the European Commission on July 14, 2021, was signed by the European Parliament and the Council on May 10, 2023 and published in the Official Journal of the EU on May 16, 2023 and officially entered into force on May 17, 2023. The Accord expects European Union importers to pay a carbon tax on the carbon emissions of their goods. The aim of the mechanism is to prevent carbon leakage and create a worldwide incentive for low-carbon production. After the transition period, European Union importers will purchase certificates corresponding to the embedded emissions of the goods they import. Accordingly, the transitional implementation of the GDRM will start on October 1, 2023 for the iron and steel, aluminum, cement, fertilizer, electricity and hydrogen sectors. gas emission reporting obligation, while financial obligations in the form of a carbon tax will start to be implemented in 2026. The current European Union emissions trading system will be modified to sustain economic development in the face of potential loss of competitiveness due to carbon leakage. The shift of producers to countries without carbon pricing will be on the agenda for countries like Turkey, which exports a significant share of its exports to the European Union.

Within the scope of combating global climate change, the Green Deal Action Plan was prepared in cooperation with relevant institutions, organizations, non-governmental organizations and universities under the coordination of the Ministry of Trade in order to ensure the green transformation of the Turkish economy and published on 16 July 2021. From carbon regulations at the border to building a green and circular economy; from clean and secure energy sustainable The Action Plan includes 32 targets and 81 actions under 9 main headings ranging from transportation, sustainable agriculture to green finance, which is key to realizing this transformation. For the implementation and further development of the Action Plan, work is being carried out within the Green Deal Working Group and 20 Specialized Working Groups established with the participation of all relevant stakeholders. For the implementation and further development of the Action Plan, work is being carried out within the Green Consensus Working Group and 20 Specialized Working Groups established with the participation of all relevant stakeholders.

The main actions under the Green Deal Action Plan are listed under the following headings;

- Limiting carbon emissions,
- A green and circular economy,
- Green financing,

– A clean, affordable and secure energy supply,

- Sustainable agriculture,
- Sustainable smart travel,
- The fightclimate change,
- Establishing the principles of diplomacy,

– Raising awareness of the Green Deal.

As exports to European Union countries are still the main target market for Turkish exports, the GCC is likely to have a significant impact on emission-intensive Turkish exports. Within the scope of the Green Deal Action Plan, under the coordination of the Ministry of Industry and Technology, in order to support the reduction of greenhouse gas emissions in priority manufacturing industry sectors that may be subject to the Border Carbon

The efforts to determine the road map and activities have made significant progress. In this context, road maps for the steel, aluminum, cement and fertilizer sectors are nearing completion.

In addition, strengthening the technological infrastructure for green transformation is also a priority. In this context, under the coordination of TUBITAK and the Ministry of Industry and Technology, in cooperation with the Technological Transformation Specialized Working Group, which includes all relevant institutions, potential producers and technology developing companies and universities, preparatory work on the "Green Growth Technology Roadmap" is being carried out. Six pilot sectors, namely Iron-Steel, Aluminum, Cement, Chemicals, Plastics and Fertilizer, have been identified and it is planned to finalize the Green Growth Technology Roadmap in 2023.

9.3. EFFECTS OF CHANGE

While climate change is increasingly challenging the sustainability of the industrial sector in Turkey and increasing the risks of Natech accidents, which are defined as industrial risks arising from natural hazards, the sector's awareness and efforts to adapt to climate change are still at an early stage.

Industry puts pressure on the atmosphere, water and soil, in short, on receiving environments through natural resource consumption, wastes and pollutants in general. Although regulations to control the impacts of industry on the environment globally are becoming more widespread and relatively tighter each year, the consequences and costs of industrial pollution remain significant. The social costs or externalities associated with industrial pollution remain significant, damaging human health, ecosystems, infrastructure and climate.

While most business organizations are currently identifying and specific climate change-related risks and impacts, such as increasing water scarcity, through their overall sustainability plans, environmental management systems, risk management frameworks and product research and development teams, they have not developed a comprehensive response to the need for adaptation. However, this approach is contributing positively to the creation of "no-regret" adaptation measures for companies. Few companies appear to take a comprehensive and focused look at climate risks and opportunities and develop a dedicated adaptation strategy as part of their overall approach to climate change. To effectively leverage the synergies between adaptation and GHG mitigation, especially for the industrial sector , long term adaptation targets should be established together with mitigation planning. Mobilizing the necessary investments for adaptation is an area that is less restricted or regulated by law than mitigation, requiring more awareness raising and cooperation at stakeholder level.

At this point, it is important that medium and long-term actions are planned together for both areas on a sector-by-sector basis. Adaptation actions can provide additional mitigation benefits while helping to achieve socio-economic objectives. This also applies to mitigation initiatives that can provide additional adaptation benefits. It is important to take into account and observe the adaptation - mitigation synergy in the preparation processes of the National Contribution Statements that countries are obliged to submit under the Paris Agreement. Adaptation mitigation policy proposals that are incompatible with mitigation objectives should only be considered where they are the only option.

In addition to planning for disaster protection, it is also critical to mitigate damages that have already occurred. While the primary objective is to build early warning and forecasting systems and coordinate necessary actions with all relevant stakeholders, preparing for the potential consequences of climate hazards is also imperative for industrial safety issues such as critical infrastructure protection, water and food safety, and Natech accident risks.

Natural disasters can trigger Natech accidents, which can have potentially major social, environmental and economic impacts, but are often overlooked. Natech accidents can result in multiple and simultaneous releases of hazardous substances over large areas, damaging safety barriers or systems, or even destroying systems. Prevention and mitigation of accidents

They can also cause damage to lifelines, which are often needed for life lines. Therefore, specific methodologies and guidance are required to mitigate the impacts of natural disasters.

Natech accidents are localized but need to be considered in national risk assessments. Climate change, industrial growth and rapidly developing and changing demographics will increase the likelihood and impact of exposure to such disaster risks in the future.

The risks of climate change need to be considered by business as business risks. In order to support sustainable development, there needs to be a strategic engagement of business against climate risks, considering the link between the needs of business and the needs of society. In this way, adaptation to climate change and its risks can be achieved with a more open and robust preparation (Figure 38).

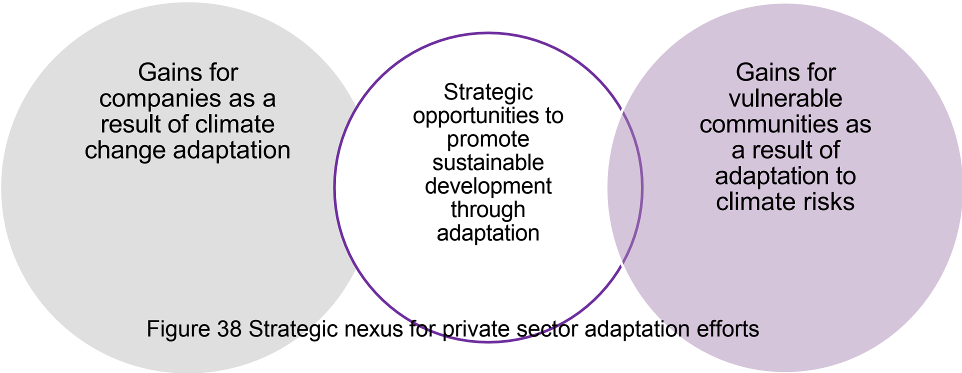

Figure 38 Strategic nexus for private sector adaptation efforts

Measures taken by business to adapt to climate change have numerous positive benefits. These are listed below:

- Ability to reduce and better manage risk
- Activities sustainability guaranteeing
- Preventing damage to assets or interruptions in input supply
- Financial benefits (lower costs, new revenue streams)
- Expanding into new markets
- Social leave
- Reputational benefits with external stakeholders, including meeting current and future customer expectations
- Competitive advantage over companies that do not adapt to climate change.

In addition to these benefits, future possibilities for leveraging adaptation efforts by accessing new public finance streams earmarked for climate change adaptation, in particular the development of products and services that facilitate adaptation and support adaptive capacity building, are enumerated.

Policymakers play a key leadership role in accelerating, facilitating and supporting business engagement in climate change adaptation. These efforts need to be scaled up where they are most needed and supported by policy decisions (Figure 39).

Figure 39 Business Benefits of Adapting to Climate Change

Measures such as developing sectoral policies according to national climate change adaptation targets, making smart water management mandatory in infrastructure projects, establishing early warning systems for disasters and raising climate change awareness should be taken to identify climate change risks and adaptation measures to be taken. It is very important that businesses also take part as key stakeholders in the process of determining adaptation solutions to climate change.

The G20 industry-led TCFD, established in 2016, has published draft recommendations for firms to make voluntary, consistent, comparable, reliable and transparent disclosures on climate-related financial risks for lenders, insurers, investors and other stakeholders. These recommendations include measures such as greenhouse gas emissions and energy and water efficiency, as well as financial sector measures. The TCFD recommendations greatly assist financial sector analysts in pricing climate-related risks and opportunities.

It is also important to detail the impacts on the supply chain for facilities operating in the sector by sub-industry and location. The characteristics of supply chains are characterized by many factors such as size, location, product and logistics diversity, and trade network. and industry branches and even facilities, it would be useful to scale it based on the results obtained on a national basis.

Industrial Sector Risk Analysis: Heavy Rainfall

In order to analyze climate risks at the provincial level in Turkey for the industrial sector, firstly, an impact chain was created according to the hazard of heavy rainfall and presented in Figure 40. In the impact chain, relevant indicators were selected to analyze the risk of the sector, but the analysis was carried out with the data available within the scope of the study.

When the exposure of the industrial sector in Turkey is assessed, it is generally observed that the western half of the country has high and very high levels of exposure. In the eastern half of the country, exposure is relatively low.

In general, provinces with very high and high exposure stand out in terms of the number of OIZs and employment in industry. It is noteworthy that the provinces of Istanbul, Bursa, Izmir, Kocaeli, Ankara, Kocaeli, Ankara and Tekirdağ, where very high levels of exposure are detected, are also located in regions with relatively intensive water use and agriculture-based industrial sectors such as food and textile

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Yağış miktarı ve sıklığında artış	Sel ve taşkın	OSB sayısı	Çalışan sayısına göre ölçeklendirme (Mikro)	Faal dernek sayısı	Üretim maliyetlerinin artması
	Şiddetli yağışlı gün sayısında artış	Endüstriyel ve ticari birimlerin oranı	Sanayinin GSYİH'deki payı	Ar-Ge ve tasarım merkezi (TGM sayısı)	Pazar payı kaybı
		Sanayide istihdam sayısı	Büyük endüstriyel kaza riski olan tesisler (alt seviye)	AAT'si olanların toplam tesis sayısına oranı	İş ve verim kayıpları
		Sanayi kapasite rapor sayısı	Yaşanan toplam sel ve taşkın sayısı	Lise ve üzeri eğitim almış nüfus oranı	
			İllere göre ihracat	Kişi başı toplanan ortalama atık miktarı	

Figure 40 Impact Chain: Industrial Sector and Heavy Rainfall

However, under the CORINE Land Cover Classification, under Industrial and Commercial Units, exposure is very high and at high levels in provinces with the largest areas of land used predominantly by industrial activities of conversion and manufacturing, trade, financial activities and services, including growing industrial facilities, and their associated land and access infrastructure.

Looking at the sensitivity of the industrial sector to heavy rainfall in provinces, it is again found that sensitivity is higher in the western half of the country and in metropolitan areas. In general, more than half of the 81 provinces have medium or sensitivity. In the eastern provinces, sensitivity is at very low to low levels.

When the adaptive capacity of the provinces is evaluated, it is seen that the capacity is generally high in the provinces located in the Marmara Region, Aegean and Mediterranean Coasts, Eastern Black Sea Coasts and the west of Central Anatolia; especially in the Southeastern provinces and Eastern Anatolia relatively low levels in the southern provinces.

Turkey's sensitivity and adaptive capacity at the provincial scale components When the vulnerability levels of provinces to heavy rainfall are evaluated together, high levels of vulnerability are found in the Central Black Sea and its inland areas, in the provinces located in the eastern part of Central Anatolia, in the provinces of the Aegean Region, which are generally located inland, and in the provinces in the Eastern Mediterranean Region.

The risk map obtained by analyzing exposure, vulnerability and hazard components together at the provincial scale in Turkey is presented in Figure 41. Accordingly, almost more than half of the 81 provinces are identified as having moderate or above risk. The risk of heavy rainfall is particularly high in Balıkesir, Manisa, Aydın, Denizli in the Aegean Region; Mersin, Adana, Hatay in the Mediterranean Region; Gaziantep in the Southeast; Sakarya, Kastamonu, Samsun, Amasya, Ordu and Giresun in the Black Sea Region. high level.

Figure 41 Current Period Risk Map: Industrial Sector and Heavy Rainfall Relationship

Industrial Sector Risk Analysis: Drought

Vulnerability and risk analysis of drought hazard for the industrial sector specific to the provinces was conducted. With impact chain Figure 42 prepared for use in the analysis presented. Since the indicator set used in the drought risk analysis is quite similar to the hazard of heavy rainfall, a drought risk map was prepared in the industrial sector (Figure 43).

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Ortalama sıcaklık artışı	Kuraklık	OSB sayısı	Çalışan sayısına göre ölçeklendirme (Mikro)	Faal dernek sayısı	Üretim süreçlerinin çalışma koşullarının artan sıcaklıktan etkilenmesi
Toplam yağış miktarında azalma	Yağış miktarı ve yağışlı gün sayısında azalma	Endüstriyel ve ticari birimlerin oranı	Sanayinin GSYİH'deki payı	Ar-Ge ve tasarım merkezi (TGM sayısı)	Hammadde ve ürün depolama koşullarının etkilenmesi, daha fazla iklimlendirme ihtiyacı
	Ardışık kurak gün sayısında artış	Sanayide istihdam sayısı	Gıda ürünleri imalatı kayıtlı üretici sayısı	AAT'si olanların toplam tesis sayısına oranı	Su temin edilememesi nedeniyle üretimin sekteye uğraması
		Sanayi kapasite rapor sayısı	Büyük endüstriyel kaza riski olan tesisler alt seviye	Lise ve üzeri eğitim almış nüfus oranı	Üretimde verimlilik kaybı
			İllere göre ihracat		Maliyet artışı
					İşgücü kaybı

Figure 42 Impact Chain: Industrial Sector and Drought

Accordingly, it was observed that the risk was higher especially in the southern half of the country. Balıkesir, Manisa, Denizli, Afyonkarahisar, İzmir, Aydın in the Aegean region; Konya, Karaman, Sivas, Malatya, Kahramanmaraş, Ankara Kırıkkale, Aksaray, Niğde in Central Anatolia; Şanlıurfa and Diyarbakır in the Southeast and Erzurum in the East were identified as provinces with risks above high levels.

When the results are evaluated, the adaptive capacities of the provinces with high exposure need to be strengthened as a priority, especially for the textile industry, which is based on agriculture and sensitive to water supply in general.

In the light of the assessments made in terms of industrial sector scale and sub-sectoral distribution in high-sensitivity provinces, water and energy saving practices priority

In the medium term, it is important to increase adaptive capacity and reorient the industrial portfolio so that the sub-sectoral distribution shifts towards relatively more value-added and less resource-intensive sectors.

Affectability high It is important to focus on information activities to strengthen adaptation capacity, primarily through OIZs in the provinces ranked as "priority", and to ensure the sustainability of the industrial sector by providing technical and, where appropriate, financial support for the creation of the necessary infrastructure.

Figure 43 Current Period Risk Map: Industrial Sector and Drought Relationship

9.4. ADAPTATION MEASURES

The industrial sector will be made climate resilient by conducting data-based risk analyses, and insurability
the number of green procurement criteria will be increased, collaborations be encouraged and elements of adaptation to a changing climate will be included in green procurement criteria.

For the industrial sector, there are a wide range of factors such as basic operations (physical assets, efficiency of production processes, cost of operation and maintenance activities, health and safety, labor and labor productivity), value chain (ability to supply raw materials and services, customer demand for specific products and services, etc.) and more. vulnerability factors need to be determined in 3 main tiers covering the wider network (infrastructure needed to export or import, public services such as energy, water services, etc.) (

Figure 44).

In this context, vulnerability and risk analyses should be conducted starting from the priority sectors to be identified. The results of these analyses will form the basis for many practices, from updating facility-specific and local emergency plans prepared by AFAD to insurance arrangements.

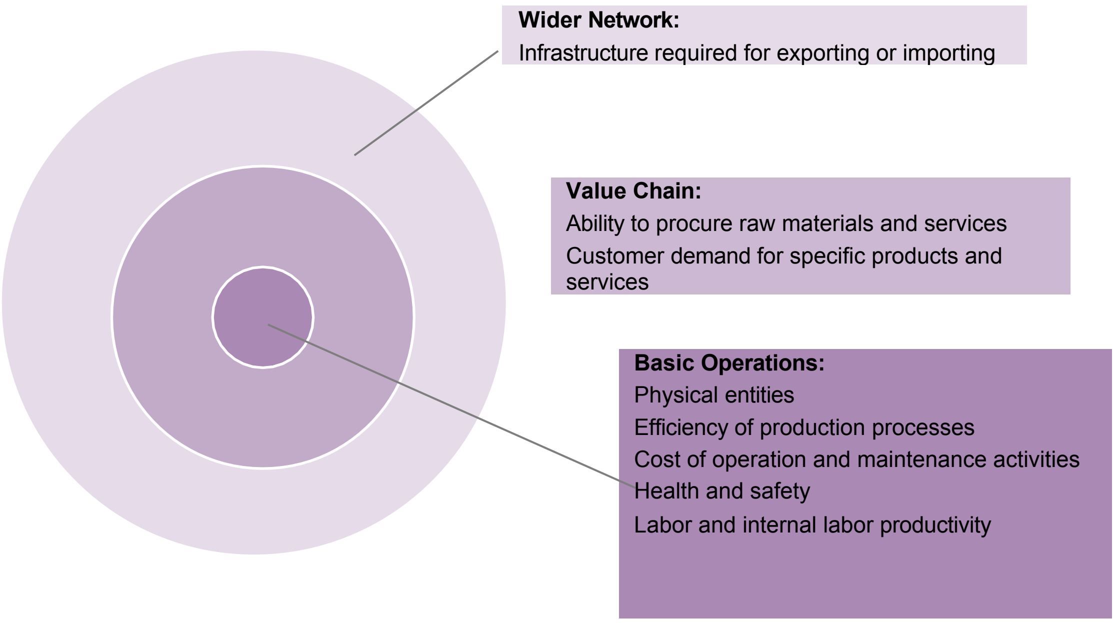

Figure 44 Vulnerability Factors of the Industry Sector

It is considered that the data that will constitute the basis for planning adaptation action specific to the industrial sector at national and local level is not sufficient for the research and analyses that need to be carried out. The industrial sector, which has climate change issues on its agenda with a focus on greenhouse gas mitigation, has very basic indicators such as water consumption by source, recycling rates
in the scope of data monitoring
is required. The 12th Development Plan addresses

([5]) Providing data flow through the indicators proposed in this context will enable detailed analysis by sub-sectors, establishment scales and locations.

Triggered technological risks and major industrial accident risk

[5] 880.4. Water efficiency will be increased by adopting the best available techniques in industry.

facilities under the control of the Ministry of Environment and Urbanization and prioritization develop adaptation actions.

As a potential domino , technological risks such as fires, explosions and leaks triggered by natural disasters such as floods, landslides and lightning are of strategic importance for the industrial sector. Triggered technological risks can originate from chemical processes, pipelines and facilities that process, store or transport hazardous materials, and their impact on other infrastructures can cause fires, explosions and toxic or radioactive releases.

Disaster risk reduction measures may not always consider technological hazards in industry, and chemical accident prevention activities may not cover certain aspects of triggered technological risks. This creates a need for specific methodologies and guidance for risk assessment and management for industrial facilities.

Triggered technological risks can gradually have major social, environmental and economic impacts. They can cause multiple and simultaneous releases of hazardous substances over large areas, damage or destroy safety barriers or systems, and damage lifelines that are often needed to prevent and mitigate accidents. In addition, emergency responders may often be ill-equipped and poorly trained, as they are often required to handle several incidents simultaneously and respond to the consequences of natural hazards in parallel.

With a proactive approach, taking into account the possible impact of climate change on the severity of extreme climatic events, in order to minimize business interruptions and the accompanying economic losses, in addition to regulatory obligations, the business community can, on their own initiative, take a structure of facilities specific a series of measures can develop. Indicators for a legal framework for the control of triggered technological risks could include components such as land-use planning, security incidents, contingency planning, etc., as well as rules, guidelines and standards describing how to implement the framework. assessment of safety standards, especially in light of the impacts of climate change, would also be an important contribution. Incorporating triggered technological risks into ecological risk management frameworks alongside technological risk regulations would be a potentially important adaptation action.

During the planning phase of a hazardous facility, it is critical that it is designed to take into account the risks that may arise from natural hazards. In addition, organizing training and awareness-raising activities to help stakeholders recognize the vulnerability of hazardous facilities to natural disasters will play a decisive role in increasing adaptive capacity.

Reassessment of facilities under the risk of technological risks and/or major industrial accidents triggered by climate change induced disasters according to climate projections and vulnerability and risk analyses. Reviewing the risk analysis and emergency plans of each facility within the scope of adaptation to climate change, making necessary updates, identifying prioritized adaptation actions and implementing the identified actions.

Strategic Objective 2. Prior to investment projects, the impacts of climate change on investment and the impacts of investment on climate are assessed and monitored together.

Prior to investment projects, assessing the impacts of climate change on the investment and the impacts of the investment on climate together and

The updating of existing legislation and actions to monitor the provisions already in force are important for long term planning. While potential environmental impacts are assessed in detail in the content of the documents prepared under the current Environmental Impact Assessment legislation, regional receiving environment carrying capacities and the physical climate risks of the region should become decisive in the decision-making phase of investment implementation.

Safety and environmental considerations should come first in decisions on land use and the location of hazardous industrial activities. It is crucial to ensure that appropriate safety measures are taken for industrial facilities and that they are not built in areas vulnerable to natural disasters and other risks. Assessing the potential environmental and health risks posed by hazardous industrial installations, raising awareness of these risks and identifying the safest and most sustainable alternatives in cross-sectoral dialog is crucial in this respect. Therefore, there is a continuing need for greater integration of industrial safety, land use planning and environmental assessment procedures in order to make coordinated decisions on accident prevention and risk reduction.

In addition, within the scope of the green transformation requirements in the new organized industrial zones to be established, criteria such as site selection, regional capacity of ecosystem services, etc. should be considered.

Investment incentive legislation and practices (priority given to investment location allocation) should be adapted to climate change.
review from a compliance perspective,

Decision and Monitoring processes industry sector across made which is
Consideration of vulnerability and risk analyses to be taken.

Strategic Objective 3. To make the necessary updates as a result of the review of insurance legislation increase insurability against the impacts of climate change.

As the frequency of extreme climate events increases due to climate change, the possibility of not being able to adapt to them in a timely and adequate manner also increases. In this case, it is inevitable that insurance premiums will come into play and businesses will need to protect themselves in this area.

The issue of the insurability gap is particularly relevant for SMEs in regions prone to extreme weather and events to ensure the sustainability of their businesses. with is something that can be directly related. Many businesses do not yet consider this area to be covered by insurance. On the other hand, potentially high premiums may be a deterrent for many enterprises, even if they are aware of them. In this context, the development of instruments to financially support SMEs will be decisive for the widespread implementation of the practice.

Insurance coverage for facilities at risk of industrial accidents and triggered natural technological hazards is of particular importance. Compensation for damages in the event of an accident can be financially devastating for these facilities. In addition to preventive actions, the indemnities to be received within the scope of insurances can be decisive for organizations to continue their existence after exposure to physical climate risks.

For businesses that can financially afford the premiums in the first place, details such as determining the scope correctly and organizing the internal procedures of the business (accident definitions, guidelines, etc.) accordingly will be decisive in terms of compensating the losses.

Monitoring of insured industrial facilities affected by climate change induced disasters and climate hazards.

Providing fast and practical access to national projections and databases for the studies to be carried out by the industrial sector.

Access to national projections and databases by sector organizations and scientists working in this field;

- Organization at the level of conducting detailed vulnerability and risk analyses
- Providing fast and practical access to climate projections and using them in the studies to be carried out by the industrial sector
- Supporting the work of industrial organizations towards science-based targets with national databases
- Industry sector, national/international organizations, research centers and universities develop nature and technology-based adaptation solutions

will make valuable contributions to the process. In addition, it is important for inclusiveness and complementarity that all in-country studies are conducted from the basic analysis of the moon.

Identifying the industrial sub-sectors with the highest vulnerability to climate change and preparing adaptation guidelines for these sectors.

Strategic Goal 5. Encourage collaborations within the sector (mentoring system and training of trainers).

Discussions during stakeholder engagement activities revealed that a significant portion of businesses and sectoral civil society organizations have only basic knowledge about climate change.

In general, it can be said that the main source of information for micro and small businesses on many issues is communication with peer businesses. Sharing experiences and advice with other businesses is often done through online searches or more than the use of public information websites.

In particular, creating platforms to support SMEs to access and discuss sector-specific information and collaborate with other businesses on climate-related risks and opportunities will be one of the key communication areas to support the process.

It will be necessary to support the SME sector, including new businesses, by providing clear and specific information on the current and projected climate-related risks facing businesses, and to support businesses to identify and use the approach that best suits them to manage climate risk and take advantage of the associated opportunities.

SNY6. Organizing a training of trainers program through the sector.
Strengthening the technical information capacity of industrial enterprises, in particular SMEs, for adaptation to the impacts of climate change.

Strategic Goal 6. Promote the inclusion of climate change adaptation elements in green procurement criteria

As part of this strategy, it is proposed to include adaptation elements in the green procurement guidelines. A transition plan could also be put forward, starting with priority sectors (e.g. construction) and the large producers that supply them with their main commodities (e.g. cement, steel producers). Increasing the use of alternative raw materials and fuels could also be an additional benefit.

Technical and financial support for technological transformation investments at the commercialization stage for manufacturers of materials that will be subject to green procurement criteria to support mechanisms can be put on the agenda.

Voluntary in the industrial sector

buy	intake	for	will be made
updates		Harmony elements of including	

provide information on how to provide information to the public.

SOURCE: Industry

MOEU (2022). Environmental Permit and License Document Inquiry. Retrieved from

STB. (2022). Socio-Economic Development Ranking Surveys (SEGE). Retrieved from https://www.sanayi.gov.tr/merkez-birimi/b94224510b7b/sege.

TCFD (2016). Implementing the Recommendations of the TCFD, Task Force on Climate Related Financial Disclosures. Retrieved from https://www.fsb-tcfd.org/publications/.

TUIK (2020). Annual Gross Dormitory Inside Revenue, 2019. Retrieved from https://data.tuik.gov.tr/Bulten/Index?p=Yillik-Gayrisafi-Yurt-Ici-Hasila-2019-33671

TÜİK (2021). Annual Industry and Services Statistics, 2020. Retrieved from https://data.tuik.gov.tr/Bulten/Index?p=Yillik-Sanayi-ve-Hizmet-Istatistikleri-2021- 45836

TURKSTAT (2022). Labor Force Statistics, January 2021. Retrieved from https://data.tuik.gov.tr/Bulten/Index?p=Isgucu- Istatistikleri-Ocak-2021-37486.

ULAŞIM
İLETİŞİM

climate adaptation

10.1. GENERAL FRAMEWORK

Significant infrastructure investments in our country in terms of regional and urban transportation and communication and While there are gains, a transportation system with limited diversity of modes and even more transportation-communication .

Turkey has an advanced infrastructure in terms of highways has. Although railways started to be developed with the investments made in the first period of the Republic, there has been a predominant investment tendency for the development of highways since the 1950s. However, in the last 20 years, investments have been made for the development of high-speed and high-speed rail network. In addition, modernization investments are being made to make the existing conventional lines suitable for electrification. Airline transportation has been an important area of investment since the 1990s. share, and there has been a significant increase in the number of airports in the country. The use of rivers and canals for maritime and waterways transportation is limited, but there are ports that play an important role in national and international transportation.

In parallel with these infrastructure facilities, 93% of passenger transportation is carried out by roads, while the share of railways is less than 1% (Figure 45). Share of airlines
6.3%, while the share of maritime transport is negligible in passenger transport, but 6% in freight transport. Railways
Although the share of freight transportation is higher than passenger transportation, it is below 5%.
Roads are also the most dominant sector in freight transportation with a share of 89.4% (NAB, 2022). When pipelines are included in this analysis, the share of roads in freight transportation is around 80%, with an estimated 10% share in pipelines (UAB, 2011).

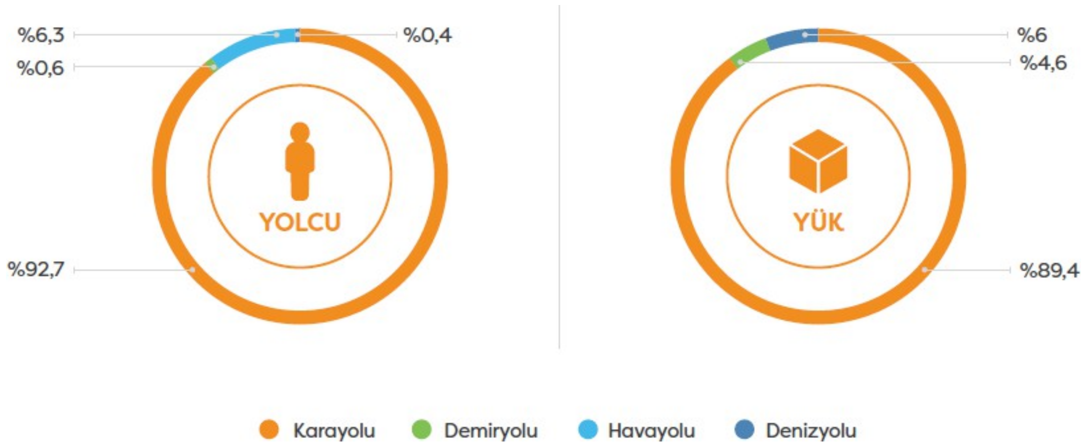

Figure 45 Domestic Passenger and Freight Transportation Rates by Transportation Types in Turkey (2021)

Pedestrian trips still have an important share in urban transportation. Although it varies according to the physical and geographical characteristics of cities, spatial size and travel distances, 30-50% of urban trips are made on foot. In fact, this trend is characteristic of cities in developing countries where car ownership is relatively low. In developed countries While the number of automobiles per 1000 inhabitants is in the range of 400-600, this ratio is 167 in Turkey (NAB, 2022). The rate of increase in automobile ownership and use is very high. In 1990, the number of automobiles per 1000 people in the country was only 25, whereas it has increased 6 times since then.

Despite the increase in automobile ownership and use, public transportation dominates the use of motor vehicles in our cities. Local governments have adopted the principle of developing and improving public transportation and ensuring that increasing proportions of trips are made by public transportation. Metro, light rail and tramway investments are becoming widespread; regional rail services are being developed on the existing railway network; trolleybuses, electric buses and dedicated bus routes are increasing. In cities with sea and water elements, there are practices to develop and encourage public transportation systems such as sea buses, ferries and ferries. Individual transportation carried out by small entrepreneurs is also one of the services that can be classified as public transportation. In addition to private public buses, intermediate public transportation systems such as minibuses and minibuses also play an important role in urban transportation.

Although the use of bicycles as a mode of urban transportation has been limited to certain cities, in recent years, bicycle transportation master plans (BİSUAP) have been prepared in many cities and bicycle sharing systems have been established.

The use of e-scooters as a shared system is also becoming widespread.

Developing technology and communication infrastructure is important for the information society, which is a national goal in the communication sector. In Turkey, the mobile phone ownership rate is 102%, and the mobile internet high-speed 3G and 4.5G subscriber rate is 99.5% (ICTA, 2022). The fixed broadband user rate is 21.4%, which is much lower than the rates of mobile phone ownership and high-speed internet users, suggesting that efforts should be made to increase the use of fixed broadband. Increasing the share of fiber infrastructure in fixed broadband connections is also important for high speed and capacity access.
27%. Having quality access conditions in both mobile and fixed broadband access and increasing the number of subscribers are important for the efficient use of communication tools and access to information by the entire population. In addition, the availability, quality and prevalence of these technologies in early warning and emergency response, including climate hazards, are important issues.

10.2. SECTORAL LEGAL FRAMEWORK AND RESPONSIBLE INSTITUTIONS

The issue of climate change in the transportation sector has been addressed mainly within the framework of greenhouse gas mitigation strategies in our country, and there is a significant accumulation of these strategies in the sector, and there are many policy and strategy documents.

The Ministry of Transport and Infrastructure and its affiliated and related institutions (General Directorate of Highways, General Directorate of State Railways of the Republic of Turkey, General Directorate of Maritime AffairsGeneral Directorate of Civil Aviation, State Airports Authority, General Directorate of Communication, Information and Communication Technologies Authority, etc.) are responsible for the transport and communication sectors at the national level. At the local level, municipalities are responsible for urban transport, but for nationally important infrastructures (ports, airports, railway stations, road crossings) the decision-making and planning authority lies with the aforementioned national institutions. The role of municipalities includes the provision of public transport, traffic regulations, parking areas, pedestrian sidewalks and bicycle lanes. In settlements with metropolitan status, metropolitan municipalities are responsible for the preparation of transportation master plans, the provision of public transportation services throughout the city, and the arrangements for motor vehicle, bicycle and pedestrian traffic on main arteries and avenues, while district municipalities are responsible for lower level connections and street, parking lot, etc. arrangements at the neighborhood scale. In addition, in metropolitan municipalities, there is an institutional structure that enables decision-making by establishing Transportation Coordination Centers within the metropolitan municipality.

The legislation that constitutes the legal framework in the sector is generally the laws and regulations that give responsibilities to the above-mentioned institutions for carrying out transportation activities and developing the necessary infrastructure. In addition, the Regulation on Procedures and Principles for Increasing Energy Efficiency in Transportation includes measures to reduce energy consumption and ensure energy efficiency in transportation at national and local level.

As can be understood from the emphasis on energy reduction in the aforementioned regulation, the issue of climate change for the transportation sector is mainly addressed within the framework of greenhouse gas emission reduction strategies. The share of the transportation sector in $CO_{(2)}$) emissions, the main greenhouse gas causing climate change, is around 25% worldwide. Reducing these emissions from the sector is of vital importance in the fight against climate change in terms of reducing greenhouse gas emissions and slowing down the climate change process. For this reason, mitigation strategies for climate change in the sector are a framework that has been universally discussed relatively more and developed comprehensively. Strategies for adaptation to the impacts and hazards of climate change, on the other hand, are relatively new topic of discussion. This is the case across the world and is also valid for our country.

Therefore, there is a significant accumulation and a large number of policy and strategy documents on GHG emission reduction strategies in the sector. Development Plans are among the most important of these, and since the 1970s, strategic targets have been adopted to develop multi-modal transportation, to ensure integration between different modes, and thus to change the transportation system that has become dependent on road transport. In urban transportation, public transportation based urban transportation

The emphasis on the development of transportation systems has been included in the aforementioned plans since the same years. With the 8th Five-Year Development Plan covering the years 2001-2005, the issue of the environmental impacts and negative externalities of transportation and the need to reduce greenhouse gas emissions from the transportation sector have become prominent targets in the sector; in this direction, the development of railways, more efficient use of maritime routes, and the improvement of pedestrian and bicycle transportation conditions in urban transportation, in addition to public transportation, have started to take an important place in the plans.

Another important example of a national policy document is the Transportation Master Plan. The first national master plan was prepared in 1982; this plan for the period 1983-1993 emphasized the need to increase the share of railways and maritime routes in transportation by developing them, and the need to build infrastructure for urban transportation in a way to encourage public transportation. A Communication Master Plan was also prepared for the same period, and the main emphasis was on the need to realize infrastructure investments with new technologies for a modern communication and communication infrastructure.

In the 2005 Transport Master Plan Strategy for the 2005-2015 period, the impact of the sector on climate change was emphasized and the objectives of reducing greenhouse gas emissions and developing environmentally sustainable transportation systems were adopted. In the 2015-2017 National Transport Master Plan, under the heading of environmental sustainability, emphasis placed on passenger transportation by rail; targets such as priority for pedestrians in urban transportation, transition from private vehicle use to public transportation and bicycle and pedestrian transportation are adopted; and the goal of reducing carbon footprint is emphasized.

The Transportation and Communication Councils in our country also set national strategies in their final declarations and provide guidance. to reduce greenhouse gas emissions in the sector. In this context, in order to reduce greenhouse gas emissions in the sector, there is an emphasis on the development and promotion of railway infrastructure throughout the country, public transport, bicycle and pedestrian transportation in urban transportation, and the widespread use of clean energy vehicles. Within the scope of communicationthe creation of a modern and advanced communication infrastructure in the light of technological developments is at the forefront.

Within the scope of the Climate Change Action Plan (CCAP) covering the years 2011-2023, the transportation sector was addressed as a sector where mitigation strategies were developed; ensuring the balanced use of transportation modes in freight and passenger transportation by developing an intermodal transportation system, restructuring urban transportation in line with sustainable transportation principles, alternative fuel and clean vehicles technologies and increasing efficiency in energy consumption in the sector. In Turkey's Climate Change Adaptation Strategy and Action Plan 2021-2023 of the same date, the transportation and communication sectors are not addressed under separate headings; however, it is stated that the transportation sector is affected by climate change hazards and therefore, the costs of impact should be taken into account in transportation plans and the sector should adapt to climate change.

In the 2011 Turkish Transportation and Communication Strategy Target 2023 Document, the issue of climate change is also emphasized within the scope of mitigation strategies. Although it is stated that the sector will be affected by climate conditions, strategies for mitigation have been adopted. In the 2053 Transportation and Logistics Master Plan prepared in 2022, greenhouse gas emissions reduction strategies are emphasized in line with the environmental sensitivity and energy efficiency target.

emerges. However, although not defined as an adaptation strategy, the need to take measures to increase flexibility and resilience in transport and logistics activities was emphasized.

In the Accessible Transportation and Communication Strategy document, fair access for all is emphasized as a requirement of the principle of inclusiveness, and the improvement of access, communication and communication opportunities in case of disaster is emphasized. for projects are envisaged.

The transportation sector is also included in the recommendations of the Climate Council held in February 2022. The sector was discussed in the agenda of the Greenhouse Gas Mitigation Commission and actions to reduce greenhouse gas emissions were determined. However, among the recommendations is the statement that "synergy between the mitigation strategy in the transportation sector and the adaptation strategy to climate change should be ensured, and the vulnerability of the sector should be reduced". Furthermore, the recommendation that "sectoral early warning systems should be established, developed and organized to work in an integrated manner in order to adapt to climate change" draws attention to the role of transportation and communication sectors in this field.

Although there is no legislation directly related to the transportation and communication sector , transportation

It can be said that there is an emphasis on both mitigation and adaptation in the Environmental Impact Assessment (EIA) Regulation, which is an effective legal process on investments.
Annex-3 General Format of Environmental Impact Assessment in the EIA Regulation published in the Official Gazette dated 29.07.2022 and numbered 31907 in part location field "Chapter III: Project Construction and Business Environmental Impacts and Measures to be Taken", the Project's impact on climate (nature and magnitude of greenhouse gas emissions) and how the Project will mitigate climate change are discussed. will be affected substance with It is seen that the issue of adaptation to climate change is addressed with the expressions of disaster or accident risk related to the project due to climate change. Furthermore, the Official Gazette dated 08.04.2017 and numbered 30032 In the Gazette Published in Strategic Environmental Evaluation (SEA) Regulation, Annex 4 "To be Included in the SEA Report Necessary Information" title under "plan/program biological diversity population, health, fauna, flora, soil, water, air, climate factors, material assets, cultural heritage (including architectural and archaeological heritage), landscape and the above Factors between "Possible significant impacts on the environment, including ***interrelationships***, and social and economic impacts (These impacts will include secondary, cumulative, mutually reinforcing, short, medium and long term permanent and temporary, positive and negative impacts)" and the issue of adaptation to climate change is also emphasized.

10.3. EFFECTS OF

Identifying the users with the highest vulnerability and identifying the most used and therefore the most users, which are of strategic importance for our country Identification and prioritization of transportation and communication infrastructures as critical infrastructures, which will affect issues.

Transportation and communication sectors are among the sectors most affected by climate hazards. When assessing the impacts of climate change on the sector, it is necessary to evaluate both the impacts on infrastructures and the impacts on transportation and communication activities, namely passenger and freight transportation, data transmission and communication. Transportation and communication sectors also have vital importance in terms of early warning, emergency assistance, response and evacuation opportunities before and during climate hazards, and the negative impact of the sector from hazards also reduces emergency management capacity.

All climate hazards affect the transportation and communication sectors. Floods and floods caused by heavy rainfall have serious impacts on infrastructure and access and communication facilities. Extreme weather events such as storms and strong winds also affect these sectors, and heat waves are a climate hazard that can cause serious deformation in infrastructure, adversely affect transportation and communication activities, and significantly threaten passenger health.

Vulnerability analysis in transportation and communication sectors is addressed under 3 headings: Regional transportation, urban transportation and communication. While comprehensive assessments are conducted for each topic, vulnerable users and highly users and infrastructures prioritized. This approach is a basis for action.

In developing proposals, it will ensure that measures are implemented by taking into account "universal design standards" that take into account the needs of users with mobility limitations (such as disabled, elderly, pregnant, children, and children). In addition, identifying the infrastructures that are of strategic importance for our country, that are used the most and therefore will affect the most users, and identifying them as critical infrastructures are also among the priority issues within the scope of the analysis.

Climate Change Impacts on Long-Distance Regional Transportation

The fact that up to 90% of regional and national transportation, freight and passenger transportation is carried out on highways in our country indicates that the number of people and transportation activities that will be exposed to impacts on highways in the face of climate hazards will be high. This will of course negatively affect the tourism sector, as well as industry, agriculture and trade through freight transportation. The fact that multi-modal transportation infrastructure has not yet been put into practice across the country shows that alternative mode choices may not be possible in the face of possible disruptions on the highway.

Regions where transportation is spatially concentrated are particularly risky regions in terms of vulnerability. In line with the population density, location of industrial centers and port regions in the country, the density of total road transportation is concentrated in the East and South with a focus on Istanbul-Izmit- Sakarya-Bursa. Marmara It is located in the Ankara, Izmir, Antalya, Konya, Eskişehir, Eskişehir, Gaziantep and Samsun-Trabzon corridors and foci, followed by the Mersin-Adana-Hatay corridor.

Eastern and Southern Marmara Region, where transportation is most concentrated, at the same time

According to climate projections, these are the regions where heavy rainfall and an increase in windy days are most expected. These two climate hazards also apply to the Eastern Black Sea region, which also stands out in terms of exposure as it marks a corridor where transportation is concentrated. In terms of days with strong winds, projections point to the Aegean Region as well as Marmara and Eastern Black Sea, and the concentration of transportation in this region is also an important issue. Therefore, it is important to take precautions against flood and flood risks and strong winds on highways in the aforementioned busy transportation corridors and foci.

The risk of heat and waves also comes to the fore in terms of freight transportation concentrated in the Central Anatolia Region and Adana-Osmaniye-Hatay corridor: In line with climate projections, these regions are the regions where temperature increase and heat waves are expected the most and the risk of fire is also high. As corridors where freight transportation is concentrated, issues such as melting / vomiting of asphalt and the suitability of the landscape along the road against fire risk will be important for the sustainability of transportation and traffic safety.

In addition to the general flow chart analysis of the road network, passenger and freight transport densities analyzed by considering provincial borders show that Istanbul has a much higher density than other provinces. The passenger-km traffic density is almost twice as high as the density in Izmir and Ankara, which follow Istanbul. At this point, it should be reminded that the analysis is related to the highway network and does not include all of the density in urban transportation connections. This situation requires that adaptation efforts against climate hazards in Istanbul, as the province with the highest exposure, should be handled with care.

In our country, highways are the most intensive means of transportation activity.

The fact that it is a mode of transportation has led to a policy of continuous expansion of the road network (including highways). It should not be forgotten that highway and motorway investments made to meet the intense demand are a factor that increases the asphalt surface and decreases the permeable surface, thus increasing the risk of flooding and flooding in case of heavy rainfall. In this context, in the analysis of provinces, an assessment was made regarding the areas covered by highway and motorway infrastructure within the provincial surface area, and it was taken into account that the sensitivity may increase in provinces with relatively more highway surface area. According to this analysis, the share of highway area within the provincial borders of Istanbul in the provincial surface area is significantly higher than in other provinces. When urban roads are added to this calculation, the ratio will increase. Istanbul is followed by Kocaeli and Yalova in the same region, and then Izmir, Sakarya, Trabzon and Hatay. Istanbul, Kocaeli, Yalova, Sakarya, Sakarya and Trabzon, which are located in the Marmara and Black Sea Regions, where the increase in total precipitation is expected to be the highest, emerge as the provinces that are expected to be highly vulnerable in this respect.

Although modes of transportation other than road are of limited use in transportation in Turkey, considering the increasing trend in air transportation in passenger transportation, it is seen that climate change impacts in this sub-sector will also increase exposure. Istanbul is the province with the highest number of air travel with two airports within the provincial borders. There is also a significant density at Antalya, Ankara, Izmir, Adana, Muğla and Trabzon airports, and these airports, which are both high-cost and vital for the tourism sector, stand out as critical infrastructures.

In our country passenger Although the share of rail in transportation is low, it is high.

HSR lines with investment costs are considered as critical infrastructures that have an important place in the country's transportation strategy. In provinces with HSR lines, attention should be paid to the risks of climate change. In this context, Istanbul, Kocaeli, Sakarya, Bilecik, Eskişehir, Ankara, Konya, Karaman and Sivas are the provinces that should be evaluated in terms of the resilience of this infrastructure within provincial borders.

Although the share of domestic maritime transportation is limited in our country, we have ports that are logistically critical and intensively used in freight transportation. Especially considering the density in Kocaeli, Istanbul, Tekirdağ and İzmir Aliağa Ports, resilience is an important issue in these ports, which can be defined as critical infrastructure. Due to the location of the first three ports, the risk of flooding and flooding in the face of expected heavy rains comes to the forefront; for Izmir Aliağa Port, the fact that this region is the region where an increase in the number of extremely windy days is expected is an important issue for port services, ships underway and in port.

Climate Change Impacts on Urban Transportation

The fact that pedestrian trips are still significant in urban transportation in our country and that pedestrians are the most vulnerable users in the face of extreme weather events and heat waves makes this issue a priority. Resilient pedestrian infrastructure, protective measures against climatic conditions, and the development of engineering or nature-based solutions to provide shade and shelter are a necessity. Cycling is still limited, but all interventions can protect cyclists as well as pedestrians from risks.

In urban transportation in our country, after pedestrian trips, the most used transportation is public transportation. Therefore, if these systems are affected by climate risks, the number of people who will be exposed to these risks will be high. In addition, especially during heat waves, the heat effect and related health risks may increase even more due to the high occupancy rate in public transportation systems with a relatively high number of users.

For users of intermediate public transportation systems such as minibuses and minibuses, the level of sensitivity can be expected to be even higher, because in these vehicles, which are generally smaller, the increase in the number of passengers the impact on comfort and temperature conditions, while the lack of a standard practice on the presence and use of vehicle air conditioning systems are important problems.

For cities with a water element, the negative effects of extreme weather events are inevitable on routes where public transportation services are provided by ferries, ferries and sea buses.

The rapid increase in automobile use in our cities makes urban corridors with high traffic density and congestion more sensitive. The main cause of traffic congestion in these corridors is the high number of automobiles, but all users are affected. During floods and overflows caused by excessive rainfall, evacuation possibilities are limited on congested roads. In cities where multi-storey intersections have been built in parallel with the increase in automobile use, it has been observed that these investments have not solved the problem of traffic congestion, and that multi-storey intersections are infrastructure elements that fill up rapidly during floods and floods and create serious life risks as they are extremely difficult to evacuate.

Population size in cities is also an important indicator when assessing exposure levels. In settlements with a high population, mobility and the number of trips are also high. Population density means density in traffic congestion is a factor that can increase rainfall. In addition, population density brings with it building density, which may also mean that there is less permeable surface in the city against heavy rainfall. In this respect, in Istanbul, Kocaeli, Yalova, Bursa, Sakarya in the Marmara Region, where an increase in heavy rainfall is expected the most, population density will increase the vulnerability to floods and overflows due to the low permeable surface, as well as evacuation difficulties due to the possibility of traffic density and congestion. In fact, current experiences already reveal these problems and risks for these cities. The Black Sea Region is also a region where an increase in precipitation is expected, and the relatively high population density in Zonguldak, Trabzon, Samsun and Ordu should be considered in this context.

As expected, the number of vehicles in the provinces, another factor that may increase traffic congestion, emphasizes the province of Istanbul. However, in order to evaluate traffic congestion, the number of vehicles should be proportioned to the population. The provinces with the highest car ownership are Ankara, Muğla, Antalya and Burdur. These provinces are risky cities in terms of traffic congestion, and therefore may face evacuation difficulties in case of emergency intervention.

The cities with the lowest levels of automobile ownership are generally those with low income levels. It would not be erroneous to assume that people living in these cities make most of their journeys by walking, cycling and public transportation. For walking, cycling and public transportation users, all climate hazards pose serious risks; however, heat waves are a particularly important health hazard for these users. According to climate projections, temperature increases are most likely to occur in Eastern and Southeastern Anatolia and Central Anatolia, while heat waves are expected to occur especially in Southeastern Anatolia. In this case, in all Eastern and Southeastern Anatolian provinces where walking, cycling and public transportation use is relatively high, walking and cycling access conditions should be provided in a way that is sensitive and resilient to heat waves, and necessary measures should be taken in public transportation.

It can be said that cities with high-quality, high-capacity public transportation systems with a high level of service have a high adaptive capacity. In particular, urban rail systems are seen as elements that increase adaptive capacity due to their features such as air conditioning, travel comfort and not being affected by traffic congestion. These systems are also extremely costly investments and should be considered as critical infrastructures that need to be protected against climate hazards.

It is also important for cities to have a transportation master plan in terms of adaptive capacity. is also a significant potential for adaptive capacity in cities that have adopted transportation systems management and accordingly demand management, traffic management and intelligent transportation systems practices. While this capacity has been developed to manage and reduce traffic congestion, it can also be used as an effective tool to provide emergency management during climate change hazards and to redirect demand to safer corridors and modes. The effectiveness of these interventions will of course also depend on the quality of the communication infrastructure.

Climate Change Impacts in the Communications Sector

When the use of communication infrastructure and communication opportunities in Turkey is analyzed, the provinces with the lowest rates of mobile phone ownership and 3G and 4.5G subscriber rates are Şırnak, Muş, Bitlis, Van, Siirt, Batman, Mardin, Şanlıurfa, Iğdır and Gümüşhane. Şanlıurfa, Diyarbakır, Van, Bitlis, Şırnak and Muş are the provinces with the lowest penetration level, which is the ratio of the number of Internet subscribers to the population. It should be noted that there is a significant lack of capacity and sensitivity in these provinces, which are concentrated in Eastern and Southeastern Anatolia, in terms of early warning and communication capability before and during climate change hazards and disasters.

The ratio of the number of fixed broadband internet subscribers in the number of broadband internet subscribers indicates that the user's efficiency based on information technologies may be higher, that business is or can be done with more and high volume of data, and thus the potential for development in the field of information technologies, and the prevalence or potential of informatics and R&D institutions in this direction; it plays an indicator role in these matters. In terms of this indicator, there is a significant lack of capacity and sensitivity in Eastern and Southeastern Anatolia provinces.

The ratio of fiber infrastructure subscribers in the number of fixed broadband internet subscribers is important in terms of the quality of the connection and the potential for business volume based on internet technologies. Regional variations in the share of fiber infrastructure subscribers are limited; however, due to the high cost of this infrastructure element and the important role it plays in the provision of quality services in the communication sector, it should be protected.

critical infrastructure and its resilience needs to be increased.

Another important issue in terms of critical infrastructure is data centers in the communications sector. These centers are most densely located in the Marmara Region. Especially in this region, where an increase in the number of heavy rainfall and windy days is expected, the resilience of these data centers is an important issue.

Risk Analysis in Transportation and Communication Sector: Heavy Rainfall and Heatwave

Transportation and Communication sectors the different indicators for heavy rainfall and heat waves, which are the main climate hazards affecting the countryare analyzed one by one above. provinces based on one These assessments were then taken together with provincial climate projections and a national risk analysis and modeling was conducted. The impact chain used in the analysis is presented in Figure 46.

For the risk analysis for heavy rainfall in the transportation sector, elements such as population density, intensity of road use, ratio of road and highway surface area to provincial surface area, number of motor vehicles and critical infrastructures such as airports, ports, YHT, as well as the form and continuity of settlements in the provinces taken into consideration in determining the level of exposure.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Yağış miktarı ve sıklığında artış	Sel ve taşkın	Nüfus yoğunluğu	Su yüzeyleri oranı	Yeşil şehir alanları oranı	Trafik güvenliğinde bozulma
	Şiddetli yağışlı gün sayısında artış	Karayollarında toplam yolcu taşımacılığı	1000 kişi başına otomobil sayısı	Mobil telefon abone sayısı oranı	Halk sağlığında bozulma
		Karayollarında toplam yük taşımacılığı	Nüfus artış hızı	Atıksu arıtma tesisi ile hizmet verilen belediye nüfusu oranı	Ekonomik kayıplar: erişim, altyapı
		Karayolu ve otoyol yüzeyi oranı	Yaşanan toplam sel ve taşkın sayısı	Kanalizasyon şebekesi ile hizmet verilen belediye nüfusu oranı	Acil servis erişiminde aksama
		Motorlu kara taşıt sayısı	Altyapının niteliği, drenaj özellikleri*	KDD ve TCDD tarafından projelendirmede dere yatağı geçişleri, drenaj ve sanat yapılarının meteorolojik veriye göre projelendirilmesi*	
		Sürekli şehir alanı oranı	Geçirgen olmayan karayolu asfalt yüzeyin en fazla olduğu iller*	Türel ve güzergah çeşitliliği*	
		Havalimanları, tren hatları, limanlar*	Çevredeki kapatılmış dere yatakları*	Afet Yönetim Planları*	
			Taşkın ve dere yatakları geçişlerindeki sanat yapılarının niteliği*	Kullanıcı bilgilendirme ve talep yönetimi*	
			Sulak alanlarda konumlanan ulaşım altyapıları*		

Figure 46 Impact Chain: Transportation Sector and Heavy Rainfall

*The * symbol indicators not used in risk analysis.*[6]

[6] These indicators have not been used in risk analyses due to lack of comparable data, but it is considered useful to take them into account in future studies.

Factors that increase susceptibility to heavy rainfall are the proportion of water surfaces in the provinces, automobile ownership, population growth rate, and the number of floods and floods experienced. Of course, the quality of the infrastructure and drainage features, closed stream beds in the vicinity, the quality of art structures at flood and stream bed crossings, and the presence of transportation infrastructures located in wetlands will also increase sensitivity. However, these are indicators for which a comparative data infrastructure is not yet available for our provinces.

The proportion of green areas in settlements, the proportion of mobile phone subscribers, the proportion of municipal population served by wastewater treatment plants, and the proportion of municipal population served by sewerage networks were taken into consideration as adaptive capacity. In our country, KGM and TCDD take measures for climatic conditions in the design of highways and railways, and there is an adaptation capacity in this direction. However, since these are issues that cannot be compared on a provincial basis, risk not covered in the analysis, but highlighted as information in the impact chains. Providing a diversity of modes and routes will also create an important adaptive capacity; in addition, early warning, information and response capacity can be increased by making Disaster Management Plans.

In light of these data, according to the transportation sector risk map obtained for the current period for heavy rainfall hazard and presented in Figure 47, although there is a high risk in Istanbul, Kocaeli, Yalova and Tekirdağ in the Marmara Region, the risk is highest in Sakarya and Balıkesir. Manisa and Muğla in the Aegean Region; Mersin, Osmaniye, Hatay, Kahramanmaraş and Diyarbakır in the south; and Konya in Central Anatolia stand out as the provinces with the highest risk. In the north, a risk zone in the form of a continuous corridor is observed in the Central and Eastern Black Sea regions.

Figure 47 Current Period Risk Map: Relationship between Transportation Sector and Heavy Rainfall

Similar indicators such as population density, settlement structure and continuity were used in the risk analysis of the communication sector against the threat of heavy rainfall; in addition, the length of fiber optic cable, which is considered as critical infrastructure, also taken into account at the exposure level. Lack of data Although not included in the assessment, the nature of the infrastructure and the fact that it has been damaged for any reason and has risen to the surface is also an important issue, as seen in the impact chain diagram presented in Figure 48.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Yağış miktarı ve sıklığında artış	Sel ve taşkın	Nüfus yoğunluğu	Süreksiz şehir alanı oranı	Yeşil şehir alanlarının oranı	Ekonomik kayıplar: altyapı
	Şiddetli yağışlı gün sayısında artış	Fiber optik kablo uzunluğu	Su yüzeyleri oranı	Orman alanları oranı	Acil servis erişiminde aksama
		Sürekli şehir alanı oranı	Nüfus artış hızı	Mobil telefon abone sayısının oranı	Halk sağlığı
		İletişim altyapıları: Altyapının hasar görmesi veya çökmeler sonucu yüzeye çıkması*	Yaşanan toplam sel ve taşkın sayısı	Atık su arıtma tesisi ile hizmet verilen belediye nüfusunun oranı	Havayollarında aksama ve trafik güvenliği sorunları
		İletişim altyapısını yoğun kullanan sektörler ve firmalar*	Altyapının niteliği, drenaj özellikleri*	Kanalizasyon şebekesi ile hizmet veren belediye nüfusunun oranı	
			Kanalizasyon ve yağmur suyu sistemi*	Projelendirmede drenaj konusuna verilen önem*	
			Geçirgen yüzey miktarı*	Altyapı planları*	
			Kapatılmış dere yatakları*	Afet Yönetim Planları*	
			Yüksek maliyetli fiber optik kablo altyapısının en fazla olduğu iller*	İnternet destek sistem ve planları*	

Figure 48 Impact Chain: Communication Sector and Heavy Rainfall

*The * symbol indicates indicators that are not used in risk analyses* [7].

[7] These indicators have not been used in risk analyses due to lack of comparable data, but it is considered useful to take them into account in future studies.

Data such as the sectors and number of companies in provinces that use communication infrastructure intensively should also be considered if reliable comparable data infrastructure is available. In terms of adaptive capacity, the inclusion of drainage in project design and the existence of internet support systems and plans in provinces are also important as highlighted in the impact chain; however, comparable data infrastructure is not available.

In the light of these data, the communication sector risk map obtained for the threat of heavy rainfall is given in Figure 49. According to this

The highest risk provinces are Sakarya and Düzce, two neighboring provinces in the Marmara and Western Black Sea Region; Samsun, Ordu, Giresun, Trabzon, Rize in the Central and Eastern Black Sea Region; Manisa in the Aegean Region; and Mersin, Osmaniye, Hatay, Kahramanmaraş, Diyarbakır and Şırnak in the south. When high and medium risk provinces are also taken into account, a concentration is observed in the coastal regions, while Konya and Kayseri in the inland region have relatively high risk.

Figure 49 Current Period Risk Map: Relationship between Communication Sector and Heavy Rainfall

The indicators used to determine exposure in the risk analysis for temperature increases and heat waves in the transportation sector include population density, intensity of use and settlement form (due to the urban heat island effect). In addition, the number of intercity bus and train passengers should also be taken into account when a database is created to enable analysis. In the sensitivity analysis, the settlement form, the proportion of road and highway surface in the provinces,

population growth rate and car ownership as an indicator that can provide information on public transport, walking and cycling. Bus occupancy and average travel times, bus air conditioning facilities and vehicle equipment, traffic density, road pavement material and its effect on temperature, roadside landscape features should also be considered if comparable data is available on a provincial basis. In terms of adaptive capacity, indicators similar to heavy rainfall conditions were used.

and can also increase adaptive capacity in the future indicators regulation has been made regarding the occupancy rates of public transportation vehicles in settlements

also underlined by a chain of influence (Figure 50).

the presence of roads with trees and shade, roadside landscaping features and road pavement material, vehicle air conditioning and vehicle exterior surface conditions

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Ortalama sıcaklık artışı	Sıcak hava dalgası	Nüfus yoğunluğu	Süreksiz şehir alanı oranı	Nüfus artış projeksiyonu	Yolculuk konforunda ve sağlık koşullarında düşme
Aşırı sıcak gün sayısında artış	Ardışık sıcak gün sayısında artış	Karayollarında toplam yolcu taşımacılığı	Karayolu ve otoyol yüzeyi oranı	Yeşil şehir alanları oranı	Asfaltta erime
		Karayollarında toplam yük taşımacılığı	1000 kişi başına otomobil sayısı	Mobil telefon abone sayısı oranı	Trafik güvenliğinde bozulma
		Sürekli şehir alanı oranı	Nüfus artış hızı	Doluluk oranına ilişkin düzenleme, denetleme ve yaptırım*	Halk sağlığında bozulma
		Şehirlerarası otobüs ve tren yolcuları*	Otobüs doluluk oranları*	İklim duyarlı olarak yenilenmiş otobüs filosu: İklimlendirme ve araç çatı dış yüzeyi*	Acil servis erişiminde aksama
			Otobüs seyahat süresi ve uzunluğu*	Ağaçlıklı ve gölgelikli yollar*	
			Seyahat süresine etki eden trafik yoğunluğu*	Karayollarında iklime göre farklılaşan yol malzemesi standartlarına ilişkin düzenleme*	
			Otobüs iklimlendirme koşulları ve diğer teknik özellikleri*	Yol kaplama malzemesi*	
			Karayolları kaplama malzemesi*	Yol kenarı peyzaj tasarım yaklaşımı*	
			Yol kenarı bitki örtüsü özellikleri*		

Figure 50 Impact Chain: Transportation Sector and Heatwave

*The * symbol indicates indicators that are not used in risk analyses* [8].

[8] These indicators have not been used in risk analyses due to lack of comparable data, but it is considered useful to take them into account in future studies.

The risk analysis map made with this data is given in Figure 51 and the risk of heat waves in the transportation sector is evaluated. Accordingly, most of the provinces in the Southeastern Anatolia Region have emerged as very high-risk provinces. In addition to these provinces, Aydın, Bolu, Konya, Manisa, Mersin, Muğla and Tekirdağ are among the very high risk provinces. When high and medium risks are taken account, a concentration is observed in the western and southern part of the country, while the eastern part and the Black Sea provinces have a low risk level for heat waves.

Figure 51 Current Period Risk Map: Transportation Sector and Heat Wave Relationship

In the risk analysis for heat waves in the communication sector, the exposed infrastructures and users and the indicators that increase sensitivity to heat are similar. In addition, although there is no comparable data on a provincial basis, the effective use of communication technologies and tools in early warning, emergency aid and response has been included in the impact chain as important indicators. Airline transportation is also a sector that makes intensive use of communication infrastructure and facilities. can be taken into account and included in the assessments. In terms of adaptive capacity, the presence of green areas in settlements in terms of microclimate and cooling effect, as well as mobile phone usage rates are important.

Considering the possibilities of data center collapse and fire due to heat wave, the existence of disaster management plans is of course an important capacity component, and the impact chain prepared in the light of this information is shown in Figure 52 with presented.

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[9] These indicators have not been used in risk analyses due to lack of comparable data, but it is considered useful to take them into account in future studies.

TEHLİKE		MARUZİYET	ETKİLENEBİLİRLİK		RİSK
İklim Sinyali	İklim Etkisi		Duyarlılık	Uyum Kapasitesi	
Ortalama sıcaklık artışı	Sıcak hava dalgası	Nüfus yoğunluğu	Süreksiz şehir alanı oranı	Nüfus artış projeksiyonu	İletişim sinyallerinde kayıp
Aşırı sıcak gün sayısında artış	Ardışık sıcak gün sayısında artış	Fiber optik kablo uzunluğu	Karayolu ve otoyol yüzeyi oranı	Yeşil alanlar oranı	Yangınlar
		Sürekli şehir alanı oranı	Nüfus artış hızı	Mobil telefon abone sayısının oranı	Acil servis erişiminde aksama
		İletişim sistemleri*	İletişimin acil müdahale ve afet sırasındaki haberleşme için hayati önemi*	Afet Yönetim Planları*	Havayollarında aksama ve trafik güvenliği sorunları
		İletişim altyapısını yoğun kullanan sektörler ve firmalar*	İletişim altyapısını yoğun kullanan havayolu sistemleri*		

Figure 52 Impact Chain: Communication Sector and

** symbol indicates indicators not used in risk analysis*

The communication sector risk analysis map for the heatwave hazard is presented in Figure 53, which shows that most of the provinces in the Southeastern Anatolia region are either very high or high risk provinces. Adjacent to this region, the provinces of Kayseri, Konya, Mersin and Niğde are at very high risk. The findings of the survey are noteworthy. In addition, Aydın, Denizli and Manisa in the Aegean Region and Tekirdağ in the Marmara Region are very high risk provinces. As also identified in the transportation sector, the eastern part of the country and the Black Sea provinces have a low risk level for heat waves.

Figure 53 Current Period Risk Map: Communication Sector and Heat

10.4. ADAPTATION MEASURES

Resilience of critical infrastructures climate-induced disasters the vital role of transportation and communication will be taken into account and transportation and communication efficiency and passenger health will be ensured; greenhouse gas climate mitigation with emissions reductions synergies will be created between change adaptation strategies.

Ensuring resilience against climate change hazards in the transportation and communication sectors, which play a vital role in our country's economic and social development, public health, safety and quality of life, ensuring passenger health, and ensuring uninterrupted transportation and communication activities that affect many economic sectors are of utmost importance. In addition, transportation and communication have critical importance in terms of early warning, response, evacuation and communication opportunities against climate hazards. Therefore, adaptation, resilience, efficient and effective functioning of these sectors should be ensured within the scope of climate change adaptation actions.

In Turkey, the impact of the transportation sector on climate change has been comprehensively addressed and evaluated, and GHG emission mitigation strategies and actions have been adopted in many policy and strategy documents and legislation regarding this sector, which plays an important role in GHG emissions. However, actions regarding the impact of climate change on the transportation sector and ensuring the resilience of the sector against these impacts, in other words adaptation, have remained limited. However, there is a high potential for synergy between GHG emission mitigation and climate change adaptation strategies. For example, within the scope of GHG mitigation strategies, developing railways and increasing their share in passenger and freight transportation, which have been adopted in Turkey's policy documents

The railways will only be resilient in the face of climate hazards, able to provide uninterrupted freight and passenger transportation, and able to provide a level of service that can ensure passenger health by taking climate conditions into account. Similarly, public transportation systems, bicycle and pedestrian conditions should be climate compatible to minimize the impact of heavy rainfall and heat waves, which are the main climate hazards, and encourage the use of these modes. Moreover, due to the critical role of urban rail systems in meeting the mitigation target, these infrastructures should be protected from climate hazards by ensuring their resilience. Another issue of great importance in terms of GHG mitigation is modal diversity in both national/regional transportation and urban transportation, and this action is also of strategic importance in terms of adaptive capacity: The existence of a multi-modal, multi-alternative, flexible transportation infrastructure and operating system reduces GHG emissions by changing road- and automobile-based transportation trends, while providing a capacity to manage and direct access and transport demands in emergency situations due to climate hazards.

Therefore, the main strategic objective of the transportation and communication sector in the Climate Change Adaptation Strategy and Action Plan is set as follows:

Resilience of critical infrastructures will be enhanced; passenger health and transportation and communication activities will be safeguarded; efficient and effective transportation and communication will be ensured during climate change-induced disasters; synergies will be created between isera gas emissions mitigation and climate change adaptation strategies.

In line with this main objective, 4 strategic sub-objectives have been identified and adaptation actions have been established under them:

Ensuring the resilience of critical infrastructures in transportation and communication.

It includes actions that focus on increasing the resilience of critical infrastructures and ensure that infrastructures are more ready and resilient to climate change hazards through technological interventions and engineering solutions. While there is a need to ensure resilience for all infrastructures, some infrastructures and some regions and corridors may be prioritized according to the level of exposure, i.e. intensity of use, and resilience can be increased through the integration of emerging technologies. In addition, infrastructures that serve the country's economic and social development goals and ecological protection policies also need to be protected and secured by ensuring their resilience. In line with these two criteria, some infrastructures are considered as critical infrastructures and detailed explanations are given in the previous sections. Therefore, protection and resilience of the most intensively used critical infrastructures, which are of strategic importance for our country, against some climate change hazards, taking into account the high-risk regions in terms of climate hazards, are priority action areas.

In this context, 3 main actions have been identified for the resilience of regional transportation, urban transportation and communication infrastructures.

First action on roads, railways, in ports In line with future climate projections, it is envisaged that critical routes and infrastructures at airports and airports, for which requirements are identified in line with future climate projections, will be made resilient against floods, floods, fires, strong winds and storm risks.

In line with this action, conducting a baseline assessment and needs assessment for all infrastructures will be an important step. Nevertheless, some of the findings made within the scope of this study and evaluations will shed light on prioritization and phasing.

For example, to increase the resilience of highways to flooding and inundation, infrastructure interventions such as culverts, evacuation pumps, protective barriers and trenches for flooding and inundation should be implemented in the Marmara Region, Aegean Region, Samsun and the Eastern Black Sea Region, where the intensity of use is high and where heavy rainfall is most expected. Regarding the danger of temperature increases and heat waves, the use of road materials resistant to asphalt melting/vomiting should be considered as a priority intervention throughout Central Anatolia and the Mediterranean Regionespecially in the Konya-Mersin and Adana-Osmaniye-Hatay corridors, where these climatic events are most expected.

Resilience against floods and overflows caused by heavy rains, which affect railways, which have an important place in the country's strategies, should be ensured, protective barrier and trench measures should be implemented where necessary in line with future climate projections on both YHT and HT routes and conventional lines, and monitoring with sensors should be implemented. technologies The use of these measures should be expanded. The presence of such measures for the current climate conditions on HSR and HT lines is a valuable capacity component and the requirement should be assessed in the context of future climate projections.

Measures should also be taken for uninterrupted rail-ferry service. In particular, in order to prevent the shallowing in Lake Van from adversely affecting the railway-ferry operation, interventions such as dredging of the Van Pier and rehabilitation of the dock-ramp, which have already been planned by the relevant institutions, should be implemented rapidly within the scope of this action.

The development of maritime routes is also an important part of our country's long-standing commitment to multimodal is a critical issue in terms of transportation strategy. In Kocaeli, Istanbul and Tekirdağ Ports and İzmir Aliağa Port, measures should be taken against floods and overflows as well as strong winds and storms, and assessments should be made on the technical components of vehicles used in domestic and international ferry services across the country to ensure their climate resilience.

Airports are also critical infrastructures where resilience needs to be increased. Infrastructure measures should be taken against these risks at airports in Istanbul, Izmir, Muğla and Trabzon provinces, which are located in regions where heavy rainfall, strong winds and storms are expected. In addition, drainage assessments should be made and engineering measures should be taken due to the location of Milas-Bodrum Airport in the Güllük Delta and wetlands and the location of Samsun Çarşamba Airport.

The second action concerns the resilience of urban transportation infrastructures. In case of heavy rainfall, additional structural elements should be constructed at vehicle and pedestrian road stream crossings in cities; drainage pumps should be installed at multi-level intersections and drainage systems of vehicle roads should be improved. The selection of pilot provinces for this action can be determined according to the results of the risk analysis. Balıkesir, Diyarbakır, Giresun, Hatay, Hatay, Kahramanmaraş, Konya, Manisa, Mersin, Muğla, Ordu, Osmaniye, Rize, Sakarya, Samsun and Trabzon provinces, which are the provinces with the highest risk in terms of the impacts of heavy rainfall on the transportation sector, can be considered within the scope of pilot projects.

It is also important to ensure the resilience of urban transportation infrastructures against heat waves and to use resilient materials. The provinces of Southeastern Anatolia, which are the provinces with the highest risk for the transportation sector in terms of heat waves, and Aydın, Bolu, Hatay, Kahramanmaraş, Konya, Manisa, Mersin, Muğla, Osmaniye and Tekirdağ should be considered for pilot applications.

It is also important to make infrastructures, from pedestrian and bicycle transportation to automobile and public transportation (including public transportation modes that use maritime transportation facilities), sheltered and resilient against wind and storm hazards. Especially in coastal cities, protective barrier and shelter measures should be taken to protect roads from storms and sea waves.

As mentioned before, in settlements that have invested in urban rail systems, which are critical infrastructure, these infrastructures should also be made resilient to all kinds of climate risks, and this issue is also emphasized within the scope of the action in question.

The third action addresses the resilience of critical infrastructure in the communications sector. As a high-cost infrastructure, all electronic communication infrastructure, especially fiber-optic cable infrastructure, is a critical infrastructure and needs to be made resilient against climate hazards. In addition, in the Marmara Region, where the data centers in the communication sector are located most intensively, the resilience of these centers against all climate hazards should be increased.

In line with climate projections in highways, railways (HSR, HT and conventional lines), ports and airports needed critical climate change of routes and infrastructures

sourced risks against resistant hale from to be brought in.

NCC2. Make urban vehicle, bicycle and pedestrian roads and all public transportation (rail, bus, maritime transport) infrastructures resilient to climate change-related risks.

NCC3. Protecting data centers, base stations and electronic communication infrastructure in the communication sector against climate disaster risks to make them resistant.

Strategic Objective 2. Ensuring transportation and passenger health by reducing the level of vulnerability.

The strategic objective aims to minimize the vulnerability of both infrastructures and users, and includes actions to ensure passenger health through various engineering measures as well as nature-based solutions, and to ensure uninterrupted service delivery in transport and communications.

One of the factors that increase the vulnerability to heavy rainfall, floods and overflows, which are the main hazards affecting the sector, is the decrease in permeable surfaces due to urbanization and the development of transportation networks. Therefore, increasing permeable surfaces will increase the absorption of rainwater during heavy rainfall and reduce the destructive effect. For this reason, the use of highly permeable paving materials on hard surfaces of roads, pavements, squares and parking lots in urban settlements, provided that they do not adversely affect road stabilization conditions, has been identified as one of the main actions towards this target.

In addition, increasing the permeable surface by building green infrastructures in cities is one of the areas of action that will be effective in this regard. Green infrastructures include not only green areas but also green roofs (in this context, public transportation stop roofs), green facades, roadside trees and landscaping. Planning these systems in continuity will also enable them to function as drainage channels.

In addition to green infrastructures, blue infrastructures can also provide continuous drainage. Many river beds in our cities have been closed in the process of urbanization over time, which significantly increases the level of vulnerability. The fact that some riverbeds have been closed and converted to asphalt means that during heavy rainfall, the movement of water that cannot find its way along these roads and in the stream bed can cause flooding in various parts of the city. Therefore all our settlements, making the closed rivers, streams and canals visible again and landscaping around them as green and blue infrastructure areas will also reduce vulnerability.

Green and blue infrastructures function as wind corridors as well as drainage channels and can reduce vulnerability to heat waves. Therefore, the action emphasizes green and blue infrastructures in reducing the impact of both heavy rainfall and heat waves.

Passenger health in vehicles is a critical issue in the face of heat waves. Therefore, another action should be to ensure that buses and minibuses used for intercity passenger transportation, as well as vehicles providing public transportation services in cities, have air conditioning and ventilation systems; measures such as renewing the exterior surfaces of vehicle roofs with the use of materials and colors that do not let in high heat should be implemented. The provinces in the Southeastern Anatolia Region and Aydın, Bolu, Hatay, Kahramanmaraş, Konya, Manisa, Mersin, Mersin, Muğla, Osmaniye and Tekirdağ, which are the provinces with the highest risk for the transportation sector in terms of heat waves according to the risk analysis, should be prioritized as pilot regions and provinces.

Another action that can reduce the impact of the heat wave on travelers and include measures to address the risk of fire is the use of cooler pavements and landscape elements on roads. Renovation of roads using pavements with cooler pavements should be considered in areas with high road temperatures and in urban areas with heat island effect.

It would be appropriate to consider the provinces listed above as pilot regions and provinces.

Areas with high temperatures on highways are also areas where the risk of fire increases. Therefore, identifying roadside landscape elements that increase the risk of fire and replacing them with suitable alternatives is an important issue in terms of transportation, communication and passenger health and safety and is included in the scope of this action. Roadside landscaping should also be considered in terms of providing shelter and shade in urban areas. Providing tree-lined and sheltered roads for both vehicular, pedestrian and bicycle routes is an important issue in terms of heat waves. can reduce vulnerability. In addition, at intersections and crossings where waiting can be made on bicycle and pedestrian paths, sheltered and shaded areas should be created with trees or materials that also have green roof features. Of course, for bicycle paths, it is important to choose landscaping whose roots will not adversely affect the road surface.

While implementing these action proposals aiming to ensure passenger health, "universal design standards" that take into account the needs of users with mobility restrictions (such as disabled, elderly, pregnant, pregnant women, children, etc.) should be observed and the requirements of the principle of fair access for all should be fulfilled.

NCC4. Use of highly permeable paving materials on hard surfaces of roads, sidewalks, squares and parking lots in urban settlements.

NCC5. Increase green and blue infrastructures, permeable surfaces and drainage facilities in urban settlements and mitigate the impact of heat waves.

NCC6. Public transportation, school buses vehicles and intercity

transportation used bus passe nger

in minibuses air conditioning an d an d an d

renewal of private and public public transport vehicle fleets with ventilation systems and the use of materials and colors that do not let in high temperatures.

NCC7. Evaluation of pavement materials that reduce surface temperature where high temperatures are experienced on highways and urban roads, afforested and sheltered vehicle, bicycle and pedestrian paths

landscaping that increases the risk of fire

elements of approp with

changing it. riate alternatives

Increasing emergency management and response capacity by improving accessibility, communication and evacuation capabilities during climate-related disasters.

Improving accessibility, communication and evacuation capabilities to enhance emergency management and response capacity during climate-related disasters. The main issue in this context is a transportation system that offers a diversified infrastructure and accordingly multi-modal transportation. Establishing a flexible transportation infrastructure with a high level of modal diversity and inter-modal integration possibilities across the country, and in this context, developing rail and maritime alternatives where possible, will not only serve mitigation strategies, but also ensure effective management of travel demands and traffic in case of emergency, and increase rapid response and evacuation possibilities. For example, during the fire hazard in Muğla and Antalya provinces in July 2021, it was understood that maritime evacuation facilities were an extremely important capacity component. Changing the road-dependent transportation system is therefore an action that provides synergies between mitigation and adaptation strategies.

The same is true for urban transportation. By developing opportunities for species diversity and interspecies integration in cities

The capacity to intervene and evacuate in emergencies is also greatly increased, and emergency traffic management is rendered efficient and effective.

In line with this action, investments should be made to improve rail and maritime transportation; maritime transportation alternatives should be developed within the scope of urban transportation in seaside settlements; maritime transportation should be integrated with the terrestrial public transportation system and systems such as bicycles and e-scooters as micromobility transportation. Similarly, cycling infrastructure should be developed and integrated with public transportation. Integration of automobile and public transportation is also one of the interventions that should be considered within the scope of this action.

The role of advanced and qualified public transportation systems in ensuring diversity in cities is of utmost importance. In this context, it is important to plan rail systems (supported and justified by urban transportation demand forecasts, of course), which provide a relatively healthier transportation opportunity and a high level of service in the face of climate hazards, especially heat waves. In addition to rail systems, as a frequently emphasized issue in the world literature, the widespread use of dedicated bus lanes and bus lanes as a fast and effective alternative in case of emergency in urban transportation this Action should be evaluated within its scope.

Modal diversity and integrated transportation is a capacity component that increases response and evacuation capacity and reduces the number of users affected by traffic congestion and congestion and potential accidents. In this context, more extensive use of pipeline infrastructures in fuel transportation should also be considered in line with this diversification action. In particular

In severe storms and rainfall, as well as in heat waves, accidents of fuel vehicles due to climate hazards pose serious risks. Since highways are already a heavily used transportation infrastructure, the number of users affected, i.e. the level of exposure, is high. Expanding the transportation of these hazardous fuels through pipelines could contribute to the goal of multimodal transportation and reduce the level of negative impact on road response and access in emergency situations.

Another action to increase emergency management and response capacity during climate-related disasters is, of course, the preparation of Transportation Communication and Climate Change Emergency Action Plans. These plans should be prepared at both national and urban scales, and the principle of improving emergency management by prioritizing vulnerable groups should be adopted.

Within the scope of this action, early warning and information systems for climate hazards should also be developed by taking into account transportation and communication infrastructures; in this context, early warning and information systems should be differentiated for long (15-day), medium (weekly) and short-term (daily/hourly) weather forecasts and all kinds of climate hazards. In the process of developing early warning capacity, wind and other climate sensors should be deployed on critical transportation routes. opportuniti es should be evaluated.

Smart City and Intelligent Transportation Systems should also be considered as important tools for early warning and information. The development of applications related to travel routes and options, including climate hazards and emergency information, features to guide travel demands is also emphasized within the scope of this action.

Of course, uninterrupted operation of communication systems is essential for the effective use of both such smart city applications and early warning, emergency information and response-evacuation capacity. Therefore, another action within the scope of this strategic objective is to ensure the uninterrupted and effective operation of communication tools such as data centers, internet, cameras, etc. with infrastructure support for additional energy provision.

NCC8. Establishing a flexible transportation infrastructure with a high diversity of transportation modes and high opportunities for inter-modal integration both in the country and in cities.
NCC9. Develop early warning and transportation information systems for climate hazards, including smart and mobile applications.
Providing infrastructure support for additional energy supply to ensure uninterrupted operation of communication systems such as data centers, fixed/mobile base stations, internet, camera, etc.

It is crucial to develop planning capacity as well as early warning and emergency management capacity.

Strategic Goal 4. In line with the goal of adaptation to climate change in the field of transportation and communication Planning Improving the capacity to do so.

Planning in the field of transportation and communication in line with the goal of adaptation to climate change don't capacity building for includes actions.

While two overarching actions have been identified for the transport and communication sectors, it be noted that there are cross-cutting action areas that address common needs with other sectors.

first action to improve planning capacity on transportation and on communication increase the resilience of infrastructures and increase the vulnerability of infrastructure and users to climate change hazards will reduce legal arrangements should be put into practice. In this context, as mentioned before, the existing EIA and SEA Regulations contain important statements and explanations on this issue, and detailed legislative arrangements should be made to assess the impacts of climate change on investment in planned new infrastructure investments, and to include adaptation and resilience issues in Environmental Impact Assessments, Strategic Environmental Assessments and feasibility studies.

The need to revise the bicycle regulation regarding local transportation planning and management issues and the development of a legislative framework that includes standards and inspection mechanisms for vehicles used in public transport services are also within the scope of this action.

Another comprehensive action relates specifically to improving local planning capacity. Design guidelines should be prepared to be used as a resource for local governments in their transportation planning efforts and in particular in the preparation of Urban Transport Master Plans. For example, design guidelines for the creation of tree-lined, shaded and sheltered roads and green infrastructures on streets and avenues, as well as guidance documents on the use of permeable paving materials will be important capacity building components. In addition, climate change adaptation should be included in Urban Transportation Master Plans, Sustainable Urban Transportation Plans (SUMP) and Bicycle Transportation Master Plans (BISUAP) at local level and effective strategies should be developed.

As mentioned above, some cross-cutting action areas with other sectors should also be mentioned. As it is not specific to the transport and communication sectors, it is not mentioned here as a separate action.

However, establishing an institutional structure that will ensure coordination between institutions at national and local level is of course of utmost importance in terms of transportation planning and investment and management of communication systems. Developing urban infrastructure plans and flood management plans, an important issue for the urbanization sector, is an urbanization sector action that will also benefit critical transportation and communication infrastructures. In addition, in order to increase planning capacity, it will be regularly collected at the scale of provinces, districts and neighborhoods, shared through open access, and will use big data opportunities. will include Establishing a comparable and reliable data infrastructure is of utmost importance for the transportation and communication sectors as it is for all sectors. Providing vocational trainings at national and local level on the effects of extreme weather events caused by climate change on transportation and communication infrastructures, response and adaptation; social

Awareness raising campaigns and informing the entire public about the impacts of climate change on transportation, access and communication are also cross-cutting actions that are also important for the transportation and communication sectors.

NCC11. Infrastructures in transportation and communication resilience will Infrastr an increase, ucture d from the dangers change of users climate will reduce its vulnerability the realization of legal arrangements.

NCC12. Establishing design guidelines on increasing green infrastructures and the use of permeable paving materials on streets and avenues to be used as a resource in transportation plans, adaptation to climate change within the scope of Urban Transportation Master Plans, Sustainable Urban Transportation Plans (SUMP) and Bicycle Transportation Master Plans (BISUAP) development of strategies.

SOURCE: Transportation and Communication

BTİK (2022). Provincial Annual Statistical Bulletin on Electronic Communication Sector, 2022. .Retrieved from https://www.btk.gov.tr/uploads/pages/yillik-il-istatistikleri/2023.pdf

UAB (2011). Turkey Transportation and Communication Strategy Target 2023

UAB (2022). https://www.uab.gov.tr/uploads/pages/bakanlik-yayinlari/ulasan-erisen-turkiye- Retrieved from 171122.pdf.

UAB (2022). 2053 Transportation and Logistics Ana Plan. https://www.uab.gov.tr/uploads/pages/bakanlik-yayinlari/2053-ulastirma-ve-lojistik- Retrieved from ana-plani-rev.pdf.

UAB (2011). Turkey Transportation and Communication Strategy Target 2023.

SOCIAL

RISE UP

climate adaptation

11.1. GENERAL FRAMEWORK

The impacts of climate change should be evaluated together through social equality and human rights norms. Because these impacts create new areas of poverty, deepen inequalities and increase the problems of society such as housing, nutrition, health and displacement.

Although climate change is a common concern of countries, the responsibilities to be taken by states in this struggle, both in terms of reducing emissions and adapting to the impacts, vary according to their socio-economic development levels. In international climate negotiations, poor and developing countries need to take measures against the negative impacts of climate change from developed countries. especially they need to receive financial support.

In addition to seeking solutions to these problems that poor countries will experience due to climate change by mobilizing global policies at the level of states, it is also important to recognize that society/individual climate vulnerability to the crisis Reduce, The need to discuss what can be done to increase resilience by strengthening adaptation capacities and to analyze how climate change affects social life by taking into account the social development policies of countries has become increasingly prominent. Because the target audience of the fight against climate change is individuals and societies.

In studies on the impact of reducing the vulnerability of societies to climate change, increasing resilience and adaptation capacities, on the social development policies of countries, the social dimension of adaptation to the impacts of climate change

It is specifically stated that climate change is an important integrative element of the provision policies. In the international literature and best practices in this field, it has been observed that in the beginning, the effects of climate change on public health were mostly addressed as social determinants, the loss of jobs and income of the society was slightly touched upon, and other factors that increase social inequalities were generally neglected. However, in the current situation, inequality-oriented problems, especially poverty, have come to the fore as indirect vulnerability factors of society to climate change.

Looking at climate change adaptation action from the perspective of social development policies in Turkey, as in all developing countries, it is too early to talk about the existence of holistic interaction (macro-economic and macro-ecological policies and integration with all sectors) in measuring the resilience and adaptation of individuals and society, and therefore to perceive climate change as a social development issue. In the literature review on Turkey, it is noteworthy that the number of studies on the subject at both national and local scales is low. In these studies, it is seen that environmental sociology is dealt with theoretically, and it is understood that the approach of climate sociology (or 'climate in sociology'), which is on the agenda today in the light of conceptual and theoretical developments in environmental sociology, is not mentioned. In Turkey, the link between climate change and social development is only recently coming to the agenda at the theoretical and practical level. Therefore, what are the impacts of combating climate change on social development policies and goals in Turkey and how the reflection of climate change on society in a framework

The question of how it should be evaluated has not yet been adequately answered.

Looking at the set of values of social development from the dimension of climate change means seeing the issue as a critically important area of structural transformation.

Considering that social development policies are not the primary/direct target in the fight against climate change, but encompass broader policies and practices, it is important to ensure that society's adaptation to climate change and especially vulnerable groups are protected from climate change. effects It is inevitable to evaluate the processes that focus on eliminating the vital concerns that will arise due to the disasters that have occurred/will occur due to disasters that have occurred/will occur with a holistic approach.

This situation is a major challenge in identifying the impacts of climate change on individuals/ various segments of society and

It also brings with it the need to develop innovative strategies and policies for adaptation action.

In the context of climate change and social development in Turkey, social protection and aid policies are more prominent, and the losses and damages of the society and especially the needy segments are ensured in the aftermath of climate hazards. In Turkey, it is observed that the top policy approaches related to the prevention of climate change-related disasters caused by climate change are more oriented towards managing the emerging crisis - focusing on the hazard. In this respect, legislation, policies, plans and practices focused primarily on post-disaster management are on the agenda. However, there a need to adopt risk management-oriented social development policies for the success of climate change adaptation action.

11.2. SECTORAL LEGAL FRAMEWORK AND RESPONSIBLE INSTITUTIONS

The principle of inclusiveness should be essential for society's climate change adaptation action, and all segments of society should be included in the process.

The legal and institutional structures and strategic approaches to linking climate change with society's daily life and future expectations, and evaluating social development policies within this framework in Turkey are examined below.

Climate change and social vulnerability in Turkey on A pioneering study titled "Participatory Vulnerability Analysis" was conducted within the framework of the Climate Change Adaptation Strategy and Action Plan (2011-2023).

In the "National Communication Strategy and Action Plan on Climate Change (2019)", specific target groups that are critical and of priority importance to communicate in the fight against climate change have been selected and communication policies specific to these target groups have been determined. In the plan, the need for an approach based on joint efforts, dialogue and cooperation with all segments of society for the climate struggle is emphasized.

On February 1, 2022, the "Report of the Parliamentary Investigation Commission Established to Determine the Measures to be Taken to Minimize the Impacts of Global Climate Change, Combat Drought and Make Efficient Use of Water Resources" was discussed in the General Assembly of the Grand National Assembly of Turkey (GNAT). The report shows that the capacity of populations to mitigate or adapt to the negative consequences of climate change is shaped by factors such as income, race, class, gender, financial and political representation, that vulnerable segments of society will be more exposed to the impacts, and that they will be more vulnerable to climate change. originating from risk factors; economic and welfare loss,

It is emphasized that climate change may cause damage to health and a decline in labor productivity, poverty and involuntary forced migration, and may create significant challenges for the provision of decent work. The report clarifies the concepts of just transformation, just transition and just adaptation in order to minimize the impacts of climate change and to ensure that societies adapt to these impacts economically and socially.

In addition to the 22 members of the Climate Change and Adaptation Coordination Board (IDCC), which is an important institutional organization for high-level decision-making, some new institutions may be needed to address climate change adaptation action within the framework of social development policies. Among the members of IDUKK, the lack of some ministries and institutions that will steer the impacts of climate change on society and social development and the adaptation policies needed in this context is noticeable.

Another ministry proposed to be a permanent member of the Climate Change and Adaptation Coordination Board is the Ministry of Justice. The Ministry of Justice is the ministry primarily responsible for the implementation of the Republic of Turkey Human Action Plan. The Ministry of Justice has been working in this field since the early 2000s (e.g. relevant legislation: "Regulation on the Establishment, Duties and Working Principles of Provincial and District Human Rights Boards", Official Gazette No. 25298 dated November 23, 2003).

The negative consequences of climate change are expected to be more severe for vulnerable groups, especially children, women, disabled and elderly people, and it is necessary to mitigate these impacts and ensure the adaptation of society to climate change. Measures to be taken in this context should be based on fundamental human rights, including the right to life.

It is expected to affect many rights such as the right to respect for life, the right to property, freedom of movement.

The Human Rights Action Plan of the Republic of Turkey ('Free Individual, Strong Society; A More Democratic Turkey', March 2021 Presidential Circular) includes the objective of "The impacts of climate change on fundamental human rights will be analyzed and the results will be taken into account when formulating public policies".

This target is a first and important initiative in Turkey in terms of addressing the social dimension of combating climate change in a rights-based manner, and the Ministry of Environment, Urbanization and Climate Change has been designated as the responsible institution for the follow-up and implementation of the work related to this target.

In the Human Rights Action Plan, the implementation of each activity within the stipulated period of time is entrusted to the ministries and public institutions and organizations responsible for the relevant activity. The responsible ministry or institution or organizations will determine the ministries, institutions and organizations with which they will cooperate within the scope of the relevant activities" [10], and thus, it is stated that Total 393 The institutions responsible for the realization of the activity have been determined by taking into account their duties and authorities, and the activities are carried out in cooperation with all relevant Ministries, institutions and organizations in coordination with the responsible institutions. to life is envisaged to be passed on.

In this context, since the issue of climate change is interdisciplinary and multidisciplinary/ multifaceted/ multifactorial, and are authorized to carry out and coordinate the activities related to climate change with a holistic perspective in an effective and continuous manner with the participation and cooperation of all relevant stakeholders and as the responsible institution Environment, Ministry of Urbanization and Climate Change and Ministry of Justice.

Although the right to a healthy and habitable environment, which constitutes another aspect of the right to social welfare, is not specifically guaranteed in the fundamental human rights instruments guaranteeing human rights, it is observed that the view that this right is a fundamental human right and therefore should be guaranteed in fundamental human rights instruments is becoming more widespread and accepted in international circles. In this context, the Human Rights and Environment Drafting Group (CDDH-Env) was established in the Executive Committee on Human Rights (CDDH) of the Council of Europe and the Ministry of Justice and the Ministry of Foreign Affairs are currently following up international meetings. There may be an increase in the number of applications before national and international authorities, particularly the Constitutional Court, regarding the human rights dimension of climate change in the coming periods, and the Ministry of Justice is monitoring the policies to be determined on climate change as a result of the decisions to be rendered by the Constitutional Court and other international human rights mechanisms, particularly the ECtHR. may have an impact.

On February 2, 2022, in the Agricultural Drought Strategy and Action Plan included in the Presidential Decree on Combating Agricultural Drought and Drought Management Studies, it was stated that "All kinds of measures for economic and social support will be taken with the Plan" (Republic of Turkey Ministry of Agriculture and Forestry General Directorate of Agricultural Reform, 2022).

In the 1st Water Council held in October 2021, there are decisions to support farmers who produce using seeds of drought-resistant varieties.

[10] Presidential Circular No. 2021/9, OG dated April 30, 2021 and numbered 31470.

In order to minimize the impacts of drought, the Ministry of Agriculture and Forestry has been implementing support mechanisms for agricultural producers within the framework of the relevant legislation "Law No. 2090 on Aid to Farmers Damaged by Natural Disasters and its Implementations" and "Law No. 4081 on the Protection of Farmers' Property and its Implementations". Some legal arrangements are also in place to postpone agricultural loan debts of farmers affected by natural disasters. In addition, drought-affected farmers in the provinces receive payments from the Turkish Agricultural Insurance Pool (TARSİM) as part of compensation for losses. More producers are also encouraged to enroll in the TARSIM Pool.

The current legal basis for social service interventions for disaster victims in regions where natural disasters occur is the Social Services Law No. 2828.

In line with the "2053 Net Zero Emission Target" declared following Turkey's becoming a party to the Paris Agreement in November 2021, in order to create the infrastructure for legislation and policies to combat climate change February 2022

In the first Climate Council convened, the vulnerability and adaptation of society to climate change was addressed directly and comprehensively for the first time in the "Commission on Migration, Just Transition and Other Social Policies". This commission is a commission of the community climate It has studied vulnerability and adaptation to climate change by addressing it together with various social determinants and social inequality (migration, poverty, income distribution, inequality of opportunities for women and men, etc.), and has established a link between combating climate change and social protection and social services, and has made numerous on these issues.

The social dimension of combating climate change was also addressed by other Commissions of the Council and some recommendations were taken in this direction. "Adaptation actions should be identified and implemented in line with ensuring social resilience against the impacts of climate change" decision of the Commission on Adaptation to Climate Change and the decision of the Commission on Local Governments "In local level disasters, a transition from crisis management to risk management model should be made and the human, administrative and financial capacity required in this context should be developed and the scope of legislation should be strengthened" (Republic of Turkey Ministry of Environment, Urbanization and Climate Change, 2022).

11.3. EFFECTS OF

Demographic and socio-economic factors such as social inequalities and injustices, gender, age, disability, poverty, livelihood constraints, etc. can affect people's exposure and vulnerability to climate hazards.
shapes it.

What is basically needed to analyze the impacts of climate change on segments of society in Turkey is to build a detailed and reliable picture of the state of social determinants (inequality/equity, income distribution/poverty, equality of opportunity in education, unemployment/job loss), the vulnerable groups and the consequences (loss of life, property, nutrition, housing problems, health, etc.) that affect people's adaptive capacity to the impacts of climate change. The consequences of these impacts also vary across sectors, in different issues and to different extents.

It is also important that social development policy designs for workers whose professions will disappear or whose content will change due to the measures and policies taken against climate change and who face the risk of losing their jobs, and for new vulnerable groups that may emerge, should be made with a just transition perspective. Pursuant to Article 86 of the Presidential Decree No. 1 on the Organization of the Presidency, the regulation of working life and the development of employment falls under the responsibility of the Ministry of Labor and Social Security. In this context, it is the responsibility of the Ministry of Labor and Social Security to conduct analyses on working life due to the direct and indirect impacts of climate change, to make the necessary arrangements in the legislation and monitor its implementation; to inform sectors, trade unions, relevant institutions and stakeholders, as well as individuals and groups that will be affected by climate change and green transformation processes, and to inform decision-making and

It is the responsibility of the Ministry of Labor and Social Security to take measures to ensure their participation in implementation processes. With this responsibility, the Ministry has started to work on raising awareness on just transition, designing this process and coordination of related activities with a focus on the reflections of climate change and green transformation on working life.

An important component of these efforts is the 'Specialized Working Group on Just Transition Policies' established to assist the Green Deal Working Group established by the Presidential Circular No. 2021/15 published in the Official Gazette No. 31543 dated 16/7/2021. On the other hand, the Ministry continues to work on ensuring green transformation in labor markets, developing just transition policies and ensuring stakeholder participation. Considering these developments;

Given the importance of just transition in climate change and green transformation and its role in labor force training, employment, social protection, occupational health and safety, it is important for the Ministry of Labor and Social Security to take part in the Climate Change and Adaptation Coordination Board.

In Turkey, rainfall or heavy rainfall affects different segments of society, especially vulnerable groups, and it is important to identify these impacts.

Risk analyses could not be carried out due to the lack of detailed data needed for climate change impact analyses in terms of social development during the preparation process of the plan, however, in order to provide guidance in case these studies can be carried out in the future, risk analyses were not carried out.

New/additional indicator sets for the required data were identified and presented in Table 7.

In Turkey climate change comprehensive analysis of their impact on social development

and to develop these indicators with a holistic approach. Need there are. This one need

It is important to conduct and encourage a series of studies that will provide answers and support implementation. It would be more meaningful to conduct risk analyses after the data on the indicators in the tables are available.

Table 6 Proposed Indicator Set for Drought Risk Analysis

Tehlike		Maruziyet	Etkilenebilirlik		Risk
İklim Sinyali	Fiziksel Etki		Duyarlılık	Uyum Kapasitesi	
Toplam yağış miktarında azalma	Meteorolojik kuraklık Hidrolojik kuraklık Tarımsal kuraklık	Kişi başı milli gelirin düşmesi (Tarım) Aile tarım (mikro) işletmeleri (küçük aile çiftçileri) Çiftçi kayıt sistemine kayıtlı kadın çiftçi Tek ebeveynli hane (cinsiyet) 65 + kadın nüfus İşsiz nüfus (meslek kayıtlı/kayıtsız, yaş, cinsiyet) Doğal kaynaklardan geçimini sağlayan yoksul nüfus Savunmasız azınlık Hamile kadınlar	Mevsimlik/geçici tarım işçisi (yaş, cinsiyet) 15-49 çalışma çağındaki nüfus Çoban nüfusu Sosyal yardım alan nüfus (yaş, cinsiyet) Ayni yardım alan aile sayısı Nakdi yardım alan aile sayısı Yoksul nüfus (yaş, cinsiyet) Mahsul verimindeki değişiklik oranı Maladaptasyon yaratan yatırımlar İstihdamın tarımda mikro işletmelerde dağılımı (yaş, cinsiyet) Halk sağlığı Mahsul veriminde değişiklik (Ürün için yeterli su olmaması) Kadın çalışan nüfus sektörel kategorilere göre (tarım ve alt sektörleri (balıkçılık, sütçülük, gıda vd.) Küçük sera çiftçileri Amaç dışı tahsis edilen tarım alanları (ha) Sulama sistemlerinde düşük verimlilik Mevcut mevzuatta kısıtlar Savunmasız kesimler hakkında yerel kurumlarda veri eksikliği	Kent kırsalında ekilebilir alan BB'lerde tarıma katılımı sağlanan alan (arazi örtüsü) TÜİK sürdürülebilir kalkınma göstergeleri (2020) ve yeni üretilecekler Çevresel Göstergeler Çevresel Sürdürülebilirlik Endeksi Yoksul nüfus oranı Yetersiz beslenen nüfusun oranı TÜİK Yaşam Memnuniyeti Araştırması Tarımsal biyoçeşitlilik Genç çiftçi sayısı Girdi (yem, vb.) fiyatlarında istikrar ve denetim Ürün değişkenliğine uyum sağlayan çiftçi nüfusu Yüksek lisanslı nüfus (master, doktora) İyi tarım uygulamaları yapan küçük çiftçi işletme sayısı Organik tarım uygulayan küçük çiftçi sayısı Çiftçilerin susuzluğa dayanıklı ürün yetiştirme kapasitesi Tarım Bölgelerinde çiftçi destek miktarı Sosyal hizmetler uzmanı sayısı TARSİM sigorta havuzuna kayıtlı çiftçi (cinsiyet) Tarım araştırma enstitüleri sayısı Tarım kooperatifleri (kadın koopkooperatifleri vb.) Kadim bilgiler ile ilgili projelerin sayısı Akıllı tarım projeleri Yerel iklim eylem planlarında sosyal etkilenebilirliğin ele alınması Tarımda dijital politika ve uygulama araçları Akıllı tarım projelerine verilen devlet desteği Bu konulara ayrılan finansman imkanları Mobil telefon/internet kullanma oranı (cinsiyet dağılımı gözetilerek) Belediye meclislerine kadın temsili Adil uyum projeleri	Su kıtlığı Gıda kıtlığı Geçim sıkıntısı İş kaybı Gelir kaybı, geçim sıkıntısı Barınma sorunu Beslenme sorunu, gıdaya erişim Sağlık sorunu Eşitsizliğin derinleşmesi Üretimde düşüş nedeniyle göçe zorlanma Aile fertlerinin eğitime erişimi Soğutma ödemelerinin yüksekliği

Table 7 Recommended Indicator Set for Heavy Rainfall Risk Analysis

Tehlike		Maruziyet	Etkilenebilirlik		Risk
İklim Sinyali	Fiziksel Etki		Duyarlılık	Uyum Kapasitesi	
Toplam yağış miktarında azalma	Meteorolojik kuraklık Hidrolojik kuraklık Tarımsal kuraklık	Kişi başı milli gelirin düşmesi (Tarım) Aile tarım (mikro) işletmeleri (küçük aile çiftçileri) Çiftçi kayıt sistemine kayıtlı kadın çiftçi Tek ebeveynli hane (cinsiyet) 65 + kadın nüfus İşsiz nüfus (meslek kayıtlı/kayıtsız, yaş, cinsiyet) Doğal kaynaklardan geçimini sağlayan yoksul nüfus Savunmasız azınlık Hamile kadınlar	Mevsimlik/geçici tarım işçisi (yaş, cinsiyet) 15-49 çalışma çağındaki nüfus Çoban nüfusu Sosyal yardım alan nüfus (yaş, cinsiyet) Ayni yardım alan aile sayısı Nakdi yardım alan aile sayısı Yoksul nüfus (yaş, cinsiyet) Mahsul verimindeki değişiklik oranı Maladaptasyon yaratan yatırımlar İstihdamın tarımda mikro işletmelerde dağılımı (yaş, cinsiyet) Halk sağlığı Mahsul veriminde değişiklik (Ürün için yeterli su olmaması) Kadın çalışan nüfus sektörel kategorilere göre (tarım ve alt sektörleri (balıkçılık, sütçülük, gıda vd.) Küçük sera çiftçileri Amaç dışı tahsis edilen tarım alanları (ha) Sulama sistemlerinde düşük verimlilik Mevcut mevzuatta kısıtlar Savunmasız kesimler hakkında yerel kurumlarda veri eksikliği	Kent kırsalında ekilebilir alan BB'lerde tarıma katılımı sağlanan alan (arazi örtüsü) TÜİK sürdürülebilir kalkınma göstergeleri (2020) ve yeni üretilecekler Çevresel Göstergeler Çevresel Sürdürülebilirlik Endeksi Yoksul nüfus oranı Yetersiz beslenen nüfusun oranı TÜİK Yaşam Memnuniyeti Araştırması Tarımsal biyoçeşitlilik Genç çiftçi sayısı Girdi (yem, vb.) fiyatlarında istikrar ve denetim Ürün değişkenliğine uyum sağlayan çiftçi nüfusu Yüksek lisanslı nüfus (master, doktora) İyi tarım uygulamaları yapan küçük çiftçi işletme sayısı Organik tarım uygulayan küçük çiftçi sayısı Çiftçilerin susuzluğa dayanıklı ürün yetiştirme kapasitesi Tarım Bölgelerinde çiftçi destek miktarı Sosyal hizmetler uzmanı sayısı TARSİM sigorta havuzuna kayıtlı çiftçi (cinsiyet) Tarım araştırma enstitüleri sayısı Tarım kooperatifleri (kadın koopkooperatifleri vb.) Kadim bilgiler ile ilgili projelerin sayısı Akıllı tarım projeleri Yerel iklim eylem planlarında sosyal etkilenebilirliğin ele alınması Tarımda dijital politika ve uygulama araçları Akıllı tarım projelerine verilen devlet desteği Bu konulara ayrılan finansman imkanları Mobil telefon/internet kullanma oranı (cinsiyet dağılımı gözetilerek) Belediye meclislerine kadın temsili Adil uyum projeleri	Su kıtlığı Gıda kıtlığı Geçim sıkıntısı İş kaybı Gelir kaybı, geçim sıkıntısı Barınma sorunu Beslenme sorunu, gıdaya erişim Sağlık sorunu Eşitsizliğin derinleşmesi Üretimde düşüş nedeniyle göçe zorlanma Aile fertlerinin eğitime erişimi Soğutma ödemelerinin yüksekliği

Since the beginning of the century, research and studies have been carried out by expert organizations and in some countries at the theoretical and policy level in order to clearly understand the social vulnerability profiles of various segments for community adaptation within the scope of climate change vulnerability and risk management interventions. In these studies, a wide range of theoretical and policy studies have been conducted to assess the impact of climate hazards and disasters on vulnerable population groups.

numerous methodologies are used. However social There is a general view that it is too early to say that vulnerability methodologies have been systematically integrated into climate change and disaster risk management processes.

Many studies climate change risk assessments lack social dimensions of vulnerability that are standardized, comparable and measurable. This often results in climate change being considered a 'hazard'.

In these studies, which are limited to 'assessments', it is seen that it is quite difficult to directly measure how climate change affects segments of society in many ways and how it will affect them in the future.

Therefore, it is an important constraint for sound risk analysis at this point. Social vulnerability cannot be defined in a simple way as it involves a combination of factors Risk analysis is difficult. For example, a number of factors need to be considered together, such as the fact that social vulnerability becomes visible when disasters occur, the ambiguity of indicators (e.g. prioritization of poverty indicators may not take into account that rich households may also be significantly affected by disasters), the need to measure individual characteristics related to conditions that make people less (such as social economic status) or more vulnerable (such as disability).

In terms of the occurrence of climate hazards and disasters in the regions where people live, in some cases, spatial location alone is not sufficient, and spatial analyses need to be considered together with a number of general factors to conduct vulnerability and risk analyses. For example, a household's location in a coastal area or riverbed may indicate exposure to climate hazards, but the socio-economic status of that household (poverty, inequality, access to resources, insurance, etc.) may positively or negatively change its sensitivity to climate hazards and adaptation conditions.

In particular, women farmers involved in agricultural production, women involved in the food production process, as well as women and girls in the poor are facing the impacts of climate change. For this reason, the indicators identified and the indicators linked that may occur as

It is clear that it would be useful to analyze the effects in a gender-disaggregated manner.

The most fundamental constraints in terms of data management for analyzing the vulnerability of society to climate hazards and risks in Turkey are listed below:

- The inclusiveness of traditionally produced data, which mostly reveal demographic and socio-economic characteristics, is limited. These data do not respond to reliable planning of services.
- In the context of social protection/assistance/service policies, it is not sufficient to conduct risk analysis with existing data. New indicators in risk components are needed to provide the necessary data.
- It has been observed that the data obtained in line with some policies on socio-economic development ranking and assessment do not support the mitigation of climate hazards. These data were produced in line with climate-unfriendly indicators. For example, some of the SEGE data in support of socio-economic development are produced with indicators that are not climate friendly (SEGE/Rural Ratio of Asphalt-Concrete Village Roads [11]; number of households provided with coal for fuel within the scope of social assistance [12] etc.).
- Although it is emphasized in the literature that static quantitative approaches are not sufficient to measure social vulnerabilities and that the important thing is to capture the dynamic nature of vulnerability, the main constraint in practice is the lack of a holistic perspective and the accompanying data supply problems.
- T ypologies usually developed for social vulnerability indices are sometimes specific to climate hazards as a

[11] "Socio-Economic Development Ranking Survey of Provinces and Regions SEGE-2017", Ministry of Industry and Technology, General Directorate of Development Agencies, Ankara, 2019.

It may be specific to the vulnerability of a household being located in a coastal area or in a river floodplain. However, these vulnerability analyses should also be evaluated together with classifications of segments of society focused on equity and equality such as poverty, health, labor, access to resources. These assessments are made in the literature through the use of social vulnerability indices scaled by a set of specific indicators, and these applications are widely used in many countries. These are more theory-driven, with the limitation of data-driven ones being one of the main challenges.

- The production of data sensitive to vulnerable groups climate change operates on the basis that the impact of each policy, implementation and service of each sector may be different. The production of data on vulnerable groups is aimed at quantifying these differences and formulating policies to ensure equality. There is a need to produce data with this approach.
- Another important challenge in social vulnerability and risk analyses is that the factors that will affect vulnerability and adaptive capacity are often assessed with single quantitative data. For example, it is not sufficient to assess participation in climate meetings only through numerical ratios.
- Data is not produced in a gender-sensitive manner.
- Data is not produced in certain periods and based on statistics, which makes it difficult to make comparisons in the analysis.
- Data is not collected under one roof, and the data collected by each institution is not available to the other and relevant stakeholders.
- As there is an increasing need to produce and share data on a common ground with mutual support, it is important that mechanisms for institutions to share the data they produce with other institutions are used effectively.
- Technical capacity to collect and analyze data at national and local government levelneeds to be strengthened. The institutional/legal/administrative infrastructure to generate the social data required for the adaptation of segments of society to the impacts of climate change in Turkey also needs to be strengthened.
- Qualitative as well as quantitative data is for social vulnerability and risk analysis. For this purpose, the experiential knowledge of the individual/community is not sufficiently taken into account in field studies and there is no system that would allow the evaluation of this information.
- Another constraint in determining social vulnerability is the need for higher resolution in regional climate projections. This is an important bottleneck given the need to study the impacts of climate change on society at the micro scale.
- The resources and information/data accessed are limited to public websites rather than official databases, and scientific research-based resources are extremely limited.
- Most information/data accessed is not directly relevant to the main focus of social vulnerability and risk analysis.

The impacts of climate change on society can be interdisciplinary and complex databases that include cross-cutting vulnerable population groups are needed to analyze the resilience and adaptation of vulnerable groups. Assessments should include 'poor and unemployed'; 'farmer and landless'; 'disabled and vulnerable households'; 'elderly women and seasonal workers'; children and common classifications such as 'migrant'; 'widow and poor' Consideration should be taken into account.

It is inevitable that children will be exposed to the impacts of climate change. As stated in the UNICEF report on "Climate Crisis is a Children's Rights Crisis: Climate Risk Index for Children" in 2021, every consequence of climate change directly affects children and their access to their rights. In this framework, it is especially recommended by the Ministry of Family and Social Services (General Directorate of Child Services/Department of Children's Rights) to conduct climate change social impact analyses on children's rights and to continue the adaptation process and develop policies for and with children who are in vulnerable groups and in need of special policies.

Poor households are unable to compensate for losses and damages from climate-related disasters caused by extreme weather events - as their crops are unproductive due to severe drought to be- more can also become poorer. In some areas, poorer households may be the most vulnerable, while in other areas the more affluent, with more to lose financially in flood damage, are more vulnerable.

While poverty is often associated with increased climate risk, it may not be the only possible indicator of vulnerability. Wealthy households can also be vulnerable to climate risks. High-cost investments can lead to higher losses, and in some cases the rich may take longer to recover from disasters than middle-income or poor households.

When analyzing the impacts of climate change, the state of individual or societal adaptive capacities and external factors (legal, institutional structuring, existence of policies and action plans, sectoral vulnerabilities, ecological systems, resilience of cities, etc.) are important. Like vulnerability measures, adaptation measures can also change and diversify.

The climate change literature is replete with theories on the difficulty of developing indices of adaptive capacity that take into account all factors that contribute to adaptation and resilience to climate hazards. It has also proven difficult to develop simple typologies. The most obvious reason for this difficulty is the lack of baseline fieldwork data either or missing .

11.4. ADAPTATION MEASURES

Climate change in Turkey legislation to adapt by incorporating social transformation renewal, managerial, institutional, policy and planning arrangements, awareness and capacity-building trainings, stakeholder consultations to enhance the adaptive capacity of the community. supportive soft cohesion actions to strengthen it will be prioritized.

Basic assumptions that will shed light on strengthening the conceptual link between social development and combating climate change in Turkey; i) the adaptation of groups at risk to climate change should be primarily strengthened against the social and economic injustices caused/to be caused by climate change, ii) climate change adaptation management approach that considers the interests of nature and society should be essential, iii) social justice determinants (even if indirectly related to climate change) should be taken into account in climate change adaptation and social development policies and practices in order to create integrated and multiple benefits/co-benefits, and iv) social conditions related to equal opportunities for women and men (equality, equity, poverty, etc.) should be taken into account by adopting a fair adaptation approach.) equitable adaptation approach to climate change at national and local level. Harmony policies. These assumptions are expected to support Turkey's efforts to combat climate change, not only for short-term risks, but also in the long term and create an important opportunity to achieve the Green Development Revolution goals.

Climate change adaptation efforts in society will provide While it is important to calculate the benefits, each of the practices planned to be carried out at the sectoral level with the climate change adaptation action plan will provide opportunities for society and The calculation of benefits is also important and necessary.

From a societal perspective, local communities have an important role to play in combating climate change. In this respect, it is important to strengthen cooperation between communities and other relevant organizations to stabilize the climate system and protect biodiversity, recognizing the intrinsic link between biodiversity and climate change. For this, it would be useful to i) promote a change in mindset to restore and maintain the health of all ecosystems in a timely and culturally appropriate manner and ii) use diverse knowledge systems and practices, including local knowledge, to transform the global approach to climate change and biodiversity.

Incorporating the impacts of climate change on social life and measures into socio-economic development and ecosystem protection strategies at all levels (national, regional, local) and incorporating a social development component into the policy, planning and implementation processes of adaptation to the impacts of climate change in each sector.

Consider the multifaceted impacts of climate change on social development in top policy documents such as Turkey's Long Term Climate Strategy.
Producing statistics that will enable demographic and socio-economic analysis of those employed in sectors affected by climate change.

Strategic Objective 2. Social protection policies will be developed to strengthen the resilience and adaptation of society against actual/potential climate hazards.

SKL3. Social Protectio n policies social assistance and social work programs to help individuals/households respond to the impacts of climate change to reduce vulnerability and strengthen resilience, provinces with high social vulnerability.

SDL4. Encourage research on climate-friendly alternative social assistance policies within the framework of social protection policies.

Moving away from crisis management approach to a risk management model for the adaptation of society to climate change and strengthening the legal, institutional, administrative, scientific, human financial capacity required in this context.

Conduct analyses on how climate change affects the social lives of all segments of society, especially vulnerable groups (elderly, children, persons with disabilities) and initiate development programs supported by local governments.

Implementation of climate change national adaptation policies for the welfare of all segments of society, with a focus on rights and interest-based approach and equal opportunities.

SDG6. Quantify women's differential vulnerability to climate change and identify benefits from adaptation, taking into account relevant SDGs and sector adaptation actions.

SOURCE: Social Development

MOEUU (2022). Climate Council Decisions. https://iklimsurasi.gov.tr/public/images/sonucbildirgesi.pdfRetrieved from

TOB (2022). Strategy and Action Plan for Combating Agricultural Drought (2023-2027). Agrarian Reform General Directorate. https://www.tarimorman.gov.tr/TRGM/Belgeler/0TARIMSAL%20%C3%87EVRE%20 VE%20DO%C4%9EAL%20RESOURCES%20Protection%20DA%C4%B0RE%20BA %C5%9EKANLI%C4%9EI/Yay%C4%B1nlar%C4%B1m%C4%B1z/Tar%C4%B1msal Retrieved from %20Kurakl%C4%B1kla%20Mu%CC%88cadele.pdf

AFET RİSK AZALTMA

iklime uyum

12.1. GENERAL FRAMEWORK

Reduces community resilience, exacerbates existing conditions of vulnerability and social inequality, and more frequent and large-scale climate change-related disasters that cause new ones.

Climate and disaster risks are increasing worldwide and climate-related disasters have become more frequent in the last 50 years (World Meteorological Organization, 2021). In the last 5 years, the number of people harmed or killed by climate change-related disasters has increased compared to the previous 5 years. Climate and disaster risks are increasing at an unprecedented rate, and Turkey is the subject of the latest scientific research as one of the most disaster-prone countries in the European region and the Mediterranean Basin, which is experiencing the reality of extreme climate events and climate change most harshly.

In 2019, 936 extreme events such as heavy rains/floods (36%), storms (27%) and hail (18%), including earthquakes affecting population and infrastructure, resulted in an average annual loss of 0.20% of GDP (MGM, 2020). OECD (Organization for Economic Cooperation and Development) average loss It's 0.09%. (International Finance Corporation, 2022). On the other hand, drought has the largest share, accounting for 1.6% of GDP (USD 12.352 billion) according to the current Annual Average Loss (AAD) values calculated for Turkey. This is followed by earthquakes (0.3%), indirect losses (0.2%), and indirect environmental risks (each 0.1%), followed by the climate change disasters. The index for all climate change-induced disasters is US$17.35 billion, or 2.2% of current climate change NOAA, 2021 GDP. These losses are much higher when calculated for the RCP4.5 and RCP8.5 scenarios; in the first scenario 21.5 billion USD or 2.8% of GDP, while in the second scenario it is USD 24.31 billion or 3.2% of GDP (ESCAP, n.d.).

"Turkey's geographical, climatic and socio-economic conditions it highly vulnerable to the impacts of climate change and other environmental hazards. Adaptation and resilience are therefore important priorities for Turkey. The most important drivers of this vulnerability are climatic factors, population exposure (e.g., the proportion of the population exposed to floods and forest fires), and socio-economic factors (e.g., the share of agriculture in the economy)" (The World Bank, 2022).

In 2021, 2,793 forest fires occurred across Turkey and 139,503 hectares of forests were damaged in these fires (Ministry of Agriculture and Forestry, 2021).

According to the United Nations Economic and Social Commission for Asia and the Pacific, the top three natural disasters in Turkey between 1970 and 2021 are floods, earthquakes and waves. Accordingly, 43 flood disasters occurred between 1970-2021 and approximately 1 million 805 thousand people were affected by these disasters. In addition, floods caused a loss of USD 2.8 billion. On the other hand, 758 people lost their lives in the floods. Moreover, the damage caused by the drought in Turkey was calculated as 1.2% of GDP (ESCAP, n.d.).

In addition, according to AFAD's Natural Events Statistics for 2022, in 2022 there were 450 floods/floods18 avalanches859 landslides, 13 sinkholes, 21,054 earthquakes, 137 rock falls and 451 other disasters (AFAD, 2023).

Antalya, Balıkesir, İzmir, İstanbul, Konya, Mersin, Ordu, Van, Muğla, Aksaray, Çorum, Bursa between 2010-2021, A total of 8,274 meteorological disasters affected the provinces of Elazığ, Kayseri, Manisa, Kastamonu, Nevşehir and Aydın. The three most common meteorological disasters during the period were storms (32%), heavy rains/floods (30%) and hail (17%). In addition, extreme temperature events have been frequent in recent years; in the case of Cizre in southeastern Turkey, the temperature measured in July 2021 of +49.1°C broke the national record. The previous record high was +49.0°C in 1962 and the second highest was +48.6°C on July 30, 2000 in the same city (Ministry of Environment, Urbanization and Climate Change, General Directorate of Meteorology, 2022).

Various small-scale disaster events also continuously suppress community resilience and deplete limited resources and capacities. However, climate risks are not evenly distributed across the country and vary depending on the type of hazard, the level of exposure and vulnerability, and the coping capacity of the disaster risk management system at all levels.

In line with climate projections, this trend is expected to increase further in the future, taking into account the expected impacts of climate change, adverse environmental conditions and increasing pollution, ever-increasing urbanization, increasing migration patterns and other risk factors. As a result, it is projected that there will be an increase in the frequency, intensity and impact of climate change-related disasters that will significantly affect the resilience of the country and local communities, particularly women, youth, the elderly and other vulnerable groups, by worsening existing vulnerability and social inequality situations and creating new ones.

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The United Nations (UN) Intergovernmental Panel on Climate Change (IPCC) Report Climate Change 2022: Impacts, Adaptation and Vulnerability states that Turkey is one of the most vulnerable countries in Europe to extreme weather events.

The IPCC 2022 Report emphasizes that the severity of drought in the Mediterranean Region will remain extremely high in the Mediterranean specific CCP4 section.

It is also mentioned that Lake Beyşehir, the largest freshwater lake in Turkey, may dry up completely by 2070.

Turkey's disaster risk management system includes critical needs such as focusing the predominantly post-disaster response on pre-disaster as well as post-disaster response, clearly allocating roles and responsibilities among key stakeholders, improving risk governance at national and local levels, enhancing inter-sectoral coordination and cooperation, and making financing for risk reduction sustainable and stable. Turkey is classified as a very high risk country (16.23) and 30th out of 192 countries in terms of indicators of "very high exposure, inadequate coping capacity, moderate sensitivity and very low adaptive capacity" (World Risk Index 2022) (World Risk Report 2022, n.d.).

Therefore, increasing resilience and adaptation actions need to be designed and implemented at all levels. In this context, the Strengthening Adaptation Action in Turkey Project aims to increase social resilience by strengthening adaptation to climate change, especially at the sectoral and urban level.

12.2. SECTORAL LEGAL FRAMEWORK AND RESPONSIBLE INSTITUTIONS

A comprehensive disaster risk management system has been established in Turkey to prevent and mitigate the impacts of existing and emerging climate and disaster risks.

Although there are still some gaps and various challenges to establish and operationalize a systematic mechanism for climate and disaster risk reduction, it is one of the key issues for sustainable and resilient development. In this context, policy and regulatory frameworks have been established in line with the main documents adopted, and the relevant structure is illustrated in Figure 54; Eleventh Development Plan (2019-2023) and Twelfth Development Plan (2024-2028) disaster risk reduction regulations, Integrated Urban Development Strategy and Action Plan -KENTGES (2010-2023), Provincial Disaster Risk Reduction Plans (IRAP), Turkey Disaster Response Plan (TAMP) (2014), National Earthquake Strategy Document and Action Plan - UDSEP (2012-2023), Green Consensus Action Plan (2021), Turkey Disaster Risk Reduction Plan (TARAP) (2022), Ministry of National Education Climate Change Action Plan (2022Climate Change Strategy (2010-2023) National Climate Change Action Plan (CCAP) (2011-2023), Turkey National Climate Change Adaptation Strategy and Action Plan 2011-2023, Seventh and Eighth National Communications under UNFCCC, Intended National Contribution (2015) and Updated First National Contribution (2023)

"Turkey has started to lay solid foundations for building adaptation and resilience by developing planning and policies at different levels of institutions and in different sectors. At the same time, significant efforts are being made to mainstream climate change adaptation and disaster risk reduction into national development processes. However, further actions are needed to establish and finance priority actions and to develop strategies and capacity for building resilience. need to be realized" (The World Bank, 2022).

Social and economic losses caused by weather and climate-related extreme events and disasters are increasing in many parts of the world, including Turkey, with significant regional and inter-annual variability. The nature, intensity and impact of extreme weather and climate events and disasters are closely linked to economic, social, geographic, demographic, cultural, institutional and governance (e.g. adaptation) factors, environmental and ecological factors, as well as exposure and vulnerability. Most of Turkey is located in the subtropical Mediterranean climate zone with dry summers. Turkey is a country with medium to high level risk for climate change and future climate risks. In this context, on monitoring, climate change vulnerability and risk assessments and adaptation measures to mitigate the adverse effects of climate change to work (UNFCCC, 2023)

Disaster and Emergency Management Presidency (AFAD) was established to implement comprehensive policies, measures and actions and to ensure integrated disaster risk management through coordination of relevant institutions and organizations at all levels of governance. In 81 provinces, Disaster and Emergency Management Directorates have been established, and these directorates report to the governorate and are directly responsible to the governor. Within the framework of AFAD, "creating social awareness about disasters, coordination and cooperation for the sustainability of disaster-related issues to provide, The National Disaster Risk Reduction (DRR) Platform was established to "assess the needs, monitor and evaluate the implementation of disaster risk reduction policies to contribute to their integration into sustainable development plans and policies at all levels" (UNDRR, n.d.). At the same time, the Presidency Strategy and Budget

Policies and priorities in the field of disaster management are determined within the scope of the Development Plan, Medium Term Program and Presidential Annual Program prepared under the coordination of the Presidency, and the Public Investment Program and budget are prepared in line with these priorities (AFAD, 2022).

In the 12th Development Plan, policies and measures related to climate change-induced disasters have been identified. Under "Strengthening adaptation capacity by increasing social resilience" (Objective 833), the following policies and measures have been identified regarding climate change-induced disasters (833.5.), increasing resilience to climate change through education and awareness-raising activities on extreme weather events, desertification, erosion, water and soil protection (833.6.), evaluating and maximizing the use of nature-based solutions and green infrastructure opportunities within the scope of disaster risk reduction (833.7.)" policies and measures.

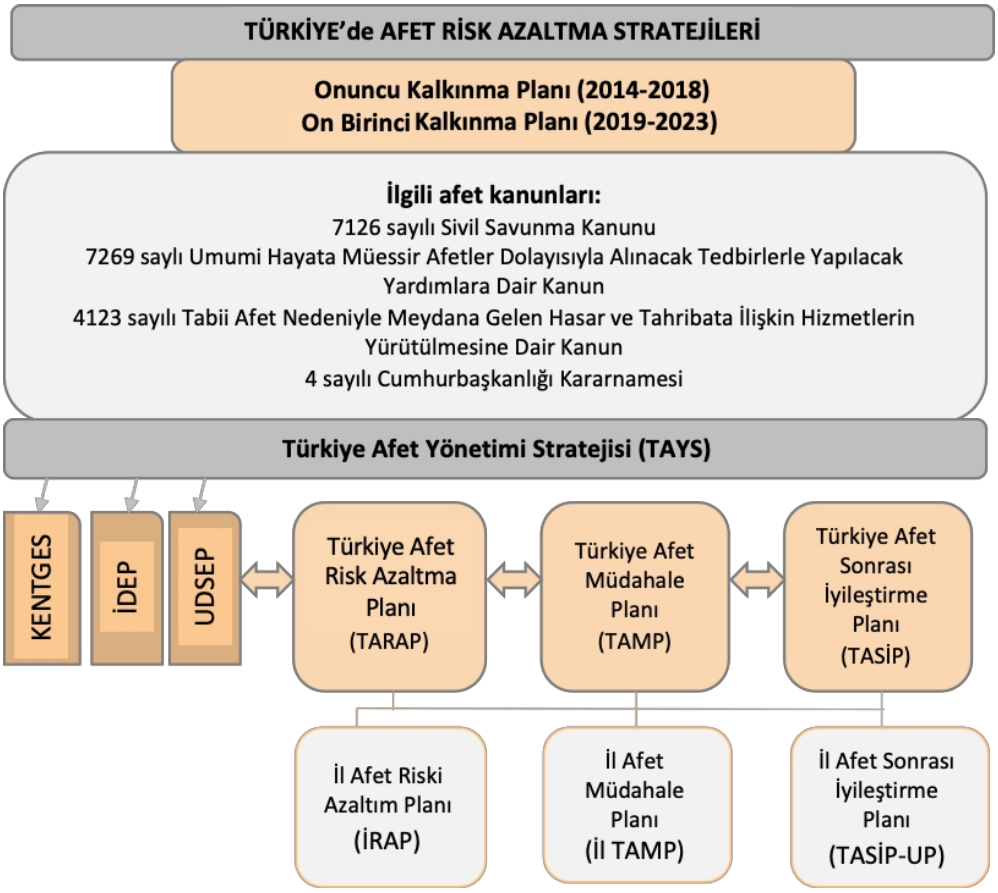

Figure 54 Disaster Risk Reduction Strategies in Turkey

Source: (ibid, p.15)

Note 1: Turkey Post Disaster Recovery Plan (TASIP), Provincial Post Disaster Recovery Plan (TASIP-UP) and Turkey Disaster Management Strategy (TAYS) are in draft stage.

Note 2: The Twelfth Development Plan (2024-2028), published in the Official Gazette dated 01.11.2023 and numbered 32356 (Repeated), includes issues related to climate change and disaster risks under the title of "Disaster Resilient Living Spaces, Sustainable Environment." (For more information, see: https:)

12.3. EFFECTS OF

In Turkey, adaptation solutions need to be developed and implemented to combat the expected impacts of climate change.

Turkey is greatly affected by disasters due to its geology, topography and climate characteristics and carries a high level of risk due to its location. The types of disasters that affect the country the most are earthquakes, floods, rockfalls, landslides, avalanches and avalanches. forest fires. In 2020-2022 alone, earthquakes in Elazığ province, floods in Giresun province, earthquakes in İzmir province, floods in Rize and Artvin provinces, forest fires in Antalya and Muğla provinces, floods in Sinop, Bartın and Kastamonu caused significant loss of life and property. These recent disasters have spread over a wide area in terms of the areas affected and their frequency (ibid., p. 6).

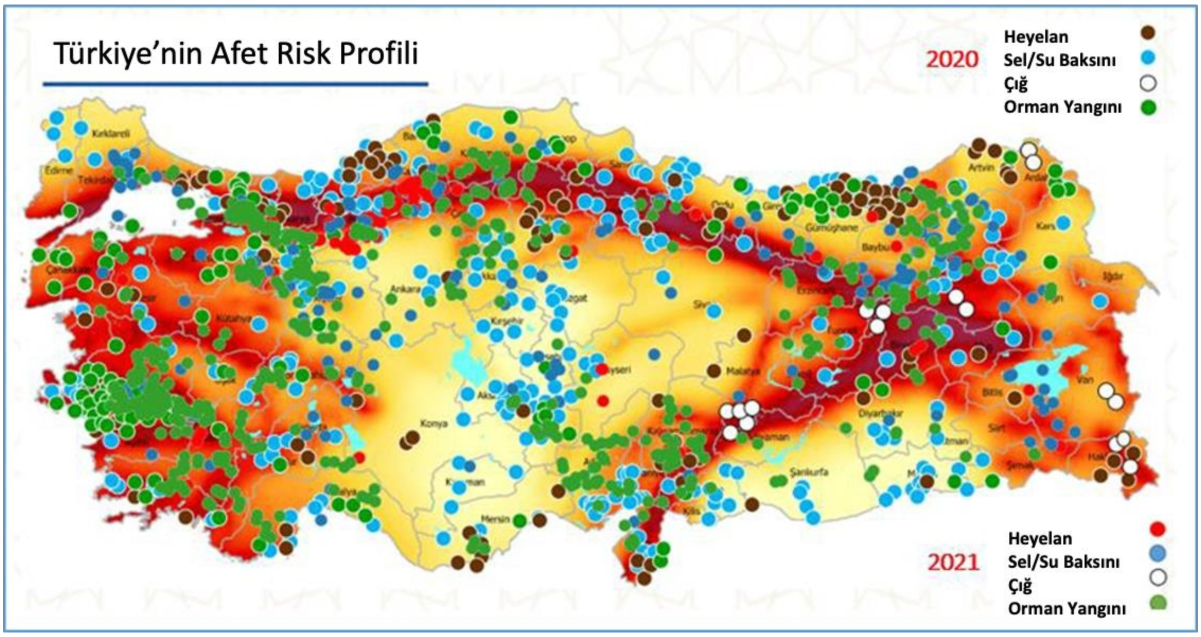

Figure 55 Risk Profile of Natural Disasters Occurring in Turkey

Table 8 Main natural disasters occurring in Turkey

(GFDRR, n.d.)

River flooding	High
Coastal flooding	High
City flood	High
Earthquake	High
Landslide	High
Forest fire	High
Drought	High
Extreme temperatures	High

According to the report published by the World Bank, for 6 countries including Turkey climate risk and vulnerability classifications are shown in Figure 56 (The World Bank, 2022).

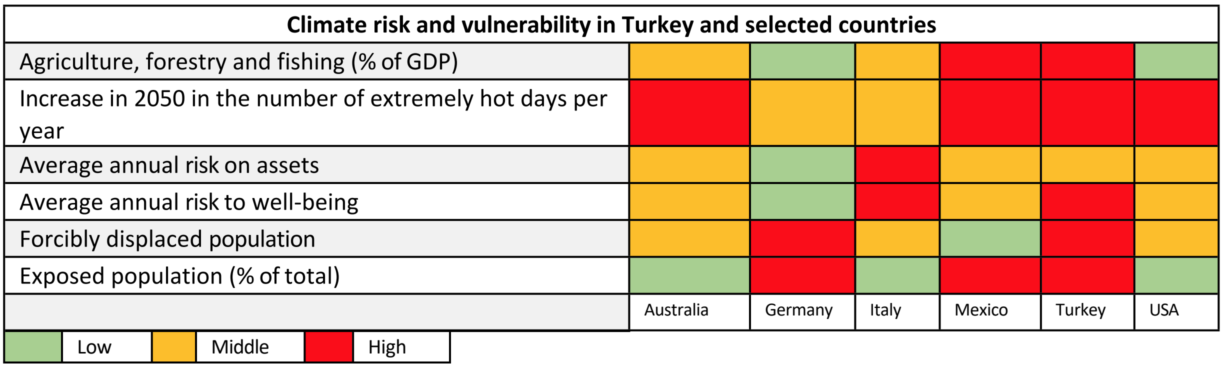

Figure 56 Climate Risk and Vulnerability in Turkey and Selected Countries

According to INFORM, led by the Joint Research Center of the European Commission, Turkey's INFORM Risk Index (DRMKC, n.d.) is moderate (4.7) and ranks 45th in a list of 191 countries, with the highest scoring countries having the lowest risk. According to the country's multi-year trend line for risk dimensions, the current situation in risk reduction is improving overall, although the level of risk is increasing. However, according to the newly created INFORM Climate Change (CC) Tool [13] assessment, the country's INFORM CC Risk is 4.9 points. According to the RCP4.5 and RCP8.5 scenarios, INFORM CC Risk is projected at the same level for both 2050 and 2080, although exposure, vulnerability and severity of projected hazards are increasing (DRMKC, n.d.).

The provinces with the highest risk of floods and floods, which have been exposed to many disasters in the last 70 years, are Erzurum (440 floods), Sivas (319), Van (265), Bitlis (247) and Kayseri (215) (AFAD, 2020). "Floods and floods occur in this region due to various reasons such as sudden and heavy rainfall, deforestation, urbanization in valleys, sedimentation blocking the flow of streams and rivers, and narrowing of river beds due to construction activities" (AFAD, 2022).

Landslides triggered especially by rainfall high on the disaster risk profile. In the country A significant portion of settlements, 5,472 settlements or 15.31% of the total, are exposed to this disaster. "When the areal distribution of landslides is analyzed, it is seen that landslides frequently occur in the Eastern Black Sea Region (Trabzon and Rize provinces and their surroundings) and the Central and Western Black Sea Region (Karabük, Bartın, Zonguldak, Kastamonu and their surroundings) due to surface and topographic reasons. (AFAD, 2020). On the other hand, with the DEMIS software developed by DGMM, erosion severity classes, areas susceptible to erosion in terms of different land use types and different slope groups and annual average soil losses of these areas were determined and mapped.

Forest fires are both heat waves and human-induced and have become more frequent in recent years. Fire-sensitive forests constitute 65% of Turkey's forests. The effect of climate change and global warming is to reduce the amount of moisture in the combustible materials in the forest, resulting in the occurrence of large forest fires in forests in regions that are not vulnerable to fire. For example, Antalya and Muğla provinces experience fire disasters more frequently and on a larger scale, particularly affecting local communities and local ecosystems. Forests are experiencing soil loss due to erosion and climate change impacts. This situation causes disruption of the water regime and brings disasters such as desertification, floods, landslides, droughts and avalanches." (AFAD, 2022). At the same time, other climate

[13] The INFORM Climate Change tool provides insights intoclimate change risk analysis. It helps users to easily navigate through different scenario combinations and at different points in time, to investigate risk, hazard and exposure variables, vulnerability differentials and possible changes in population.

The frequency, intensity and severity of hazards caused by change are also increasing. Examples include extreme temperatures, heat waves, storms and heavy rainfall causing coastal flooding.

Storms occur in Turkey, especially in the North Aegean and Central Mediterranean regions. The provinces where strong winds and storms are frequently observed are Balıkesir, İzmir, Konya, Kayseri, Kars and Elazığ. Looking at the distribution by years, it is seen that there has been a rapid increase in storms since 1998." (AFAD, 2022). On the other hand, changes in surface and groundwater levels and precipitation regime frequently cause sinkholes in some provinces such as Konya. "Although sinkholes were not perceived as a threat in the past due to reasons such as low population density and limited agricultural and industrial areas, sinkholes now pose a threat to human life due to the spread of these events over wider areas." (ibid.).

According to the data of the General Directorate of Meteorology Annual Area Precipitation in Turkey, 2008 was recorded as the year with the least amount of precipitation received. This is followed by 2013, 2017, 2020 and 2021 (MGM, n.d.).
. The impacts of drought go beyond agriculture, water management and related sectors and also affect overall food security. Within the scope of Strengthening Climate Change Adaptation Action in Turkey Project, climate hazards including drought, heavy rainfall, heat waves, forest fires, cold waves and strong winds were analyzed for eleven priority sectors until 2100 according to RCP4.5 optimistic scenario and RC8.5 pessimistic scenario. In this context, in the last two decades, Konya and Karaman provinces have the highest meteorological drought values [(14).] Hatay and Kahramanmaraş provinces, followed by Hatay and Kahramanmaraş provinces. Meteorological drought is higher in Eastern Anatolia than in Turkey as a whole. According to the RCP4.5 scenario, a 20% decrease in drought intensity is expected in the Western Black Sea Region and eastern Marmara during 2021-2040, while drought is projected to increase in the rest of the country. According to the RCP8.5 scenario, by the 2060s, drought intensity is projected to increase by an average of 40% in the South Aegean Region and exceed 80% in eastern and southeastern Turkey.

Due to climate change, as a result of industrialization and unplanned urbanization, there is a significant increase in the number of floods and overflows [(15]and the damage they cause. In the current periodthe annual total precipitation of heavy rainfall along the Taurus Mountains in the Mediterranean Region and in the provinces of Antalya, Mersin and Adana reaches 280 mm, while the maximum annual total precipitation of heavy rainfall is around 360 mm in the Eastern Black Sea Region in the provinces of Giresun, Trabzon, Rize and Artvin. In general, for both scenarios, total precipitation is projected to increase in the north of Turkey and decrease in the south. In addition, according to both scenarios, the most severe decrease is projected to occur in the Mediterranean Region in the period 2061-2100. According to the RCP4.5 scenario, the regions with the highest increase in total precipitation due to heavy rainfall are Eceabat region of Çanakkale province, while according to the RCP8.5 scenario, it is the Eastern Black Sea Region, especially Artvin and Ardahan provinces. While 100% increase is projected in the regions with the highest increase in total precipitation due to heavy precipitation, 60% change is projected in the regions with the highest decrease.

[14] Taken from the Sectoral Vulnerability and Risk Analysis in Turkey prepared within the scope of the study.

[15] Taken from the Sectoral Vulnerability and Risk Analysis in Turkey prepared within the scope of the study.

is predicted. As a result, the total amount of precipitation caused by heavy rainfall is projected to increase in the north of Turkey and decrease in the south.

In the current period, the frequency of heat waves [16] has the highest value on average per year.
12 days are observed around Mersin in the Mediterranean Region. It is observed that the frequency of heat waves increases especially when moving from the north to the south of Turkey. According to the RCP8.5 scenario, the maximum increase of 30 days in the first period of the next period is predicted to be at least 90 days in the last period, especially for Şırnak, Van and Hakkari provinces in Eastern Anatolia.

In addition, an increase of approximately 60 days is predicted in the South Aegean and Mediterranean Regions, especially in the 2060s compared to both scenarios. For both scenarios, the places where heat waves will show the least increase in the future periods are generally to be the Black Sea coasts and the provinces on the southern coasts of the Marmara Sea.

Almost 60% of the country's forested areas are exposed to forest fires [17]. Deforestation leads to soil loss through erosion, flooding, landslides, avalanches and desertification that can cause drought. According to the Canadian Fire Weather Index (CFI), which represents fire weather for the current period, the highest fire risk value in Turkey is observed in ŞanlıurfaMardin and Gaziantep provinces in the Southeastern Region. The Aegean, Marmara and Eastern Anatolia Regions have medium-low fire risk, while the Black Sea Region has the lowest values. Looking at the future period, According to the RCP4.5 scenario, the country as a whole In the 21st century, a +/- 20% change is predicted. Towards the end of the century, weather conditions favorable to forest fires in Artvin, Ardahan, Iğdır and Kars provinces in northeastern Turkey will increase by 40% compared to the current period; in the Marmara Region
It is projected to decrease by 15%. In addition, Antalya and Burdur provinces in the Mediterranean Region, Çankırı and Çorum provinces in Central Anatolia and Southeastern Anatolia are projected to increase by 30% and 20% respectively in the period 2081-2100.

Looking at cold waves in the current period (UNDP, 2022), the number of days when the lowest temperature falls below 2°C in an average year is 240 days in Ardahan and Van provinces, covering approximately 8 months throughout the year. The highest cold wave frequency values are observed as approximately 18 days in Southeastern and Eastern Anatolia Regions. In addition, the cold wave frequency is approximately 16 days in Ankara and Yozgat provinces in the Central Anatolia Region and in the west of the Mediterranean Region. It is estimated that the cold wave frequency will be in a continuously decreasing trend in the future periods. According to both emission scenarios, the change in cold wave frequency is projected to decrease gradually from east to west of Turkey in the future.

In the current period, the thresholds used for determining high winds (UNDP, 2022) are highest in the Marmara and Central Anatolia Regions.

No major differences between the two emission scenarios are foreseen in future projections. There will be an increase in the number of days with strong winds in Marmara, Western and Central Black Sea and North Aegean regions; the opposite will be the case in the Mediterranean and Eastern Anatolia Regions will take place is estimated.

[16] Taken from the Sectoral Vulnerability and Risk Analysis in Turkey prepared within the scope of the study.
[17] Taken from the Sectoral Vulnerability and Risk Analysis in Turkey prepared within the scope of the study.

12.4. ADAPTATION MEASURES

Climate change is expected By strengthening disaster risk understanding and knowledge for adaptation to its impacts, transformative risk governance will be established, capacity building, awareness raising and resilience will be ensured through stable and sustainable investments.

Turkey is exposed to a wide range of natural hazards such as drought, heavy rainfall and floods, extreme heat waves, forest fires, cold waves, storms, earthquakes, landslides, erosion, sinkhole formation. With the exception of earthquake risk, all other risks are increasing in frequency, intensity or severity due to climate change. Climate hazards occur directly or as chronic stressors affecting the resilience and durability of industrial and technical facilities. In addition to the impacts of other risk factors, the expected increase in the number of events and the consequent damage and loss will significantly affect Turkey's sustainable and resilient development and vulnerable groups will be the most affected.

Therefore, specific adaptation actions aiming to contribute to building resilience across the country are being designed and planned for implementation. These actions are not only about the link between climate change adaptation and disaster risk reduction. mutual It will not only strengthen the link, but also ensure the adoption of a seamless whole-of-government and whole-of-society approach to reducing existing climate and disaster risks and anticipating and mitigating the adverse impacts of new and emerging risks. In addition, it will ensure that these actions are aligned with existing risk reduction priorities in the country, sustainable and resilient development frameworks and mechanisms under international

It is important to emphasize that adaptation actions are fully aligned with obligations and overall efforts to adapt to potential climate change impact. These adaptation actions are grouped under different strategic objectives as follows

Strengthening understanding of climate change and disaster risk and information infrastructure for sustainable and resilient development.

Climate change increases the impacts and severity of climate-related hazards, leading to complex and cascading risks that increase loss and damage, erode society and generally make it more difficult to achieve sustainable development efforts. In addition, poverty, inequality, urbanization, environmental degradation, demographic change, lack of risk-based policies and the need to update legislation, global pandemics, and the widening range of factors that increase disaster risks highlight the need to transform the approach to understanding existing and new risks.

The first action therefore includes a comprehensive understanding of the evolving, systematic, dynamic and interconnected nature of climate and disaster risks. These are TARAP Strategic Objective 1 (Strategic Priority 1: Understanding Disaster Risks) on identifying and assessing disaster hazards and risks at the local and national level, and Sendai Disaster Risk Mitigation It is related to the recommendations envisaged for risk assessment and related issues in the Voluntary National Report of Turkey for the Mid-Term Review of the Implementation of the Framework. Existing risk and hazard assessments will be further improved by using a preventive approach in risk assessments and integrating long-term scenarios and models related to climate change. In order to improve risk-based planning and decision-making processes, as well as to improve foresight to prevent future and imminent risks climate change

It is crucial that projections are integrated into existing studies and assessments based on the analysis of past climatic and disaster events. Therefore, to support decision makers, practitioners and relevant stakeholders to improve climate change and disaster risk reduction policy and risk reduction-based development, technical guidelines should be developed to guide comprehensive and systematic analysis and assessment of risks in the context of climate change. To support the assessment process, several studies and action plans will be prepared for the most affected provinces on priority climate hazards (e.g. storms, hail, erosion, desertification and forest fires). The National Climate and Disaster Risk Assessment Report will summarize the assessment of all relevant risks and hazards that form the basis for decision-making, planning and mainstreaming of disaster risk reduction (DRRand climate change adaptation (CCAacross sectors to enable risk-based policy development and sustainable and resilient development. For better visualization and integrated analysis, all flood risk assessments and river basin Management In addition to the completion of the plans, preparation of integrated risk and hazard maps for the wide dissemination of risk information and is planned to be published. Finally, the government's efforts and actions to respond to increasing challenges such as degraded ecosystems, biodiversity loss, climate change, increasing frequency of extreme weather events, Ecosystem Based DRR and Nature Based Solutions should be implemented within the framework of the adaptation plan. This is in line with the principle of "leaving no one behind" promoted by the Voluntary National Report of Turkey for the Mid-Term Review on the Implementation of the Sendai Framework for Disaster Risk Reduction and to ensure that

Application measures groundwork.

The last action under this strategic objective is related to the early warning system, a tool adaptation actions that will contribute to preparing communities for climate-related hazards. This action emphasizes a multi-hazard early warning system that aims to reach all members of society and includes preventive and post-disaster responses, including warning for fast- and slow-onset disasters. This action will support the country's compliance with the Sendai Framework, in particular Goal G on early warning and risk information, and reporting to the Sendai Monitoring Mechanism.

Conduct comprehensive risk assessment and planning studies in order to identify climate change risks more clearly.

ARA2. For fast and slow developing events warning systems,

society all segments to reach

Objective, Foresight and intervention

including Multi-Hazard Early

Development of the Warning System.

Ensuring transformative risk governance to strengthen climate change and disaster resilience.

This action set follows on from the previous action set and aims to support the transition from a reactive to a preventive approach to climate and disaster risk management, with a predominant focus on response, while transforming risk governance in general. The starting point is an examination of key national and local frameworks for sustainable and resilient development from a climate change and disaster risk sensitive perspective. This is followed by their mainstreaming into key development planning sectors. To this end, the recently developed UNDP regional "Risk-Based Development: Disaster Risk Reduction and Adaptation to Climate Change".

Strategy Tool for Integration of IDU and DRR into national development planning, using the "Strategy Toolkit for Integration of IDU and DRR into Development" to develop a national strategy for integrating and mainstreaming IDU and DRR into national development planning. guides development can be supported. As a result, policy and regulatory frameworks identified through the operational review can be updated. The mainstreaming process does not end with the integration of these issues. It continues with the application of tools to support mainstreaming, such as cost benefit analysis, multi-criteria analysis and similar tools related to climate change adaptation, across sectors and at all levels of government, decision-making processes and existing and new programs and projects. These tools relate to a variety of areas, such as identifying and comparing different policy options for climate and disaster resilience; and identifying, establishing and implementing gender-sensitive adaptation arrangements and actions. In the TARAP document, there are seven targets and 30 actions for climate change risks and 1151 actions in 36 provincial plans for meteorological and climate change related disasters in IRAPs. In practice, the methodological framework and technical guidance will enable spatial planning to support the TARAP objectives in a climate and disaster sensitive manner to strengthen its implementation in this regard.

In order to implement all these actions, it aims to increase institutional cooperation and coordination, and to promote partnerships with various traditional and non-traditional stakeholders involved in building resilience. In particular, it is important to bring together the work of existing coordination bodies for climate change and disaster risk reduction and to establish sectoral working groups. In parallel, it is important to ensure that all relevant stakeholders are better equipped to ensure disaster and climate resilience.

It is important to expand the scope of work and portfolio of the National DRR Platform with climate change adaptation issues so that it functions as a multi-hazard, multi-risk and multi-sectoral communication, networking and knowledge development mechanism where they can interact. On the other hand, it is necessary to strengthen existing partnerships and establish innovative partnerships with universities, research institutions, private sector organizations, TRCS and NGOs to achieve a whole-of-society approach to risk reduction. It is important that universities and research institutions become more actively involved in the adaptation cycle by leveraging their expertise and knowledge and providing incentives for research and development activities. The Voluntary National Report of Turkey for the Mid-Term Review of the Implementation of the Sendai Framework for Disaster Risk Reduction points to the need to develop research projects to develop scenarios and simulations that illustrate the benefits that can be achieved by reducing disaster risks and mitigating loss and damage that would otherwise be ignored. Working together will bring continuity in carrying out adaptation actions aimed at building knowledge infrastructure and providing technical support to the private sector in mitigating climate and disaster risks. AFAD, TRCS, NGOs and associations play an important role in increasing climate and disaster resilience and reaching out to all members of communities.

In this context, the starting point for the development of critical infrastructure resilience is the recent , which aims to support authorities and practitioners in implementing adequate actions in the design of relevant resilience development policies in partnership with other agencies, business owners and/or service providers before, during and after disasters

Guidelines on Critical Infrastructure and Resilience Building in Europe and Central Asia (UNDP, 2022). As a result, the roadmap on critical infrastructure will be revised, followed by an update of policy and normative frameworks. On the implementation side of adaptation, ensuring the robustness and resilience of technical guidance and infrastructure investments to protect against climate and disasters for studies will be supported.

The last action under this strategic objective contributes to improving the assessment process of losses and damages arising from climate change impacts. It can be said that the insurance system in Turkey is in development and has built a detailed system primarily against earthquake-related disasters. Important steps have also been taken in agricultural insurance with the establishment of TARSİM. Nevertheless, when the Turkish insurance system is evaluated as a whole, it is difficult to say that the principle of pre-disaster protection has not yet been fully realized. Depending on the diversity of disaster risks, it can be said that participation in the insurance system is still below the level of developed economies. In this respect, there is a need to improve insurance mechanisms. Turkey Loss and Damage Platform will serve as a central data and information repository on relevant losses and damages.

ARA3. National and local sustainable and resistant development in planning climate to change Harmony and risk of systematic integration of disaster mitigation. **RIA4.** Ensure that policies and sectors are aligned to enhance the disaster resilience of critical infrastructures. legislation, including climate change

Consideration by Revise to be taking application for d guides an Preparation.

ARA5. Climate disasters Why? is missing and damages to be met Scope, Insurance mechanism, improving the loss and damage assessment process and establishing the Turkey Loss and Damage Platform.

Strategic Objective 3. Developing institutional capacity and raising awareness to achieve inclusive and responsive climate change and disaster resilience.

Building resilience to climate and disaster risks and strengthening adaptation to climate change requires the understanding and engagement of authorities at all levels within the framework of good governance. The ultimate goal is to achieve lasting behavioral change in the long term. Awareness raising addresses the knowledge of individuals and organizations, ensuring that all relevant regional and urban authorities understand specific climate impacts and take action to respond to them. to pass aims to provide.

In this context, raising awareness and building capacities of key policy makers, decision makers and the administration enable the formulation, adoption and implementation of policies and regulations based on climate change and disaster risk reduction. Sensitizing administrators to ensure the integration of adaptation into national policies and sectors, and ensuring sustainable and stable financing are prerequisites for successful adaptation actions. Accordingly, effective and efficient cross-sectoral cooperation, coordination and communication are key to the realization of practical adaptation measures and actions, while key staff and technical experts in the competent ministries and institutions are key to the implementation of practical adaptation measures and actions. Through a train-the-trainer approach, comprehensive and systematic trainings should be provided to ensure sustainability of the response, while enhancing, resilient and developing the adaptive capacity of each institution.

Furthermore, no one should be left behind when designing and implementing awareness-raising and capacity-building activities, and the needs and capacities of particularly vulnerable groups should be at the center of the issue. The capacities and potentials of target groups can contribute to building the resilience of social groups and communities. In addition, in line with the recommendations of the Turkish Voluntary National Report for the Mid-Term Review of the Implementation of the Sendai Framework for Disaster Risk Reduction on the inclusion of business and industry sectors in professional trainings on risk reduction (AFAD, 2022), key sector business and industry representatives and practitioners should also be targeted, ensuring business preparedness and sustainability in the context of severe climatic conditions and increasingly new risks. Finally, those involved in disaster and emergency response activities also need to be adequately trained professionally in mitigating, preparing for and responding to the severe and increasing impacts of climate and disaster risks. In addition, guidance on the provision of psychological support following climate change-related disasters is planned as a resilience-building tool for professionals and populations affected by disasters.

The most recent academic studies and scientific projections increasingly recognize the impacts of climate change and climate change-induced disasters as factors that increase human mobility. In 2020 alone, more than 30 million people were displaced within their own countries due to disasters (Gemenne, Zickgraf, Hut, & Betancourt Castillo, 2021). In this context, due to its geographical location, Turkey, due to humanitarian crises, climate change, and various other factors, has become a place where mass migrations of people who have to migrate due to experience. The volume of mass migration, the duration of migrants' stay in Turkey, and the transformation of the concept of migration from a temporary phenomenon to a permanent phenomenon make it imperative for Turkey to be prepared for mass migration at any time, resulting in the need to develop policies, targets and implementation strategies to mitigate the risks of mass migration (AFAD, 2022). Recent figures support this context. For example, According to TurkStat statistics in 2021 in Turkey 2,777,797 people, 47.5% male and 52.5% female (TÜİK2023 i.e. 3.28% migrated from one province to another. In addition, there are 3,279,152 Syrians under temporary protection in the country as of 28.09.2023 (Republic of Turkey Ministry of Interior Directorate of Migration Management, 2023). Therefore, the link between human mobility and climate-related hazards in the country needs to be better understood to be adequately integrated into the National Migration Policy and action plans. The starting point of this new approach is to better understand the impacts of climate change-related adversities on human mobility and to address migration policies accordingly.

ARA6. Disa ster resistance an d increase Techni cal for corporate capacity Development.

ARA7. Taking into account the displacements that may occur due to climate change-induced risks in the National Migration Policy and action plans and ensuring that adaptation to climate change is taken into account in migration management
take part in the process.

Strategic Goal 4. Making stable and sustainable investments in the context of climate change and disaster resilience.

Adaptation actions in this group include actions that shape feasible and inclusive adaptation actions and express a holistic and disaster risk reduction approach to climate change.

This set of actions covers a variety of structural and non-structural measures and actions for climate hazards, such as protection against floods, storms, droughts, landslides, avalanches and wildfires, implemented at various levels. This set of actions includes a variety of structural and non-structural measures and actions to address prominent climate hazards, such as protection against floods, storms, droughts, landslides, avalanches and wildfires, implemented at various levels. It also includes the design and implementation of adaptation actions aimed at improving the resilience of the energy and industrial sectors, international and local airports, tourism and cultural heritage sites, and environmental management facilities.

The adaptation approach to increase resilience is a "Build Back Better" approach to climate change adaptation and mitigation.

Better (Better) and Leave No One Behind (LNOB), and allow for measures to guide adaptation to climate change. This be done by implementing resilient recovery practices that integrate climate change impacts, organizing ecosystem-based disaster risk reduction and disaster waste management, and providing support to improve services for the population.

Post-disaster reconstruction and
Construction process climate change effects, ecosystem based disasterRisk reduction considerations on Consideration by taking realization.

SOURCE: Disaster Risk Reduction

AFAD (2021). Turkey Disaster Management Strategy Document and Action Plan. https://www.afad.gov.tr/kurumlar/afad.gov.tr/e_Kutuphane/Planlar/AFAD_2019_2023_STRATEGIC_PLAN.pdf

AFAD (2022). Mid- Term Review of the Sendai Framework: National Report of Turkey. Retrieved from https://sendaiframework-mtr.undrr.org/media/84534/download.

Asian Disaster Reduction Center (2019). Turkey Country Report 2019. https://www.adrc.asia/countryreport/TUR/2019/Turkey_CR2019A.pdfRetrieved from

Economist Impact. (n.d.) Explore countries. https://impact.economist.com/sustainability/project/food-security-index/explore- Retrieved from countries.

Copernicus (n.d.). EFFIS StatisticsRetrieved from effis.jrc.ec.europa.eu.

Gemenne, F., Zickgraf, C., Hut, E., & Betancourt Castillo, T. (2021). Forced displacement related to the impacts of climate change and disasters. Reference Paper for the 70th Anniversary of the 1951 Refugee Convention.

Global Facility for Disaster Risk and Recovery (GFDRR). (n.d.). Think Hazard, Turkey: Retrieved from https://thinkhazard.org/en/report/249-turkey

International Finance Corporation. (2022, June). *Turkey- Country Climate and Development Report*. International Finance Coorperation: ifc.org/wps/wcm/connect/a4e13764-36e4-4dba-8d4b-b07b648156b8/Turkey+CCDR+Full+Report.pdf?MOD=AJPERES&CVID=o6cFvmp

MGM (2022). Turkey General Annual Spatial Precipitation. https://www.mgm.gov.tr/veridegerlendirme/yillik-toplam-yagis-verileri.aspx Retrieved from

MGM (2022). Turkey Meteorological Disasters Evaluation (2010-2021). Retrieved from https://www.mgm.gov.tr/FILES/genel/raporlar/meteorolojikafetler2010-2021.pdf.

AFAD (2020). Overview of 2019 in the Scope of Disaster Management and Nature-Borne Event Statistics. Retrieved from Reports/2019yilidogakaynakliolayatistikleri.pdf.

IB (2023). Syrians under Temporary Protection by Years. Directorate of Migration Management. Retrieved from

The European Commission Disaster Risk Management Knowledge Centre (DRMKC). (n.d.). Country Risk Profile. https://drmkc.jrc.ec.europa.eu/inform-index/INFORM- Retrieved from Risk/Country-Risk-Profile.

The European Commission Disaster Risk Management Knowledge Centre (DRMKC) (n.d.). INFORM Climate Change Tool. https://drmkc.jrc.ec.europa.eu/inform-index/INFORM- Retrieved from Climate-Change/INFORM-Climate-Change-Tool.

The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). (n.d.). Risk and Resilience Portal - Republic of Turkey. https://rrp.unescap.org/country-profile/TUR: Retrieved from https://rrp.unescap.org/country- profile/TUR#paragraph-id--24424.

The World Bank (2022). Country Climate and Development Report: Turkey. Washington: The World Bank Group.

Retrieved from https://openknowledge.worldbank.org/entities/publication/01826a0c-059f-5a0c-91b7-2a6b8ec5de2f

TURKSTAT (2023). Statistics, 2021. Retrieved from https://data.tuik.gov.tr/Bulten/Index?p=Ic-Goc-Istatistikleri-2021-45869.

MGM (2020). 2019 Year Meteorological Disasters Evaluation Retrieved from https://mgm.gov.tr/FILES/genel/raporlar/2019MeteorolojikAfetlerDegerlendirmesi.pdf

UNDP (2022). Guidance notes on building critical infrastructure resilience in Europe and Central Asia. Retrieved from https://www.undp.org/eurasia/publications/guidance-notes-building-critical-infrastructure-resilience-europe-and-central-asia

United Nations Disaster Risk Reduction (DRR) (n.d.). Turkey National Platform. Retrieved from https://www.preventionweb.net/national-platform/turkey-national-platform.

World Economic Forum (2023). Global Risks Report 2023. Retrieved from https://www3.weforum.org/docs/WEF_Global_Risks_Report_2023.pdf

World Meteorological Organization (2021). Weather-related disasters increase over the past 50 years, causing more damage but fewer deaths. Retrieved from https://public.wmo.int/en/media/press-release/weather-related-disasters-increase-over-past-50-years-causing-more-damage-fewer.

WeltRisikoBericht. (2022). The WorldRiskReport. Retrieved from https://weltrisikobericht.de/wp- content/uploads/2022/09/WeltRisikoBericht-2022_Online.pdf.

YATAY CUTTING EYLEMLER

climate adaptation

13.1. COMMON ISSUES, TRADE-OFFS AND SYNERGIES ACROSS

Adaptation to climate change cannot be addressed in isolation as there are strong linkages between many sectors. The impact of adaptation action in one sector on other sector(s) should be considered.

The link between climate change adaptation and the Sustainable Development Goals (SDGs) is important. Climate change adaptation is specifically linked to SDG13 , which aims to "take urgent action to combat climate change and its impacts" and specifically includes the objectives of strengthening resilience and adaptive capacity to climate-related hazards and climate change-induced disasters, integrating climate change measures into national policies, strategies and planning, and improving education, awareness-raising and human and institutional capacity for climate change mitigation, adaptation and early warning. However, adaptation also has important linkages with other SDGs. For example, progress towards increased resilience to climate change; Health and Quality of Life for People (SDG3), Quality Education (SDG4), Clean Water and Sanitation (SDG6), Affordable and Clean Energy (SDG7), Decent Work and Economic Growth (SDG8), Industry, Innovation and Infrastructure (SDG9), It is closely linked to and likely to contribute to Sustainable Cities and Communities (SDG11), Life in Water (SDG14) and Life on Land (SDG15), and even Partnerships for the Goals (SDG17).

As was mentioned in many consultation meetings during the process, there is a need for inter-institutional coordination to address cross-sectoral climate change adaptation issues. This includes coordination for ministries, academia and NGOs, municipalities and the private sector with responsibilities for climate change adaptation. mechanisms requires development.

Important common issues related to the sectors are summarized below:

Macroeconomic and social status are factors that significantly affect adaptive capacity to climate change. When the results of previous vulnerability and risk analyses are analyzed, it is seen that the adaptive capacity component, which has an important role in determining the risk in almost every sector, is largely composed of socio-economic indicators. Climate change projections sectors It is also to take demographic and social changes and expectations into account when assessing the climate change impact of climate change, both for planning in terms of resource management and for increasing resilience to climate change.

Adaptation actions in one sector may impact on one or more other sectors. Therefore, it is important to consider sectoral analyses in a holistic manner. For example, creating green belts between croplands and roads can be considered as an adaptation action for agriculture, but its potential for water filtration, microclimate regulation functions, pollination benefits, as well as its potential to protect transport infrastructure from wind and snow can be considered as other adaptation benefits.

Possible measures for a sector to adapt to climate change may be beyond the direct control of that sector. This is particularly true for the health sector, where key actions affecting human health are based on areas such as sanitation and water supply, education, agriculture, trade, tourism, transportation, development and housing, highlighting the need for adaptation actions potentially affecting human health to be understood by other sectors.

While many actions related to increasing the resilience of agriculture also contribute to mitigation, increasing efficiency in energy demand and reducing demand can also be interpreted as an adaptation action. The fact that the need for energy infrastructure does not increase at the same rate as a result of increasing population and consumption habits increases the resilience of the sector to climate change.

Sector interdependencies can be positive and negative. For example, an increase in sustainable agricultural practices can increase the resilience of the farmland ecosystem and hence crop yields, but the increase and intensification of agricultural areas can also harm biodiversity through pollution, land conversion and increased need for irrigation and improper irrigation practices. Adaptation activities in various sectors (forestry, urban environment, biodiversity and ecosystem services, human health and agriculture) have a positive impact on the tourism sector. In this context, it can be said that there is a symbiotic relationship between many sectors.

There are strong sectoral relationships in terms of infrastructure services. All sectors depend on the efficient functioning of infrastructure for energy, transportation, water, information and communication technology networks. Therefore, any climate-related impact affecting these infrastructures will have broad consequences for other sectors. also interdependencies between infrastructures that can affect each other. The efficient functioning of the urban environment is related to urban infrastructures.

In terms of disaster risk reduction; although disaster risk reduction is treated as a separate sector in the Climate Change Adaptation Strategy and Action Plan, actions against a related disaster are planned in almost every sector. For example, it is possible to include actions to prevent floods and overflows in water resources management and urban sectors.

Synergies between adaptation and mitigation should be exploited. Adaptation to climate change The issue has only recently started to enter the agenda of many sectors, especially economic sectors. Until recently, greenhouse gas emission mitigation issues occupied the agenda intensively. However, as a result of research and developing literature, it is observed that many climate change adaptation efforts have a positive impact on mitigation activities and mitigation efforts have a positive impact on adaptation actions. While many actions related to increasing the resilience of agriculture also contribute to mitigation, increasing energy efficiency and reducing demand can also be interpreted as an adaptation action.

13.2. INTER-SECTORAL RELATIONS IN THE CONTEXT OF AND RISKS

The key interrelationships of climate change risks and vulnerabilities across sectors (rather than sector linkages in the context of adaptation options) are summarized below. These include both the vulnerability and risk of a particular sector and its potential consequential impacts on other sectors, and the impacts of other sectors on that sector. For example, a severe flood can directly damage agricultural crops, transportation, energy and other infrastructure, and affect other sectors such as tourism; it can trigger an increase in food and transportation prices, leading to difficulties in access to food. Access to water, especially for the disadvantaged, can be problematic. Disasters such as floods and flooding can be expected to affect transportation infrastructure, as well as have negative impacts on populations living in watersheds and coastal areas.

Water resources management is a very important sector that directly or indirectly affects almost all economic sectors and systems whose monetary value cannot be measured. As frequently repeated in regional climate projections for Turkey, a decrease in total precipitation and changes in precipitation regime are expected. Based on the necessity of separate evaluation on the basis of basins, while no significant change in water potential is expected in some basins, water scarcity is predicted in some basins. With this situation, it is possible to say that there will be a serious competition environment for existing water resources in the fields of agriculture, drinking and potable water, energy, industry, tourism, biodiversity and ecosystem services.

Diminishing water resources will trigger pollution, which can lead to contamination of irrigated agricultural products, deterioration of food and water quality, and public health problems. Polluted water will also lead to the degradation of ecosystems, which will further degrade water quality. will cause degradation. Habitat loss due to the degradation and destruction of water resources and the reduction of wetlands, which are also carbon sinks, will result in serious problems.

Managing marine areas; Climate change is a major challenge, negatively affecting marine ecosystems and communities worldwide. Sea level rise, extreme weather events and ocean acidification are making marine areas even more vulnerable. These changes threaten the sustainable use of marine resources and services.

Marine space management in inter-sectoral relations;

i) Understand the stakeholders and their priorities.

ii) Develop a shared vision for sustainable marine area management.

iii) It is important to build strong cooperation mechanisms.

Agriculture is the sector that consumes the most water in Turkey with a consumption of around 80%, although it varies from year to year. Considering the climate change projections, in which the frequency of droughts is expected to increase, the importance of reducing water consumption in agriculture becomes clearer. Increased water use in agriculture will affect all sectors that compete for water resources due to food security. Biodiversity and ecosystem services will also be negatively affected by the reduction in water levels, especially in wetlands. The increasing use of pesticides water pollution. The use of pesticides and the increase in agricultural areas are also among the important causes of biodiversity loss. However, with controlled and properly agricultural practices positive impacts of agriculture can also be observed. Sustainable farming methods can offer advantages such as conserving biodiversity, improving soil health and using water resources more efficiently. It is therefore important to promote sustainable agricultural practices to reduce the environmental impacts of agriculture.

A reduction in the production of agricultural and food products will not only jeopardize food security but will also result in higher prices. This is especially the case for low-income urban dwellers. segments can lead to malnutrition. It also emphasizes the importance of combating climate change and sustainable agricultural practices. Sustainability-oriented farming methods can create agricultural systems that are more resilient to climate change by protecting ecosystems. This can help maintain food security and support environmental and social sustainability. Changes in food quality can lead to public health problems, such as resistance to biocidal products and malnutrition due to inadequate and unhealthy food.

The impacts of climate change on agricultural production will also affect the industry related to agricultural products. There may be a decrease in employment opportunities for farmers who directly earn income from agriculture (including animal husbandry, fisheries, beekeeping, etc.) as well as agriculture-based industry.

Impacts such as drought and increase in temperatures will increase the need for irrigation water and hence electricity consumption, as well as increase the need for cooling, leading to both additional investment needs and an increase in energy costs.

Due to the degradation of **biodiversity and ecosystems**, there is an increase in water pollution due to the loss of natural filtering properties. Reduced water holding capacity of ecosystems is also a significant threat to water availability. In addition, coastal and

The carbon sequestration capacity of marine ecosystems (blue carbon) is directly linked to marine biodiversity and ecosystem degradation.

Unsustainable increase in agricultural activities and areas will negatively affect biodiversity, while agricultural production efficiency may decrease and invasive species may increase due to decreases in pollination, difficult control of pests and diseases, reduced soil formation, loss of genetic diversity and regulatory ecosystem services. The destruction of pastures and steppes will negatively affect livestock, while those who rely on ecosystem services (foresters, fishermen, beekeepers, etc.) will also be negatively affected.

These negative impacts on water and agriculture can lead to changes in air, water, soil and food quality and associated health problems. Vector-borne and zoonotic diseases are also expected to increase with climate change. With changing and emerging disease patterns, it is beneficial to start research on all these issues rapidly.

Damage to biodiversity and ecosystem services due to climate change may affect many types of tourism, especially eco-tourism, including outdoor, forest sports, sea-sand-sun tourism. When we look at the social dimension of the issue, the most damaging will be able to see will be citizens who generate income from ecosystem services.

Affecting ecosystems and green areas that function as microclimates may prevent protection from urban heat island/extreme cold. Ecosystems have preventive properties against disasters such as floods, erosion and landslides. Disruptions in ecosystems may directly harm the society with the increase in disasters, as well as infrastructures such as energy, transportation and communication may be adversely affected by these disasters.

From a **public health** perspective, links have been made above with biodiversity, water and agriculture. However, it should be emphasized that outdoor workers can be directly affected by climate hazards. Agricultural and construction workers, tourism workers, transportation and logistics workers are the first groups that come to mind in this respect. In addition, worker productivity is expected to decline in general due to extreme heat. Women, children, pregnant or breastfeeding women and the elderly, who stand out as vulnerable groups, are expected to be affected by different hazards in different ways. If the health sector is not sufficiently organized, it is likely to face delays in responding to emergencies in the face of increasing climate hazards, epidemics and disasters. The resilience of the health infrastructure needs to be increased to enable the necessary interventions. There is also a risk that climate change will increase the incidence of infectious diseases and consequently epidemics and pandemics. Temperature changes may also cause biological species to change their current habitats. This situation may affect not only agriculture and tourism-related sectors, but all sectors. Therefore, making human beings the focus of the solution with a holistic One Health approach, without separating them from animal, plant and ecosystem health, will provide a unique opportunity to achieve the Sustainable Development Goals.

While an increase in **energy** demand is expected in the summer months due to temperature increases, the need for heating is expected to decrease slightly in many regions during the winter months. The extension of the summer season due to rising temperatures may lead to a further boost in tourism and a further increase in energy demand.

If the increase in demand for wood for energy purposes is not adequately controlled, forest may need to increase inspections as they will be negatively affected. It may create pressure to produce more wood from forests.

Increasing demand and the rise in energy prices as a result of energy demand may increase energy poverty, especially in urban areas, and consequently health problems and expenditures may increase.

Increase in **tourism** activities due to possible long summer season may put pressure on ecosystem services and sectors such as agriculture, water and transportation. Increased demand for urban services may challenge local governments, especially in the areas of waste and wastewater.

In the **industrial** sector, if the location of industrial facilities needs to change due to the physical impacts of climate change, there may be pressure on ecosystems and natural values important for tourism. As mentioned in the previous sections, the industrial sector is expected to face serious competition with many other sectors for water resources. Occupational health and safety issues are likely to increase due to climate sensitivity.

Problems in **transportation and communication sector** infrastructures due to climate change will affect many areas, especially the quality of urban life. It will manifest itself as a decrease in agriculture, industrial raw material and product logistics, transportation of employees, and tourist satisfaction. In case of disasters due to climate change, the functioning of many sectors, especially the service sector, may be adversely affected as the communication infrastructure may be damaged.

When the relationship between climate change adaptation from the **social development** dimension and other sectors is considered, many intersection points stand out. Most of these have been addressed in other sectors. Possible increase in water, food and energy prices, socio-economic and socio-spatial injustice

In cases where social vulnerability is not adequately addressed in spatial planning processes and location decisions, vulnerable populations may be more exposed to climate hazards.

Changes in the income of agricultural sector workers affect the rural population structure due to reasons such as migration, and migration to cities increases. Women stand out as the group more affected by climate change in the agricultural sector.

In the perspective of **disaster risk reduction,** activities to be carried out for risk reduction affect many areas from infrastructure investments to economic sectors, from public health to environmental health. In addition, the vulnerability of rescue services that become difficult due to communication and transportation problems during disasters may cause disadvantaged groups not to be reached or to be reached late.

Socio-economic impacts due to the fact that disabled and other vulnerable groups are more affected by disasters and social services cannot reach disadvantaged groups sufficiently afterwards is observed.

13.3. BARRIERS TO ADAPTATION TO

A review of the vulnerability and risk analysis sectoral reports reveals the main barriers and gaps in climate change adaptation efforts. Common and interconnected issues are summarized below. The categories of gaps and barriers used here are linked to the adaptive capacity to reduce vulnerability to climate change addressed in Turkey's National Climate Change Vulnerability and Risk Assessment.

Institutional capacity gap: This barrier to the institutional/administrative capacity and expert capacity of organizations responsible for climate change adaptation policies and actions. Some institutions related to adaptation to climate change have reached a certain level of knowledge and capacity as they have been working on the issue for many years. However, many institutions are just starting to work on the subject. Both the need to develop a culture of cooperation and working together among institutions and the differences in the level of knowledge among institutions emerge as a problem, especially for sectors/areas that are closely related to each other.

In addition, the inequality in capacity and participation between central, regional and local governments carries the risk of excluding or not paying sufficient attention to some institutions when determining climate change policies and climate change adaptation priorities at the local and regional level.

There may be differences in the level of awareness among decision-makers. On the other hand, specific capacity building programs should be established to enable staff to integrate information into the planning and management process, and skills and tools for informed decision-making should be developed. competencies needs to be increased.

Information and data gaps: This topic addresses gaps in information and uncertainties in specialized research and gaps in adaptation policy-making. refers to. These knowledge gaps include uncertainties related to climate projections and associated risks, the monetary value of the costs and benefits of adaptation, vulnerabilities at the local level, and the availability of data for monitoring and evaluation phases. These information and data gaps are also linked to the institutional capacity and policy and legal framework issues identified above. Moreover, such gaps can prevent stakeholders of some sectors from taking action. For example, a major barrier for energy companies to act on the risks of extreme weather events is uncertainty and a lack of tools to incorporate these risks into corporate decision-making.

Finance and human resources: One of the most important shortcomings in adaptation to climate change is financial resources in almost every sector. It can be said that there is mostly dependence on European Union funds on the subject. In many sectors, projects that have high returns and serve other purposes in the short term are prioritized. Since the effects of most adaptation actions in the relatively long term, short-term returns are preferred.

On the other hand, since financial studies on the costs and benefits of climate change adaptation actions are limited, there is not enough information on financial returns. However, it is observed with the disasters that the cost of inaction is increasing day by day.

Another important deficiency is trained human resources. The lack of sufficient knowledge on climate change among the employees of institutions, especially decision makers, causes adaptation activities to be hampered and inter-institutional cooperation cannot be sufficiently developed. There is a need to improve the capacities of all stakeholders on adaptation to climate change.

13.4. STAKEHOLDERS TO CROSS-CUTTING ISSUES

Considering the actions targeted to be implemented within the scope of cross-cutting issues, it can be said that the Ministry of Environment, Urbanization and Climate Change (MoEUCC) and its Climate Change Directorate (CAU) play an important role. MoEU is the national focal point for climate change. One of the main responsibilities of the Climate Change Directorate is to "determine policies, strategies and actions at national and international level within the scope of Turkey's efforts to combat and adapt to climate change, to carry out negotiation processes, and to ensure coordination with institutions and organizations".

Horizontal cross-cutting actions are by their very nature actions that require significant cooperation and coordination between different units, institutions and stakeholders.

In the action tables, expression IDUKK, which covers the member Ministries and other institutions, is specified in order to cover not only the secretariat of IDUKK but also all units working on the subject in these institutions.

As emphasized in the introduction, the issue of adaptation to climate change is one of the most important issues in the development of countries. policies In addition to all these institutions, local governments (as emphasized in the urban and other sectors) and their representative unions, which are direct parties to many actions, are very important as they cannot be considered separately.

Academia and research centers for conducting R&D studies, which are in great need in eliminating the information deficiencies required for conducting both risk and vulnerability analyses and benefit and cost analyses in decision-making processes, NGOs that provide important contributions in obtaining qualitative information as well as quantitative information when necessary, and even the private sector, which is very keen on reducing its risks, to adaptation to climate change studies. can make important contributions.

On the other hand, in order to ensure that all segments of the public, which are at the center of all actions, feel themselves as part of the solution in terms of ownership of the actions, to create platforms that promote inclusive and social sustainability, where everyone can participate, without ignoring the needs of segments with different sensitivities such as the disabled, the elderly, children, etc. is required.

13.5. CROSS-CUTTING ACTIONS IN THE CONTEXT OF ADAPTATION TO

The Climate Change Adaptation Strategy and Action Plan covering the years 2024-2030 includes the following sectors.

- Kent
- Water Resources Management
- Agriculture and Food Security
- Biological Diversity and Ecosystem Services
- Public Health
- Energy
- Industry
- Tourism and Cultural Heritage
- Transportation and Communication
- Social Development
- Disaster Risk Reduction.

As mentioned in the sections above, many sectors are closely interconnected and the actions of one affect the other(s). In order to carry out climate change adaptation efforts efficiently, there are many issues that have been raised both in national/international literature reviews and by the institutions coming together in consultation meetings. Some of these issues are included in the "Barriers to Adaptation to Climate Change" section.

Many of the actions listed below under different strategic objectives are closely interrelated and over time one action will play a supporting role in the development of another action.

Strategic Objective 1. Integrating climate change adaptation into all policies and strategies

As frequently emphasized in the Vulnerability and Risk Analysis report, adaptation policies are actually closely related to development policies. When development plans, programs and policies at the national level are examined, many sector and institutional strategies directly include climate change adaptation strategies, while some institutional strategies include indirect targets . National

The Ministry of Education has recently completed its Climate Change Action Plan and the Ministry of Health has started work on updating its strategy. Documents such as the Green Deal Action Plan, Biodiversity, Drought Management Plans, National Water Plan, Rural Development Strategy, National Energy Efficiency Action Plan, Energy Efficiency Strategy Document, Water Efficiency Strategy Document and Action Plan (2023-2033) include targets on issues such as efficiency, water resources management, food security, which can be defined as adaptation actions.

It is important to conduct integrated impact assessment studies in which the impacts of these actions, which are handled separately by different sectors and institutions, are also taken into account in terms of the interactions of sectors with each other. Therefore, in addition to assessing the impact of climate change on individual sectors, there is a need for studies where the impacts of climate change are evaluated together. As a result of these analyses and assessments, risks or opportunities related to climate change will be integrated into sectoral policies, regional and national development plans. All these efforts require a wide participation and amendments to many legislations. In particular, it is necessary to carry out a wider participatory work with institutions that have a certain accumulation of experience on climate change so far, as well as with different public institutions and organizations and private sector representatives who will start to work on the subject, and in this context, to regulate the national legislation in accordance with the relevant provisions of the United Nations Framework Convention on Climate Change and the Paris Agreement. must be realized.

Another important issue, and one that should perhaps come first in the action sequence, is the need to conduct sectoral and regional impact analyses with higher resolution, which will help to formulate holistic or sectoral strategies in a healthier way. This is an important step in prioritizing and implementing actions that are appropriate to local needs. In the prioritization of actions, studies that will also address the financial dimension of the issue will be guiding for decision-makers.

This action plan does not identify individual actions related to financing strategies, but emphasizes the need to establish a relevant financing strategy.

All sectors will need to follow innovations and benefit from developing technologies in their efforts to adapt to climate change. There is an action related to R&D projects that particularly concerns technology support organizations, universities and NGOs.

Climate change adaptation efforts of local governments, which are the closest government units to citizens, are important in Turkey as they are all over the world. Adaptation action plans should also be prepared in an integrated manner with other action plans that produce solutions to climate change. For example, in the 2020-2023 National Smart City Strategy and Action Plan carried out by the MoEU, how smart city applications will be used in combating climate change is addressed under the components of Smart Environment, Smart Energy, Disaster Emergency Management and Smart Space Management.

In order to ensure that the sustainability efforts of different institutions and organizations are comparable with each other and that everyone understands them, it is important to carry out efforts within a certain standard. For this reason, it is important that sustainability reporting, which includes explanations on climate-related risks and opportunities will be an important step in achieving a common goal.

Conducting sector-specific climate change impact, vulnerability and risk analyses

Reflecting the issue of adaptation to climate change in a holistic manner in development plans and other plans, programs and policies already in force, taking into account the interactions of sectors with each other

Conducting Technology Needs Analysis (TNA) for adaptation to climate change, developing R&D and Innovation strategy and Road Map, increasing the number of research and product projects carried out in universities and technology development zones for the use of new technologies

Establishing the legislative infrastructure for the preparation of Local Climate Change Action Plan (LCCAP) and preparing LCCAP in all provinces

Ensuring sustainability reporting that includes explanations on climate-related risks and opportunities within the scope of Turkish Sustainability Reporting Standards (TSRS)

Strategic Objective 2. Enhancing institutional capacities to increase knowledge to support decision-making processes and to increase expertise, training, knowledge base building, monitoring and R&D activities related to climate change

The existence of reliable and updated environmental information in the implementation of sustainable development policies will facilitate the correct functioning of decision-making mechanisms and institutions, and will accelerate the efforts to combat climate change, which is a multidisciplinary field. Due to limited public resources and in order to fight faster, the need for the private sector and citizens to participate is frequently mentioned. However, a society with a high level of consciousness and

It is important to increase knowledge and to share the results of the work done in a transparent manner, as it can be a partner in efforts to combat the issue.

There are many institutions responsible for adaptation actions. The fact that other institutions are often unaware of the large number of actions being undertaken leads to duplication of work and inefficiency.

Data should be regularly monitored so that risk analyses can be carried out in a healthier way and targets can be observed whether they are achieved or not. Another important issue is that these data and studies on climate change should be accessible. It will be possible for experts and institutions to make the necessary analyzes and researches in a healthy way through information sharing.

For proper data management, technical capacity should be high and decision makers should have the knowledge to understand the consequences of their decisions in terms of climate change. For this reason, the capacities of all relevant Ministries, local organizations and relevant boards need to be improved through basic in-service trainings on adaptation to the impacts of climate change and the situation in Turkey.

Ensuring that national and local scale data required for conducting climate change vulnerability and risk analyses are identified and collected in a single source
Collecting the content produced by stakeholders on climate change in a single source and ensuring access by all stakeholders

Strategic Goal 3. Increasing knowledge, awareness and consciousness on adaptation to climate change in a way to ensure that citizens are part of the solution, and ensuring participation in decision-making mechanisms

When vulnerability and risk analyses are analyzed, one of the most striking issues is the importance of socio-economic status for climate change adaptation capacity. Significant changes are expected in many sectors to achieve long-term goals. Many new business areas will require new competencies and skills. In this sense, work should start in terms of human resource planning.

On the other hand, since adaptation to climate change requires significant costs and human resources, public investments as well as the contribution of the private sector and citizens are required.

TARAP at national level and IRAP at local level

Conducting fair transition studies to protect employment in the process of adaptation to climate change
In order to identify the new qualifications and skill requirements that the climate change adaptation process will create in employment
national occupational standards and
nation
competencies Detect to be al
updating; ion determined an
examination and certification according to d
qualifications
activities execution national
mainstreaming dal

Starting from pre-school to the last stage of post-graduate education, the learning outcomes in the curricula should be assessed from the perspective of sustainable development goals and climate change. From the eye updating, training trainers, increasing the number of undergraduate, graduate and doctoral programs on climate change in different disciplines (law, education, social sciences, engineering, etc.)
YKS11. Socialclimate change

By utilizing mass communication and broadcasting tools (social media, digital applications and games, TV series, movies, etc.) to raise awareness, especially by increasing climate change literacy and promoting environmentally sensitive consumption habits
behavior change at the societal level

to ensure for of your work
Making

14. ADAPTATION STRATEGY AND ACTION PLAN ANI

Kent

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Strategic Objective 1. Increasing the adaptive capacities and resilience of cities and urban dwellers.					
KNT1	Identification of urban areas and structures at risk of flooding and flooding, improvement and transformation by taking into account the needs of vulnerable groups, creation of evacuation escape corridors, opening of closed stream lines, creation of protection zones around stream beds	Municipalities*	ÇŞİDB (İM, , İLBANK), İB (, İÖİ), TOB (SYGM, DSİ), UAB (KGM), TBB	2024-2030	Size of urban area converted due to flood risk (ha); Length of infrastructure renewed due to flood risk (km); Size of the area where flood evacuation corridor is implemented (ha)
KNT2	Increasing the resilience of building roofs and facades against severe weather events, expanding location-specific green roof, facade and smart building applications	Municipalities*	(MHGM, İM, TOKI, YPİGM), TBB	2024-2030	Green roofed and/or Number of buildings with green facades (number): Green roofed building number of buildings to total number of buildings (%); Number of municipalities legislation (number)
KNT3	Improving urban infrastructure, increasing its capacity, restructuring drainage systems, unbundling combined sewerage (storm water, wastewater) systems, using smart systems (monitoring through sensors)	Municipalities*	ÇŞİDB (İLBANK, CBSGM, TOB (DSI), UAB (KGM), UMT	2024-2030	Capacity increase d (renewed) length of infrastructure (m or km); Parsed length of sewerage infrastructure (km); Renewed Drainage line length (km); Created permeabl e surface/area size (ha)
KNT4	Kent climate Monitoring stations evaluation of the establishment of	Municipalities* (IDSADB)	MOEU (MGM), Universities, UMT	2024-2028	Number of urban climate monitoring stations established (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Revising legislation and plans to increase adaptation capacity to climate change					
KNT5	Conducting studies on reviewing and revising the zoning legislation within the scope of climate change	ÇŞİDB (MHGM, MPGM)	MOEU (CAO)	2023-2028	Prepared by draft legislative amendment (present/absent)
KNT6	Within the scope of adaptation to climate change, developing guidelines that take into account climate data, including issues such as site selection, spatial planningurban designprevailing wind direction, passive ventilation and insolation, construction and implementation	MOEU (MPGM, MHGM), Municipalities*	MOEU (CAU), Universities, ASHB (DG EYHGM), UM UMT	2023-2028	Local climate sensitive urban design guide/guide (number)
KNT7	Creating risk maps for urban areas using spatial data	Municipalities*, MoD (DED)	ÇŞİDB (MGM, CBSGM, ÇEMGMİDB), TOB (SYGM, DSI), SB (HSGM) Governorships, District Governorships Universities, NGOs, UMT	2023-2028	Risk analysis map prepared (number)
KNT8	Reviewing and revising spatial plans and plan-making processes at all levels that require revision in line with local climate change action plans and analyses	Municipalities*, MoEU (MPGM), CTB (DGMM), Municipality (PDMM), HMB (PA)	STB (SBGM), (YYGM, İDB, , KA, Universities	2025-2030	Number of plans revised in line with the local climate change action plan (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Strategic Goal 3. Ensuring sustainable urbanization that is balanced with nature and climate resilient					
KNT9	Creating green (ecological) corridors with new parks, groves, plantations and planted gardens with accessible and dense natural surfaces within the urban fabric; transforming unused (brown) areas/buildings into green areas or emergency shelter areas/spaces; creating green corridors on the periphery of urban settlements and between industrial zones and settlements	Municipalities*, MoD (DED)	ÇŞİDB (İLBANK, TOB (OGM), Governorships, ASHB (DG EYHGM), Universities, TUBITAKUMT	2024-2030	New made green area size (ha); Number of newly planted trees in urban areas (number); Kent on the periphery size of green corridor created (ha); Industry region created next to green corridor size (ha); The size of the area converted from unused vacant land to green space (ha) and number (number);
KNT10	Protecting existing water surfaces; creating rain ditches and natural water surfaces in urban and peri-urban areas; transforming public spaces into a design that collects and transfers water to a storage system during heavy rainfall	Municipalities*	ÇŞİDB (İLBANK, TOB (SYGM, DSI), TBB	2024-2030	Size of protected water surface (ha); Size (ha) and number (number) of water surfaces created; This one in scope renewed square size (m^2); Created rain number of ditches/gardens (number)
KNT11	Establishing sub-centers and pedestrian zones with a pedestrian-oriented approach for sustainable urban transportation, carrying out pedestrianization projects, and ensuring that the pedestrianization projects are compatible with climate impacts such as extreme temperatures	Municipalities*	(ÇYGM, YYGM), ASHB (EYHGM)UAB (KGM, HGM), TBB	2024-2030	Created pedestrian size of the region (ha); Number of sub-centers created in new plans (number); Pedestrianization Project number (number)
KNT12	Implementing urban agriculture practices on fertile agricultural lands within the city, creating urban orchards	Municipalities*, MoAF (TRGM)	TOB (TAGEM, OGM)	2024-2030	Urban agricultural area size (ha); Kent orchard Number of and size (number, ha or m^2)

Water Resources Management

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Strategic Objective 1. Improving the political and legal framework in the field of water resources management, increasing data and information production and sharing, strengthening institutional capacity, cooperation and awareness					
SUY1	Preparation of basin-scale management plans, implementation and follow-up of measures, precautions and actions within the scope of existing management plans	TOB (SYGM, TRGM)	ÇŞİDB (ÇYGM, MGMİLBANK, STB (SGM, SBGM), DB (EÇGM), İB (İİGM, AFAD), KTB (YİGM), SB (HSGM), UAB (ABDİGM), TOB (, TAGEM, , , DSİ), Governorships, Municipalities*	2024-2030	Number of basins for which basin-scale management plans (basin protection action plan, basin water allocation plan, basin management plan, basin flood management plan, basin drought management plan) have been prepared (number); Proportion of measures, measures and actions implemented for these basins (%); Number of Drinking and Potable Water Safety Plans from Source to Tap (number); Number of basin-based Water Efficiency Action Plans (number); Number of basins/provinces for which water footprinting studies were conducted (number);
SUY2	Developing monitoring and information systems to ensure effective water and wastewater management, creating an inventory on the quantity and quality of surface and groundwater resources and sectoral water consumption	TOB (SYGM, DSI), ÇŞİDB (ÇYGM, ÇEDİDGM)	ÇŞİDB (TVKGM, MGMİLBANK, STB (SGM, SBGM), DB (EÇGM), (İİGM, AFAD), KTB (YİGM), SB (HSGM), UAB (ABDİGM), TOB (DKMPGM, TRGM, TAGEM, BSGM, SUEN), TÜİK, Governorships, Municipalities*	2024-2030	Number of users of the National Water Information System (number); Basin/province at the level of Wastewater Information Number of system users (number); Number of facilities with Continuous Wastewater Monitoring System at basin/provincial level (number); Number of active groundwater and surface water stations monitoring water quantity at basin level (number); Number of active groundwater and surface water stations conducting water quality monitoring at basin level (number); Number of enterprises monitored with measurement system on surface and groundwater use at basin/provincial level (number); Basin-based groundwater sectoral water allocation data (number of documents-allocation amount)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
SUY3	Su management for development of legislation	MOAF (SYGM)	TOB (DSI, DKMP)	2024-2030	Published Water Law (yes/no); Published Flood Law (yes/no)
SUY4	Determining the impacts of climate change on water resources, lakes, wetlands and coasts	MOAF (SYGM)	TOB (DSIDKMP, TAGEM), İDB	2024-2030	Climate projections for Turkey based on current data sets and scenarios (available/not available); Number of basins for which climate change impacts have been identified (number); Number of lakes/wetlands with identified climate change impacts (number); Proportion of coastal areas studied for sea level rise (%)
SUY5	Monitoring the implementation of the Water Efficiency Strategy Document and Action Plan (2023-2033) within the Framework of Adaptation to a Changing Climate	MOAF (SYGM)	Public Institutions / Organizations, NGOs, Universities, Private Sector	2024-2033	Water loss rate in drinking water systems (%); Water recovery rate in tourism facilities (%); Average daily water consumption per person households and individual water use (L/person*day); Agricultural irrigation efficiency rate (%); Water recovery rate in industry (%)
Ensuring the protection, improvement and efficient use of water resources					
SUY6	Continuation of basin protection activities related to surface and groundwater resources from which drinking and potable water is supplied or planned to be supplied	TOB (SYGM), BB, HYMK	ÇŞİDB (ÇYGM, ÇEMGM, MGM, İLBANK), STB (, SBGM, DB (EÇGM), İB (İİGM, AFAD), KTB (YİGM), SB (HSGM), UAB (ABDİGM), TOB (DSİ, DKMPGM, TRGM, TAGEM, BSGM, SUEN), Governorships	2024-2030	Number of basin protection plans prepared for water resources that are supplied or planned to be supplied with drinking and potable water (number); Implementation rate of actions in the prepared protection plans (%)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
SUY7	In order to protect the quality of water resources, updating discharge standards and parameters and implementing them in all basins, increasing the amount of treated wastewater, increasing the reuse rate of treated wastewater to 15% by 2030	ÇŞİDB (ÇYGM), (SYGM)	STB (SGM, SBGM), TOB (DSI), ÇŞİDB (İLBANK), KTB (YİGM), İB (İÖİ), Municipalities*, OIZ	2024-2030	Updating the standard (present/absent); Number of existing wastewater treatment plants at basin/province level (number); Proportion of wastewater treated and discharged at basin/province level (%); Basin/province at the level of purified waste water reuse rate (%); Budget of support programs (TL)
SUY8	Monitoring water quality and water levels of aquatic ecosystems in terms of the effects of climate change, preparing water budgets of all natural lakes, primarily lakes from which water is withdrawn for sectoral usepreparing/revising and implementing management plans of protected areas and wetlands related to aquatic ecosystems, identifying, improving and restoring damaged wetlands, creating artificial lakesponds and artificial wetlands using natural resources	TOB (DKMPGM, DSISYGM), ÇŞİDB (TVKGM), HYMK	ÇŞİDB (ÇYGM, ÇEMGM, MGM), STB (SGM, SBGM), DB (EÇGM), IB (İİGM, AFAD), KTB (YİGM, SB (HSGM), UAB (ABDİGM), TOB (TRGM, TAGEM, BSGM, SUEN), Governorships, Municipalities*, Universities	2024-2030	Number of aquatic ecosystems monitored at basin level (number); Number of lakes for which water budgets were prepared at basin level (number); Number of management plans prepared at basin level (number); Implementation rate of actions identified in basin level management plans (%); Number of wetlands improved and restored at basin level (number); Number of artificial lakes, ponds and artificial wetlands created at basin level (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
SUY9	Preparation of legal framework for stormwater management, inventory of stormwater infrastructure and pollution sources Preparation and updating	Municipalities*, MoAF (SYGM)	ÇŞİDB (ÇYGM, KDB, İLBANK)	2024-2030	Number of legislation prepared (number); Number of inventories prepared (number); Number of inventories updated (number)
SUY10	Reducing the rate of water losses in municipalities in line with the relevant legislation and the targets of the Water Efficiency Strategy Document and Action Plan in the Framework of Adaptation to a Changing Climate, expanding the use of alternative water resources such as rainwater harvesting and the use of gray water in cities, increasing access to safe drinking water networks	Municipalities*, MoAF (SYGM)	TOB (SUEN), IB (), (TEGM), ÇŞİDB (İLBANK), Unions for Providing Services to Villages, UMT	2024-2030	Ratio of the number of municipalities complying with the provisions of the Regulation Amending the Regulation on the Control of Water Losses in Drinking Water Supply and Distribution Systems on water loss rate at provincial level to the total number of municipalities (%); Number of parcels to which the provisions of the By-Law on Stormwater Collection, Storage and Discharge Systems and the By-Law on Amendments to the Planned Areas Zoning By-Law are applied at provincial level (number); Legislation for gray water use (present/absent); Proportion of municipal population served by drinking and potable water network (piped system) at provincial level (%)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
SUY11	In agricultural irrigation in line with the objectives of the Water Efficiency Strategy Document and Action Plan within the Framework of Adaptation to a Changing Climate efficiency dissemination of enhancing practices	TOB (TRGM, DSI, SYGM)	TOB (IMTIGEM), IB (İÖİ Municipalities*, Irrigation Unions, Irrigation Cooperatives	2024-2030	Proportion of irrigation area using modern irrigation method at basin/province level (%); Proportion of irrigations with irrigation efficiency of 60% and above to total irrigated area at basin/province level (%); Proportion of irrigation area rehabilitated at basin/provincial level (%); Proportion of the area irrigated with treated wastewater or drainage water to the total irrigated area at basin/provincial level (%); Proportion of the area under night irrigation system operation at basin/provincial level (%); Proportion of irrigation area automated at basin/provincial level (%); Number of meters installed in piped irrigation systems at basin/provincial level (number); Proportion of irrigation areas for which land consolidation and in-field development services projects were prepared at basin/provincial level (%)
SUY12	Determining the protection areas of groundwater resources for drinking water purposesconducting studies on groundwater bodies, preparing annual groundwater withdrawal monitoring and control reports in groundwater operation areas, installing meters in groundwater operation wells, increasing underground dams and groundwater artificial supply structures	TOB (DSI, SYGM)	MoU, Municipalities*, Irrigation Unions, Irrigation Cooperatives	2024-2030	Number of drinking water supply wells and springs for which protection areas have been identified at basin level (number); Number of reports prepared at basin level (number); Percentage (%) of groundwater operation wells to total operation wells that are required to be fitted with meters in accordance with Law No. 167; Number of underground dams and artificial feeding facilities constructed at basin level (number); Number of basins where the quantity and quality groundwater is determined (number); Number of basins for which measure programs have been identified (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
SUY13	Monitoring and recording the use of surface and groundwater in industrial enterprises, industrial zones and sites, ensuring efficient and recovery of water resources in industry, service, tourism, energy and mining sectors within the framework of the legislation to be established and the Water Efficiency Strategy Document and Action Plan within the framework of Adaptation to the Changing Climate	TOB (DSİ, SYGM), MAPEG, ÇŞİDB (ÇYGM), , İB (İÖİ), Municipalities*	STB (SBGM, SGM), ETKB (EVÇED), OSB, TOBB, TÜİK	2024-2030	Number of enterprises for which monitoring studies on surface and groundwater use at basin/provincial level were conducted (number); Rate of implementation of actions in water efficiency action plans (%); Ratio of reused water to total water use at basin/provincial level (%)
SUY14	Structural measures within the scope of flood control works should be carried out by considering nature-based solutions, flood forecasting and early Warning systems, continuing the capacity rehabilitation works of flood and flood facilities, continuing the capacity rehabilitation works of flood and flood risk areas. soil conservation efforts, accelerating upstream flood control efforts, developing a drought forecasting and early warning system Establishment and dissemination	TOB (DSI, SYGM, OGM, TAGEM)	(ÇEMGM)IB (PPA, Municipalities*	2024-2030	Basin at the level of recommended Nature ratio of based solutions to total measures (%); Number of flood forecasting and early warning systems installed at basin level (number); Basin at the level of of facilities with rehabilitated capacity (%); Soil conservation works in areas with flood and flood risk at basin level (number, %); Number of upstream basin studies for flood control at basin level (number); Ratio of upstream measures to total measures (%); Number of drought early warning systems established at basin level (number)

Agriculture and Food Security

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Strategic Objective 1. Developing policy and legal framework for adaptation of the agriculture sector to climate change, strengthening institutional capacity, cooperation and awareness					
TAR1	Reviewing and updating agricultural policies and legislation in order to create a sustainable and competitive agricultural sector that is resilient to climate change, uses technology effectively, and takes into account the product pattern and water budget in accordance with the water availability of the basin	TOB (TRGM, SYGM)	TOB (BÜGEM, HAYGEM, BSGM, TAGEM, SGB, GKGM, ABDİGM, İM), SBB, Universities	2024-2030	Report on review of agricultural policies taking into account adaptation to climate change (yes/no); Number of amended legislation (number)
TAR2	Planning agricultural production on the basis of agricultural basins or enterprises and revising agricultural supports to achieve the targets in these plans	TOB (TRGM, HAYGEM, BÜGEM)	TÜİKTÜBİTAK, SBB, HMB, Municipalities*, UMT, Universities	2024-2030	Land Use Plans (number); Animal Production Plan (present/absent); Crop Production Plan (present/absent);
TAR3	Scaling up training, awareness-raising and capacity-building activities for stakeholders operating in the agriculture sector in order to adapt to the impacts of climate change	TOB (EYDB)	ÇŞİDB (ÇEMGM)TOB (SUEN, SYGM), Municipalities*, UMT, TOBB, MoNE (HBÖGM), MoAF (EYDB), KA, UNDP, FAO, IFAD, Universities, Turkish Red Crescent, NGOs	2024-2030	Number of trainings for farmers (number); Number of trainings for technical staff (number); Number of trainings for managers (number); Number of trainings for private sector and CSOs (number); Number of trainings for women (number); Number of trainings targeting vulnerable groups (such as the poor, persons with disabilities, seasonal workers, children and youth) (#); Number of studies on drought and efficient use of water (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Ensuring the protection, development and sustainable use of ecosystems and natural resources in agricultural production					
TAR4	In crop production and animal husbandry, conducting studies to determine the appropriate crop pattern and animal husbandry system that can ensure the effective use of soil and water resources and the protection of biodiversity at the provincial and/or district level and preparing guides to guide farmers	TOB (BÜGEM, HAYGEM, TAGEM)	TOB (IM), TUBUTAK, TOB (TKDK, , KA, Municipalities*, UMT, Universities	2024-2030	Number of provincial advisory production pattern guidelines (number); number of advisory production pattern guidelines (number); provincial advisory livestock system guides (number); Number of district advisory livestock system guides (number); Number of farmers participating in irrigation trainings (number)
TAR5	Ensuring the protection of the qualities of agricultural lands, pastures and rural landscapes, monitoring pasture capacities and productivity, identifying and implementing options that will help water balance in pastures and increase productivity	TOB (TRGM, TAGEM)	TOB (OGM, BÜGEM), Municipalities*, UMT	2024-2030	Size of cultivated agricultural land in the province (ha); Size of settlement pasture (ha); Size of pasture improved in the province (ha);
TAR6	Developing nature-based solutions guide for agricultural activities at national level, developing an ecosystem-based food production model, implementing and disseminating agroforestry activities in the agricultural environment	TOB (TRGM, TAGEM)	TOB (OGM), TUBUTAKÇŞİDB (ÇEMGM), TOB (TKDK, , KA, Municipalities*, UMT, Universities	2024-2030	List of Nature-Based Solutions in Agricultural Production (present/absent); Ecosystem-oriented food production model (present/absent); Size of agroforestry area (ha)
TAR7	Promoting sustainable aquaculture compatible with climate change, protection, development and sustainable use of aquatic biodiversity, plan to combat invasive species in fisheries creation of	TOB (BSGM, TAGEM)	TOB (TKDK), TUBUTAKBKİ, KA, Municipalities*, UMT, Universities	2024-2030	Fishing models appropriate to the ecosystem (present/absent); List of climate change compatible and non-climate change compatible practices in aquaculture (present/absent); Response plan (present/absent)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
TAR8	Improving support for households and enterprises engaged in beekeeping; taking into account the linkage (risk relationship) with other sectors (especially fruit production, tourism and honey forest)	TOB (HAYGEM)	TOB (OGM, TKDK), BKİ, , KA, Municipalities*, UMT, Universities	2024-2030	Research report on the impact of climate change on beekeeping and adaptation (yes/no)
Increasing R&D studies on the impact of climate change on agriculture and adaptationdeveloping databaseinformation technologies and innovation practices in agriculture and carrying out agricultural activities accordingly					
TAR9	Supporting and developing R&D studies on climate change impacts and adaptation in the agriculture sector	TOB (TAGEM)	TOB (GKGM, BTGM), SBB, TUBUTAKYÖK, Universities, TUBITAK	2024-2030	Climate change effects Number of research supported on the subject (number); Plant disease and pests Number of research supported on the subject (number); Alternative feed sources Number of research supported on the subject (number); Reclamation Research (classic, biotechnological and molecular genetics) number (number)
TAR10	Identification and monitoring of socio-economic factors that play an important role in determining vulnerability in the agricultural sector (province, district, village level)	TOB (TRGM), TÜIK	TOB (BTGM, TAGEM, IM), Municipalities*, UMT	2024-2030	Identified socio-economic Factors list (present/absent); Rural population socio-economic data at provincedistrictvillage level

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
TAR11	Developing database, information technologies and innovation applications and innovative activities in agriculture and conducting agricultural activities accordingly	TOB (TAGEM)	TOB (BÜGEM, HAYGEM, İM, BTGMTRGM), TÜBİTAK, Universities	2024-2030	Number of plant species/variety lists compatible with expected conditions at provincedistrictvillage level (number); Number of animal species/breed lists compliant with expected conditions at provincedistrictvillage level (number); Number of agricultural calendars at provincialdistrictvillage level in line with expected conditions (number); Number of cultural operations recommendation lists at provincialdistrictvillage level (number); Agricultural data sharing portal (yes/no); Digital agricultural drought monitoring system (yes/no) Agri-environment indicator list (yes/no); Forecast and Warning Systems area (ha); Number of products covered by Forecast and Warning Systems (number)
TAR12	Reducing loss and damage to critical infrastructures (irrigation, cold chain, modern storage, transportation infrastructure, etc.) and improving the insurance system by taking into account the impacts of climate change	TOB (TRGM, TAGEM)	STB (TUYSGM), UAB (AYGM), TB (İTGM), ÇŞİDB (İDB), TOB (TKDK, DSİ,), BKİ, KA, Municipalities*, UMT	2024-2030	Inventory of water storage systems (present/absent); Irrigation methods irrigated According to area width (ha); Number of insurance programs (products) related to climate change (number); Number of farmers with insurance (number); Number of cold storage (number); Village-district-province-province highway, railway current situation and potential investment report (available/not available)

Biodiversity and Ecosystem Services

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Increasing awareness and capacity on biodiversity, ecosystem services, nature-based solutions, ecosystem-based adaptation, ensuring data and information sharing among all stakeholders, preventing confusion of authority and strengthening cooperation					
BEK1	Conducting climate and nature literacy programs within the scope of adaptation to climate change, updating education programs in schools and universities with a focus on skills and qualifications required for the protection of biodiversity and ecosystems, developing nature conservation projects, organizing communication campaigns using different tools for different target audiences	MEB (TEGM, HBÖGM, OÖGM), ÇŞİDB (TVKGM), TOB (DKMPGM, OGM)	ÇŞİDB (İDB, ÇEMGM, YÖK, , TRT, KTB (RTÜK), GSB, Universities, Turkish Red Crescent, NGOs, Private Sector	2024-2030	Number of programs prepared (number); Number of projects developed (number); Number of campaigns organized (number); Number of communication materials prepared (number); Number of participants (number)
BEK2	Increasing institutional capacities in the field of biodiversity and ecosystems, ensuring coordinated data and information sharing among all stakeholders, preventing confusion of authority and strengthening cooperation	TOB (DKMPGM), ÇŞİDB (TVKGM)	TOB (OGM, SYGM, DSI, BSGM, TAGEM, BÜGEMTRGM), (ÇEMGM, ÇEDİDGM, MPGM, İDB), İB (JGK), UAB (DGM), TAE, OAE, Universities, NGOs, Private Sector	2024-2030	Number of inter-institutional protocols (number); Number of in-house trainings (number); Number of personnel participating in training (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Reducing the pressure of factors that threaten biodiversity and ecosystem services, such as habitat fragmentation and change, pollution and overuse					
BEK3	Updating the legislation on biodiversity and ecosystem services with a focus on nature conservation, harmonizing protected area categories with international standards, and strengthening cooperation and coordination among relevant institutions to ensure effective management in these areas,	ÇŞİDB (TVKGM, ÇEDİDGM), TOB (DKMPGM, OGM)	IDUKKTOB (TAGEM), Universities, NGOs	2024-2030	Legislation From the eye migration workshop (present/absent); Changed/updated legislation number (number); Amendment to Articles 16, 17, 18 Additional Article 16 of the Forestry Law (yes/no); EIA Regulation Impact reduction hierarchy including to be (Avoidance > Mitigation > Compensation) (present/absent)
BEK4	Preventing, monitoring and controlling land/habitat change and air, water, soil, plastic and noise pollution that harm biodiversity	ÇŞİDB (ÇEDİDGM), TOB (DKMPGM, OGM)	Municipalities*, UMT, MoAF (DSI,), MoEnvU (DGDEU, DGVWRT)	2024-2030	Updated Threshold values list (present/absent); Number of legislations prepared (number); Number of audits (number); Ratio of natural areas to the country's surface area in accordance with international land cover classifications (%); Distribution of forests by forest fragment size (number and %)
BEK5	Sustainable management and utilization of forest, agriculture, livestock and water resources Ensuring Identifying sustainability challenges and preparing a roadmap to address them	TOB (OGM, TAGEM, BÜGEM, BSGM, TRGM, HAYGEM)	TOB (DSİ, DKMPGM, SYGM, SUEN), (ÇEMGM, TVKGM), Universities, NGOs	2024-2030	Number of workshops (number); Roadmap and guidelines prepared (number); Monitoring and evaluation report prepared (yes/no)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Researchmonitoring and evaluation of the impacts of climate change on biodiversity and ecosystem services					
BEK6	Identifying and cataloging all species in living classes, investigating the interactions of climate change with biodiversity and ecosystem services, identifying critical species and habitats, carrying out projects to monitor their ecology and populations, developing strategies and taking measures to identify, monitor (introduction, early detection, spread), control (eradication and management) invasive alien species	TOB (DKMPGM, BSGM, TAGEM), ÇŞİDB (TVKGM)	ÇŞİDB (MGM), TOB (BÜGEM, DSİ, OGM, , SUEN), TB (GGM) , TAE, OAE, Universities, NGOs	2024-2030	Scope expanded National Biodiversity Inventory (present/absent); Potential Natura2000 sites (number); Number of species and habitats at risk (number); Inventory of species and habitats that will be primarily affected by climate change (present/absent); Species/habitat/ecosystem Monitoring and evaluation guidelines (number); Number of species/habitats/ecosystems monitored (number); Number of studies on the ecology of critical species taking into account climate change (number); Number of monitoring projects on invasive alien species (number); Number of species and habitats taken under protection (number)
BEK7	Conducting research to compile traditional ecological information to identify, map and integrate the products and services provided by ecosystems and the contributions of nature to humans into both spatial plans and administrative plans	ÇŞİDB (ÇEMGM, TVKGM)TOB (DKMPGM, OGM, BÜGEM, TAGEM, SYGM, BSGM)	TUBUTAKTAE, OAE, Universities, NGOs	2024-2030	Number of ecosystem services mapping projects (number); Number of traditional ecological knowledge research (number); Ecosystem services Number of projects for livelihood providers (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
BEK8	Monitoring climate change-induced biotic (e.g. insect and fungal damage) and abiotic factors (e.g. storms and snow cyclones) that damage forests and making an inventory of the area/wood damaged, monitoring and/or predicting long-term climate change impacts, adaptation-based ecosystem management effective in forests, Forest prioritizing preventive measures in the fight against fires	TOB (OGM)	TOB (DKMPGM), ÇŞİDB (TVKGM, ÇEMGM)	2024-2030	Abiotic and biotic damage monitoring system (present/absent); Annual amount of forest area and wood damaged by abiotic and biotic factors (ha, m^3); Number of action plans prioritizing fire prevention measures (number); Number of adaptation-based forest management plans (number); Number of Integrated Ecosystem Research and Monitoring Sites (LTER) established (number); Afforestation rate in fire-affected areas (percentage)
Increasing the amount of protected areas for effective nature conservation, restoring damaged ecosystems and integrating climate change adaptation into management plans					
BEK9	Contributing to international efforts to increase the proportion of marine and terrestrial protected areas to 30% globally	TOB (DKMPGM), ÇŞİDB (TVKGM)	TOB (OGM, SYGM, DSI, BSGM, TAGEM, BÜGEMTRGM), ÇŞİDB (ÇEMGM), UAB (DGM)	2024-2030	Ratio of protected areas to the country's surface area (%)
BEK10	Species/habitat conservation action plans and management and development plans of protected areas will include the protection of biodiversity, ecosystem services support and inclusion of climate change adaptation issues	TOB (DKMPGM), ÇŞİDB (TVKGM)	TOB (OGM, DSI, SYGM), ÇŞİDB (ÇEMGM)	2024-2030	Number of plans prepared (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
BEK11	Inventory of destroyed and fragmented ecosystems, ensuring the restoration of destroyed ecosystems throughout the country, connecting fragmented ecosystems with ecological corridors	TOB (DKMPGM, OGM, TAGEM, BSGM), ÇŞİDB (TVKGM, ÇEMGM)	TOB (TRGM, SYGM, DSI, BÜGEM), , TAE, OAE, Universities, NGOs	2024-2030	Inventory of degraded/fragmented ecosystems (present/absent); Ecological restoration targets (% for 2030 and 2040); Number of ecological corridors (number); Number of pilot ecological restoration projects (number); Land Degradation Offsetting Action Plan (present/absent); Number of biodiversity offset pilot projects (number); Number of land degradation offset pilot projects (number)
BEK12	Identifying good practice examples in Turkey and internationally on issues such as nature-based solutions and ecosystem-based adaptation and conducting sample implementation projects	TOB (DKMPGM, TRGM), ÇŞİDB (TVKGM)	TOB (OGM, SYGM, DSI, BSGM, TAGEM, BÜGEM)ÇŞİDB (ÇEMGM), UAB (DGM), Municipalities*, Research Institutes, Universities, NGOs	2024-2030	good practice examples (number); Number of nature-based solution pilot projects (number)

Public Health

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Strategic Objective 1. Strengthening the infrastructure for evidence-based analysis, assessment and reporting on climate change in the field of health and increasing R&D studies					
SAG1	Developing a list of indicators and health impact chains based on the Climate and Health Profile of Turkey; establishing a system for data collection, continuity, analysis and harmonization of these studies with existing practices such as notification, early warning, etc.	SB (HSGM, SBSGM)	(İDB), TÜİK, Universities	2024-2025	Number of indicators (number); Number of health impact chains for climate hazards (number); TurkStat climate and health bulletins (number); disease (number/population*100)
SAG2	Increasing epidemiological research on the physical, mental and social impacts of climate change; identifying places and populations with high vulnerability to potential hazards at regional and city level; planning health services according to climate determinants	MOH (HSGM)	(İDB), TÜBİTAK, YÖK, TUA, KA, Universities, MoH (DGSA, KHGM, ASHGM, SGGM, SBSGM, SaYGM)	2024-2030	Number of studies (number); Number of publications (number); Number of plans prepared (number)
SAG3	Preparation of legislative infrastructure within the scope of Health Impact Assessment of measures taken for climate change	MOH (HSGM)	IDUKK Municipalities*	202-2030	Draft legislation (present/absent)
SAG4	joint R&D with other sectors and disciplines for monitoring, protection, prevention and early of diseases caused by climate change (heat, cold, ultraviolet-relateddue to deterioration of water, air, food quality; animal and vector-borne, new, re-emerging infectious; mental health) increasing the number of studies	MOH (HSGM)	TUBITAK, YÖK, Universities	2024-2030	Number of R&D studies (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Strengthening the capacity, cooperation and awareness on climate change and health perspective in all institutions and organizations at national and local level					
SAG5	Establishing a high-level coordination unit, working groups and climate and health ethics committees to carry out activities such as monitoring and communication	MOH (HSGM)	MOEU (CAU), Universities, TOBB (SHM), Presidential Communications Directorate	202 - 2026	Coordination unit (present/absent); Number of working groups (number); Number of ethics committees established at national, regional and/or provincial level (number); Number of working group reports (number)
SAG6	Determining the periodic agenda item of the Public Hygiene Boards in the provinces as climate change and health impacts or protection of urban health from the negative impacts of climate change	MOH (HSGM)	Provincial Public Hygiene Boards	2024-2030	Number of agenda items related to climate change (number)
SAG7	Preparation and use of climate-sensitive disease list; identification of climate-sensitive diseases within the country, preparation of climate and health dictionary for disciplines and sectors	MOH (HSGM)	MOEU (MGM), Universities	2024-2025	Number of disease codes (number); Number of diseases coded at national and local level (number) and their distribution (%); Prepared dictionary (present/absent)
SAG8	Initiating, developing and disseminating climate and health literacy studies, training the manpower working in the health sector	MOH (HSGM)	ÇŞİDB (MGM)MEB, YÖK, Universities	2024-2026	Number of trainings (number); Number of participants (number) (breakdown by first, second and third steps)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
SAG9	Re-organization of educational curricula and practice guidelines related to environment, cities, climate and health with a climate change and health perspective	MEB (TEGM), YÖK, SB (HSGM), ÇŞİDB (İDB)	Universities	2024-2026	Number of courses addressing the relationship between climate and health (number); Number of climate and learning objectives in F5s (#)
SAG10	Ensuring accreditation of health facilities as climate change resilient facilities	MoH (HSGM, KHGM, SaHGM, SGB)	TUSKA	2024-2026	Number of accredited facilities (number)
SAG11	Increasing the number of plans, programs and projects carried out in cooperation with national/local public and community in the field of climate and health and increasing community participation in adaptation efforts	MOH (HSGM)	ÇŞİDB (YYGM)STK, Municipalities*, Municipality (PDMM)	2024-2030	Number of completed plans, programs and projects (number); Number of CSOs participating in climate and health studies (number)
SAG12	Reviewing Occupational Health and Safety (OHS) legislation with respect to occupational safety, occupational diseases and public health aspects related to climate change impacts and adaptation, identifying risks and making updates	MOLSS (OHSS)	(IDB), STB (SGM), TOB (OGM), SB (HSGM)	2024-2025	Updated legislation (present/absent)

Energy

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Developing the political and legal framework for the adaptation of Turkey's energy sector to climate change, strengthening institutional capacity and cooperation, increasing the production and sharing of information and data					
ENR1	Providing necessary training and awareness-raising activities to public institutions and private sector decision-makers in the energy sector to improve their institutional capacity and information networks on climate change adaptation	MENR	MOEU (CAO)	2024-2030	Number of trainings (number); Number of participants (number)
ENR2	Identifying and assessing the needs for climate services in the energy sector and the risks arising from climate change	MENR	MOEU (MGM, CAO)Municipalities*, International Organizations Working on Climate Change Organizations, MoAF (DSİOGM)UMT	2024-2025	Number of inter-institutional cooperation protocols (number); Number of risk analyses (number)
ENR3	Integrating climate risks and climate change adaptation into energy policy documents	MENR	MOEU (CAU), TOBB, Private Sector	2024-2030	Number of policy documents including adaptation to climate change (number)
Strengthening the generationtransmission-distribution and storage infrastructure in energy resources, taking into account the necessary designs and increasing the flexibility of the electricity energy system in order to ensure adaptation to climate change					
ENR4	Integrating climate change adaptation into relevant decisions affecting water resources management and operation of HEPPs with dams, increasing water retention capacity or preference for HEPPs with pumped storage, increasing durability of dam bodies and power plant equipment and turbine efficiency	MOAF (DSI)	MENR, Municipalities* (SUKI), UMT, Private Sector	2024-2030	Number of water management plans of dams that take into account adaptation to climate change (number); Number of HPPs with pumped storage (number); Increased water holding capacity (m^3); Number of damaged power plant equipment (number);

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
ENR5	Taking necessary measures to protect open lignite quarries and stockpiles from climate hazards such as floods and heat waves	MENR	Private Sector	2024-2030	Number of water spray cooling systems (number); improved drainage systems (number)
ENR6	Conducting vulnerability and risk analyses for coastal energy facilities against sea level rise taking necessary precautions	MENR	MEUU (CAU, MoFD, MGM, GDoE), Private Sector	2024 -2030	Number of risk and vulnerability analyses (number); Number of equipment taken precautions (number); drainage systems improved (number)
ENR7	Taking measures to prevent damage to overhead electricity transmission-distribution infrastructure due to climate hazards	MENR	MoAF, Private Sector	2024-2030	Length of distribution line undergrounded (km); Hawaii transmission in the lines plant length of line (km) where the cover is controlled; Length of vegetation controlled overhead distribution lines (km)
ENR8	Taking measures against the impacts of climate change at oil and natural gas exploration and production platforms, transmission and distribution pipelines and tank farms	MENR	TANAP, Private Sector	2024-2030	Reinforced Oil and natural number of gas facilities (number); Length of flexible pipelines (km) Number of drainage systems (number)
ENR9	In WPPs harm and efficiency reduction of losses	MENR	Municipalities*, Private Sector	2024-2030	Number of wing heating systems (number); Number of dust, sand, snow and hail removal modules in use (number)
ENR10	Establish early warning and response systems for energy management to improve maintenance schedules and respond quickly to post-disaster recovery needs	MENR	MoD (AFAD)Special Sector	2024-2030	Improved maintenance (number); Early and response systems (number)
ENR11	In order to increase energy efficiency in buildings, use of new and efficient technology/devices starting from the building design and popularization of district heating/cooling systems	MENR	ÇŞİDB (MHGM, ÇYGMTOKİ, STB (SGM), TÜBİTAK, TSE, Private Sector	2024-2030	Energy efficiency practices in buildings (number); Number of district heating and cooling systems (number); Number of energy performance standards implemented (number)

Tourism and Cultural Heritage

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Increasing the capacity of tourism investments and enterprises to adapt to climate change in terms of infrastructure					
TUR1	Developing criteria for building tourism facilities resilient to climate risks, transforming existing ones and increasing their adaptive capacity	KTB (YİGM, TGA)	ÇŞİDB (MPGM, KDB, YYGM), (DKMPGM), Municipalities*, UMT, KTB (NPL Area Presidencies)	2024-2026	Number of projects prepared (number)
TUR2	legal and administrative and administrative and management to transform, inspect and support tourism facilities in accordance with the developed criteria creation of infrastructure	KTB (DGMM)	MOEU (DGMMU), Municipalities*, UMT, ASHB (DG EYHGM)	2025-2030	Number of regulations/circulars/principles/criteria published (number); Number of units established (number); Number of projects supported (number)
TUR3	Providing trainings and technical support and to disseminate sustainable tourism practices nationally in tourism enterprises and destinations Ensuring	KTB (NPL)	SBB (SKYGM), STK, TOBB, ASHB (EYHGM)	2024-2027	Number of trainings provided (number); Number of sustainable documents (number)
Strategic Objective 2. Improving social infrastructure in the tourism and cultural heritage sector to develop capacity to adapt to climate change					
TUR4	Organizing training and awareness-raising activities and increasing technical capacity in educational institutions, responsible organizations and sector-related NGOs on the impacts of climate change on the tourism sector and cultural heritage and adaptation measures	KTB (AEGM, KVMGM, VGM)	MEB (HBÖGM, TEGM), YÖK, KTB (KVKBKM, İM, RTÜK), ISŞKUR, Municipalities*, NGOs, TOBB	2024-2030	Number of training and awareness campaigns (number); Cultural legacy and climate number of activities on change (number)
TUR5	destination management that will increase the capacity to adapt to climate change by ensuring local ownership, joint action and cooperation between parties in tourism destinations destination creation of offices	KTB (NPL)	STB (KA), KTB (Area Presidencies) Municipalities*, UMT, NGO, TOBB	2024-2029	Number of local destination management offices (number)
TUR6	Identification of climate risks to movable and immovable cultural heritage elements and areas and prioritized intervention areas and needs Preparation of guidelines to guide the determination of the	KTB (KVMGM, VGM)	KTB (KVKBKM), ÇŞİDB (İDB, MGM), UAB	2024-2026	Number of guidelines prepared (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
TUR7	Identifying and mitigating the vulnerability of cultural heritage to climate hazards, carrying out studies and coordination for the protection of cultural assets and ensuring local, national and international cooperation	KTB (KVMGM, VGM)	KTB (YİGM), TMK, Municipalities*, UMT, ICOM, ICOMOS, UNDP, UAB, MoI (ShGK), MoD (LCD), NGO, TOBB, ASHB	2024-2030	Number of meetings held (number); Number of completed projects (number)
TUR8	Preparing promotional materials in accordance with target markets, changing tourist preferences and motivations, sustainable and responsible tourism approach and using them in country and destination-based promotions	KTB (NPL)	KTB (TGM), STK, TOBB	2024-2026	Number of promotional materials prepared (number)
Strategic Objective 3. Taking climate change adaptation into account in strategic and spatial decisions related to tourism and cultural heritage and ensuring coordination among authorized institutions					
TUR9	Updating the strategic objectives for preserving and transferring cultural heritage to the future within the scope of the update of the national tourism strategy, taking into account climate change adaptation actions	KTB (DGMM)	KTB (KVMGM, VGM), ÇŞİDB (MPGM), TOB (DKMPGM)	2024-2025	Updated national tourism strategy (present/absent)
TUR10	Considering adaptation to climate change in spatial plans to be prepared for potential tourism areas that may arise due to climate change, ensuring sustainable land use	KTB (DGMM)	ÇŞİDB (MPGM, (DKMPGM), KTB (KVMGM), Municipalities*, Municipality (PDMM)	2024-2027	Number of projects prepared (number); Number of spatial plans prepared (number); Prepared by number of regulations/circulars/principles/criteria (number)
TUR11	Preparation of sustainable tourism strategies to identify and develop focal points for niche tourism types in special themes and areas in order to reduce vulnerability to climate change	KTB (DGMM)	KTB (TGA), TÜRSAB	2024-2030	Number of strategies/principles/plans prepared (number); Number of tourism business certificates issued (camping, tent, tent car, caravan, motorhome, bungalow...etc.)

Industry

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Identify facilities at risk of triggered technological risks and major industrial accidents and develop adaptation actions as a priority					
SNY1	Re-evaluation of facilities under the risk of technological risks and/or major industrial accidents triggered by climate change-induced disasters according to climate projections and vulnerability and risk analyses	ÇŞİDB (ÇEDİDGM), IB (AFAD)	ÇŞİDB (İDB, ÇYGM), SB (HSGM, STB (SGM, ÇSGB (ÇGM), OSBUK	2024-2027	Detection study (present/absent)
SNY2	Reviewing the risk analysis and emergency plans of each facility within the scope of adaptation to climate change, making the necessary updates, identifying priority adaptation actions and implementing the identified actions	ÇŞİDB (ÇEDİDGM),	ÇŞİDB (ÇYGM)STB (SGM), IB (AFAD), STB (SGM, ÇSGB (ÇGM), OSBUK	2025-2030	Facility-based monitoring and reporting system (present/absent); Number of compliance actions implemented (number)
Strategic Objective 2. Prior to investment projects, assess and monitor the impacts of climate change on the investment and the impacts of the investment on the climate together					
SNY3	Reviewing investment incentive legislation and practices (primarily investment site allocation) from a climate change adaptation perspective, taking into account the vulnerability and risk analyses conducted across the industrial sector in decision-making and monitoring processes	STB (TUYSGM)	(İDB, MİLE), KOSGEB, OSBÜK	2025-2030	Number of investment location allocation incentives where harmonization criteria are assessed (number)
Strategic Objective 3. Making the necessary updates as a result of reviewing the insurance legislation to increase insurabilitythe impacts of climate change					
SNY4	Monitoring of insured industrial facilities affected by climate change induced disasters and climate hazards	SEDDK, Insurance Information Center	TSB, ÇŞİDB (İDB), , STB (SGM), İB (AFAD)	2025-2030	Number of insured facilities affected by climate hazards (number); Compensation paid for damages caused by climate hazards (TL); Proportion of damages covered by insurances (%)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Ensuring fast and practical access to national projections and databases for the studies to be carried out by the industrial sector					
SNY5	Identifying the industrial sub-sectors with the highest vulnerability to climate change and preparing adaptation guidelines for these sectors	TOBB	KOSGEB, TÜİKOSBÜK, STB (SGM)	2024-2030	Number of sectoral harmonization guides (number)
Encouraging collaborations within the sector (mentoring system and training of trainers)					
SNY6	Organizing a training of trainers program through the sector	TOBB	(İDB), TÜSİAD, MÜSİAD, , STB (SBGM, SGM), KOSGEB, Chambers of Industry	2024-2026	Number of training of trainers programs (number); Number of participants (number)
SNY7	Strengthening the technical information capacity of industrial enterprises, in particular SMEs, for adaptation to the impacts of climate change	TOBB	TÜSİAD, MÜSİAD, OSBÜK, STB (, SBGM, KAGM), KOSGEB, Chambers of Industry	2026-2030	Number of trainings (number); Number of participants (number)
Strategic Goal 6. Encourage the inclusion of climate change adaptation elements in green procurement criteria					
SNY8	Providing information on the inclusion of compliance elements in the updates to be made for voluntary green procurement in the industrial sector	TOBB	TÜSİAD, MÜSİAD, , STB (SGM, SBGM), KOSGEB, Chambers of Industry	2024-2026	Number of information/workshops on green procurement with adaptation elements (number)

Transportation and Communication

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Ensuring resilience of critical infrastructures in transportation and communication					
ULŞ1	Making critical routes and infrastructures needed in highways, railways (HSR, HT and conventional lines), ports and airports resilient to climate change-induced risks in line with climate projections	UAB (AYGM, KGM, TCDD, TKYGM, LFYDB, TDİSHGM, DHMİ)	UAB (DGM, SGB, UEİMB), TOB (DSİ), IB (), ÇŞİDB (MGM, İDB), Universities, TOBB, TMMOB	2024-2030	Current situation assessment and needs assessment (present/absent); Number of planning and project design studies (number); Length and number of infrastructure interventions carried out (km, number)
ULŞ2	Making vehicle, bicycle and pedestrian roads and all public transportation (rail, bus, sea transportation) infrastructures in cities resilient against climate change-induced risks	Municipalities*, NAB (KGM, TCDD)	UAB (AYGM, HGM), IB (AFAD)ÇŞİDB (MGM, İDB), TOBB, Universities, TMMOB, UMT	2024-2030	Length and number of infrastructure interventions carried out (km, number); Length and number of drainage system improvement works on roads (km, number); Length and number of protective barriers and bulwarks from storms and sea waves in coastal cities (km and number); Length of roads (vehicle, pedestrian, bicycle) with shade and shelter from heat waves (km); Revision of the By-Law on Bicycle Lanes (yes/no); Legal regulation on technical components of public transportation and school/workplace service vehicles (yes/no)
ULŞ3	Making data centers, base stations and electronic communication infrastructure in the communication sector resilient against climate change-induced disaster risks	BTK	UAB (HGM, AYGM), TUBUTAK, IB (AFAD, ÇŞİDB (MGM), Universities, TOBB, TMMOB	2024-2030	Monitoring report on compliance with service quality obligations determined by the ICTA (yes/no)i

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Strategic Objective 2. Ensuring transportation and passenger health by reducing the level of vulnerability					
ULŞ4	Use of highly permeable paving materials on hard surfaces of roads, sidewalks, squares and parking lots in urban settlements	Municipalities*, UAB (KGM)	Universities, UMT, TMMOB	2024-2030	Provinces realized People meetings (present/absent); Number of provinces where public meetings were held, number of people attending the meetings (number); Number of planning and project design studies (number); Size of infrastructure intervention (m^2) and/or number of projects (number);
ULŞ5	Increasing permeable surfaces and drainage opportunities with green and blue infrastructures in urban settlements, reducing the impact of heat waves	Municipalities*	TOB (DSI), TBB, Universities, TMMOB	2024-2028	Increase in the amount of green space (m^2); Increase in the amount of green space per capita (m^2); Length of rivers restored to the city (km)
ULŞ6	Renewal of private and public public transport vehicle fleets with the use of air conditioning and ventilation systems in public transport vehicles, school buses and buses and minibuses used in intercity passenger transportation, and the use of materials and colors that do not let in high temperatures	Municipalities*	UAB (KGM), Transportation Service Providers, Universities, TOBB, TMMOB, TSE, STB, UMT	2024-2030	Number of renewed vehicles (number); improved vehicles (number); Ratio of the number of vehicles with air conditioning and ventilation equipment to total fleet (%)
ULŞ7	Pavement that reduces surface temperature in areas with high temperatures on highways and urban roads (cooler pavements) material, constructing afforested and protected vehicle, bicycle and pedestrian paths, replacing landscape elements that increase fire risk with appropriate alternatives	UAB (KGM), Municipalities*	Universities, TMMOB, UMT	2024-2030	Length of roads with cool pavement (km); Number of sheltered roads and sheltered crossings/waiting areas (km, number); Fire risk for made number of landscape interventions (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Increasing emergency management and response capacity by improving accessibilitycommunication and evacuation facilities during disasters					
ULŞ8	Establishing a flexible transportation infrastructure with a high diversity of transportation modes and high opportunities for inter-modal integration both in the country and in cities	UAB (SGB), Municipalities*	UAB (HGM, AYGM, KGM, TCDD, TKYGM, DGM, TDİ, SHGM, DHMİ), SBB, ETKB, Universities, TMMOB, UMT	2024-2030	Railroad network to be extended investment realized (TL); Investment in maritime transportation (TL); In cities your journeys to mods according to the distribution of balanced to be (% trip distributions); Investment planning for public transport, bicycle and pedestrian transportation in city plans and transportation plans (present/absent); Rail system and/or dedicated busway investments (TL); Investments in bicycle paths (TL);
ULŞ9	Development of early warning and transportation information systems for climate hazards including smart and mobile applications	Municipalities*	MOEU (CAU), Universities, TOBB, TMMOB, UMT	2024-2028	Number of smart/mobile applications for warning and information purposes (number)
ULŞ10	Ensuring uninterrupted operation of communication systems such as data centers, fixed/mobile base stations, internet, camera, etc. with infrastructure support for additional energy supply	BTK	UAB (HGM, AYGM), Universities, TMMOB	2024-2030	Monitoring report on compliance with service quality obligations determined by ICTA (yes/no)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Strategic Goal 4. Improving planning capacity in the field of transportation and communication in line with the goal of adaptation to climate change					
ULŞ11	Implementing legal regulations that will increase the resilience of infrastructures in transportation and communication and reduce the vulnerability of infrastructure and users to climate change hazards	UAB (AYGM), BTK, ÇŞİDB (ÇEDGM)	ÇŞİDB (İLBANK), Municipalities*, UMT, Universities, TMMOB	2024-2025	Legislation to include climate change adaptation and resilience in feasibility and EIA reports (yes/no)
ULŞ12	Developing design guidelines on increasing green infrastructures and the use of permeable paving materials on streets and avenues to be used as a resource in transportation plans, Developing climate change adaptation strategies within the scope of Urban Transportation Master Plans, Sustainable Urban Transportation Plans (SUMP) and Bicycle Transportation Master Plans (BISUAP)	Municipalities*, UMT, MoU (DGoII, DGB)	(EYDB, İDB, MPGM, YYGM,), TOB (EYDB), Universities, TMMOB	2024-2025	Number of design guidelines (number); Number of plans including adaptation strategies (number)

Social Development

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
the impacts of climate change on social life and measures into socio-economic development and ecosystem conservation strategies at all levels (national, regional, local) and incorporate a social development component into each sector's climate change adaptation policyplanning and implementation processes					
SKL1	Taking into account the multifaceted impacts of climate change on social development in Turkey's Long Term Climate Strategy	MOEU (CAO)	SBB (SKYGM)	2024-2025	Long-term climate change strategy including social development elements (present/absent)
SKL2	Producing statistics that will enable demographic and socio-economic analysis of those employed in sectors affected by climate change	TUIK	ÇSGB (İÇDB, İŞKUR), ASHB (, KSGM, İB (GİB)	2025-2026	Inventory of statistically produced and classified data and information (present/absent)
Strategic Objective 2. Improving social protection policies to strengthen the resilience and adaptation of society against actual/potential climate hazards					
SKL3	Improving social assistance and social service programs implemented within the framework of social protection policies by taking account provinces with high social vulnerability in order to reduce the vulnerability of individuals/households to the impacts of climate change and strengthen their resilience	ASHB (SOYGM, SGB)	(İDB, ASHB (DHDB, EYHGM, ÇHGM, KSGM), MEB (DHGM), ÇSGB, (ÇGM), Higher Education Council, Governorships, District Governorships, Municipalities*, UMT, Regional Scale Municipal Unions, Turkish Red Crescent, SYDV	2025-2028	Number of social service types developed (number); Number of implementation projects planned in line with green social services (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
SKL4	Encouraging research for climate-friendly alternative social assistance policies within the framework of social protection policies	ASHB (SGB, SOYGM, ÇHGM, EYHGM, KSGM)	Universities, YÖK, TURKSTATMoNE MoLSS (ÇGM), Governorships, District Governorships, Municipalities*, UMT, SYDV, Turkey Bar Association, NGO, SHF	2025-2030	Number of supported research (number); Number of applications (number)
Moving away from the crisis management approach to a risk management model for the adaptation of society to climate change and strengthening the legal, institutional, administrative, scientific, human and financial capacity required in this context					
SKL5	Conducting analyses on how climate change affects the social lives of all segments of the society, especially vulnerable groups (elderlychildren, persons with disabilities) in line with their differentiated needs and initiating development programs supported by local governments by taking into account the various needs of each population group	ASHB (DHDB, EYHGM, ÇHGM, KSGM, SGB)	ÇŞİDB (İDB, CBSGM), MEB (DHGM, ÇSGB (ÇGM), STB (KAGM), Universities, TUBITAK	2025-2030	Number of completed analyses (number); Number of local development programs supported (number)
Implementation of climate change national adaptation policies for the welfare of all segments of society with a focus on rights and interest-based approach and equal opportunities					
SKL6	Quantifying women's differential vulnerability to climate change and identifying the benefits from adaptation, taking into account relevant SDGs and sector adaptation actions	ASHB (DHDB, ÇHGM, EYHGM, KSGM, SGB)	MEB (TEGM, SGB), EU (İHDB), IB (STİGM), ÇSGB (ÇGM), Universities, NGOs	2025-2030	Report taking into account SDG 5 targets (yes/no)

Disaster Risk Reduction

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Strengthening understanding of climate change and disaster risk and information infrastructure for sustainable and resilient development					
ARA1	Conducting comprehensive risk assessment and planning studies in order to identify climate change risks more clearly	(AFAD), ÇŞİDB (), TOB (SYGM)	IDUKK(SGB), KTB (SGB), Municipalities*, UMT, Universities	2024-2027	Number of hazard-specific research studies and action plans by type (number); National climate risk assessment report (yes/no); Number of integrated risk and hazard maps published at various scales (printed/electronic) (number); Number of basin flood risk management plans published (number); Number of river basin management plans (number);
ARA2	Development of a Multi-Hazard Early Warning System that includes forecasting and response actions, including warning systems for fast and slow-moving events, aiming to reach all segments of society	IS (AFAD)	ÇŞİDB (MGM, ÇEMGM)(DSİ, OGM, TAGEM, TRGM, BÜGEM, SYGM, (HSGM), ETKB (MTA), UAB, Municipalities*, UMT, Turkish Red Crescent, Mobile Operators, Media Organizations, NGOs	2024-2026	Number of information and data sharing protocols and Standard Operating Procedures (number)Number and type of hydrometeorological solutions and models (number); Multi-Hazard Early Warning System (yes/no); Notification system reaching all segments of the society and individuals (yes/no)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Ensuring transformative risk governance to strengthen climate change and disaster resilience					
ARA3	Systematic integration of climate change adaptation and disaster risk reduction in national and local sustainable and resilient development planning	IDUKK	SBB, IB (AFAD), ÇŞİDB (ÇEMGM, ,), ASHB (SGB), ÇSGB (), (SGB), KTB (SGB), Municipalities*, UMT, Universities	2024 - 2030	Guidance for the inclusion of disaster risk reduction in national development planning processes (present/absent); Number of updated policy documents, laws and regulations (number); Number of methodologies and technical guidelines prepared for climate and disaster sensitive spatial planning (number); Number of updated spatial plans (number);
ARA4	Revising policies and legislation, including sectors, to increase the disaster resilience of critical infrastructures, taking into account climate change and implementation preparation of guidelines	IDUKKIB (AFAD)	ASHB (SGB), ÇŞİDB (İDB, (ÇGM), GSB (SGB), KTB (SGB), SB (HSGM), MENR, Municipalities*, UMT, Universities	2024 - 2030	Climate resilient critical guide (yes/no); Number of updated legislation (number);
ARA5	Within the scope of covering losses and damages caused by climate change-induced disasters, development of insurance mechanism, improvement of loss and damage assessment process and establishment of Turkey Loss and Damage Digital Platform	SEDDK, IB (AFAD), HMBTOB (TRGM)	(, MGM), TOB (OGM), TÜİK, TCIP, Insurance Information Center, Insurance Companies, Insurance Association of Turkey, ÖRYM, TOBB (SEİK)	2024-2026	Developing insurance legislation cover the impacts of climate change (yes/no); Number of policies issued (number); Review of existing loss and damage assessment process (present/absent);
Strategic Objective 3. Developing institutional capacity and raising awareness to achieve inclusive and responsive climate change and disaster resilience					

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
ARA6	Enhancing institutional and technical capacity to improve disaster resilience	IS (AFAD)	ÇŞİDB (ÇEMGM), (SGB)ÇSGB (SGB), GSB (SGB), KTB (SGB, RTÜK), MEB (DHGM), SB (HSGM), AB (SGB), TOBB, Governorships, Municipalities*, UMT, Universities, Private Sector, NGOs	2024 -2030	Awareness raising and Educationactivities number (number); Number of participants in trainings for vulnerable groups (#, disaggregated m/f); Number of organizations participating in trainings (number);
ARA7	Taking into account displacement due to climate change-related risks in the National Migration Policy and action plans and climate change the inclusion of cohesion in the migration management process	IB (RA)	IB (AFAD), ÇŞİDB (), SB (HSGM), Turkish Red Crescent, MoNE (DG DHGM), MoLSS (DGLSS, DGMM)	2024- 2030	Systematic assessment report of climate change impacts on population movements and migrant populations (available/not available); Population mobility analysis according to climate change risk scenarios (present/absent);
Strategic Goal 4. Making stable and sustainable investments in the context of climate change and disaster resilience					
ARA8	Realization of post-disaster reconstruction and construction process by taking into account climate change impacts and ecosystem-based disaster risk reduction	ÇŞİDB (MHGM, ÇYGM, YPİGM,), IB (AFAD),	ÇŞİDB (İDB, İLBANK, ÇEMGM, MPGM, KDB), İDUKK, ASHB (SGB), ÇSGB (), GSB (SGB), KTB (SGB), SB (HSGM), TOB (SYGM), Municipalities*, UMT, Universities, Private Sector, TRC	2024-2030	Number of practices taking into account adaptation to climate change (number)

Horizontal Cutting Actions

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Strategic Objective 1. Integrating climate change adaptation into all policies and strategies					
YKS1	Conducting climate change impact, vulnerability and risk analyses specific to sectors	MOEU (CAO)	İDUKK, ASHB (SGB), ÇSGB (ÇGM), KTB (SGB)(SGB)GSB (SGB), MSB (SGB)	2024-2026	Sectoral vulnerability and risk analyses (existing/non-existing), number of sectors (number);
YKS2	Reflecting the issue of adaptation to climate change in a holistic manner in development plans and other plansprograms and policies already in force, taking into account the interactions of sectors with each other	IDUKK	ASHB (SGB), ÇSGB (ÇGM), KTB (SGB), AB (SGB), GSB (SGB), MSB (SGB), STB (KAGM), Universities	2024-2030	Number of plans prepared/updated (number)
YKS3	Conducting Technology Needs Analysis (TNA) for adaptation to climate change, increasing the number of research and product projects carried out for the use of new technologies	TUBITAK	İDUKK, ASHB (SGB), ÇSGB (ÇGM), KTB (SGB)(SGB)GSB (SGB), MSB (SGB), KOSGEB, Universities, Private Sector, Higher Education Council, NGOs	2024-2030	Technology Needs Analysis (present/absent); research and product projects (number); R&D support amount (TL)
YKS4	Establishing the legislative infrastructure for the preparation of Local Climate Change Action Plan (LCCAP) and preparation of LCCAP in all provinces	Governorships, Municipalities*, MoEU (IDB)	TBB	2024-2026	NCCAPs prepared (number); Legislation prepared (present/absent)
YKS5	Sustainability reporting that includes disclosures on climate-related risks and opportunities under the Turkish Sustainability Reporting Standards (TSRS) ensuring that it is done	KGK	MoLSS (DGMM), Private Sector	2024-2026	Number of reports prepared (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
Strategic Objective 2. Enhancing institutional capacities to increase knowledge to support decision-making processes and to increase expertise, training, knowledge base building, monitoring and R&D activities related to climate change					
YKS6	Ensuring that national and local scale data required for climate change vulnerability and risk analyses are identified and collected in a single source	(İDB, CBSGM)	Municipalities*, UMT, Universities	2024-2030	TUCBS climate change data layer (present/absent) and number of entries (number);
YKS7	Gathering the content produced by stakeholders on climate change in a single source and ensuring access by all stakeholders	MOEU (CAO)	IDUKKMunicipalities*, Private Sector, Universities, NGOs	2024-2030	Climate portal (present/absent); content entered (number)
Strategic Goal 3. Increasing knowledge, and on adaptation to climate change in a way to ensure that citizens are part of the solution, and ensuring participation in decision-making mechanisms					
YKS8	Conducting fair transition studies to protect employment in the process of adaptation to climate change	MOLSS (DGMM)	İŞKURUniversities, Trade Unions, NGOs, Municipalities*, UMT	2024-2030	Number of training programs related to new areas of employment (number); Created new profession Number of standards (number)
YKS9	Determining and updating national occupational standards and national qualifications by identifying the new qualifications and skill requirements that the climate change adaptation process will reveal in employment; examination and certification according to the determined national qualifications activities execution and dissemination	ÇSGB (ÇGM), MYK	İŞKUR, Universities, Trade UnionsNGOsTOBB, MoNEMunicipalities*UMT	2024-2030	Number of analyzes and reports (number); Number of national occupational standards published and/or updated (number); Number of national qualification certificates published and/or updated (number); Number of occupations certified (number); Number of people certified (number)

Action No	Action	Responsible Institution	Related Institutions	Implementation Period	Monitoring Indicators
YKS10	Starting from pre-school to the last stage of postgraduate education, reviewing and updating the curricula in terms of sustainable development goals and climate change, training trainers, training undergraduates in different disciplines (law, education, social sciences, engineering, etc.) on climate change, Increasing the number of master's and doctoral programs	MEB (TEGM, DHGM), YÖK	ÇŞİDB(ÇGM), İŞKUR, MYK, Universities, TOBB, NGOs	2024-2030	Number of trainings for trainers (number, m/f); Number of in-service trainings/events for teachers (number); Number of participants (number, m/f); Number of programs/courses (number); Number of students (number, m/f)
YKS11	In order to raise social awareness on climate change, mass communication and broadcasting tools (social media, digital applications and games, TV series, movies, etc.) should be utilized to increase climate change literacy, to raise awareness on the environment, and to raise public awareness on climate change. responsible Conducting awareness and awareness-raising activities in educational institutions on the effects of climate change in order to ensure behavioral change at the social level, such as gaining consumption habits	MONE (DÖGM ,HBÖGM, MTEGM ÖÖGM, OÖGM, ÖERHGM , TTKB DHGM, YEĞİTEK, TEGM)	MoEU (MoEU), Directorate of Communication, YÖK, MoH (HSGM), TÜİK, KTB (RTÜK DTGM, GSB (GHGM), TÜBİTAK	2024-2030	Number of programs conducted (number); Number of views on communication tools used (number); Number of materials prepared on climate change literacy, climate and environmentally sensitive consumption habitsnature conservation (number); Number of studies applied to be conducted at the societal level, particularly on climate change literacy and climate and environmentally sensitive consumption habitsnature conservation and methods to protect from the impacts of climate change (number); Annual survey to measure the level of behavior change (present/absent); Number of theater play performances (number)

Monitoring of actions for which municipalities are responsible will be done by UMT.

ANNEX-1: AND ANALYSES

AND METHODOLOGY

Vulnerability and risk depend on a wide range of factors such as socio-economic development as well as human-induced or natural climate variability (IPCC, 2012). Therefore, the impacts of climate change may cause differences in social functioning and, depending on the severity of these differences, may cause major damage or loss of functioning in specific sectors.

Risk is the potential for outcomes where values such as people, ecosystems, culture and physical assets are at risk. According to the 5th Assessment Report (AR5) of the IPCC, the concept of risk is considered as a combination of vulnerability, exposure and hazard (Figure 57). Climate risk represents a potential consequence of the exposure of the aforementioned values to climate hazards. Systems can be exposed to a single climate risk or multiple climate risks (IPCC, 2014).

Hazard is defined as a man-made or natural physical event that can cause loss of life, injury or other health problems, damage or destruction of property, damage to structures, livelihoods, service provision, ecosystems and natural resources. It also represents the potential for a trend or physical impact as well as the physical event.

Exposure is defined as the totality of living species, ecosystems, social and natural resources, structures or economic, cultural and social assets that may be damaged by climate change. It can also be defined as elements that are exposed, unprotected, or vulnerable to risk (IPCC, 2014).

Vulnerability is defined as a predisposition to be adversely affected and is dependent on sensitivity, susceptibility to harm, coping and adaptive capacity function (IPCC, 2014). Sensitivity and capacity are two key elements of vulnerability. Sensitivity is determined by factors that directly affect the consequences of a hazard and can include physical, socio-economic and cultural characteristics of a system. Capacity refers to the state of preparedness for and ability to respond to current and future climate impacts. Coping capacity to the ability of people, systems, institutions and organizations to address, manage and overcome adverse conditions in the short to medium term using existing skills, values, beliefs, resources and opportunities. Adaptive capacity refers to the ability of people, systems, institutions and organizations to adjust to potential harm, take advantage of opportunities or respond to consequences (IPCC, 2014).

Since risk cannot be completely eliminated with the measures taken, the risk situation can be better managed through various approaches such as reducing sensitivity and exposure, increasing adaptation capacity or sharing the risk. Action plans prepared according to sectors are very important to manage risk correctly.

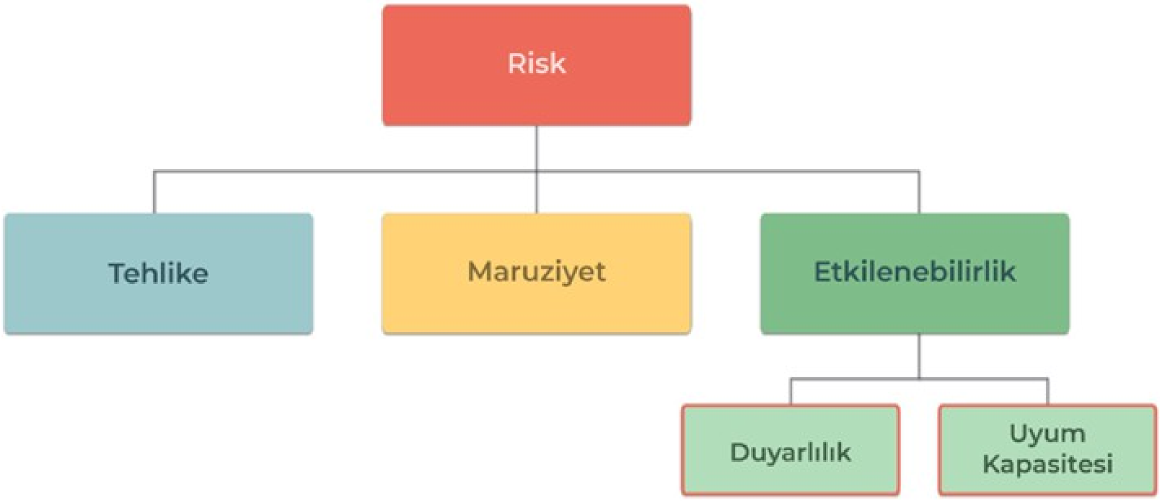

Figure 57 Risk Components According to IPCC AR5 Approach (IPCC, 2014)

The method of vulnerability and risk analysis is based on this conceptual framework and determined according to the IPCC reports. According to the 5th Assessment Report of the IPCC, risk is defined as a function of hazard, exposure and vulnerability (IPCC, 2014) and this definition is expressed as in Equation 1.

$$R = f(T, M, E) \qquad [1]$$

Where R is risk, T is hazard, M is exposure and E is vulnerability shows. There are two key elements of vulnerability: sensitivity (S) and capacity (C). A "potentially vulnerable group" is a group that is both vulnerable and susceptible to climate change at the same time. These potentially vulnerable groups into those with and without coping or adaptive capacity. Groups without coping or adaptive capacity are directly vulnerable because they cannot cope with the impacts of climate change (Nguyen, 2015). If the capacity of a region is very low or absent, the vulnerability of that region is much higher. This situation is also referred to as "lack of coping capacity (LCC)" in some studies and the adaptive capacity (IC)

Denoted as $(1 - UK)$ with the difference from 1 [(Das, et al., 2020a), (Johnson, Depietri, & Breil, 2016)]. Therefore, vulnerability can be expressed as follows:

$$E = D \times (1 - UK) \qquad [2]$$

The final version of the risk formula is thus obtained by multiplying hazard, exposure, susceptibility and lack of adaptive capacity. The risk analysis equation is then shown in Equation 3 below.

$$R = T \times M \times D\,(1 - UK) \qquad [3]$$

The methodology used for the calculation of climate change-related risks can be presented in eight stages (Figure 58). Within the scope of the study, first, **preliminary preparation** was made for each sector. The preliminary preparation phase is of great importance for risk studies, as this step, and every step that follows, is shaped by the questions answered in this phase. The scope of the analysis was determined with the results identified and targeted in the preliminary preparation phase.

Following the preliminary preparation phase, **the impact chain** was created according to the sectors. The impact chain is the stage used in risk calculation, where the factors affecting the system are determined analytically. After the impact chain is established, **indicators** that will best reflect the climate risk in the relevant components determined.

1	Establishing the chain of influence
2	Identification of indicators
3	Data collection
4	Normalization process
5	Weighting
6	Risk calculation
7	Normalization process
8	Classification

Figure 58 Steps in Risk Analysis

Once the indicators of each component of the impact chain were identified, data were requested from institutions and sources and collected. Since the data obtained from different institutions and sources have different units or are unitless, they were first **normalized** and standardized. In this way, it is ensured that they are comparable with each other. After the standardization process, **the weighting process** was started. The indicators identified for risk components within the scope of the study were weighted by Principal Component Analysis (PCA). Indicators selected sectorally for each of the exposure, sensitivity and adaptive capacity components were weighted by PCA analysis for each component and then multiplied by their weights to obtain risk component values (Equation 4).

$$M, D, K = \sum_{i=1}^{n} X_i \times A_i \qquad [4]$$

A_i, i is the weight value of the indicator, X_i is the weight value of the indicator

i represents the value of the indicator itself. The values of the exposure, susceptibility and capacity components obtained with the help of PCA analysis and the hazard variables selected for the sector are **classified** between 1 and 5 in a similar way to (Das, et al., 2020a) before being given as input to the risk formula. In the specified classification

The thresholds used are shown in Table 9.

This **classification is based on quantiles**, which means that the data is divided into class intervals of a defined size. This separation is not based on the actual numerical values of the data, but on percentiles based on its distribution. After the data is divided into percentiles, the values that fall within the threshold limits can be moved to a higher or lower class, and an equal number of values can be assigned to each class. is not appointed.

Table 9 Thresholds and Class Equivalents Used for Classification of Risk and its Components by Quantiles

Lower Threshold (>)	Upper Threshold (<=)	Classroom
0	0,2	Very Low
0,2	0,4	Low
0,4	0,6	Middle
0,6	0,8	High
0,8	1	Very High

At the national scale, risk components (exposure, sensitivity and adaptive capacity) were calculated with the data obtained for 81 provinces of Turkey, and **sectoral risk was calculated** as shown in Equation 3. After the risk analysis was completed, the results were normalized and classified again.

The first of the risk components, the hazard component, was identified as climate hazards. These sectorally selected hazards were analyzed for the current period (1990-2019) and the future period (2021-2100). In the study, climate hazards obtained with RCP4.5 and RCP8.5 scenarios for future period projections 2021-2040, 2041-2060, 2061-2080 and 2081-2100, each divided into four periods of 20 years.

To be evaluated within the scope of the study 6 climate hazards have been identified and these are; Heat Wave, Drought, Heavy Rainfall, Forest Fire, Cold Wave and Strong Wind, respectively. For the analysis of the identified climate hazards, an extreme climate index was determined for each hazard and calculated for the current and future period. In the risk analysis, sectoral indicators determined according to the current period conditions and future period risk analyzes were made by considering only the projections of climate hazards. Thus, optimistic and pessimistic

The risks of the sectors in the future periods were determined according to the RCP4.5 and RCP8.5 scenarios. All these analyses are explained in more detail in the National vulnerability and risk analysis report.

The national stakeholder meetings held within the scope of the study identified the climate hazards that affect the sectors the most, and the selected climate hazard was used in the risk analyses conducted for each sector. After determining the climate hazard to be used for each sector in risk analysis studies, indicators were defined for the sectors and risk analyses were conducted and mapped in line with the available data. The prominent climate hazards for Turkey were heavy rainfall, drought and heat waves. Within the scope of sectoral vulnerability and risk analysis, sectors were analyzed with one or more climate hazards. Accordingly, urban, transportation and communication, water resources and industry sectors have studied the heavy precipitation hazard; water resources, agriculture, ecosystem, energy and industry sectors have studied the drought hazard; transportation and communication, urban, health, energy and tourism sectors have studied the heat wave hazard and the risk results obtained are presented in the sectoral sections of the report.

TURKEY AND MULTI-HAZARD ANALYSIS RESULTS

Located between temperate and subtropical climate zones, Turkey has different climate types due to its topography and being surrounded by seas on three sides. While more temperate climate characteristics are observed in the coastal regions, continental climate characteristics are observed in the interior under the influence of the North Anatolian and Taurus Mountains. Under the influence of different climate zones, Turkey's average temperature for the last 30 years (1991-2020) was approximately 13.9°C, while the average temperature for the last 11 years (2012-2022) was 14.1°C.

When the average temperature values of Turkey in the current period covering the period 1990-2019, which was determined within the scope of the project, are analyzed, the highest temperature values are observed in Southeastern Anatolia, Aegean and Mediterranean Regions. Especially in Şanlıurfa in the Southeastern Anatolia Region, Adana and Antalya in the Mediterranean Region, Muğla and Aydın in the Aegean Region, the average temperature 18°C. The average temperature values, which vary around 12-13°C in the Marmara and Central Anatolia Regions, decrease as we move towards the east and reach values close to 0°C in the Eastern Anatolia Region.

According to the measurements made by the General Directorate of Meteorology, the average total precipitation in Turkey for the last 30 years has been approximately 573.4 mm (MGM, 2022). The average total precipitation reaches the highest values in the northeast of Turkey and the lowest values in the Central Anatolia Region. Especially in the Eastern Black Sea Region around Artvin, Rize and Trabzon, total precipitation exceeds 1800 mm. Total precipitation reaches 1000 mm in the Western and Central Black Sea, the south of the Aegean and the high parts of the Taurus Mountains. Aegean In the region, the highest amount of precipitation reached approximately 1000 mm in Muğla province. The lowest total rainfall in Turkey is around 300 mm in Konya, Aksaray and Karaman provinces.

Looking at the average temperature changes in the future period, although an increase in average temperatures is projected for both scenarios (RCP4.5 and RCP8.5) towards the end of the century, the amount of increase differs between the scenarios. According to the results obtained, the average temperature in Turkey is projected to increase by approximately 1.5°C for scenarios in the 2021-2040 period. In the last period of the century, 2081-2100, the average temperature increase is expected to reach 3°C according to the RCP4.5 scenario. However, according to the RCP8.5 scenario, it is estimated that the temperature increase will reach 6°C towards the end of the 21st century, with the highest values occurring in the Eastern and Southeastern Anatolia Regions. For both scenarios, the change in average temperature is expected to be highest in the Eastern Anatolia Region and lowest in the Thrace region of the Marmara Region and around the North Aegean.

When the change in total annual precipitation in the coming period is analyzed, an increase is generally expected in the north of Turkey, while an increase is expected in the south; in the south decrease is projected. However, the change in total annual precipitation in Turkey is expected to be larger than in the RCP8.5 scenario. Total precipitation is projected to decrease by -20% to -20% for both scenarios until the 2060s.

It is estimated to vary between +20%. However, by the 2060s, there will be a decrease of more than 20% in total precipitation in the south of Turkey and an increase of up to 30% in the north

[18] . According to the RCP4.5 scenario, the maximum decrease in total annual precipitation is expected in the Mediterranean Region in the period 2061-2080, while the maximum increase is expected in the Marmara Region by 2040s. According to the RCP8.5 scenario, the maximum increase of up to 30% is expected in the Eastern Black Sea Region in the period 2081-2100, while in the Mediterranean Region Teke Plateau
It is estimated that there will be a decrease of up to 50%. Within the scope of the study, the frequency of extreme events occurring today in return periods of 2, 10, 20, 50 and 100 years was also determined. The future frequency of extreme climate events across Turkey was evaluated by comparing it to the reference period (Figure 59).

[18] Details of the study can be found in the Turkey Sectoral Vulnerability and Risk Analysis report.

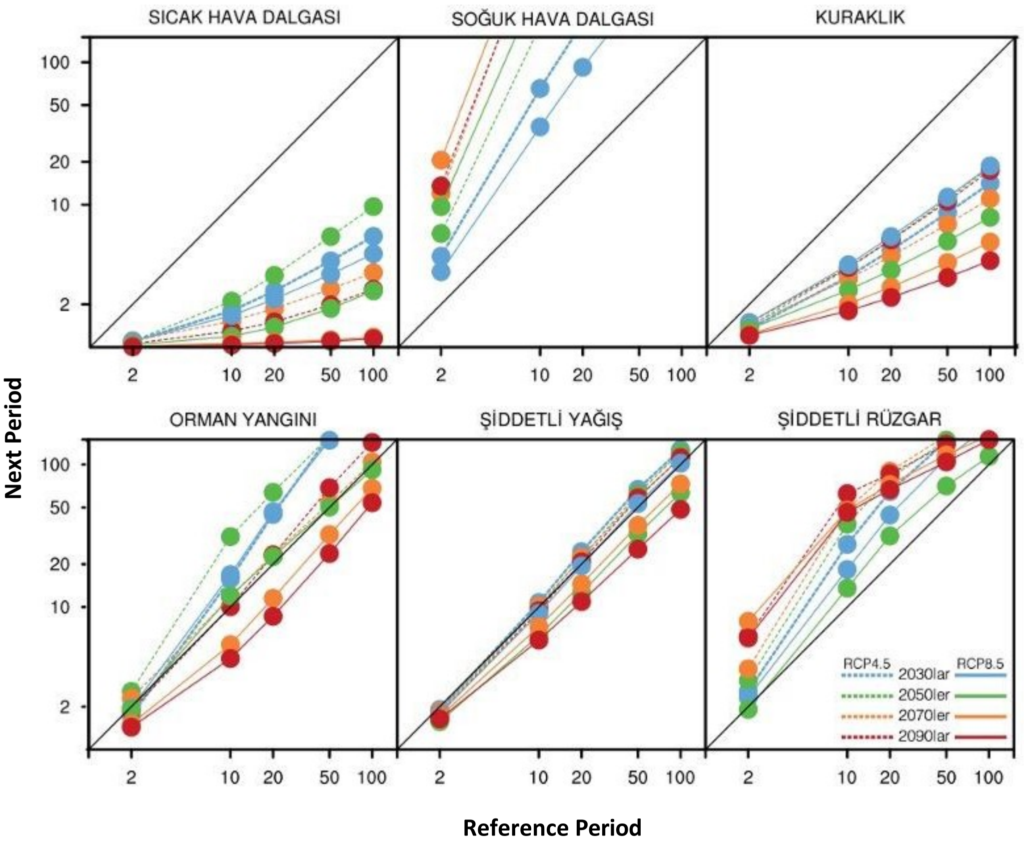

Figure 59 Changes in the Frequency of Extreme Climate Hazards in Turkey

According to the results obtained, the frequency of **heat waves** across Turkey increases in future projections. Heat waves, which occur every 2 years in the reference period, are expected to occur every year in the future according to both scenarios. The most dramatic increase in heat waves is estimated to be seen in the 2090s period of the RCP8.5 scenario. According to the RCP8.5 scenario, heat waves that occur once every 10 years in the reference period are expected to occur once a year by the end of the century, while heat waves that occur once every 100 years are expected to occur 2 to 3 times by the 2050s and once a year by 2100. According to future projections, heat waves are identified as a hazard that is expected to occur almost every year. In contrast to heat waves, the frequency of **cold waves** is projected to decrease in all periods across the country.

Cold waves, which occur every 2 years in the reference period, are projected to occur every 12 years in the 2070s according to the RCP4.5 scenario and every 20-21 years according to the RCP8.5 scenario. With a return period of 100 years in the reference period, the probability of cold waves in the future is predicted to decrease considerably and become almost non-existent by the end of the century.

The expected frequency increases in heat waves are more pronounced in the **drought** hazard. This situation reveals dramatic results for both emission scenarios. Droughts that occur every 2 years in the reference period are expected to occur almost every year in the future according to both scenarios. Again, droughts that occur once in 10 years in the reference period are to occur every 2 to 3 years in the future, and droughts that occur once in 50 years are expected to occur every 8-10 years.

This suggests that the drought hazard will become almost permanent under both scenarios.

According to the results obtained by analyzing the FWI (Fire Weather Index) index, which expresses the atmospheric conditions favorable to forest fires for **forest fire** hazard, which depends on parameters such as temperature, wind and relative humidity, the frequency of forest fires in Turkey in the future periods differs according to both scenarios. According to the RCP4.5 scenario, an increase is estimated in the future period for all return periods. RCP8.5 scenario According to When the results are evaluated, it is predicted that the frequency will decrease until the 2050s and the frequency will increase by the 2050s. Forest fires in Turkey, which occur once every 10 years in the reference period, are projected to decrease in frequency until the 2050s.

Although it is expected to occur every 17 years, it is predicted to occur every 4 years from the 2050s to the end of the century. Likewise, fires that occur once every 20 years are projected to occur once every 9 years by the end of the century, while fires that occur once every 100 years are projected to occur once every 54 years by the end of the century.

The frequency of occurrence of **heavy rainfall** hazard in future periods periodically exhibits opposite trends for the two scenarios. Heavy rainfall tends to decrease according to the RCP4.5 scenario while it shows an increasing trend according to the RCP8.5 scenario. According to the RCP8.5 scenario, which is stated as the pessimistic scenario, it is estimated that heavy rainfall, which occurs once in 10 years in the reference period, will occur once in 6 years towards the end of the century; heavy rainfall, which occurs once in 20 years, will occur once in 11 years and heavy rainfall, which occurs once in 100 years, will occur once in 49 years towards the end of the century. However, due to the regional variations in the distribution of precipitation across Turkey, the frequency of heavy precipitation will also vary regionally.

The frequency of **severe wind** hazard is expected to decrease for both scenarios in future projections compared to the reference period. Severe wind events that occur once every 10 years in the reference period are expected to occur once every 63 years in the RCP4.5 scenario and once every 46 years in the RCP8.5 scenario by the end of the century.

ANNEX-2: PARTICIPATING INSTITUTIONS IN ACTION PLAN PREPARATION

- Presidency of the Republic of Turkey, Presidency of Strategy and Budget
  - Directorate General for Sectors and Public Investments
- Ministry of Environment, Urbanization and Climate Change
  - General Directorate of Local Governments
  - Directorate General for European Union and Foreign Relations
  - General Directorate of Geographic Information Systems
  - General Directorate of Environmental Impact Assessment, Permitting and Inspection
  - Iller Incorporated Company
  - General Directorate of Meteorology
  - General Directorate of Spatial Planning
  - General Directorate of Infrastructure and Urban Transformation Services
  - General Directorate of Vocational Services
  - Housing Development Administration
  - General Directorate of Construction Works
  - Climate Change Directorate
  - General Directorate of Environmental Management
  - Directorate of Urban Transformation
  - General Directorate for the Protection of Natural Assets
  - General Directorate of National Real Estate
  - Turkish Environment Agency
- Ministry of Justice
  - Department of Human
- Ministry of Family and Social Services
  - General Directorate of Family and Community Services
  - General Directorate of Child Services
  - General Directorate of Elderly Services
  - General Directorate on the Status of Women
  - General Directorate of Disabled and Elderly Services
  - General Directorate of Social Assistance
  - Department of Support Services
  - Presidency of Strategy Development
- Ministry of Labor and Social Security
  - Turkish Employment Agency
  - General Directorate of and Safety
  - General Directorate of Labor
  - Audit Department
  - Directorate General for International Labor Force
  - Presidency of Strategy Development
- Ministry of Foreign Affairs
  - Directorate for EU Affairs Directorate General for Relations with the European Union
  - Directorate General for Energy and Environment
  - Turkish National Agency
- Ministry of Energy and Natural Resources
  - Department of Energy Efficiency and Environment
  - Energy Market Regulatory Authority

  - Electricity Generation Corporation
  - General Directorate of Turkish Electricity Transmission Corporation
  - General Directorate of Mineral Research and Exploration
- Ministry of Youth and Sports
  - General Directorate of Youth Services
  - Presidency of Strategy Development
- Ministry of Treasury and Finance
  - Turkish Statistical Institute (TurkStat)
  - Natural Catastrophe Insurance Pool
  - General Directorate of Foreign Economic Relations
  - General Directorate of Borrowing
  - Public Procurement Authority
  - Insurance and Private Pension Regulation and Supervision Agency
- Ministry of Interior
  - Presidency of Strategy Development
  - Department of European Union and Foreign Relations
  - Disaster and Emergency Management Presidency
  - General Directorate of Provincial Administration
  - Gendarmerie General Command
  - Directorate of Migration Management
  - Directorate General for Relations with Civil Society
- Ministry of Culture and Tourism
  - General Directorate of Cultural Heritage and Museums
  - General Directorate of Research and Training
  - General Directorate of Foundations
  - General Directorate of Investment and Enterprises
  - Radio and Television Supreme Council
  - Turkey Tourism Promotion and Development Agency
  - General Directorate of Foundations
  - Regional Directorates for the Protection of Cultural Assets
  - Provincial Directorates
  - Turkey Tourism Promotion and Development Agency Area Directorates
- Ministry of National Education
  - General Directorate of Basic Education
  - General Directorate of Lifelong Learning
  - General Directorate of Secondary Education
  - General Directorate of Support Services
  - General Directorate of Innovation and Education Technologies
- Ministry of National Defense
  - General Directorate of Mapping
  - Naval Forces Command
  - Presidency of Strategy Development
- Ministry of Health
  - General Directorate of Public Health
  - General Directorate of Health Information Systems
  - General Directorate of Health Services
  - General Directorate of Public Hospitals

  - General Directorate of Emergency Health Services
  - General Directorate of Health Promotion
  - General Directorate of Health Investments
  - Presidency of Strategy Development
- Ministry of Industry and Technology
  - General Directorate of Development Agencies
  - General Directorate of Industrial Zones
  - General Directorate of Industry
  - General Directorate of Incentive Implementation and Foreign Investment
  - Scientific and Technological Research Council of Turkey (TÜBİTAK)
- Ministry of Agriculture and Forestry
  - General Directorate of State Hydraulic Works
  - General Directorate of Forestry
  - General Directorate of Agricultural Research and Policies
  - General Directorate of Nature Conservation and National Parks
  - General Directorate of Fisheries and Aquaculture
  - Turkey Water Institute
  - General Directorate of Agricultural Reform
  - General Directorate of Animal Husbandry
  - General Directorate of Crop Production
  - Presidency of Strategy Development
  - General Directorate of Food and Control
  - General Directorate of Water Management
  - Directorate of Agriculture and Rural Development Support Institution
  - General Directorate of Information Technologies
- Ministry of Trade
  - Directorate General for International Agreements and EU
  - General Directorate of Trade
  - General Directorate of Customs
- Ministry of Transport and Infrastructure
  - General Directorate of Highways
  - State Airports Authority
  - General Directorate of Maritime Affairs
  - General Directorate of Infrastructure Investments
  - General Directorate of Communication
  - Directorate General of Civil Aviation
  - Directorate General for European Union and Foreign Relations
  - State Railways of the Republic of Turkey
  - General Directorate of Shipyards and Coastal Structures
  - Department of Port and Ferry Management
  - General Directorate of Turkish Maritime Enterprises Inc
  - Presidency of Strategy Development
  - General Directorate of Transportation Services Regulation
- Information and Communication Technologies Authority
- Supreme Organization of Organized Industrial Zones (OSBÜK)
- Turkish Red Crescent
- Union of Municipalities of Turkey

- Irrigation Unions
- Irrigation Cooperatives
- Development Agencies
- United Nations Development Program
- International Fund for Agricultural Development
- Food and Agriculture of the United Nations
- Regional Development Administrations
- Council of Higher Education
- Turkish Radio and Television Corporation
- Agricultural Research Institutes
- Forestry Research Institutes
- General Hygiene Committee
- Turkish Health Services Quality and Accreditation Institute
- Trans Anatolian Natural Gas Pipeline Project
- Turkish Standards Institute
- UNESCO National Commission for Turkey
- International Council on and Sites
- International Council of Museums
- Association of Turkish Travel Agencies
- Small and Medium Enterprises Development Organization
- Insurance Information Center
- Insurance and Private Pension Regulation and Supervision Agency
- Turkish Industry and Business Association
- Independent Industrialists' and Businessmen's Association
- Chambers of Industry
- Union of Chambers of Turkish Engineers and Architects
- Social Assistance and Solidarity Foundations
- Turkish Bar Association
- Federation of Social Work
- Mobile Operators
- Media Organizations
- Insurance Association of Turkey
- Special Risks Management Center
- Public Oversight Authority
- Vocational Qualification Authority
- Turkish Radio and Television Corporation
- Special Provincial Administrations
- Municipalities
- Universities